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Simple-sum Versus Divisia Monetary Aggregates for Malaysia: Cointegration, Error-Correction Model and Exogeneity

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Keywords: Divising money aggregates, cointegration, error correction model, exogeneity

ABSTRAK

Kajian ini cuba menentukan hubungan jangka panjang di antara wang dan pendapatan di Malaysia. Agregat kewangan Divisia dibentuk untuk Malaysia dan dibandingkan dengan agregat kewangan Campuran-mudah untuk tempoh masa 1980:1 hingga 1994:4. Hubungan jangka panjang di antara agregat-agregat kewangan dan pendapatan dinilai menggunakan kaedah dua peringkat Engle-Granger (menguji kointegrasi) dan rangka kerja pembetulan-ralat untuk menguji "weak exogeneity" dan "superexogeneity". Keputusan kajian menyarankan penggunaan agregat-agregat kewangan sebagai petunjuk-petunjuk dasar tidak tertakluk kepada "Lucas critique" dan juga agregat kewangan Divisia berpotensi digunakan untuk tujuan dasar kewangan di Malaysia.

ABSTRACT

In this study we attempt to investigate the long run relationship between money and income in Malaysia. We constructed Divisia monetary aggregates for Malaysia and compared its performance with the Simple-sum monetary aggregates for the period 1980:1 to 1994:4. The long run relationship between the monetary aggregates and income were evaluated using the Engle-Granger's two-step procedure (testing for cointegration) and the error-correction for weak exogeneity and superexogeneity. Our result suggest that the use of monetary aggregates as policy indicators are not subject to the Lucas critique and that there is potential role for Divisia monetary aggregates as a useful guide for monetary policy purpose in Malaysia.

INTRODUCTION

The financial system in Malaysia has undergone a radical structural transformation. In the 1960s, the financial system was characterised by financial markets dominated mainly by the Central Bank and commercial banks with demand deposits and currency as the main financial instruments and regulated low interest rates. However, in the 1990s, the scenario has turned into a more efficient and sophisticated financial system characterised, among other things, by the prevalence of various non-bank financial intermediaries, varieties of interest-bearing financial assets with varying maturity dates and a spectrum of interest rates offered, market-determined interest rates and well-developed money, commodity and capital markets.

The development within the financial system has important implications for the purpose of monetary policy. For the past forty years, the Malaysian monetary authority has focused on the narrow money supply M1, as an indicator or guide for monetary policy purposes. However, more recently, the Central Bank has been concerned with the behaviour and the stability of money supply M1 as a policy tool. The Central Bank realised that as a result of rapid growth and innovations in the financial sector, there has been a shift out of currency holdings and

demand deposits into interest-bearing deposits of the commercial banks, finance companies, merchant banks and other non-bank financial intermediaries, thus showing substitution between non-interest-bearing and interest-bearing financial assets (Bank Negara Malaysia 1985). As a result more emphasis is now given to broader money supply M2 and M3 for monetary management.

The purpose of the present study is three-fold. First, the study investigates the long-run relationship between money and income in the error-correction framework for a developing country – Malaysia. Second, the study addresses the issue of whether the Lucas critique is relevant in the case of monetary aggregates used for policy variables in Malaysia. Third, is to provide alternatives to the monetary aggregates currently defined and published by Bank Negara Malaysia. The alternative monetary aggregate propose is the Divisia aggregate which according to Barnett (1980) (who pioneered this line of work), is an appropriate measurement for the monetary services of a nation.

METHODOLOGY

The Estimation Approaches

In recent years, discussion in econometric analysis has focused on the time series properties of economic variables. A key concept underlying much of econometric theory is the assumption of stationarity. This assumption has important consequences for the interpretation of economic models and data. This is so because the level of a stationary series, for example, will not vary greatly with the sampling period and has a tendency to return to its mean value (Granger 1986; Hendry 1987). On the other hand, the properties of non-stationary series, which are more interesting to study, are quite different from those of stationary ones because the former will be characterised by a time varying mean which have a tendency to drift away from its mean. Some possible sources of non-stationarity deal with polynomial time trends, unit roots and integrated series (Granger 1986; Engle and Granger 1987).

It is generally argued that testing for the presence of unit roots in the autoregressive representation of a time series can be considered as testing for stationarity. This is because the test amounts whether certain coefficients of the representation are unity. Accordingly, the question of how many times we should difference the series or whether to detrend a series to achieve stationary may also be answered.[1]

Since our interest is to determine the long-run relationships between monetary aggregates and nominal income, the first step is to determine the order of integration of each of the series involved. The standard procedure for determining the order of integration of a time series is the application of augmented Dickey-Fuller test (Dickey and Fuller 1979) which requires regressing Δy_t on a constant, a time trend, y_{t-1} and several lags of the dependent variables to render the disturbance term white-noise. Then the t-statistic on the estimated coefficient of y_{t-1} is used to test the following null and alternative hypothesis:

$$H_0 : y_t \sim I(1) \quad \text{vs} \quad H_1 : y_t \sim I(0)$$

The null hypothesis is saying that variable y_t is stationary to the order one or it is integrated of order one compared to the alternative that y_t is integrated of order zero. If the null cannot be rejected, it is said that y_t probably need to be differenced once to achieve stationarity. If on the other hand, the null is rejected then y_t is stationary in its level form. The critical values are called the 'ADF statistics' and are available in Fuller (1976), Engle and Yoo (1987) and in MacKinnon (1991).

If the null hypothesis cannot be rejected then y_t is non-stationary and it may be I(1) or I(2), or have an even higher order of integration. To find out the order of integration, the test is repeated with Δy_t in place of y_t, thus regressing $\Delta^2 y_t$ on a constant, Δy_{t-1} and several lags of $\Delta^2 y_t$. The ADF statistic therefore tests the following:

$$H_0 : \Delta y_t \sim I(1) \quad \text{vs} \quad H_1 : \Delta y_t \sim I(0) \text{ i.e.}$$
$$H_0 : y_t \sim I(2) \quad \text{vs} \quad H_1 : y_t \sim I(1)$$

If the ADF statistic is not large and negative then we cannot reject H_0 and y_t cannot be I(1). In this case the test is repeated with $\Delta^3 y_t$ as the

1. For references and further discussion on unit roots, see Perman (1991) and Dolado *et al.* (1990).

dependent variable and so on, until the order of integration is determined. To supplement the ADF unit root test, we also estimate the Phillips and Perron (1988) (hereafter the PP test) unit root test. The PP unit root test is a non-parametric method of detecting whether a time series contains a unit root. This test is robust to a wide variety of serial correlation and time dependent heteroskedasticity.

After determining that the series are of the same order of integration, we test whether the linear combination of the series that are non-stationary in levels are cointegrated. To conduct the cointegration test, we follow the popular Engle and Granger (1987) two-step procedure for testing the null of no cointegration. The first step of the Engle and Granger's procedure is to determine α as the slope coefficient estimate from the OLS regression of y on a constant (c) and x. A test of cointegration is then that the residuals μ_t (i.e. y_t-c-αx_t) from the 'cointegrating regression' be stationary. So in the second step, the ADF unit root test is conducted on the residual μ_t so as to reject the null hypothesis of integration (of order 1) in favour of stationarity, using the critical values which are provided in Engle and Yoo (1987) and MacKinnon (1991). If the ADF statistics are not large and negative then it is likely that the series are not cointegrated. A less powerful test of cointegration is the 'cointegrating regression Durbin-Watson' (CRDW) statistic where cointegration is rejected if the Durbin-Watson statistic is too low. The critical values for CRDW are provided by Engle and Yoo (1987).

If it was shown that x and y are both I(1), but are cointegrated, then the two series will be generated by an error-correction model of the following form,

$$\Delta y_t = c_0 + \sum_{i=1}^{q} \phi_i \Delta y_{t-1} + \sum_{j=0}^{p} \lambda_j \Delta x_{t-j} + \theta \mu_{t-1} + \varepsilon_t \qquad (1.1)$$

where μ_{t-1} is the lagged residuals saved from running the static cointegrating regression with y on a constant and x. The error-correction mechanism (ECM) is usually referred to μ_{t-1}. Our point of interest is that $\theta<0$ and significant implies that x and y are cointegrated.

Testing for Lucas Critique

The concept of exogeneity and its testable application has been introduced by Engle *et al.* (1983) and Engle and Hendry (1993). Engle *et al.* (1983) have proposed three types of exogeneity: weak exogeneity, strong exogeneity and superexogeneity. The test for exogeneity is important because in empirical applications, while only weak exogeneity is needed for estimation purposes and for testing, and strong exogeneity for forecasting, superexogeneity is required for policy analysis. According to Engle *et al.* (1983), the concept of superexogeneity is closely associated with the Lucas (1976) critique. Lucas (1976) argues that an econometric model is unstable and will perform poorly in different time period because the underlying structure changes as expectation-generating mechanism and/or policy regime changes over time. Therefore, a relevant economic series or an economic model needs to be invariant to these changes to be useful for policy analysis.

Favero and Hendry (1992) have shown that the concept of superexogeneity can be used to examine if a policy variable is subject to the Lucas (1976) critique. More recently, the relevance of Lucas critique on the performance of economic modelling has been subjected to rigorous empirical investigations and testings in the literature (Favero and Hendry 1992; Fischer 1989; Fischer and Peytrignet 1991; Caporale 1996; Kwan and Kwok 1995; Kwan *et al.* 1996). However, the majority of the studies conclude that the Lucas critique is not of empirical significance in accounting for the failures of the econometric models (see also Fischer 1988). Thus, in our case, if a monetary aggregate possesses the superexogeneity status, that is, the coefficient of money variable is invariant to policy changes, then policy evaluation using this approach is possible and thus useful to the monetary authority.

Lets consider the following simple regression model,

$$y_t = a + bx_t + \varepsilon_t \qquad (1.2)$$

where y_t and x_t have normal distribution with means $E(y_t) = \mu_y$, $E(x_t) = \mu_x$ and variances and covariances given by $var(y_t) = \sigma_y^2$, $var(x_t) = \sigma_x^2$, and $cov(y_t,x_t) = \sigma_{yx}$. The conditional distribution of y_t given x_t is,

$$y_t \mid x_t \sim IND(a + bx_t, \sigma^2) \qquad (1.3)$$

where 'IND' denotes independently and normally distributed, $b = (\sigma_{yx}/\sigma_x^2)$, and $\sigma^2 = [\sigma_y^2 - (\sigma_{yx}/\sigma_x^2)]$. The joint distribution of y_t and x_t can be written as,

$$f(y_t, x_t) = g(y_t|x_t)h(x_t) \quad (1.4)$$

where $g(y_t|x_t)$ involves the parameter Φ and $h(x_t)$ is the marginal distribution of x_t. Based on equation (1.1), a variable is said to be weakly exogenous for estimating a set of parameters Φ, if inference on Φ conditional on x_t involves no loss of information. Weak exogeneity represents a necessary condition for satisfactory single-equation regression model. Furthermore, in a dynamic context, weak exogeneity allows feedback from the endogenous to the exogenous variables and therefore, weak exogeneity may tell us nothing about the direction of causality of y_t to x_t or x_t to y_t. In other words, weak exogeneity implies that the marginal distribution $h(x_t)$ does not involve the parameter Φ. On the other hand, if x_t is weakly exogenous and is not Granger caused by any of the lagged values of y_t, it is said to be strongly exogenous. Thus, Granger non-causality (from y_t to x_t) is considered to be a necessary condition for strong exogeneity. As for superexogeneity, if x_t is weakly exogenous and the parameters in $g(y_t|x_t)$ remain structurally invariant to changes in the marginal distribution of x_t (i.e. to changes in regime or policy interventions), then x_t is said to be superexogenous (Engle *et al.* 1983).

In our case, to construct a test for the null hypothesis that money, x_t is weakly exogenous, we first estimate an instrumental variable estimates of x_t, and then test for the presence of the predicted values of x_t in the dynamic error-correction model. The significance of the residuals or the fitted estimates from the instrumental variables regression may be tested with a *t*- or *F*-tests. In this study, the following general autoregressive model for money supply (the instrumental variable equation) is estimated,

$$\Delta_4 x_t = \alpha_0 + \sum_{i=1}^{L} \beta_i \Delta_4 x_{t-i} + DUM + \omega_t \quad (1.5)$$

where dummy variables, DUM act as proxies for possible structural breaks. The estimated ϖ_t is then substituted in the conditional model specified by equation (1.1) as follows,

$$\Delta y_t = c_0 + \sum_{i=1}^{q} \phi_i \Delta y_{t-1} + \sum_{j=0}^{p} \lambda_j \Delta x_{t-j} + \theta\mu_{t-1} + \delta_1 \varpi_t + \varepsilon_t \quad (1.6)$$

If ϖ_t is significant in terms of the t-statistic in the dynamic error-correction model, then the null hypothesis that money is weakly exogenous is rejected. On the other hand, to test for superexogeneity, the estimated ϖ_t and the square estimated ϖ_t^2 are included in equation (1.1) and test for their joint significance as follows,

$$\Delta yt = c_0 + \sum_{i=1}^{q} \phi_i \Delta y_{t-1} + \sum_{j=0}^{p} \lambda_j \Delta x_{t-j} + \theta\mu_{t-1} + \delta_1 \varpi_t + \delta_2 \varpi_t^2 + \varepsilon_t \quad (1.7)$$

A significant *F*-test indicates a rejection of superexogeneity.

Sources of Data and the Construction of Divisia Aggregates

Data on money supply M1 and M2, monetary components, bank reserves, rates of return on financial assets, bank lending rate used in the computation of the Divisia monetary aggregates were collected from various issues of Quarterly Economic Bulletin published by Bank Negara Malaysia.

Despite the ability of money supply M1, M2 and M3 to predict nominal income in Malaysia, the practice of Bank Negara Malaysia in computing the national money supply aggregates is flawed. Barnett (1980) has emphasized that the conventional "Simple-sum" monetary aggregate which was calculated on the assumption that their components receive equal weights of one, is an incorrect measurement of the flow of monetary services. 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:

$$s_{it} = p_{it}q_{it}/\Sigma_j p_{jt}q_{jt}. \quad (1.8)$$

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

$$p_{it} = (R_t - r_{i,t})/(1 + R_t) \quad (1.9)$$

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

$$G(Q_t) = \sum_{i=1}^{n} s_{it}^* G(q_{it}) \qquad (1.10)$$

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 1.[2] From Table 1, 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 *et al.* (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'.

However, the proper implicit rate imputation for 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

$$DDr = r_L [1 - (BR/DD)] \qquad (1.11)$$

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 1, we follow the envelope approach, that is, a series of benchmark rate is formed by selecting the benchmark rate which is higher than the rate of return of each monetary asset components. This will ensure that $p_i \geq 0$ (Mullineux 1996). Furthermore, Binner (1990) proposes adding 0.10 points to the benchmark

TABLE 1
Information used to construct divisia aggregates

Money	Asset Components	Rate of Return
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 = rL*(1-RRDD), where rL is commercial bank's base lending rate (percent p.a.), and RRDD is reserve requirement on demand deposits.
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, FDr, 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 Goverment securities (5 & 20 years).*

Source: Author's calculation.

2. Divisia M3 is excluded from the analysis because data on savings and fixed deposits at discount houses and Bank Islam, interest rates on deposits at merchant banks, discount houses and Bank Islam are not available.

where 'IND' denotes independently and normally distributed, $b = (\sigma_{yx}/\sigma_x^2)$, and $\sigma^2 = [\sigma_y^2 - (\sigma_{yx}/\sigma_x^2)]$. The joint distribution of y_t and x_t can be written as,

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Information used to construct divisia aggregates

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Source: Author's calculation.

2. Divisia M3 is excluded from the analysis because data on savings and fixed deposits at discount houses and Bank Islam, interest rates on deposits at merchant banks, discount houses and Bank Islam are not available.

rate to ensure that this rate will be non-zero.

As for income variable, since GNP is only available annually, we follow Gandolfo's (1981) technique to interpolating quarterly data from annual observations.

THE EMPIRICAL RESULTS

Results of Integration Tests

Table 2 presents the results of the unit root tests on the levels and first-differences of the series. In order to choose the appropriate lag length, we follow the procedure suggested by Campbell and Perron (1991). According to this approach, we start with some upper bound on k, say k_{max}, chosen a priori. Estimate an autoregression of order k_{max}. If the last included lag is significant (using the standard normal asymptotic distribution), select $k=k_{max}$. If not, reduce the order of the estimated autoregression by one until the coefficient on the last included lag is significant. If none is significant, select k=0. Results in Table 2 clearly indicate that income and all four monetary aggregates are stationary after they have been first-differenced. In Table 3, we present the results of the cointegration test between the monetary aggregates and income. The results of the unit root test on the residuals of the cointegrating regressions for all monetary aggregates suggest that the null hypothesis of non-cointegration can be rejected at five percent significance level. But, on the contrary, the CRDW statistics indicate that there is no long-run relationship between income and both the

TABLE 2
Results of integration tests

Series	Series in levels		Series in first-differences	
	ADF	PP	ADF	PP
Simple-sum M1	-1.04 (6)	-0.28 (3)	-3.34* (5)	-7.89** (3)
Simple-sum M2	-0.50 (1)	-0.32 (3)	-5.58** (1)	-6.84** (3)
Divisia M1	-1.28 (4)	-0.28 (3)	-7.80** (1)	-7.99** (3)
Divisia M2	-1.44 (4)	-1.28 (3)	-6.19** (1)	-8.39** (3)
Income	-0.09 (8)	-1.28 (3)	-4.45** (3)	-5.59** (3)

Notes: Asterisks (*), (**) denote statistically significant at 10 and 5 percent level respectively. The critical values are –3.49 (1%) and –3.18 (10%) (see MacKinnon, 1991).

TABLE 3
Results of cointegration tests

Series	Cointegrating regressions				ADF auxiliary regressions	
	Coefficient on regressors					
	Constant	α	R^2	CRDW	ADF	Lags
Simple-sum M1	1.70	0.84	0.98	0.48	-3.87**	4
Simple-sum M2	1.39	0.77	0.96	0.22	-3.68**	3
Divisia M1	0.05	1.02	0.98	0.54	-4.27**	4
Divisia M2	0.90	0.83	0.96	0.21	-3.38*	12

Notes: At 5 percent significance level, the critical values for CRDW is 0.78 (see Engle and Yoo, 1987), and cointegration test is -3.45 (see MacKinnon, 1991). Asterisks (*), (**) denote statistically significant at 10 and 5 percent level respectively.

3. Engle and Yoo (1987: p. 157) note that, "We have examined the behavior of the Durbin-Watson statistic from the co-integrating regression. Unfortunately, the discrepancy between the critical values for different systems remains significant even for the sample size two hundred. This is not surprising since the statistic is not asymptotically similar as are the preceeding tests. Hence this statistic does not appear to be useful for testing co-integration".

TABLE 4
Results of error-correction models

Variables	Simple-sum M1	Simple-sum M2	Divisia M1	Divisia M2
Constant	0.0147	0.0080	0.0122	-0.0015
	(9.9107)*	(2.7156)*	(4.9017)*	(0.6821)
ECM_{t-1}	-0.1282	-0.1134	-0.2638	-0.0411
	(6.9545)*	(3.0237)*	(7.0821)*	(2.9624)*
Δy_{t-1}	0.5441	0.7221	0.2169	1.0098
	(11.647)*	(10.253)*	(4.0415)*	(22.474)*
Δy_{t-3}			0.1858	
			(3.3911)*	
Δy_{t-4}		-0.3944		-0.3633
		(7.4493)*		(9.6407)*
Δy_{t-5}	0.1523	0.5254		0.3558
	(3.7358)*	(7.6567)*		(9.5287)*
Δy_{t-8}	-0.2487	-0.3788		-0.3504
	(5.7118)*	(6.4828)*		(10.931)*
Δy_{t-9}		0.2583		0.3566
		(6.2560)*		(11.022)*
Δy_{t-10}		-0.0558		
		(2.6248)*		
Δy_{t-13}		0.0844		
		(2.6111)*		
Δy_{t-15}	-0.0697			
	(3.4623)*			
Δm_t	0.0533	0.0659	0.1343	0.0508
	(2.2491)*	(2.0333)*	(2.2128)*	(1.5161)
Δm_{t-4}	-0.1801			
	(6.2235)*			
Δm_{t-6}		-0.0764		
		(1.8758)		
Δm_{t-7}	-0.1031			
	(3.0923)*			
Δm_{t-8}	0.1936	-0.1003		
	(5.3586)*	(2.6688)*		
Δm_{t-9}	0.0575	0.0717		
	(2.1047)*	(2.2513)*		
Δm_{t-11}	0.1938			
	(5.9527)*			
Δm_{t-12}			0.0145	
			(0.2122)	
Δm_{t-16}	-0.0893	-0.0866		
	(2.9004)*	(2.2492)*		
Δm_{t-19}		0.0801		
		(2.2190)*		
Δm_{t-20}	0.1129	0.0945		
	(3.6200)*	(2.6790)*		
D84:1				0.1078
				(17.598)*
D84:2				-0.1106
				(12.586)*
D86:1			-0.0599	
			(6.0728)*	
R-squared	0.92	0.95	0.82	0.97
SER	0.003	0.003	0.009	0.005
DW	2.68	2.53	1.49	2.36
Weak exogeneity test:				
t-statistic on θ_1	0.3373	0.1843	-0.8184	0.4329
Superexogeneity test:				
t-statistic on θ_1	0.3386	0.2249	-0.4960	0.4993
t-statistic on θ_2	1.2406	-0.2998	-1.5263	-0.6900
F-statistic, $\theta_1 \cap \theta_2 = 0$	0.827 [0.452]	0.061 [0.941]	1.513 [0.235]	0.330 [0.721]

Notes: ECM denotes error-correction term, i.e. the residuals from running the static cointegrating regression. SER denotes standard error of regression. DW denotes Durbin-Watson statistic. D denotes dummry variable. Numbers in parentheses (.) are *t*-statistics and numbers in the square brackets [.] are *p*-values. Asterisk (*) denotes statistically significant at the 5% level.

Simple-sum and Divisia monetary aggregates (M1 and M2). Nevertheless, since CRDW statistic has low power compared to the Engle-Granger's two-step approach,[3] we conclude that there is long-run relationship between monetary aggregates and income in Malaysia.

Results of the error-correction models estimated for each of the monetary aggregates are presented in Table 4. For all error-correction models estimated, the final models were derived according to the Hendry's 'general-to-specific' specification search and the congruency of the models with the data generating process (Hendry 1987) are observed from a battery of diagnostic tests which include the test for serial correlation, heteroskedasticity, normality of the residuals and incorrect functional form (not reported here in order to conserve space, but is available from the author upon request). Generally, the diagnostic tests indicate well-fitting error-correction models for each monetary aggregates that fulfills the condition of serial non-correlation, homoskedasticity, normality of residuals and no specification errors.

A very important observation is made from Table 4. The results for both Simple-sum and Divisia money (M1 and M2) suggest that money and income is cointegrated. In all four estimated equations, the coefficient of the error-correction terms are significantly different from zero at the five percent level. The t-statistics of the ECM terms are large and negative, and therefore support the notion that monetary aggregates and income in Malaysia exhibit long-run relationships over the period under study. This result suggests that both Simple-sum and Divisia money (both M1 and M2) are good intermediate indicators for monetary policy purpose.

The results of weak exogeneity tests as shown by the significance of the t-statistics of ϖ_t in the conditional models are presented in the lower section of Table 4. The results clearly indicate that for all four monetary aggregates, when the residuals ϖ_t from the money supply equation is added to the conditional model, the coefficient of ϖ_t is insignificantly different from zero at the five percent level. This indicates that Malaysia's monetary aggregates are weakly exogenous in the income equation. As a consequence, the use of a single-equation regression in estimating the impact of monetary aggregates on income is justified. And when both ϖ_t and ϖ_t^2 were included in the income equation, the results of the *F*-test indicate that their coefficients are statistically insignificant at the five percent level, joint hypothesis of superexogeneity cannot be rejected. This finding suggests that the monetary aggregates are not subject to the Lucas critique.

CONCLUSION

The question of the appropriate empirical definition of money is one of the most debatable and unsettled issues in economics. A survey by Kumah (1989) indicates that in general, the measurement of money supply used by the monetary authorities for over 150 countries is limited to M1, M2 and M3, depending on the level of development or monetisation of the financial system. As the financial sector develops, new financial intermediaries emerge, offering varieties of interest-bearing financial assets with various maturity dates, and these financial assets will be added as components of money giving a broader concept of monetary aggregates. However, the practice of adding the components of financial assets together without appropriately taking into consideration the weight of each assets components was criticised by Barnett (1980). They argued that in monetary aggregation, it is not which assets are to be included in the measure of money supply 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.

In this study we have constructed and computed Divisia monetary aggregates for Malaysia. The purpose of this paper is to investigate the long-run relationships between the alternative monetary aggregates and national income during the era of financial innovation and deregulation in Malaysia. Alternative monetary aggregates included in the analysis are Simple-sum (both M1 and M2) and Divisia (both M1 and M2) monetary aggregates. The Divisia aggregates are constructed using the method proposed by Barnett (1980). The long-run relationships between the monetary aggregates and national income were evaluated using the Engle-Granger's two-step procedure (testing for cointegration) and the error-correction framework.

The major results of this paper may be summarised as follows: First, the empirical tests

indicate that income and all four monetary aggregates employed in this study are integrated of order one. Second, the cointegration test between the monetary aggregates and nominal income using the Engle-Granger's two-step procedure suggests that the two series are cointegrated. Third, our error-correction models further support the long-run relationships between money and income in Malaysia. Fourth, our weak exogeneity test suggests that the estimated single-equation error-correction model for income is well specified. Fifth, the superexogeneity test indicates that the use of monetary aggregates as policy indicators are not subject to the Lucas critique and therefore suggests that using monetary aggregates for making policy evaluation is possible. Finally, we conclude that there is potential role for Divisia monetary aggregate as a useful guide for monetary policy purpose in Malaysia.

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APPENDIX

The estimated instrumental variable regressions (i.e. money supply reaction function) used in the exogeneity tests are recorded below;

$$\Delta sm1_t = \underset{(5.2783)}{0.0307} + \underset{(2.0997)}{0.2167}\Delta sm1_{t-1} - \underset{(2.1507)}{0.2614}\Delta sm1_{t-6}$$

$$+ \underset{(3.2847)}{0.3537}\Delta sm1_{t-12} - \underset{2.3287)}{0.2841}\Delta sm1_{t-17} - \underset{(2.6871)}{0.0569}D86{:}1$$

$$- \underset{(2.6380)}{0.0505}D92{:}2 + \underset{(5.8554)}{0.1164}D93{:}4 \qquad (A1)$$

R2 = 0.766 D.W. = 1.90

$$\Delta sm2_t = \underset{(8.2860)}{0.0625} - \underset{(2.0667)}{0.2901}\Delta sm2_{t-13} - \underset{(3.5736)}{0.4685}\Delta sm2_{t-18}$$

$$- \underset{(2.5135)}{0.3852}\Delta sm2_{t-19} - \underset{(2.4951)}{0.0379}D88{:}1 - \underset{(2.3929)}{0.0369}D90{:}2$$

$$- \underset{(2.0875)}{0.03131}D91{:}2 + \underset{(3.0422)}{0.0453}D93{:}4 + \underset{(4.5874)}{0.0694}D94{:}1 \qquad (A2)$$

$R^2 = 0.735$ D.W. = 2.19

$$\Delta dm1_t = \underset{(3.8479)}{0.0165} + \underset{(5.4929)}{0.5141}\Delta dm1_{t-4} - \underset{(2.3337)}{0.2238}\Delta dm1_{t-10}$$

$$+ \underset{(2.5189)}{0.2545}\Delta dm1_{t-12} - \underset{(4.4220)}{0.0680}D84{:}3 - \underset{(2.1834)}{0.0344}D84{:}4$$

$$- \underset{(3.5096)}{0.0548}D85{:}2 - \underset{(2.1439)}{0.0339}D90{:}4 \qquad (A3)$$

R2 = 0.773 D.W. = 2.00

$$\Delta dm2_t = \underset{(3.8097)}{0.0240} + \underset{(2.7508)}{0.3702}\Delta dm2_{t-4} - \underset{(2.1909)}{0.3202}\Delta dm2_{t-6} + \underset{(2.9371)}{0.0662}D87{:}2$$

$$+ \underset{(3.2184)}{0.0678}D94{:}1 \qquad (A4)$$

$R^2 = 0.373$ D.W. = 2.18

The data are quarterly and cover the period 1981:1-1994:4. sm_j and dm_j denote Simple-sum and Divisia money respectively and j = 1,2 (1=M1, 2=M2). The inclusion of dummies, D proxy for regime shifts is also necessary to produce homoscedastic residuals. And Δ is the difference operator.

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Exchange Rate and the Demand for Money in Malaysia

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ABSTRAK

Kajian ini menyelidik hubungan jangka panjang di antara kadar pertukaran wang asing dan permintaan wang di Malaysia. Keputusan ujian nisbah kebolehjadian Johansen-Juselius (1990) menyokong kepentingan kadar pertukaran asing bagi m2 tetapi tidak bagi m1. Keputusan ujian nisbah kebolehjadian Hansen-Johansen (1993) pula mendapati parameter jangka masa panjang adalah tidak stabil disebabkan kesan krisis kewangan di rantau ini. Keseluruhan analisa mendapati hanya sebahagian keputusan empirikal menyokong hubungan di antara kadar pertukaran wang asing dengan permintaan wang.

ABSTRACT

This paper investigates the long run relationship between exchange rate and money demand in Malaysia. The Johansen-Juselius (1990) likelihood ratio tests support the importance of exchange rate in m2 but not in m1 money demand. The Hansen-Johansen (1993) likelihood ratio tests however found some evidence of instability in the long run parameters and this could be due to the recent financial crisis in this region. Overall analysis has provided support to the empirical investigation of the relation between exchange rate and money demand.

INTRODUCTION

This study empirically investigates the long-run relationship between exchange rate and money demand in Malaysia. The precursor to this study was the work of Mundell (1963). Mundell argued that in addition to the interest rate and income, the demand for money is likely to depend upon the exchange rate. Therefore, an important feature of this study is, firstly, to conduct a specific test using the likelihood ratio (LR) test proposed by Johansen and Juselius (J-J) (1990) whether the exchange rate can be considered as an additional determinant of the demand for money in Malaysia. Secondly, if exchange rate is accepted in the cointegrating space of money demand, this study proceeds with the specific test developed by Hansen and Johansen (H-J) (1993) for testing the long-run parameters constancy.

There are a number of seminal studies on various issues relating to the demand for money in Malaysia, for example, Semudram (1981); Rahim (1986); and Ghaffar and Habibullah (1987). Most of these studies used partial adjustment specification. Moreover none of them explored the series properties and the cointegration technique. A recent paper by Tseng and Corker (1991), however, investigate on different issue such as the impact of financial liberalisation by focusing on the source of instability during the 1980s. This study attempts to determine whether the exchange rate can be considered as an additional determinant of the demand for money and its long-run parameters stability.

Having mentioned the introduction above, the following sections present the model, empirical results and finally the study's concluding remarks.

THE MODELS AND THE SOURCES OF DATA

Two different models are estimated. Firstly, the base-line model using the Goldfeld-type (1973) approach:

$$\log m_t = a + b \log y_t + c \log ir_t + \varepsilon_t \quad (1.0)$$

and secondly, the augmented model to include the nominal exchange rate:

$$\log m_t = a + b \log y_t + c \log ir_t + d \log ex_t + \varepsilon_t \quad (2.0)$$

where m is the real money stock, y is the real income, ir is an opportunity cost variable[1]; and ex is the nominal exchange rate; with the following theoretical expected sign: $b > 0$; $c < 0$; $d < 0$[2]. Two definitions of money stock are utilised namely, narrow money ($m1$) and broad money ($m2$)[3]. The real gross domestic product (*GDP*) is used as a scale variable. The 3-month Treasury Bill rate is used as a proxy of an opportunity cost and finally the nominal exchange rate is measured by the US dollar (*USD*) per unit of Malaysian Ringgit (*RM*). The Consumer Price Index (*CPI*) is used as a deflator.

The quarterly data used spanning 1987:q1 to 1998:q2. The sample period 1987:q1 is chosen as a starting point because neither quarterly data of Gross Domestic Product (*GDP*) nor Gross National Product (*GNP*) is available in Malaysia before this period. All data are collected from the Bank Negara Malaysia (Central Bank of Malaysia) Quarterly Bulletins except the GDP is collected from the published reports by the Department of Statistics, Malaysia.

EMPIRICAL RESULTS

The integration properties of the individual series are investigated by using the augmented Dickey-Fuller (ADF) test[4]. The lag length is determined based on the Schwarz Bayesian Criterion (SBC)[5]. The results show that all variables are stationary in their first differences. The results are summarised in Table 1.0. Clearly, the results indicate that all series are stationary after first differences.

As mentioned before, both equations (1.0) and (2.0) are estimated using the Johansen-Juselius (1990) maximum likelihood cointegration procedures. The choice of lag length k or the order of VARs system is based on the SBC procedure. The results indicate that

TABLE 1.0
Summary of augmented Dickey-Fuller (ADF) test statistics

Series	Levels		First differences	
	Include an intercept but not a trend	include an intercept and a linear trend	include an intercept but not a trend	Include an intercept and a linear trend
m1	-1.8779[1]	-1.1319[1]	-3.8462[1]*	-4.2511[1]*
m2	-0.4848[1]	-3.0008[1]	-4.9913[1]*	-4.8226[1]*
y	-1.7409[2]	-2.1882[2]	-11.668[1]*	-11.976[1]*
ir	-1.7037[1]	-1.7363[1]	-4.7199[1]*	-4.5754[1]*
ex	-0.7149[3]	-0.4339[3]	-3.7519[1]*	-4.3592[1]*

Notes:
Numbers in brackets are the lag lengths based on SBC.
* denotes significant at the 5% level.

1. *ir* is computed as log (1 + *ir*)
2. A simple interpretation on d < 0 is that as result of depreciation of the Malaysian Ringgit (a decrease in ex), the demand for cash balances in Malaysia increases.
3. M1 is defined as currency and demand deposits held by the non-bank private sector held at the commercial banks, plus net issues of NCD to the private sector and repo transactions affected by the commercial banks (Bank Negara Malaysia, 1994; 410).
4. See Engle and Granger (1987).
5. See Schwartz (1978).

TABLE 2.0
Cointegration analysis (with unrestricted intercept and no trends)

	Series in cointegrating Vector	Null	Alternative	λ_{max}	95% critical values	λ_{trace}	95% critical values
Set 1	*m1, y, ir*	$r = 0$	$r = 1$	77.56*	21.12	86.14*	31.54
		$r \leq 1$	$r = 2$	5.94	14.88	8.58	17.86
		$r \leq 2$	$r = 3$	2.64	8.07	2.64	8.07
Set 2	*m2, y, ir*	$r = 0$	$r = 1$	27.23*	21.12	32.79*	31.54
		$r \leq 1$	$r = 2$	3.82	14.88	5.56	17.86
		$r \leq 2$	$r = 3$	1.74	8.07	1.74	8.07
Set 3	*m1, y, ir, ex*	$r = 0$	$r = 1$	82.16*	27.42	101.96*	48.88
		$r \leq 1$	$r = 2$	11.59	21.12	19.80	31.54
		$r \leq 2$	$r = 3$	7.92	14.88	8.20	17.86
		$r \leq 3$	$r = 4$	0.28	8.07	0.28	8.07
Set 4	*m2, y, ir, ex*	$r = 0$	$r = 1$	31.83*	27.42	60.98*	48.88
		$r \leq 1$	$r = 2$	19.99	21.12	29.15	31.54
		$r \leq 2$	$r = 3$	8.22	14.88	9.16	17.86
		$r \leq 3$	$r = 4$	0.94	8.07	0.94	8.07

Notes:
r is the number of cointegrating vector.
* denotes significant at the 95% level.
Test is carried out using CATS in RATS package

the order of VARs at 3 are acceptable by the data representation with unrestricted intercept and no trends for Sets 1 and 2. Whilst, the order of 2 is acceptable for Sets 3 and 4 with unrestricted intercept and no trends. In Table 2.0, the results of cointegration analysis for four set of variables are summarised. The first two sets of variables belong to equation (1.0). Whilst the last two sets belong to equation (2.0) where the nominal exchange rate is included in *m*1 and *m*2 money demand, respectively.

Based on the maximal eigenvalues (λ_{max}) and trace statistic (λ_{trace}), both tests strongly reject the null of no cointegration (r = 0) for each set of variables of interest. Furthermore, both tests also accept that at most the presence of one cointegrating vector (CV) in each set of variables. Hence, there is no significant evidence of more than one cointegrating vector for all sets of variables.

As indicated in the Introduction, the J-J likelihood ratio test is conducted to determine whether the exchange rate belongs to the cointegrating space of each money demand function. This test is based on the estimated eigenvalues of restricted λ^* (without exchange rate) and unrestricted λ (with exchange rate) ith cointegrating vector[6], as follows:

$$-2\ln(Q) = T\sum_{i=1}^{r}\ln\{(1-\lambda_i^*)/(1-\lambda_i)\} \quad (3.0)$$

Asymptotically, this statistic has a χ^2 distribution with $r(p\text{-}s)$ degrees of freedom, where r is the number of cointegrating vector, p is the dimension of unrestricted cointegrating space and s is the dimension of restricted cointegrating space. The restriction embedded in the null hypothesis is binding if the calculated value of the test statistics exceeds that in a χ^2 table. The test results are summarised in Table 3.0.

The tests indicate that the exchange rate can be excluded from the *m*1 cointegrating space. Whilst in the *m*2 cointegrating space, it is permissible to include the exchange rate in the model. Based on these findings, the following discussion will only focus on testing the stability of long-run parameters of m2 money demand where nominal exchange rate is included in the cointegrating vector. To test whether the estimated long-run parameters are stable over time in the cointegrating space x'=[*m*2, *y*, *ir*, *ex*],

6. See, Bahmani-Oskooee et al. (1998) for more recent application of this technique.

TABLE 3.0
The J-J likelihood ratio tests of restricted and unrestricted cointegrating vectors

Series in	Normalised Cointegrating Vector	Restricted Eigenvalue λ^*	Unrestricted Eigenvalue λ	χ^2, $(p\text{-}s)r$	Remark
Set 1	[1.0, -2.5, 3.1]	0.8284		$\chi^2(1)$ =	exchange rate can be
vs.				0.75	excluded from *m*1
Set 3	[1.0, -2.6, 3.3, -0.1]		0.8455		cointegrating vector
Set 2	[1.0, -2.9, 2.8]	0.4615		$\chi^2(1)$ =	exchange rate can be
vs.				4.595*	included in *m*2
Set 4	[1.0, -2.8, 3.4, -0.3]		0.5149		cointegrating vector

Notes:
The critical value of $\chi^2(1)$ = 3.84 (2.71) at the 5% (10%) significance level.

TABLE 4.0
Testing the long-run parameters constancy

Sample	No. of cv	Eigenvalue (t)	H-J statistics@	Remark
1987q1 - 1998q2	1	0.5149 (44)	-	
1987q1 - 1998q1	1	0.5877 (43)	- 6.99	accept Ho
1987q1 - 1997q4	1	0.7356 (41)	- 25.49*	reject Ho
1987q1 - 1997q3	1	0.7328 (41)	-24.45*	reject Ho
1987q1 - 1997q2	1	0.7120 (40)	- 20.86*	reject Ho
1987q1 - 1997q1	1	0.7247 (39)	- 22.09*	reject Ho

Notes:
@ The critical value of $\chi^2(3)$ = 7.81 at the 5% sigificance level.

the following H-J likelihood ratio test statistics is utilised:

$$t\sum_{i=1}^{r}\ln\left[\frac{1-\lambda_i^*(t)}{1-\lambda_i(t)}\right] \qquad (4.0)$$

which has a χ^2 distribution with $(p\text{-}r)r$ degrees of freedom, where p is the dimension of cointegrating space and r is the number of cointegrating vector. In equation (4.0), λ^* is the largest eigenvalue from the corresponding subsamples and λ is the largest eigenvalue from the whole sample. The intuition behind this test is that small values for the test statistics imply that the estimated long-run parameters are stable over time. The test results are summarised in Table 4.0.

As reported in Table 4.0, the statistics shows the following results: (1) most of the cointegrating vectors take the sign pattern that is consistent with money demand; (2) in all selected subsamples and the whole sample, the cointegrating vector remains at 1; (3) the H-J test rejects the long-run parameter stability in all subsamples after 1997:4. This result implies that in spite of the acceptance of exchange rate as an additional determinant in *m*2 money demand, the recent East Asian financial crisis[7] has probably caused instability of the long-run parameters. However, there is no evidence of a structural shift in broad money demand prior to the financial crisis.

CONCLUSION

The Johansen-Juselius (1990) likelihood ratio tests strongly support the importance of exchange rate in *m*2 but not in m1 money demand function in Malaysia. The positive sign on the exchange rate and negative sign for treasury bill in the normalised *m*2 vector perhaps indicate that the

7. As a result of this crisis, the Malaysia Ringgit depreciated nearly 60% against the US dollar.

US dollar as well as treasury bill are substitutes for monetary assets. Hence the possibility of currency substitution between Malaysian Ringgit and the dollar cannot be ruled out. Thus providing some support to McKinnon's (1982) hypothesis of currency substitution.

The Hansen-Johansen (1993) likelihood ratio tests provide some evidence of instability in the long-run parameters after 1997q:4 and this could be due to the recent financial crisis in this region. In conclusion, the whole analysis has provided a partial support to the empirical investigation of a stable long-run relationship between exchange rate and money demand in Malaysia.

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Auditor Switch Decision of Malaysian Listed Firms: Tests of Determinants and Wealth Effect

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Keywords: Audit switch, audit quality, revaluation effect

ABSTRAK

Kajian ini menilai rasional ekonomi untuk mengganti juruaudit oleh firma-firma tersenarai dengan meneliti kesan keputusan ini terhadap perubahan harga saham firma-firma tersebut (atau dikenali juga sebagai kesan harta). Keputusan pihak pengurusan firma untuk mengekal atau menggantikan juruaudit ini melibatkan satu perubahan ke atas firma-firma audit yang berbeza kualiti. Kualiti audit ditakrifkan dengan mengklasifikasikan firma-firma audit kepada firma-firma Tahap 1 (Big-5) dan firma-firma Tahap 2 (bukan-Big 5). Ciri yang membezakan antara dua kumpulan produk audit dipercayai menjadi kredibiliti yang dibawa oleh setiap kumpulan dalam perjanjian audit. Faktor-faktor yang berhubung dengan pilihan firma audit dan perubahan untuk ciri-ciri firma berkaitan pilihan juruaudit disiasat menggunakan model regresi logistik. Hasil kajian menunjukkan bahawa penggantian juruaudit oleh firma-firma tersenarai sebahagiannya diterangkan oleh perubahan dalam pengurusan dan pertumbuhan perolehan. Perubahan dalam ciri-ciri firma seperti pertumbuhan aset, pembelian aset tetap kepada jumlah aset, kemampuan mempengaruhi orang lain dan perubahan dalam aktiviti kewangan menerangkan penggantian juruaudit. Hal ini menunjukkan tiada bukti kesan harta signifikan daripada pengumuman penggantian juruaudit.

ABSTRACT

This article examines the economic rationale for auditor change by Malaysian listed firms by examining audit switch effect on share prices. The auditor change decision by management to retain or to change involves a switch across audit firms with different quality. Audit quality is defined by classifying the audit firms into Tier 1 (Big-5) firms and Tier 2 (non-Big 5) firms. The distinguishing attribute between the two groups of audit products is believed to be the credibility that each group brings to the audit engagement. Factors associated with the choice of audit firm and changes for firm characteristics associated with auditor choice were investigated using the logistic regression model. The findings show that the auditor switch of Malaysian listed firms is partly explained by changes in management and turnover growth. Changes in firms' characteristics such as asset growth, purchase of fixed asset to total asset, leverage and changes in financing activities explain auditor switches. There appears to be no evidence of significant wealth effect from auditor switch announcements.

INTRODUCTION

Accounting literature on auditor change decision and its implications on firm's value, credibility of financial reporting and cost of monitoring management activities is well documented in the literature emanating from the developed countries. Auditor switch decision involves

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change of incumbent auditor resulting in the choice of quality differentiated audit firms to realign the characteristics of the audit firm with the growing needs of clients under changing circumstances. Changes in management, perceived expertise of audit firms and deterioration of financial health of clients have been found to be associated with auditor change/ switch decisions. Changes in a firm's activities and perception of advances in audit technology have been shown to be associated with the choice of quality differentiated audit firms.

Changes in management might result in replacement of the incumbent auditor with a view to imbibe fresh ideas to enhance the firm's expansion policy under a changed management. Similarly, auditor replacement will be initiated if the existing audit firm lacks the expertise to keep up with the firm's expansion policies and its changed internal control systems. Firms experiencing consistent deterioration in performance may also decide to replace the incumbent audit firm with a more compliant auditor in an attempt to evade a qualified report detrimental to the value of the firm.

Change in firm's activities (expansion, contraction, financing, performance, etc.) and audit technology creates demand for the choice of quality differentiated audit firms. The rationale for choosing a relatively higher quality audit firm might be due to the growing needs of the firm, to take advantage of the audit firm's reputation. The choice of a lower quality audit firm might be prompted by a sudden contraction of business activities, to gain an ability to negotiate audit comments to reflect management's view rather than an unsolicited "fair view" as well as a desire to lower costs of engaging audit services.

Due to asymmetry of information between principals and management, management of growing firms might redirect resources, as pecuniary and non-pecuniary benefits on the job, at the expense of shareholders. The shareholders have to incur costs to ensure that management's activities are consistent with shareholders' objectives. Management of highly levered firms might be tempted to transfer wealth from their shareholders by engaging in risky investments beyond that sanctioned by shareholders. Engaging relatively higher quality audit firms mitigates against these agency costs elements of management but which are ultimately borne by shareholders.

Revaluation effect of auditor switch has been an issue of interest among investors and unlike corporate dividend and earnings announcements, which reflect a real change in expected corporate performance, auditor change announcements convey no direct apparent economic information. The economic effect from the latter event is the signal associated with different investors' interpretation about the quality of audit services provided by the auditor. Investors are observed to utilise the auditor change/switch announcements to revise their expectation of the firm's expected future cash flows, and hence its share prices. A change to higher prestige auditors might be perceived as an improvement in audit services and hence an expected positive revaluation effect may result. Similarly, a change to lower prestige audit firms might be perceived as negative news. Evidence (Nichols and Smith 1983; Eichensher *et al.* 1989) suggests that larger audit firms provide higher quality audit services by offering greater credibility to clients' financial statements than the small audit firms.

Though there is substantial documentation on determinants and revaluation effect of auditor switch announcements in developed markets, there is a hardly any documented evidence on similar issues in developing markets, like Malaysia. This research examines the determinants and the revaluation effect of auditor change announcements of firms listed on the KLSE. Section 2 presents literature on the economic rational for auditor switch. Section 3 provides discussion on methodology and data collection. Section 3 is further divided into test model, abnormal returns measures and statistical tests. Section 4 provides discussion on findings for simple parametric test, logistics regression and event study methodology. The final section summarises the findings of the paper.

LITERATURE REVIEW

The theory of the firm as amended to include Agency Problem emphasises the importance of monitoring management activities. Jensen and Meckling (1976) suggest that auditing is one monitoring device that can mitigate agency costs, implying a need for independent audit services. Based on Watts and Zemmerman's (1978) work, DeAngelo (1981a; 1981b) developed a demand and supply rationale for audit quality. Audit

quality is defined as the probability that an auditor will both discover the breach of contract (material mis-statement) and subsequently actually report it. It is implied that auditors specialise in supplying various level of audit quality and audit firm size is an effective surrogate for audit quality. Firms change their auditors to ensure a desired quality of audit service.

An analogy from product differentiated hypothesis is that firms use auditor choice as a signalling device to reveal their desirable characteristics. Investors incorporate the arrival of new information (choice of quality auditor) and re-evaluate the firm's value. Investors are willing to pay a relatively higher price for better performing firms. Holthausen and Verrecchia (1990) suggest that firms appear to signal their *ex ante* uncertainty by hiring a higher prestige audit firm to perform their audit. This signal is credible to the market since the auditor's compensation is higher exhibiting firm-specific reputation capital. Firms with unfavourable information would prefer a lower quality auditor.

The literature on auditor change documented in the developed markets offers several explanations for factors affecting both switching and its affect on share revaluation. Early work on these issues by Burton and Robert (1967) and Carpenter and Strawser (1971) provide evidence on the determinants of auditor switch decisions. They documented a positive relationship from changes in management, changes in new financing and switching auditor.

Qualified audit reports are important in determining auditor switch. Managers strategically use switch decisions to avoid any unfavourable information release to investors (Chow and Rice 1982; Crawswell 1988; Dye 1991; Citron and Tafler 1992). However, the findings of Gul *et al.* (1991) and Takia *et al.* (1993) did not support this notion. Other factors include the demand for additional audit service (Burton and Robert 1967; Lurie 1977), firms' growth (Lingbeck and Rogow 1978), financial distress (Schwart and Menon 1985; Dhaliwal and Schwartzberg 1993), and the importance of audit fee to corporate management decision (Bedingfield and Loeb 1974; Ettredge and Greenburg 1990).

There is evidence of a significant relationship between firm size, growth and choice of auditor (Healy and Lys 1986; Johnson and Lys 1986; Simunic and Stein 1987). In general, firm size increases contribute to agency costs since it creates a vast opportunity for managers to consume non-pecuniary benefits thus resulting in a demand for a quality audit firms (Tier 1) (Fama and Jensen (1983a; 1983b)). Alternatively, Johnson and Lys (1986) argue that fixed investment in the auditor error detection technology leads to specialisation in market segment and difference in technologies and cost function across market segments are likely to be reflected by difference in audit firm's size (Francis and Wilson 1988). Palmrose (1984), Eichenseher and Shields (1986), Johnson and Lys (1990) showed a positive association between leverage and choice of Tier 1; negative association for Tier 1 audit firms which underwent merger activities (Healy and Lys 1986). Healy and Lys also assert that clients who issue new debt securities remain with Tier 1 audit firms to take advantage of its reputation and thereby lower investors' information costs in assessing the investment quality. Francis and Wilson (1988) provide support for an hypothesised association between agency costs and choice of brand name after controlling for growth and client size.

Evidence of market reaction on auditor switch decision is inconclusive. Fried and Schiff (1981) examined the disclosure requirement by SEC and the degree of market reaction to such disclosures surrounding the auditor changes. The findings suggest a negative effect on average. The literature offers several explanations for negative revisions in stock prices, which, among others include, substantial direct and indirect cost associated with auditor switch and investor perception of poor economic prospect of firm's operating, financing and performance. Dupuch and Simunic (1982) suggest that firms switching to higher prestige audit firms will yield a positive response while switching to lower prestige audit firms will have negative response from market participants.

Smith and Nichole (1982) documented a dispute over accounting and auditing principles with auditors prior to the auditor switch and those of client firms which did not disclose any dispute. A systematic price decline was reported surrounding the auditor switch for a client firm which reported a dispute with the auditor.

Johnson and Lys (1990) examined the market reaction to voluntary auditor changes

and reported no price reaction. Davidson and Gribbin (1995) documented a negative abnormal return to the announcement of auditor change and postulated that it might be due to the market's lack of confidence about the motive for the change. John *et al.* (1999) showed a negative market reaction to auditor resignation and suggested that auditor resignation from office is likely to be a cost signal for audit firms particularly when a client firm is a listed company.

DATA AND METHODOLOGY

One hundred and thirty-five firms that switched their auditors over the period 1986 to 1996 were sampled. The complete data set for all analysis was available for 108 firms. The sample was verified using annual reports and announcement dates for auditor changes were obtained from the minutes of the annual general meeting. The revaluation effect of auditor switch was analysed using stock prices and Composite Index values extracted from the daily diary of KLSE.

Following Zurada *et al.* (1998), the logistic regression model is used to analyse the decision to change, retain auditor or (switch to higher or lower prestige audit firms). This model avoids normality assumptions when the dependent variable is dichotomous and produces highest classification accuracy for the traditional dichotomous response variables. The functional form of a logistic cumulative density function:

$$P\ (Y= 1|X) = \exp\ (\Sigma\beta_k\ X_k)/[1+\exp(\Sigma\beta_k\ X_k)] \quad (1)$$

The unknown parameters (α, β) are estimated using Maximum Likelihood Estimators (MLE) in contrast to ordinary regression models which are estimated by the method of Least Squares Estimators (OLS). Since the likelihood equations for logit equations are non-linear in the parameters to be estimated, algebraic solutions are not obtainable and therefore approximation by standard iterative algorithms is used.

Test Model

Parametric Test

The parametric test of the differences in the mean value of the characteristics of sampled firms (firms changing their audit firms) and control firms (client firms that did not change their audit firms) was conducted. The characteristics are turnover, average asset, acquisition, of fixed asset return on asset, leverage and liquidity position of the firms. A similar test was also conducted to examine the difference among client firms associated with quality differentiated audit firms.

Auditor Change Model

The stepwise logistic regression technique was selected to ascertain the important determinants of audit switch decision. The functional form of the regression equation is as follows:

$$Z = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 \ldots + \beta_kX_k + \varepsilon \quad (2)$$

Z= A with A = 1 or 0 indicating that a client firm did (1) or did not switch auditors (0). X = the variables identified for the model. These are management change (MGTCH), average acquisition of fixed asset to total asset (ACQUI), turnover growth (GROWTH) both prior and after the auditor switch, liquidity (LIQ), firms leverage (LEV), average returns on asset (AROA), average earnings per share (EPS), qualified audit report both prior and after the auditor switch.

Change in management could serve as principal-agents contractual arrangement as new management could demand for the replacement of an incumbent auditor with a new one with whom it has favorable dealings in the past and who will bring new ideas that is instrumental to the firm's expansion policy. This is measured by taking value of one if there is a change in management or zero otherwise. Rapid growth could be a measure of principal-agent contract. Clients who are constantly acquiring subsidiaries and expanding into new markets would demand new auditors who are more effective in discharging auditing service. Rapid growth is measured by percentage changes in turnover growth three years prior and three years after the auditor switch. Auditor effectiveness is measured by the size of the audit firm, that is whether the audit firm is a member of higher prestige auditor or otherwise prior to the auditor change. This measured by taking the value of one if pre-switch audit firm was a member of higher quality (Tier 1) audit firm or 0 for otherwise. Client firms whose reputation is tarnished by its poor performance, corporate management will try to change auditors to avoid

any unfavourable information disseminated to the capital market. A qualified report, average return on asset, average earnings per share and liquidity of the firms are used as proxy for client's reputation. Qualified audit report is a binary variable which takes the value of 1 if auditor issued qualified report one or two years prior to or after auditor switch or otherwise. An operational variable such as audit fees takes the value of 1 if there is a reduction in audit fee subsequent to auditor switch or otherwise.

Auditor Choice Model

The analysis of the firms' characteristics and the direction of auditor changes (Tier 2 to Tier 1 audit firms and vice versa) are done using logistic regression model. Previous studies (Johnson and Lys 1990; Francis and Wilson 1988) used similar models to determine the characteristics of the firms which are associated with direction of the auditor changes. The hypothesised relationship may be expressed as follows:

$$Y_j = \alpha_{j\iota} + \Sigma\lambda_j X_j + \varepsilon_{j\iota} \qquad (3)$$

where

Y_j = 1 indicating firms switching to higher prestige (Tier 1) audit firms and 0 indicates firms switching to less prestige (Tier 2) audit firms.

X_j = predictor (independent) variables, and

$(\lambda_1, \lambda_2, \lambda_3, \ldots, \lambda_k)$: the coefficient of the predictor variables.

Variable Measurements

The frequently used variables to proxy for the firm's change in activities over time are asset growth, asset size, turnover growth, changes in acquisition, firm's leverage, changes in financing, changes in operating cash flow, and average returns on asset.

Expansion: Expansion entails increasing in scope, geographical dispersion and volume of client's activities. The corresponding increase in quantity and complexity of accounting transactions results in economies for larger auditors, which provide high quality audit service (De Angelo 1981). The expansion or contraction is proxied by four operational variables namely annual growth in total assets three years prior to and three years after the switch: it is indicated as GRTHB and GRTHA respectively. Changes in average acquisition of fixed to total asset is abbreviated to CHACQ and annual growth of sales prior to the switch is abbreviated to TURNGRTHB. Therefore, the larger the size of the client's growth, the greater the demand for the services of larger audit firms.

Financing: The operational variable to proxy financing is estimated from newly issued debt and equity ratios measured as "Long term debt + Equity)/Total Asset" abbreviated to CHFA. Firms that change to larger audit firms are predicted to exhibit a higher level of post-audit changes in financing compared to ones that change to smaller audit firms (Johnson and Lys 1990). We expect a positive correlation between a firm's financing activity and the choice of higher prestige audit firms.

Profitability: The profitability of the firm is measured by two operational variables: average returns on asset (AROA) and average cash flow (ACFL). If poor returns and cash flows are exhibited prior to the event, client firms are likely to change to smaller audit firms. Therefore, the profitability prior to the auditor change should be positively correlated with auditor size.

Audit Risk: The audit risk relates to the probability of an auditor issuing unqualified opinion on materiality of mis-stated financial statements. It is difficult to measure audit risk objectively and accurately. No single proxy for audit risk is considered adequate. However, it appears to be related to client's business risk (Simunics and Steins 1987). The business risk is proxied by two operational variables namely, client firm's size (SIZE) measured by total assets and leverage (LEVR) both prior to and after auditor changes. An increase in client size entails a wider geographical dispersion and scope; therefore clients need the services of larger audit firms that have competitive advantage over the smaller firms. Higher leverage client firms would pose higher levels of financial risk, therefore, it is likely that firms with higher risk will engage the services of larger audit firms that have greater expertise to analyse the situation resulting in greater credibility to the reports.

Market Model

The standard Market Model (Sharpe 1964) is used to estimate the expected returns and average excess returns. The model expressed as follows:

$$R_{it} = \alpha_i + \beta_i Rm_t + \upsilon_{it} \qquad (4)$$

where

$$R_{it} = \frac{P_{it}-P_{it-1} + D_t}{P_{t-1}} \times 100$$

$$R_{mt} = \frac{C - C_{t-1}}{C_{t-1}} \times 100$$

R_{it} : the rate of return of the ith stock on the period t

P_{it} : stock price i at period t

P_{it-1} : stock price i at period t-1

D_{it} : Cash dividend paid to the shareholders

α : the constant average return while market yields zero returns

β : beta estimate

υ_{it} : Residual or random noise term assumed to have property of $\upsilon_{it} \sim (\sigma,\sigma^2)$

R_{mt} : the rate of returns on the market portfolio (Composite Index) for period t C_t and C_{t-1} are the values of Composite Index at period t and t-1.

To estimate the parameters of the market model, 60 monthly observations from outside the analysis period (event window) are used to avoid any misestimates of the market return around the event dates. Market Model parameters are adjusted for non-synchronous trading problem caused by thin trading using Scholes and Williams (1977) two lag and two leads model.

Abnormal Returns Measures

Abnormal returns or residual returns are prediction errors. The abnormal returns for a given share price at any time period is the difference between the actual returns and the expected returns.

$$\upsilon_{it} = R_{it} - (\alpha + \beta Rm_t) \qquad (5)$$

The average excess returns are:

$$AR_{it} = 1/N \sum U_{it}$$

N : number of sample companies across the sub-sample

AR_{it} : average abnormal returns for companies at period t

If $AR_t > 0$ and statistically significant, it indicates that the market on average reacts positively to the event and thus increases the wealth of the shareholders. To observe the cumulative effect, cumulative abnormal returns (CARs) were calculated by summing up the AR_t over various time periods of interest:

$$CAR = \sum_{-K}^{+K} AR_t \qquad (6)$$

where

$CAR_{K, L}$ = is the cumulative abnormal returns for cut-off point over the window period from K to L.

-K,...+K refer to event window surrounding auditor changes.

Statistical Tests

Individual Coefficient Estimates

To measure the relationship between the exogenous variables, X, and dichotomous response variable, individual estimate is tested. Thus this test statistics is defined as

$$t-_k = B_k/S_k$$

Where the S_k is the standard error of the coefficient and B_k is the coefficient of the individual variable in the model.

Goodness of Fit Test

In normal regression analysis, F statistics can be used to test the joint hypothesis that all coefficients except intercept is zero. A corresponding test in logistic regression that serves the same purpose is based on Likelihood Ratio. The functional form of Likelihood Ratio is as follows:

$$\lambda_{LR} = -2\left[\ln \ell(\hat{\beta}) - \ln \ell(\hat{\beta}^*)\right]$$

where

$\ln \ell(\hat{\beta})$ is the value of the likelihood function for full (unrestricted) model and $\ell(\hat{\beta}^*)$ is the maximum value of the likelihood function if all coefficients except the intercept (restricted), are zero.

The method produces a statistics that follows approximately a Chi-square distribution with k-1 (k being the number of independent variables) degree of freedom if the joint null hypothesis is true. If the alternative hypothesis were to be

accepted, λ_{LR} becomes larger. If null hypothesis is to be accepted, $\lambda_{LR} < \chi^2$

RESULTS

Differences in Characteristics of Switch and Non-switch Firms

Table 1 presents the test results on the characteristics of client firms that switched their auditors and those of control firms that did not switch their auditors over a period of five years (2 years proceeding and 2 years after the auditor switch). These are based on mean differences respectively for (a) size, (b) turnover growth, (c) returns on assets, (d) leverage of the firms, (e) acquisition of fixed asset to total asset and finally the liquidity position of the two groups. A simple parametric test was used to observe the differences in the firm's characteristics associated with switch and non-switch groups. The results suggest that both switch and non-switch groups are distinctly different from one another in a number of dimensions. For instance, the turnover growth of firms that switched their auditors is significantly larger than those that did not switch auditors over the same period. The mean values of the turnover growth over the 5-year (two years prior and two after the auditor) period for the two groups were recorded as 130 percent and 70 percent, respectively. Meanwhile, the average return on assets (ROA) of the two groups over the same period is 3.4 percent for firms that switched their auditors and 5.1 percent for non-switch firms, though not statistically significant (t-value = −1.4). The observed differences on average acquisition of fixed assets to total assets registered a marginally higher rate for firms that switched auditors, for example, the average acquisition of the two groups was 7.5 percent and 6.1 percent respectively. The differences on asset sizes, leverage and liquidity of the two groups were small and not significant at the conventional level.

Determinants of Auditor Switch

To provide an objective framework, the variables for the determinants of auditor switch were derived from agency theory and others in the accounting literature. These are turnover growth (TGROWTHB) prior to auditor switch and after (TGROWTHA), average acquisition of fixed assets to total assets (ACQ), return on assets (ROA), average earning per share (EPS), change in audit fees (AUDF), management change (MGTCHG), audit report both prior (RPORTB) and after (PRORTB) the switch, firms leverage (Leverage), liquidity of the firms (LIQ) and audit type (AUTYPE)

Table 2 presents the results of the logistic regression model explaining the determinants of auditor switch firms. Initially 13 variables were analysed using maximum likelihood estimation procedure in stepwise logistic regression based on centred data. In initial step, stepwise regression identified GROWTHB, GROWTHA, MGTCHG AND ROA as significant variables. However, in the final step, the procedure selected only three variables (GROWTHB, GROWTHA, and MGTCHG) which met the 0.10 and 0.05 levels of significance for inclusion in the final model. The chi-square value for overall model was 25 with 3 degrees of freedom (significant at the .0001 level). Based on the findings in Table 2, the joint null hypothesis (that is, all the slope coefficients are simultaneously zero) cannot be accepted. The results support the notion that auditor switch decisions of listed firms in Malaysia are mainly determined by management change, and turnover growth both prior and after auditor change. The coefficient of the explanatory

TABLE 1
Simple parametric test for mean difference between switch and non-switch sample

Characteristic	Mean Switch	Mean Non-switch	t-value
Size (RM)	617890 (000)	558508 (000)	0.28
Sale growth	1.30	.70	1.736*
ROA	.034	.051	-1.451
Leverage	0.4325	0.4221	0.309
Liquidity	1.82	1.76	.259
AvAcq	.075	.06	.78

* Marginally significant at 10 percent level

variables are consistent with theory and findings as reported in Burton and Robert (1967), Linbeck and Rogow (1978) and Takiah *et al.* (1993). Burton and Robert document a significant association between change in management and replacement of new auditor. Consistent with Takiah *et al.* (1993) in the Malaysian context, this study could not establish any significant relationship between qualified opinion and subsequent auditor switch. It also confirms the conclusion drawn by Takiah *et al.* (1993) that having profit or losses over the years does not necessarily influence the switch of auditor in Malaysia.

It must be noted that though qualified audit opinion was most strongly associated with auditor change in the US (Chow and Rice 1982), Australia (Craswell 1988) and Hong Kong (Gul *et al.* 1991), it is not a significant determinant of auditor change in Malaysia. Similarly, the findings could not establish any significant relationship between audit fee and change in audit firm, inconsistent with documented findings (Eichenseher and Shields 1983); Bedingfield and Loeb 1974).

Changes in Firm's Characteristics and Choice of Audit Firms

Table 3 summarises the descriptive statistics for firms that switch to Tier 1 audit firms and those that switch to Tier 2 audit firms. The results are for mean differences of the following variables: turnover growth, asset size, growth of asset, leverage, returns on assets, financing activities and average acquisition to total assets. There are some noticeable differences. The average turnover growth of firms that switched to Tier 1 auditor are comparatively higher than firms that switched to Tier 2 auditor recording 54 percent and 45 percent respectively, 2 years preceding the auditor change.

Meanwhile, the average asset growth before the auditor change for firms that switched to Tier 1 audit firms is higher than firms that switched to Tier 2 audit firms, recording at 50 percent and 42 percent respectively. And the

TABLE 2
Regression results on determinants of auditor switch

Vars	p-value	Model specification	Percent	
MGTCHG	.05**	Ch-Square	25.00**	(p=.000)
TGROWTHB	.07*	Classification rate	64.00	
TGROWTHA	.012**	Prediction Rate		
		Switch Group	72.00	
		Non-Switch Group	51.43	

** significant at 5 percent level. * significant at 10 percent level.

TABLE 3
Test of differences between switch to tier 1 and switch to tier 2 firms

Characteristics	Mean	Mean	t-value
Turnover growth before	.5455	.45	.27
Size before ('000)	624624	144632	2.52*
Size after	1108536	316577	2.35*
Asset growth before	.506	.418	.3117
Asset growth after	.597	.58	.049
Leverage before	.4436	.3496	1.7**
Leverage after	.4436	.37	1.6
ROA before	.041	.05	.455
Financing before	.452	.489	-.529
Financing after	.421	.40081	.393
Acquisition before	.07938	.0539	1.565

* 5 percent significant level
**10 percent significant level

size of the asset for client firms that switch to Tier 1 are significantly larger than firms that switched to Tier 2 audit firms. The average acquisition before the auditor switch is recorded at 7.9 percent for firms switching to Tier 1 audit firms and 5.39 percent for firms that switched to Tier 2 audit firms. Furthermore, firms that switched to Tier 1 auditor exhibited higher leverage than those that switched to Tier 2 audit firms, significant at 10 percent over. The return on assets for firms switching to Tier 2 audit firms is higher, registering 5 percent over those switching to Tier 1 audit firms recording 4.1 percent, but not statistically significant at the conventional level. This finding suggests some significant differences in the characteristics of firms that switched to Tier1 and Tier 2 auditor firms respectively.

Table 4 summarises the results of changes in firm's characteristics and choice of auditors using logistic regression. Initially asset size, asset growth, turnover growth, return on assets, change in operating cash flow, leverage, change in financing activities and changes in acquisition were included in the analysis.

The stepwise procedure retained 4 variables (LEVA, CHFA, GRTH, CHACQ which are statistical signal) in the analysis. The results indicate that the choice of auditor exhibits a significant positive association with changes in financing activities, leverage after the auditor changes, and growth in assets before the switch, while a significant negative association is reported for change in acquisition. Though asset size for client firms that switched to Tier 1 significantly differs from client firms that switched to Tier 2 audit firm, the regression analysis fails to exhibit a significant association between asset size and audit choice. It is only significant at 21 percent level. The coefficients of the variables are consistent with theory except for turnover growth. The negative coefficient for change in average acquisition demonstrates that firms that switch to Tier 1 auditor exhibit a higher level of average acquisition to total asset during the pre auditor change period compared to the post period, consistent with the summary findings in Table 2.

The significant positive coefficient for leverage after choice of auditor indicates that higher leverage firms pose a higher level of financial risk and increases in agency cost of debt. To allow for this possibility, client firms would engage the services of high quality (Tier 1) audit firms, who have greater expertise to analyse the situation and give greater credibility to the financial reporting than a small audit firm would. Meanwhile, evidence of a positive relationship between changes in financing activities and choice of Tier 1 audit firms showed that firms switching to Tier 1 audit firms exhibit a higher level of post-auditor change financing to increase the marketability of new securities (both debt and equity). Furthermore, the documentation of positive relationship between firms' asset growth and choice of auditor suggest that rapid growth entails substantial increases in traction volume and accounting complexity, and decentralisation of financial controlling system thus requiring the services of larger audit firms presumably having the expertise to provide specialised services. The large audit firms do have a cost competitive advantage over smaller audit firms.

The summary results show that the average acquisition for firms that switch to Tier 1 auditors are relatively higher than firms that switched to Tier 2 auditors, although the average acquisition tends to decline for former group in the post-switch period. Thus the joint-hypothesis (all the slope coefficients are simultaneously zero) can

TABLE 4
Result of the logistic regression analysis

Variables	p-value	Model specification	Percent
CHACQUI	.008	Chi-Square	17.46*
CHFA	.03	Classification Rate:	
GRTHB	.024	Overall	81.2
LEVA	.048	Switch to Tier1	95.8
TURNGB	.288	Switch to Tier2	44.4
SIZEB	.221		

* significant at 5 percent level

be rejected with a chi-square value of 17.46 with a 6 degree freedom (p=. 0069). The model correctly classifies for 81.2 percent. Earlier studies on auditor choice have documented inconsistent results on the association between clients' characteristics and direction of auditor change. The findings of this study are more consistent with the hypothesis that firms that are expected to raise debt financing demand the services of high quality auditors to monitor management activities that are detrimental to the bondholders. The leverage was hypothesised to be positively associated with the choice of Tier 1 by Palmrose (1984), Eichenseher and Shield (1986). The findings of a positive coefficient for the change in financing activities after the auditor change indicates that firms which are expecting to issue securities in the near future demand the services of Tier 1 auditors to attest credibility to the financial reporting to market participants. This is consistent with the findings of Carpenter and Strawser (1971). They asserted that firms may change auditors especially from a Tier 2 to Tier 1 auditor to increase the marketability of the new securities (debt and equity issue). Consistent with the study of Johnson and Lys (1990), this study also documents asset growth before and after auditor change, change in financing activities and change in acquisition as the major determinants of choice of auditors. However, contrary to Johnson and Lys (1990), this study documented a negative association between change in acquisition and choice of auditor. The finding of negative coefficient indicates that pre-switch acquisition for clients firms that switch to Tier 1 audit firms is comparatively higher than clients firms that change to Tier 2 audit firms.

The Wealth Effect of Auditor Switch Decision

Table-5 summarises the average abnormal returns (ARs) and cumulative abnormal returns (CARs) around the announcement day over a window of 81 days. Average daily excess returns and cumulative abnormal returns were examined for statistical significance using standard test procedure.[1] Findings indicate that auditor change on average are not associated with significant price adjustments in Malaysia. Average abnormal returns on the day of announcement itself and the 3-day (–1 to +1) excess returns are 0.092 percent and 0.0461 percent respectively. These are not statistically significant. The cumulative abnormal returns over the days (–60 to –8) and (–8 to –1) are 0.018 and 0.62 percent respectively. Post-announcement CAR over the days (1 to 8) and (8 to 20) are 0.43 percent and 0.25 percent respectively. However, none are statistically significant at the conventional level.

The client firms that switched to higher (lower) quality audit firms experienced positive excess returns at day zero of 0.12 percent and 0.69 percent respectively. The 3-day (-1 to +1) excess returns for firms that switched to lower quality audit firms recorded -0.29 percent. However these are not significant at the conventional level. The pre-announcement CAR for client firms that switched to higher quality audit firms over the days (-8 to –1) recorded a net gain of 2.25 percent with a t-value of 1.84. However, the CAR at post announcement period over the days (1 to 8) and (8 to 20) declined, recording cumulative abnormal returns of percent and –2.00 percent respectively. But none are statistically significant.

Market on average reacted negatively to client firms that switched to a lower quality auditor. The CAR over the day (-60 to -8) recorded a cumulative 0.12 percent, which is not statistically significant. However, pre-announcement CAR over the days (-8 to –1) recorded a net loss of 4.56 percent, which is marginally significant at 10 percent level. CAR in post-announcement period over the days (1 to 7) and (8 to 20) recorded a net gain of 1.68 percent and 0.13 percent respectively. However, these are not statistically significant at the conventional level.

The revaluation of auditor change type within classes is more ambiguous and there is no clear-cut direction of price changes. However, overall it appears to suggest a common stock price decline surrounding the auditor change. The average abnormal returns on the day of announcement and three days (-1 through +1) excess returns for client firms that switched from higher prestige to higher prestige audit firms

1. t-AR = ARt-0/SE(AR), t-CAR=CAR_{KL}/SE (CAR_{KL}), where SE(AR) = standard error of AR and SE(CAR) = standard error of CAR and (K.L) = cut-off point from K to L during window period

TABLE 5
Market reaction to auditor switch announcements

Trading day	Full sample AR	Tier 2-Tier 1 AR	Teir1-Tier 2 AR	Tier 1-Tier 1 AR	Tier 2-Teir 2 AR
-10	0.00146	-0.00296	-0.00294	-0.00275	0.00392
-9	-0.00147	-0.00053	-0.00812	-0.00126	-0.00344
-8	0.00019	0.00311	-0.014**	-0.00034	-0.01363
-7	-0.00392	-0.00247	-0.01710	-0.00182	0.00713
-6	0.00210	0.00781	-0.00365	0.00015	0.01354
-5	0.0054*	0.00686	0.01126	-0.00173	-0.00436
-4	-0.00073	-0.00045	-0.019**	-0.00380	0.02316
-3	-0.00019	0.01151	-0.02414	0.00186	-0.00629
-2	0.00390	-0.00093	0.021**	0.00034	-0.00480
-1	-0.00065	-0.00415	0.00005	-0.00291	0.00132
0	0.00228	0.00116	0.00690	-0.00161	0.00014
1	0.00095	0.00016	-0.00431	0.00111	-0.00295
2	-0.00042	0.00022	-0.00600	0.00180	-0.01657
3	-0.00087	-0.00484	0.00078	0.00133	0.0128*
4	-0.00213	-0.00326	0.00794	-0.00597	-0.00999
5	0.00340	0.00474	-0.00509	0.00548	-0.02116
6	0.00503	0.00514	0.022**	0.00403	0.01335
7	-0.00119	-0.00329	0.00202	-0.00001	0.00385
8	-0.00040	-0.00611	-0.00072	0.00820*	-0.00621
9	-0.00302	-0.00306	-0.00536	-0.00556	0.00227
10	0.00038	-0.00347	0.00575	0.00371	0.00479
CAR					
(-60 to -8)	0.00018	.0595*	0.00117	-0.031	-0.0358
(-8 to -1)	0.00618	.0225*	-0.04568*	-0.0098	0.00462
(1 to 7)	0.0043	0.00002	0.0168	0.0078	-0.02062
(8 to 20)	0.0025	-0.0288	0.00132	0.0168	-0.04628

* significant at 10 percent level
** significant at 5 percent level

recorded at -0.161 percent and -.34 percent respectively. These are small and insignificant. The CAR over the days (-60 to –8) and (-8 to –1) recorded a loss of 3.1 percent and .98 percent respectively, which are not statistically significant. The revaluation effect of auditor change from Tier 2 to Tier 2 reported a weak negative market reaction. Though significant positive and negative abnormal returns were reported, none of the day zero and three-day (-1 to+1) excess returns were significant, recording at 0.014 percent and -0.034 percent respectively. The CAR over the day (-60 to –8) and (-8 to –1) registered a cumulative return of –3.5 percent and 0.46 percent respectively for the Tier 2 to Tier 2 switch sample. CAR during the post announcement recorded over the (1 to 8) and (8 to 20) were –2.06 percent and –2.5 percent respectively. However these findings are not statistically significant.

To substantiate existing literature, further analysis was done to determine whether firms belonging to different levels of financial condition, and switched audit firms resulted in different market reaction. The financially healthy firm that switched audit firms resulted in a positive market reaction while financially unhealthy firms that switched audit firms resulted in a significant negative reaction surrounding the auditor changes. For financially healthy firms, the ARs for the day of announcement and 3-day (-1 to +1) excess recorded at -0.5 percent and -0.03percent respectively. Pre-announcement CAR over the days (-60 to 8) and (-8 to –1) registered a net gain of 0.63 percent and 1.53 percent respectively, but these are statistically insignificant. Post-announcement CAR over the days (1 to 8) and (8 to 20) were at 1.09 percent and –1.15 percent respectively. While CAR for financially unhealthy firms that switched auditors

over the (-60 to –8) and (-8 to –1) recorded a net loss of 15.8 percent and 1.4 percent respectively. These are not statistically significant at 10 percent level.

The revaluation effect of auditor change for client firms that received a clean opinion reported a weak positive market reaction surrounding the auditor change. The ARs for announcement day and 3 days (-1 to +1) were at 0.16 percent and .009 percent respectively. The pre-switch CAR over the days (-60 to –8) and (-8 to 1) are recorded as net gains of 1.5 percent and 0.25 percent respectively. But none are statistically significant. The post-switch CAR over the interval (1 to 20) reported a net gain of 0.11 percent. This is apparently consistent with Teoh's (1992) contention that firms will experience a positive reaction after a clean opinion than qualified opinion, because high value retention is more common after clean than qualified opinion. But none are statistically significant.

Judging from the market reaction to auditor changes, there is weak evidence that the market indeed perceives auditor change as a signal. Thus, auditor switch in this emerging capital market conveys information value associated with auditor change, but due to unknown reasons, are not producing the significant effect normally reported in some developed markets. The demonstration of weak positive market reaction reflects that an increase in firm value appears to occur, and it is not a negative market reaction documented in earlier literature from the developed markets. Observing significant cumulative abnormal returns for client firms that switch to Tier 1 audit firms prior to auditor change reflects a confirmation of quality shift also observed in other markets.

CONCLUSION

The issue of auditor has been of interest to academics, researchers and industry experts due to its strategic implication for firm value, credibility of financial reporting and monitoring costs to curtail agency costs. Despite the concerns shown in developed economies, little attempt appears to have been made in Malaysia to examine such an important issue in this fast growing economy. Thus, this paper is a modest first attempt that ascertains the determinants of auditor switch decision and its effect on share valuation of firms listed on the Kuala Lumpur Stock Exchange. Logistic regression and event study methods were used to analyse the data.

In general, findings appear to suggest that auditor switch in Malaysia is determined by changes in management and higher turnover growth. Changes in firms' characteristics such as asset growth prior to auditor switch, changes in average acquisition of fixed assets to total assets, firm's leverage, and changes in financing activities were found to be significantly associated with choice of quality differentiated audit firms.

Auditor change in general is not associated with any significant price adjustment coinciding with the announcement of auditor switch, despite a positive trend in upvaluation of such firms. However, once portfolios were formed based on the auditor change types, different results emerged. Firms that switched to higher quality audit firms experienced positive (though weak) market response while negative reaction is observed for firms that switched to lower quality audit firms. The revaluation effect from shifts within classes exhibits weak negative abnormal returns. An interesting difference in the findings of this study and those of similar studies reported in developed economies is that there is a weak positive abnormal market reaction anomalous to those reported in the developed economies. This could be due to the positive development at firm's level and significant upsurge in the Malaysian economy, which had registered average GDP growth of 8-9 percent over the test period. Alternatively, there are some still unknown missing variables confounding the results.

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Alignment of Management Control System to Corporate Competitive Orientation: Some Empirical Evidence in Malaysia

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Keywords: management control system; accounting control measures; management practices; corporate strategies; intensity of competition; competitive priority or orientation

ABSTRAK

Dengan perubahan pantas dan persaingan yang begitu hebat di persekitaran, peranan sistem kawalan pengurusan di sesuatu organisasi dalam penyediaan maklum balas maklumat kepada pihak pengurusan untuk mengawas keberkesanan dan kesesuaian strategi persaingannya untuk mencapai matlamatnya menjadi lebih mustahak. Kajian ini meninjau cara penggunaan pelbagai kaedah kawalan pengurusan dan kesepadanan kaedah kawalan ini dengan keutamaan atau orientasi persaingan firma-firma. Satu soal selidik disediakan dan dikirim secara rawak kepada 250 organisasi di Lembah Klang. Sebanyak 93 borang soal selidik dipulangkan dan dianalisis. Keputusan kajian ini menunjukkan bahawa pada keseluruhannya, organisasi-organisasi berpendapat persaingan berasaskan harga, kualiti, dan perkhidmatan/promosi keluaran mereka adalah lebih hebat dibandingkan dengan persaingan berasaskan kepelbagaian dan inovasi keluaran. Selaras dengan pendapatan mereka tentang kehebatan persaingan, keutamaan atau orientasi persaingan mereka juga lebih menumpukan kepada persaingan berasaskan harga rendah, kualiti atau perkhidmatan yang tinggi dan kurang menumpukan kepada kepelbagaian dan inovasi keluaran. Penggunaan di antara kawalan perakaunan dan amalan pengurusan moden untuk mengawas, menilai dan mengawal aktiviti organisasi adalah lebih kurang seimbang, kecuali terdapat kawalan kewangan melalui perbandingan prestasi sebenar dengan belanjawan luas digunakan. Perusahaan kecil menubuhkan sistem kawalan pengurusan secara kurang formal dan mereka juga tidak begitu mementingkan penggunaan kaedah kawalan pengurusan jika dibandingkan dengan perusahaan besar. Bukti ketidaksepadanan penggunaan sebahagian kaedah kawalan pengurusan ditandakan dalam kajian ini. Implikasi keputusan kajian ini dibincangkan.

ABSTRACT

With the rapidly changing and increasingly more competitive environment, the role of a management control system (MCS) in an organization in providing information feedback to management for monitoring the effectiveness and appropriateness of the organization's competitive strategy to achieve its goals is becoming more important. This study examines the extent of usage of various management control measures and the compatibility of these control measures with the competitive priorities or orientations of firms. A structured questionnaire was prepared and randomly sent to 250 organizations in the Klang Valley. A total of 93 usable responses were analyzed. The results show that organizations, generally, perceived competition based on product price, quality and service/promotion to be more intense than that based on product variety and innovation. Consistent to their perceived intensity of competition, their competitive priorities or orientations also stressed more highly on competition based on low price, high quality and service, with a much lower emphasis on wide product variety and product uniqueness. Except for an apparent pervasive high usage of the "budget vs. actual" financial control measure, there was a fairly balanced usage of accounting-based controls and modern management practices for monitoring, evaluating and controlling the organizational activities. Small enterprises tended to adopt less formal management control systems and had less extensive usage of the various control

measures than the large firms. Evidence of a lack of proper alignment or incompatibilities in the usage of certain management control measures was indicated in this study. The implications of the findings are discussed.

INTRODUCTION

The advancements in information technology and the imminent trend towards trade liberalization (or globalization) have significantly changed the environment in which businesses now operate and intensified competition in the market place. As a consequence, new competitive strategies are being formulated and organizational structures, as well as the related monitoring and control systems, are continuously modified to support the new strategies. In the past when business environment was relatively stable and competition was minimum, the management control system (MCS) was designed to rely heavily on accounting or cost information to monitor and control cost efficiency of daily operating activities. The traditional management accounting control system with its high emphasis on accounting and cost control measures, generally, loses its robustness when the business environment becomes less stable and more uncertain (Otley 1980). Management control system has to play a more strategic role in the current rapidly changing and highly competitive business environment. Its major role is to effectively monitor the organization's strategy implementation and progress, and to provide information feedback on the appropriateness of the existing strategies for attainment of the organization's goal(s). There is evidence that business enterprises, which match their internal structures and control systems with their strategies, may achieve high performance (Govindarajan and Gupta 1985; Chenhall 1997).

Empirical evidence on the effects of strategy on management control systems or how these control systems influence strategy and specifically, how top management could organize and use the control systems to assist the attainment of the corporate goals or objectives, is still scarce (Simons 1990). In fact, empirical studies on this issue only began to emerge in the 1990s (Langfield-Smith 1997).

With the growing interest in the relationship between management control system and strategy, the definition of management controls has been broadened to encompass both the accounting-based and non-accounting-based controls that are instituted for the attainment of long-term strategic goal(s) of an organization. Most of the literature on the effect of strategy on the design of management control system or vice versa has been normative in nature (Miles and Snow 1978; Porter 1980; Miller and Friesen 1982). Relatively few studies have examined the empirical relationships between corporate competitive priority or orientation and usage of management control measures or practices in the lesser-developed economies, like Malaysia[1]. Besides, the existing empirical evidence on the relationships between strategy types and management control system attributes, and environmental characteristics is generally limited, mixed and inconclusive (Sim and Teoh 1997; Langfield-Smith 1997). With the impending threats arising from globalization of the market place, management of business enterprises must take heed of the need to design the "right" management control systems to manage their emerging strategies for competitive advantage in the new environment (Simons 1990). This is especially critical for firms in the lesser-developed countries due to their relative disadvantages in both financial resources and human skills. A proper matching of management control system and competitive strategy is necessary to enable the management of an organization to obtain the relevant information feedback to gauge the appropriateness of its corporate competitive strategy and to use the formal control feedback processes to modify its existing strategy. This study aims to provide some empirical evidence

1 Chung (1996) and Sim and Teoh (1997) examined the relationships between management control system attributes and business strategy type based on Miles and Snow's (1978) categorization. Chung's study focused on the electronics and electrical firms in Singapore; while Sim and Teoh's study was a comparative study of Australian, Singapore and Malaysian firms. This study differs from these two studies in that the current study examines for evidence of compatibility or incompatibility between a firm's competitive priority or orientation and its usage of management control measures or practices.

on the extent of usage and compatibility of management control measures or practices in relation to the competitive priorities or orientations of firms in Malaysia.

LITERATURE REVIEW

The growing interest in the relationship between management control system and strategy arises from the awareness that environment and strategy are important determinants of the management control system used in an organization. To illustrate the need to modify the traditional control system when environment changes, Hoque and Hopper (1994) provided empirical evidence, which suggests that the standard costing systems and variance analysis are ineffective and irrelevant in times of environmental uncertainty. The traditional type of management control system design, very often, is used as organizational defensive routines to protect and continue existing practices, regardless of changes in the environment. The traditional device of monitoring performance using financial budgets may not only be ineffective, but also may even be "anti-learning" (Argyris 1990), when budgets or standards are made easily achievable to cover up fundamental problems and to continue past inefficiencies. The accounting-based control system, however, can be designed to play a significant integrative role to resolve internal conflicts and facilitate flow of pertinent information, such as relevant product costing data and benchmarking information on competitors' relative performance, to arouse awareness of impending external threats and drive the need for organizational change.

Earlier research studies focus the nature and role of management control systems in different organizational types. Miles and Snow (1978) provided descriptions of control system attributes of organizations following a defender-like strategy and those of organizations following a prospector-like strategy. Due to the stable environment that a defender firm is expected to operate in, its control system is typically characterized by centralized decision-making with formalized job descriptions and standard operating procedures. A defender firm adopts a competitive pricing strategy and hence, emphasizes heavily on cost controls and other efficiency matters. Porter (1980) also suggested that tight cost controls were appropriate for firms, which followed a cost leadership strategy. In contrast, a prospector firm tends to have a flexible structure to enable it to respond rapidly to changes in its environment. Jobs in a prospector firm are normally broadly defined and standard operating procedures are often few in order to encourage innovation. Control in a prospector firm tends to be decentralized and the firm is very much results oriented. Similarly, Porter (1980) associated firms, which were pursuing the differentiation strategy, to heavy reliance of control through coordination, rather than on formal accounting-based controls, to encourage creativity and innovation. Chung (1996) found that defender firms and prospector firms placed different emphasis on control system attributes and his results were congruent with results of studies in other cultures. However, Sim and Teoh (1997) reported that several environmental and control system attributes differed by national context in their discriminant functions that was used to classify firms into the three Miles and Snow's (1978) strategic categories.

Research interests later were extended to studies that examined empirically for systematic relationships between specific attributes of the management control system and a particular corporate strategy. Daniel and Reitsperger (1991) examined on how the management control systems of Japanese automotive manufacturers and consumer electronics companies were modified to complement and support their total quality or zero-defect strategy. They found that managers adhering to zero defect strategy were more frequently provided with information feedback on achievement of quality goals, rejects and downtime than those managers, who were only adhering to economic conformance level. This finding supports their proposition that the corporate strategy that focuses on continuous improvement and reduction of defective units has to be complemented by frequent feedback on achievement of the combined goals to foster effective quality improvements. The competitive inroads experienced by Japanese automotive and consumer electronics firms in the global market may be a consequence of the consistency or alignment between their strategy on product quality and their management control system's attributes. This is in accord with the claims by Hiromoto (1988) that Japanese management accounting systems are designed to influence employees to behave in accordance with the

corporate long-term strategic goals, rather than to keep accurate product cost information. In another study by Ittner and Larcker (1997), who examined management control practices in the automotive and computer industries in Canada, Germany, Japan and the United Sates, it was found that quality-related strategic control practices tended to be used more extensively in organizations that followed quality-oriented strategy than organizations with different strategic orientations. However, their hypothesis that organizations, which have aligned their strategic control practices more closely to their competitive strategies, achieve higher performance only has mixed support. The effects of some strategic control practices on performance were found to vary with industry and several strategic control practices even exhibited negative relationships with performance. Perera, Harrison and Poole (1997) also found support for a significant association between customer-focus strategy and the use of non-financial performance measures, an attribute of management control system. However, they too found that the performance of organizations that pursued customer-focus strategy was not significantly linked to an increasing use of non-financial performance measures. The lack of a significant relationship between corporate performance and management control attributes might be due to the lagging effect and limitation of using a point-in-time measure for organizational performance.

Khandwalla (1972) provided the first empirical evidence of the relationship between management control systems and level of competition, a critical determinant of the nature of strategy adopted by an organization. He found a strong positive relationship between the intensity of competition and reliance on the formal accounting control systems. Although, his study did not explicitly consider the nature of strategy adopted by organizations, but it is implicit that organizations that face intense competition are likely to adopt strategies of a prospector (Miles & Snow 1978) or a differentiator (Porter 1980). In view of that, Langfield-Smith (1997) opined that the formal accounting controls examined in Khandwalla's study were not those consistent with the prospector type of organizations that emphasized on flexibility and innovation, and hence, implying that Khandwalla's study did not consider the compatibility of those controls in supporting a particular strategy or level of competition. Several other empirical studies (Chung 1996: Mak 1989), however, provided evidence that was consistent with Khandwalla's study. Prospector firms were found to be associated with more sophisticated and frequent use of operational controls, including cost controls, than the defender firms because of the greater uncertainties faced by the prospector firms.

The increasing competition and the accelerating technological changes have led to the establishment of more flexible organizational structures to facilitate rapid responses to changes in market demands. The change is necessary because the traditional hierarchical organizational structures that focus on bureaucracy and activities by individual departments or units tend to dampen employees' initiatives and innovations (Bartlett and Ghoshal 1993). The management control systems in the new organizational models that have incorporated a greater level of employee empowerment and a flatter or network organizational structure are expected to play an integrative role that focus on the contributions and interrelationships of units within those organizations. Modern management practices, such as total quality management, business processes re-engineering, employee empowerment, cross-functional work teams and adoption of non-financial performance measures, are increasingly being adopted to complement the traditional accounting-based controls, to meet the serious challenges posed by the uncertainties and turbulence in the external environment. The flatter organizational structure and an enhancement in employee empowerment have made the traditional hierarchical responsibility center reporting system less necessary. Non-financial performance indicators, such as those suggested in the balanced scorecard concept (Kaplan and Norton 1992), are increasingly being incorporated to complement the traditional financial performance indicators to effectively assess the performance of the critical success factors of organizations

The earlier studies provided empirical evidence that firms in the more developed countries generally adapted their management control practices to changes in their corporate strategies. Most of the control measures examined were, however, accounting-based

controls. This study examines empirically the relationships between types of control practices (both accounting-based and modern management practices) and competitive priorities or orientations of firms in Malaysia. The findings would provide further empirical evidence on the adaptability of management control practices to changes in the competitive orientations of firms in the lesser-developed country like Malaysia.

RESEARCH METHODOLOGY

Data Collection

A structured questionnaire was prepared and pre-tested on several practising managers to ensure clarity of terms used. Two hundred and fifty copies were sent to managers and executives of a randomly selected sample of organizations located in the Klang Valley. A total of 93 (37.5%) completed and useable questionnaires were returned and analyzed.

The questionnaire was divided into three sections: Section A requested for background information on the organization and the respondent, Section B focused on the attributes of the organization's management control system and the extent of usage of those control measures or practices; Section C required a respondent to rate, on a 5-point Likert scale, the perceived intensity of five different types of competition faced by his or her organization and consequently, their perceived importance of the corresponding five types of competitive priorities or orientations.

The types of competition examined in this study were based on the three of types of competition in Khandwalla's (1972) study, except that Khandwalla's product competition was further segregated into product quality, variety and innovation. With this modification, the five types of competition examined in this study were product price, quality, variety, innovation and service/promotion. The competitive priority or orientation in this study was defined as a firm's emphasis in its competitive strategy to achieve its competitive advantage and this is conceptually similar to Khandwalla's measure of importance of each type of competition to a firm's profitability. Each of the five types of competition was related to a competitive priority or orientation. For example, when a firm perceives a high intensity of competition in price, it is expected that the firm would place a high priority (or orientation) in formulating a low product price competitive strategy. A total of twelve management control measures or practices were listed[2]. Six of the management control measures or practices were accounting-based controls, such as use of financial budgets, standard cost variances and discounted cash flow techniques; while the other six were modern management control practices, such as total quality management, business process re-engineering, employee empowerment and inter-departmental work-team.

RESULTS AND DISCUSSION

Profiles of Respondents and Organizations

The profiles of respondents and their organizations are summarized in Table 1. About 88.6% of the participating organizations were incorporated enterprises or limited companies. All limited companies in Malaysia are required legally to comply with stringent record-keeping and corporate disclosure or governance regulations. Most of the participating firms (46.2%) were from the manufacturing sector with services sector firms constituted 34.4% of the sample and more than two thirds of the organizations were Malaysian-owned enterprises. As for the respondents, more than 60% of the respondents held middle or senior management positions and about 90% of the respondents had either tertiary or professional qualification.

Perceived Intensity of Competition and Competitive Priorities or Orientations

The mean rating scores (and standard deviations) of the perceived intensity of the five types of competition, as well as those for the perceived importance of the corresponding competitive priorities or orientations are presented in Tables 2 and 3, respectively. On overall, the respondents perceived competition in product quality to be most intense and consistently, they rated *producing high quality product* to be their most

2 The control measures or practices were adopted from measures used in Khandwalla's study as well as those modern management practices discussed in the management literature. Respondents, however, were also allowed to state other management control practices used in their organizations.

TABLE 1
Profiles of respondents and organizations

Position held:	
Senior management level	18.2%
Middle management level	44.3%
Junior management level	37.5%
Age:	
< 30 years	37.2%
30 –45 years	56.4%
> 45 years	6.4%
Qualification:	
Tertiary	52.7%
Professional	37.4%
Others	9.9%
Industrial Sector:	
Manufacturing	46.2%
Services	34.4%
Others	19.4%
Number of Employees:	
< 100	30.9%
100 – 500	45.7%
> 500	23.4%
Ownership:	
Local	69.8%
Foreign	30.2%

important competitive priority or orientation. As can be seen from Table 3, the correlation between the intensity of each type of competition and importance of the corresponding competitive priority or orientation was highly significant ($p < 0.001$), except that for the product service and promotion competitive priority or orientation.

TABLE 2
Mean rating scores and standard deviations of perceived intensity of the five types of competition

Type of Competition	Mean Rating Score	Standard Deviation
Product Quality	4.48	0.70
Product Price	4.05	0.94
Product Service & Promotion	3.90	1.12
Product Uniqueness	3.82	1.07
Product Variety	3.66	1.11

Scale: 1=very low; 5= very high

Analysis of the perceived intensity of competition by industry type generally shows the similar ranking as that in Table 2 for the manufacturing and the services sectors. Firms in the "other" sector, however, ranked intensity of price competition to be more intense than product quality. The firms in the "other" sector included several commodity-type firms, such as firms in the plantation sector and oil and gas sector. Despite of their higher perceived intensity of competition on price, firms in the "other" sector were, however, consistent with firms in the manufacturing and services sectors in ranking *producing high product quality* as their most important competitive priority. Local-owned firms perceived competition in product service/ promotion to be more intense than the foreign-owned firms (4.07 vs. 3.61; F=2.987; p=0.088). Generally, the rating scores of the large firms for both the perceived intensity of each type of

TABLE 3
Mean rating scores, standard deviations and correlations of perceived importance of five competitive priorities or orientations

Competitive Priority or Orientation	Mean Rating Score	Standard Deviation	Correlation with the Corresponding Intensity of Competition
High Product Quality	4.61	0.73	0.516**
Good Customer Service & Promotion	4.17	0.90	0.166
Low Product Price	3.87	1.02	0.66**
Wide Product Variety	3.85	1.17	0.703**
High Product Uniqueness	3.74	1.17	0.522**

Scale: 1=very unimportant; 5=very important
** significant at 0.01

competition and the perceived importance of the corresponding competitive priority were higher than those of the small firms. However, the differences were not statistically significant.

Management Control Measures or Practices

The twelve control items were classified into either accounting-based controls or modern management control practices. Items 1 to 6 in Table 4 were the accounting-based controls; while items 7 to 12 were the management control practices. The average of the mean scores of the six accounting-based controls[3] was higher than that for the management control practices[4] (3.20 vs. 3.00). A closer analysis of the mean scores in Table 4, however, indicates that there was a fairly balanced usage of accounting-based controls and modern management control practices, except for an apparent pervasive high or extensive usage of the *budget vs. actual* control measure, which was the only control measure with a mean rating score above 4.00. Besides *budget vs. actual*, there were two other accounting-based controls, namely *Internal Audit* and *Responsibility Reporting*, with mean rating scores above 3.00; while in the modern management practices category, there were four measures, namely *empowerment, inter-departmental work team, TQM and non-financial measures*, with mean rating scores above 3.00. This finding suggests that the firms, as a whole, are using a combination of accounting-based controls and non-accounting modern management practices to monitor and control their operations, as suggested in the management literature.

TABLE 4
Mean rating scores and standard deviations of management control measures or practices

Type of Control Measure or Practice	Mean Rating Score	Standard Deviation
Accounting-Based Controls:		
1. Budget vs. Actual	4.08	1.03
2. Internal Audit	3.34	1.27
3. Responsibility Reporting	3.29	1.16
4. Flexible Budgeting	2.89	1.16
5. Standard Cost Variances	2.87	1.17
6. Discounted Cash Flow Techniques	2.64	1.26
Modern Management Practices:		
7. Inter-departmental Work Team	3.31	1.10
8. Empowerment	3.31	0.87
9. Total Quality Management (TQM)	3.06	1.14
10. Non-Financial Measures	3.04	1.14
11. Business Process Re-engineering (BPR)	2.69	1.11
12. Economic Order Quantity (EOQ)	2.61	1.24
Overall Accounting-Based Controls	3.20	0.74
Overall Management Control Practices	3.00	0.75

Scale: 1=very low; 5=very high

3 The measure of the overall accounting controls was a composite measure, which was computed based on the mean rating scores of the six accounting-based controls. The reliability analysis of this overall measure showed a Cochran's alpha of 0.7041.

4 The measure of management control practices was a composite measure, which was computed based on the mean rating scores of the six management control practices. The reliability analysis of this overall measure showed a Cochran's alpha of 0.7642.

Relationships Between Competitive Priorities or Orientations and Management Control Measures or Practices

The results of the correlations between the management control variables and competitive orientations are summarized in Table 5 and they indicate a few instances of lack of proper alignment or incompatibilities as discussed below.

Low Product Price Competitive Orientation

Firms with a high priority for low product price as a competitive strategy are expected to emphasize highly on accounting-based controls to manage cost efficiency. Contrary to expectation, the correlation coefficients in Table 5 show that firms with high competitive priority or orientation for low product price were associated with low usage of four of the five accounting-based controls, namely *discounted cash flow techniques, internal audit, standard cost variances* and *responsibility reporting. Budget vs. actual* was the only accounting-based control that was positively correlated to *low product price orientation* and even then the association was not statistically significant. These firms with a high priority for low product price were also associated with low usage of all of the five modern management control practices. The association of low product price competitive priority with the overall usage of modern management control practices was negative and significant ($r = -0.197$; $p < 0.05$). The two specific modern management practices that exhibited significant negative relationships were *business process re-engineering (BPR)* and *inter-departmental work-teams.* BPR is used in activity analysis to eliminate non-value added activities to improve cost efficiency and yet this approach was seemingly "unpopular" with firms whose competitive priority was to compete based on cost efficiency.

High Product Quality Competitive Orientation

Firms with a high priority for product quality are expected to be positively associated with usage of *Total Quality Management (TQM).* This study found a positive association between priority for product quality and usage of TQM, but the relationship was not statistically significant. The overall association between this product quality orientation and the extent of usage of accounting-based controls and that of modern management control practices were positive, but not statistically significant.

Wide Product Range and Product Uniqueness Competitive Orientations

Firms with a high priority for either wide product range or product uniqueness are likely to be the prospector type of organizations that emphasize on flexibility and innovation. Table 5 shows that these firms were significantly associated with a high usage of control practices, irrespective of whether accounting-based controls or modern management practices. The finding of a highly significant association with *flexible budgeting* measure suggests that firms with high priority for wide product range or product uniqueness are aware of the need to constantly revise their budgets to reflect changes in the environment. A high emphasis on *budget vs. actual* in performance evaluation, however, could influence managers to favour short-term profits at the expense of long-term competitive advantage. The highly significant association between firms with product variety or innovation orientation and usage of *discounted cash flow techniques* for evaluating investment project proposals in these firms may also be incompatible with the notion that the traditional financial appraisal techniques are inappropriate for appraisal of certain strategic investment projects, which are very long-term in nature and whose future economic benefits are difficult to predict or ascertain. The need to satisfy the conventional financial criteria under *discounted cash flow techniques* often result in radical innovations being unfairly inhibited and discouraged (Finnie 1998).

Good Sales Service & Promotion Competitive Orientation

Firms with a high priority for good sales service and promotion, generally, exhibited positive associations with usage of both the accounting-based controls and modern management practices. The significant negative association with usage of *inter-departmental work team* suggests that firms with a high priority for good sales service and promotion may be still very hierarchical in their setups. The criticism for the traditional hierarchical structure is that its bureaucracy delays decision-making process and as a consequence, the firm is not likely to be very responsive to changes in customers' needs. *Inter-departmental work team* aims to facilitate decision-making by having team members from various functional areas to jointly respond to the changing demands of the markets.

Non-Price Competitive Orientation

A composite measure of non-price competition orientation[5] was computed based on the mean rating scores of the four non-financial competitive priorities or orientations. This measure was used as a surrogate measure of firms pursuing the differentiation strategy (Porter 1980). The results, as shown in Table 5, indicate a highly significant association between non-price competitive orientation and usage of both the accounting-based controls ($p < 0.01$) and the modern management control practices ($p < 0.05$). Firms with non-price competitive priority or orientation exhibited a significant usage of accounting-based measures like *budget vs. actual, discounted cash flow techniques* and *internal audit,* while also emphasized significantly on modern management control practices like *business process re-engineering* and *economic order quantity.* These findings are consistent with those in the earlier studies by Mak (1989) and Chung (1996), which reported that prospector firms (similar to differentiator firms) had a more extensive usage of controls due to their relative high environmental uncertainties.

The correlation between the overall perceived intensity of competition and the overall usage of management control measures was not significant, but the correlation between the overall intensity of non-price competition and overall usage of control measures or practices was highly significant ($p < 0.01$). This suggests that firms, which have a high level of perceived intensity of competition on no-price dimension, tend to have a high or extensive usage of management control measures or practices to

TABLE 5
Pearson correlations between competitive orientations and management control measures

Management Control Measure or Practice	Competitive Orientation: Low Product Price	High Product Quality	Wide Product Range	Product Uniqueness	Product Promotion / Service	Non-price competition
1. Budget vs. Actual	0.072	0.039	0.268**	0.134	0.189*	0.242*
2. Discounted Cash Flow Techniques	-0.07	-0.045	0.265**	0.25**	0.174*	0.222*
3. Internal Audit	-0.031	0.002	0.176*	0.175*	0.157	0.212*
4. Standard Cost Variances	-0.086	0.067	0.199*	0.137	0.149	0.163
5. Responsibility Reporting	-0.134	-0.037	0.107	-0.021	-0.153	0.017
6. Flexible budgeting	-0.103	0.025	0.211*	0.247*	0.033	0.173
7. Total Quality Management (TQM)	-0.095	0.108	0.166	0.175*	0.141	0.202
8. Business Process Re-engineering (BPR)	-0.258**	0.076	0.30**	0.363**	0.171*	0.341**
9. Economic Order Quantity (EOQ)	-0.039	0.054	0.227*	0.171	0.126	0.216*
10. Non-Financial Measures	-0.137	0.015	0.044	0.055	-0.076	0.042
11. Inter-departmental Work Team	-0.187*	0.153	0.044	0.062	-0.193*	0.065
12. Empowerment	-0.115	0.143	0.073	0.143	-0.04	0.107
Overall Accounting-Based Controls	-0.095	0.011	0.321**	0.245*	0.183	0.268**
Overall Management Control Practices	-0.202*	0.13	0.215*	0.238*	0.057	0.242*
Overall Control Usage	-0.161	0.077	0.291**	0.263*	0.135	0.277*

** Correlation is significant at the 0.01 level (1-tailed)
* Correlation is significant at the 0.05 level (1-tailed)

5 Its Cochran's Alpha was 0.7378.

monitor performance. This finding is partly consistent to that reported in Khandwalla (1972), who found a significant positive relationship between overall competition and the overall usage of controls with price competition having the least impact on usage of controls and product competition showing the greatest impact. He attributed that to the increasing expected net benefits from application of controls as competition intensified and the increase in expected net benefits was more evident with increasing product competition. This study did not find an overall significant positive relationship between overall intensity of competition and usage of controls because of the negative relationship between intensity of price competition and overall usage of controls.

From the analysis by type of competitive priority or orientation, the apparent lack of proper alignment or incompatibilities may be summarized as follows. Firms with a high competitive priority for *low product price* did not exhibit an extensive or high usage of accounting-based controls. Even though firms with a high competitive priority or orientation for *high product quality* did exhibit a positive association usage of *TQM*, the relationship was not statistically significant. Firms with high competitive priorities for *wide product range* and *product uniqueness* used extensively some accounting-based controls that might inhibit creativity and innovation. Despite of the trend towards a greater employee empowerment and greater usage of non-financial measures to monitor the critical success factors of firms pursuing product differentiation strategy (Porter 1980), the usage of employee empowerment and non-financial measures were not significantly related to any of the non-price competitive priority or orientation.

Further analysis indicated that size had a significant influence on the usage of the management control measures. The large enterprises had a significantly more extensive overall usage of control measures (F=3.677; p=0.029) than the small enterprises. The difference in usage of accounting-based controls between the large and small enterprises was highly significant (F=3.399; p=0.038). This might be because the large enterprises, which were likely to be incorporated businesses, are required to establish more formal accounting control systems to comply with the existing financial reporting and disclosure requirements. The difference in the usage of modern management control practices between the large and the small enterprises, was, however, only moderately significant (F=2.779; p=0.067).

SUMMARY AND IMPLICATIONS

With the impending threats from globalization of the market place, businesses have to become more agile and responsive to the rapid changes in customers' needs. Competition based on non-price dimension is becoming more prevalent as trade barriers are being removed. Product life cycle is also becoming shorter and shorter, as more and more competitors enter the market. Hence, business enterprises are placing increasing emphasis on speed and responsiveness to satisfy the rapid changing needs of the market place, and on innovation to replace the rapid demise of their existing products and services. This study examines the perceptions of organizations on the intensity of five types of competition and their competitive orientations or priorities in response to their perceived intensity of the different types of competition. The results of this study indicate that the organizations were competing mainly based on product price, quality and service. Product uniqueness or innovation and wide product variety were rated as the lowest and the second lowest, respectively, in their list of competitive priorities. This observation is disturbing because survival in the new environment depends very much on the ability of a firm to innovate and extend its range of goods or services to the increasingly sophisticated and demanding buyers in the market place. This study also found evidence of a lack of proper alignment or incompatibilities between the use of control measures and certain competitive priorities or orientations. Firms with a high priority for low product price were found not to place high emphasis on accounting-based controls to manage their cost efficiency. Firms with a high competitive priority or orientation for producing high quality products were also not significantly associated to those with a high or extensive use of TQM and this is not in accord with the findings in the more developed countries, such as that reported in Ittner and Larcker (1997). The use of non-financial measures and employee empowerment was not significantly related to any of the non-price competitive priorities or orientations.

The finding of a lack of proper alignment or incompatibilities between usage of type of control measures and certain competitive priorities or orientations of firms suggests that there may be deficiencies in the design of management control systems in these firms and as a consequence, managers in these firms may not be able to effectively utilize the formal control processes to coordinate and control their operating activities to achieve competitive advantages, as intended in their firms' competitive strategies. The current study, however, is unable to identify the causes for the lack of alignment or incompatibilities, except to provide some empirical evidence of the extent of alignment in the usage of management controls to firms' competitive priorities or orientations. With the imminent trend towards globalization, the apparent lack of proper alignment may be detriment to these firms' abilities to formulate the appropriate strategies to compete with other world-class players.

Management literature has stressed on the importance of a strategic fit in the designing their management control systems and these control systems have to be modified when strategy changes in response to environmental changes. Unfortunately, management control systems often remain unchanged even though competitive strategy might have already been changed, resulting in incompatibilities as those observed in this study. Although Khandawalla (1972) opined that firms were still far from designing optimal control systems, he, however, reckoned that accountants could help the design of better control systems with proper quantification of the intangible costs and benefits of controls. In order for the designers of management control systems to be able to evaluate the effectiveness of various control measures, there must be effective communications between the formulators of the new strategy and the designers of management control systems to avoid any strategic misalignment. This is in accord with Simons (1990) who advocated the interactive management control processes, whereby a firm's competitive strategic positioning, management control measures and process of strategy formulation influence one another as the firm evolves and adapts over time, to manage and align management controls to the emerging strategy. The implementation of an effective interactive management control process requires a more open communication structure and freer flow of information within the firm.

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Unit Trust Performance Measurement: the Snail Trail Approach

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Keywords: unit trust, Snail-Trail analysis, equity growth funds

ABSTRAK

Unit amanah saham merupakan skim pelaburan yang diuruskan oleh pengurus atau organisasi dana dengan menawarkan pelbagai portfolio kepada pelabur. Jangka masa pelaburan biasanya bergantung kepada matlamat amanah saham itu sendiri. Memandangkan ia melibatkan jangka masa pemegangan yang panjang dan mendatangkan kesan berlipat-ganda, perbezaan kadar pulangan tahunan yang meskipun kecil juga amat merugikan pelabur. Oleh yang demikian, pernilaian terperinci diperlukan terhadap pencapaian amanah saham di samping pengurus dana sebelum perjanjian dibuat. Seperti yang diketahui bahawa kadar pulangan yang tinggi pada satu tempoh tunggal boleh mengelirukan jika kajian terhadap kemudahubahan pulangan pada masa lampau tidak diambil kira. Walaupun kaedah risiko pulangan terlaras digunakan untuk menyelesaikan masalah ini, namun hanya merupakan analisis ukuran pencapaian yang "snapshot" sahaja. Analisis Snail Trail telah diperkenalkan untuk menyelesaikan kelemahan ini dan memberikan gambaran yang lebih menyeluruh terhadap pencapaian para pengurus dana.

Kajian ini mengambil kira 17 buah ekuiti pertumbuhan dana. Analisis Snail Trail menunjukkan kedua-dua amanah saham Asia Progress dan KLMF Growth telah memperlihatkan kemajuan dari pencapaian pulangan tinggi berisiko tinggi dan pulangan rendah berisiko rendah kepada pencapaian tinggi berisiko rendah. Sementara, tiga buah dana didapati berada di bawah paras purata seperti yang ditunjukkan oleh gambar rajah Snail Trail. Ketiga-tiga dana ini terdiri daripada BHLB High Growth, KLMF Industry dan KLMF Aggressive Growth. Pencapaian dana-dana telah merosot prestasi sepanjang masa kini dari pulangan tinggi berisiko rendah kepada pulangan rendah berisiko tinggi. Empat buah amanah saham yang terdiri daripada SBB Premium Capital, HLB Growth, OSK Equity and RHB Capital pula menunjukkan pencapaian risiko-pulangan dana yang tekal.

ABSTRACT

Unit trust is an investment scheme that offers investors a well diversified portfolio managed by a professional fund manager or organisation. The investment horizon is medium to long term depending on the stipulated objective of the unit trust. Due to the long holding period and compounding effect, a slight difference in the annual rate of returns can be very detrimental to the investor. Therefore the performance of a unit trust as well as the fund manager must be carefully evaluated before committing to the fund. As we know, a high rate of returns in a single period can be very misleading if we do not study the volatility of the historical returns. Risk adjusted returns offer a solution to this problem, but this is only a "snapshot" performance measurement analysis. Snail-Trail analysis was introduced to overcome these drawbacks and better portray the dynamic history of fund manager's performance.

17 equity growth funds were selected for the purpose of this study. From the snail-Ttrail analysis, two promising unit trusts were found to be Asia Progress and KLMF Growth. Both funds have shown improvement in relative performance from the "high return high risk" and "low return low risk" quadrant moving up to "high return low risk", the most favourable, quadrant. Meanwhile, three funds have been classified as below average as the snail trail diagrams shown deteriorating performance. These three funds are BHLB High Growth, KLMF Industry, and KLMF Aggressive Growth, the performance of which has been falling rapidly over recent years,

from the "high return low risk" quadrant to "low return high risk" quadrant. Four unit trusts showing the most consistency in fund risk-return performance are SBB Premium Capital, HLB Growth, OSK Equity and RHB Capital.

INTRODUCTION

Unit trust is an investment vehicle that pools money from investors and the pooled fund will then be invested in a diversified portfolio. The fund will be managed by professional fund managers or asset management organisations on behalf of unit trusts investors. Investors can select the unit trust based on their investment objectives, investment strategy and risk tolerance level.

In the selection process, besides the above mentioned investor characteristics, the relative performance of the unit trust also plays an important role. Here comes the question: what do you refer to when you want to know the performance of a particular fund? We used to refer to the "league table" showing various unit trusts ranked according to their returns, or the advertisements which highlight the impressive high rates of return over the last "x" months or years.

A high rate of returns in a single period can be very misleading if we do not study the volatility of the historical returns. Therefore the risk-return tradeoffs must be studied. A diagram with standard deviation of the returns on the horizontal axis as a proxy for risk and the rate of return on the vertical axis can be plotted. This diagram is a step forward and allows explicit risk-return tradeoffs to be made. This traditional risk-return diagram presents a single or static snapshot in time over a set period. As discussed in Balzer (1991), to further improve the diagram, multiple points, each representing a set of risk-return for a specific period can be plotted on the same diagram. This diagram portrays a dynamic history of a single fund manager's performance. However, this presentation is useful only to show how a fund manager's performance has varied over time. It fails to reveal how much of that performance is due to the manager's unique skill and how much is due to fortuitous market movements enjoyed by most managers.

A very good indication of the skill component can be obtained by constructing a relative risk-return history, where the median risk and median return (for an appropriate universe of fund managers) are subtracted from the results. This process highlights a manager's value-adding and risk-reduction skills relative to its peer group.

Unlike the traditional risk-return diagram, the snail trail approach not only shows results relative to the median or average fund manager, but is a robust tool for comparing fund managers' performance.

METHODOLOGY

The relationship between risk and returns can be graphically illustrated. Relative return is plotted on the vertical axis and relative risk is plotted on the horizontal axis.

The first point on the risk-return graph is plotted as usual. The beginning and end points of the period are then rolled forward by one quarter and the return and risk for the new period are calculated and plotted on the same graph. By repeating this process, a trajectory is traced out dynamically in risk-return space.

After the compound average annual returns over the period (4 quarters) are calculated, the median returns for the same period for the universe of pooled funds are subtracted to give the relative returns.

To measure risk, there are a number of alternative computations. As in Grinblatt *et al.* (1994) and Woodward (1983), the most commonly accepted measure of risk, standard deviation of returns, has been chosen for these analysis. The standard deviation of quarterly returns over the period is calculated and annualised using the standard $\sqrt{4}$ factor (which implicitly assumes a random walk stochastic model for the return series). The relative risk is then calculated by subtracting the median standard deviation for the group of fund managers and is plotted on the horizontal axis.

It is important to note that the horizontal axis is not the standard deviation of the relative returns, but the relative standard deviation of the total returns. Use of the former would show how well a particular fund manager tracked the median. This might or might not be a useful measure depending on one's purpose. A low figure would simply indicate that the manager has nicely tracked the median, which itself might be undesirably volatile. On the other hand, a

low figure for relative standard deviation, as defined in this paper, implies low volatility of returns in the absolute sense, which is clearly desirable.

After the first point is plotted, the period is rolled forward one quarter and the calculation is repeated. One of the major advantages of the above rolling approach is that, all results are revealed — good or bad. The performance figures used in this paper are "after fee".

Fairly obvious, desirable above median returns appear above the horizontal median return line and less-desirable below-median results appear below it. Similarly, below-median volatility appears on the left of the diagram and above median volatility on the right. The most desirable region is on the top left "high return low risk" (HL) quadrant, while the least desirable is the bottom right "low return high risk" (LH) quadrant.

Irrespective of the absolute position of a set of points on the graph, the tightness of their grouping is a direct indication of the consistency of a manager's risk-return performance.

Seventeen unit trust funds were selected for the purpose of this study. These funds are categorised as growth and equity fund in Chong (1999). These funds are from EPF approved unit trust companies. Only funds with more than 100 million units in circulation will be included. By definition, a growth fund concentrates on investing in securities with growth potential. Growth may come in the form of the invested company's growth or expansion, and capital appreciation. *Growth fund*, also known as *equity fund*, invests mainly in shares traded on the stock exchange. Equity funds can be made up of local shares, shares of unlisted companies, or shares listed on foreign stock exchanges.

FINDINGS AND DISCUSSIONS

One way of visualising the relative risk-return relationship is to think of fixing the median "crosshairs" on a conventional risk-return diagram in the centre of the page and then watching how a manager moves in relation to them as the period of analysis is rolled forward in time.

Three funds with distinctive relative risk-return performance history have been selected for discussion.

BHLB Pacific High Growth Fund

With the objective of achieving high capital gains through investments in companies with high growth prospects as stated in Chong (1999), BHLB HGrowth allocated more than 70% (73% as of 14 April 99) of the total investment in equity assets.

Fig. 1: The dynamic snail trail diagram demonstrates the relative 4-quarter return/risk performance history of BHLB HGrowth. Prior to 96Q3, BHLB HGrowth was in the "low return low risk" quadrant. However, the relative performance of BHLB HGrowth improved gradually and moved up to the upper left quadrant, which is the "high return low risk" quadrant. The snail trail diagram indicated BHLB HGrowth fund manager has read the Asian financial crisis right. This outstanding relative performance exhibits the superior risk-reduction and value-added skills of BHLB HGrowth fund manager compared to the peer group; however the good performance was not upheld. The performance history exhibits poor performance in the post-crash period, when the snail trail descended from the "high return low risk" quadrant to "low return low risk" quadrant, and further fell into "low return high risk" quadrant in 1999.

As a whole, from the snail trail diagram, we can conclude that the performance of BHLB HGrowth in pre- and post-crisis period was not very outstanding (i.e. in the "low risk low return" quadrant and "low return high risk" quadrant). But performance history has shown the ability of the fund manager in lowering the risk as well as improving returns during the economic crisis indicating the superior capability of the fund manager in countering the financial turmoil.

KLMF Regular Saving

Fig. 2: From the snail trail diagram, we can see that the relative performance history of KLMF R Saving is not very consistent over time. This is a very good example of dramatic changes in performance. In 1996, KLMF R Saving was in the "low return high risk" quadrant, and later advanced into the "high return high risk" quadrant. During the early stage of the financial crisis, KLMF R Saving was in the "high return low risk" quadrant. However, the favourable performance was not maintained very long. After (98Q1-98Q4), KLMF R Saving performance has

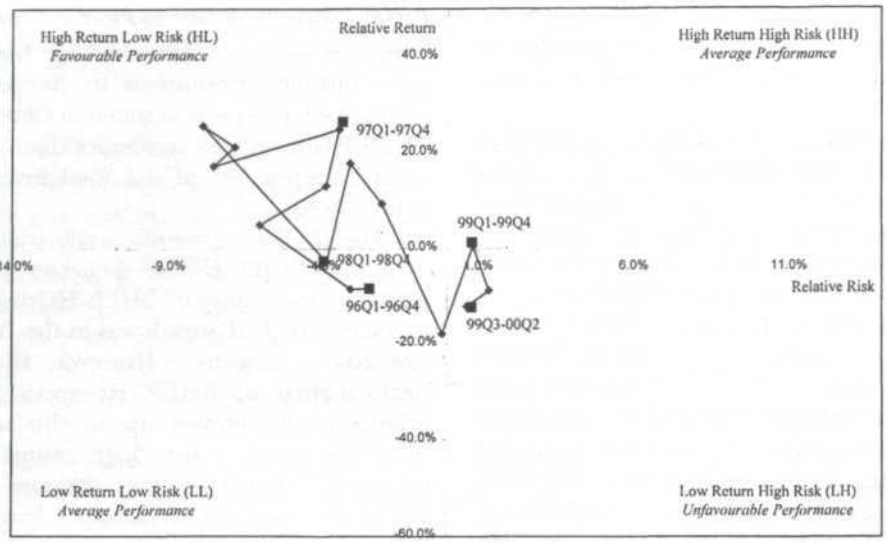

Fig. 1: Relative risk/return history (BHLB High Growth Fund)

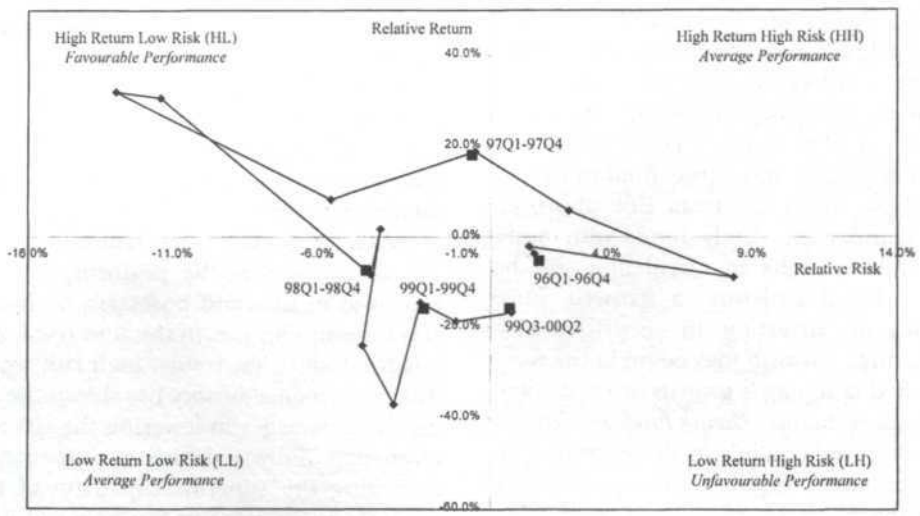

Fig. 2: Relative risk/return history (KLMF Regular Saving)

been falling, from the "low return low risk" quadrant to "low return high risk" or the unfavourable quadrant. This example shows that the single snapshot approach can be very misleading especially when the single period superior performance during the financial crisis is highlighted and promoted to the public.

As KLMF R Saving's objective is to achieve long-term capital growth while maintaining a steady growth in income, it invested heavily in fixed income securities (56%) and the money market (20%) compared to other growth funds in this study. With more than 70% of the total funds invested in non-equity instruments during the financial crisis, KLMF R Saving was able to minimise risk while securing desirable returns on investment. This might explain the KLMF R Saving performance history plots being in the above-median return quadrant with below average risk during the economic slow down. The decision of the KLMF R Saving fund manager to reallocate the assets (from equity to bond and cash) during the crisis added value to the fund as well as minimised risk.

However, during the pre-crisis period, the performance of KLMF R Saving was below average. Looking at the trend where the last point of the snail trail diagram shows a fall from "low return low risk" quadrant to "low return high risk" quadrant, might signal unfavourable future performance. From the dramatic movement of the KLMF R Saving snail trail, one should be aware of how dangerous it can be to neglect the risk dimension or the performance history of a fund.

MBF Growth Fund

Fig. 3: From the diagram, the performance history of MBF Growth indicated that MBF Growth is relatively more risky as the snail trail plots were moving on the right-region most of the time. Nevertheless, the relative risk increased dramatically during the financial crisis. The relative performance of MBF Growth was unfavourable (i.e. located in "low return high risk" quadrant) compared to many other growth funds studied. However, the relative return has shown some improvement along with the regional economy recovery but the relative risk is still higher than average. The last few plots of snail trail indicated a recent movement from the "high return high risk" quadrant to "low return low risk" quadrant exhibiting a reduction in return volatility.

As a whole, we can comment that the performance of MBF Growth is moving in tandem with aggregate market performance. The objective of the fund i.e. to achieve growth through capital appreciation by investing in high growth companies in Malaysia and Asia Pacific region, might give us an insight on the high return volatility and explain the performance of MBF Growth which is closely affected by the regional equity market movement.

Overall Performance of 17 Funds

From the appendices, using snail trail analysis, the most promising unit trusts are Asia Progress (Appendix 2) and KLMF Growth (Appendix 8). Both funds have shown improved relative performance from the "high return high risk" and "low return low risk" quadrant to "high return low risk" or the favourable quadrant.

Four unit trusts namely SBB PCapital (Appendix 18), HLB Growth (Appendix 7), OSK Equity (Appendix 15) and RHB Capital (Appendix 17) exhibit concentrated plots around the median return and risk. The tightness of their snail trail plots is a direct indication of the consistency of a fund's risk-return performance. BBMB Prime (Appendix 3) has been showing a risk reduction trend

Three funds are classified as below average as the snail trail diagrams show deteriorating performance. These funds are BHLB HGrowth (Appendix 5), KLMF Industry (Appendix 9), and KLMF AGrowth (10), where the relative performance has been falling rapidly over recent

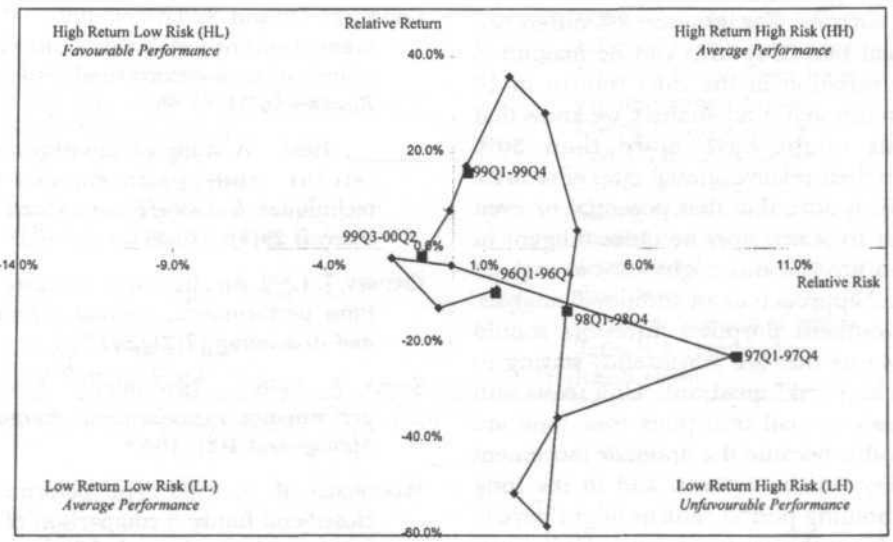

Fig. 3: Relative risk/return history (MBF Growth Fund)

years, from "high return low risk" quadrant to "low return high risk" quadrant.

Seven other unit trusts did not exhibit any significant changes in the relative performance history. Most of these 7 funds remained in the same quadrant throughout the study period or moved from/to "high return high risk"(HH) quadrant to/from "low return low risk"(LL) quadrant. Moving between these two quadrants basically is indifferent in terms of risk/return tradeoffs. These 7 funds are: KLMF Regular (remained in LL) (Appendix 11); MBf Growth (maintaied in HH) (Appendix 14); ASM (P) and ASM FPF (from HH to LL) (Appendix 12 - 13); BHLB Emerging (from HL to HH and LL) (Appendix 4); BIMB First (from LL to HH) (Appendix 6); and Pacific Pearl (from LH to LL) (Appendix 16).

CONCLUSION

From the findings, we discovered that some unit trusts have undergone quite significant, even dramatic, changes over the study period. The traditional risk-return "snapshot" fails to highlight changing performance and it fails to reveal how much of that performance is due to the manager's unique skill and how much is due to fortuitous market movements enjoyed by most managers.

Unit trust is a medium to long term investment instrument. Therefore the initial selection process of the fund is very important. Any slight difference in annual returns can turn into a very big variance at the end of the investment horizon. For instance, 2% difference in the annual rate of returns can be magnified into 21.9% variation in the total returns in 10 years. From the snail trail analysis, we know that some funds might have more than 30% difference in their relative annual rates of returns. Therefore, it is advisable that potential or even existing unit trust investors be more diligent in the selection process and might want to include this snail trail approach as an additional analysis.

For investment purposes, investors should avoid unit trusts that are consistently staying in "low return high risk" quadrant. Unit trusts with very inconsistent snail trail plots over time are also undesirable because the dramatic movement indicates very volatile returns, and in the long term, total holding period returns might deviate very much from the targeted rate. Unit trusts located in the "high return low risk" quadrant are preferred and followed by those located in "low return low risk" or "high return high risk" quadrants. Investors with different investment objectives and risk tolerance level might be interested in investing in funds located in these two regions.

Again, the dynamic performance history will save us from the pit-fall, which we might be deceived into believing by the exaggerated "x" period rate of returns as advertised. As a long-term investor, we should select our investment vehicle with great caution and not be misled by the high return figure of any single period. Instead, consistent long term above average returns with low risk is most desirable.

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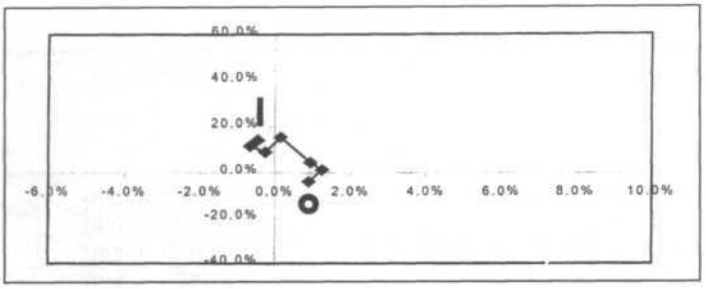
APPENDIX 1

No.	Unit Trust	Type of Fund	Units in Circulation (million) 1998/99
1	Asia UT Malaysia Progress Fund	Growth, Equity	151
2	BBMB Prime Fund	Growth, Equity	166
3	BHLB Pacific Emerging Co. Growth Fund	Growth, Equity	384
4	BHLB Pacific High Growth Fund	Growth, Equity	245
5	BIMB UT First Fund	Syariah, Growth, Equity	235
6	HLB Growth Fund	Growth, Equity	253
7	KLMF Growth Fund	Growth, Equity	658
8	KLMF Industry Fund	Growth, Equity	275
9	KLMF Aggressive Growth Fund	Growth, Equity	310
10	KLMF Regular Saving	Growth, Equity	600
11	MBf Growth Fund	Growth, Equity	118
12	OSK-UOB Equity Trust	Growth, Equity	248
13	Pacific Pearl Fund	Growth, Equity	278
14	RHB Capital Fund	Growth, Equity	239
15	SBB Premium Capital Fund	Growth, Equity	304
16	ASM First Public Fund	Growth, Equity	236
17	ASM Premier Fund	Growth, Equity	215

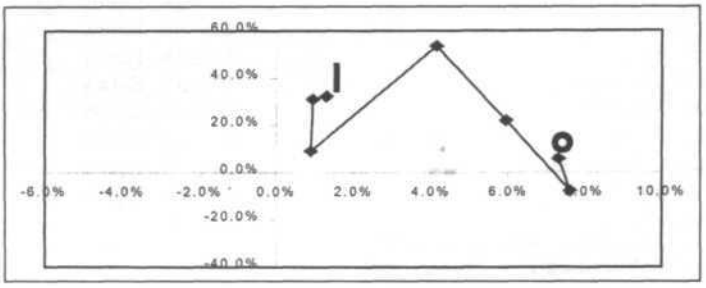
Source : *Investors' Guide To Malaysian Unit Trusts, 1999.*

No.	Unit Trust Fund	Fund Manager 1998/99
1	Asia UT Malaysia Progress Fund	Mushthaq Ahmad Ibrahim
2	BBMB Prime Fund	Koh Huat Soon
3	BHLB Emerging Co. Growth Fund	Lee Chiah Cheang (external investment advisor)
4	BHLB Pacific High Growth Fund	Lee Chiah Cheang (external investment advisor)
5	BIMB UT First Fund	Abdul Rahim Abu Bakar
6	HLB Growth Fund	Arnold Lim (external investment advisor)
7	KLMF Growth Fund	Edmond Cheah Swee Leng
8	KLMF Industry Fund	Edmond Cheah Swee Leng
9	KLMF Aggressive Growth Fund	Chong Chang Choong
10	KLMF Regular Saving	Chong Chang Choong
11	MBF Growth Fund	Philip Tan Chek Boon
12	OSK-UOB Equity Trust	Lee Seng Young
13	Pacific Pearl Fund	Chong Sui San
14	RHB Capital Fund	David Lee Chuen Chieh (external investment advisor)
15	SBB Premium Capital Fund	Pearl Wong (external investment advisor)
16	ASM First Public Fund	Zalinah A Hamid
17	ASM Premier Fund	Razali Haron

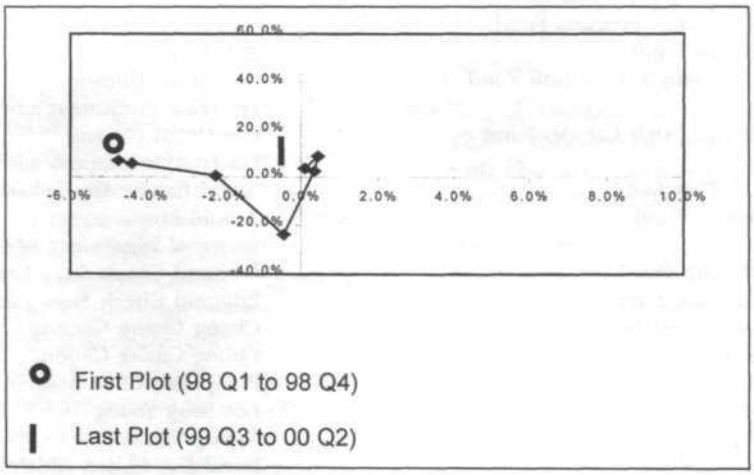
Source: *Investors' Guide To Malaysian Unit Trusts, 1999.*



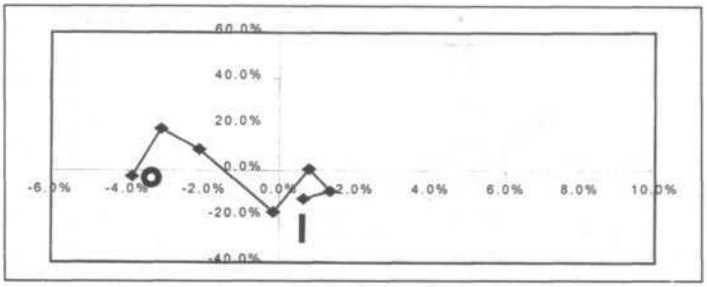
APPENDIX 2
Asia Ut Malaysia Progress Fund (Asia Progress)



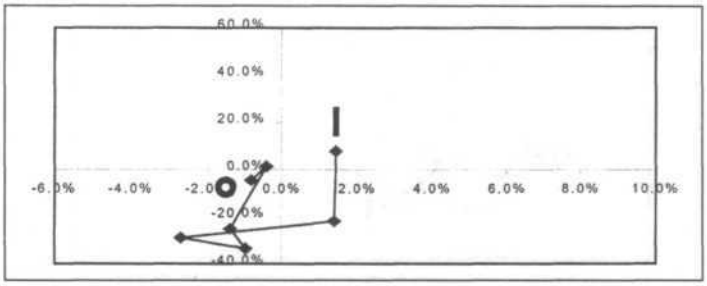
APPENDIX 3
BBMB PRIME FUND (BBMB PRIME)



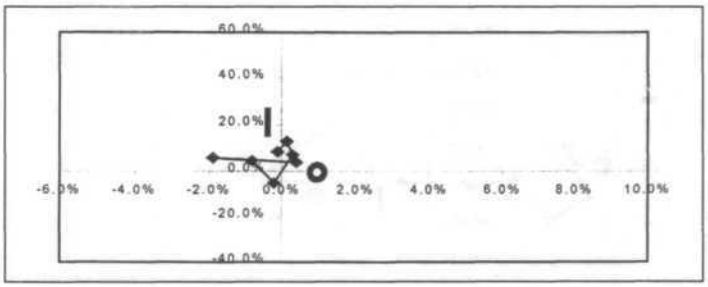
APPENDIX 4
BHLB Pacific Emerging Co. Growth Fund (BHLB Emerging)



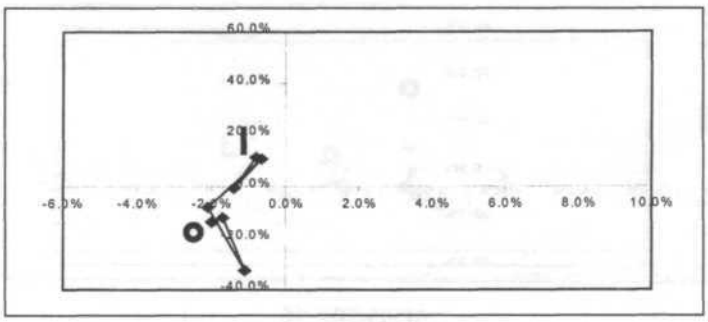
APPENDIX 5
NHLB Pacific High Growth (BHLB HGrowth)



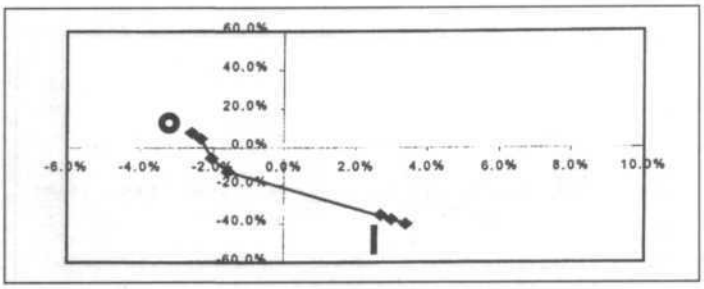
APPENDIX 6
BIMB UT First (BIMB First)



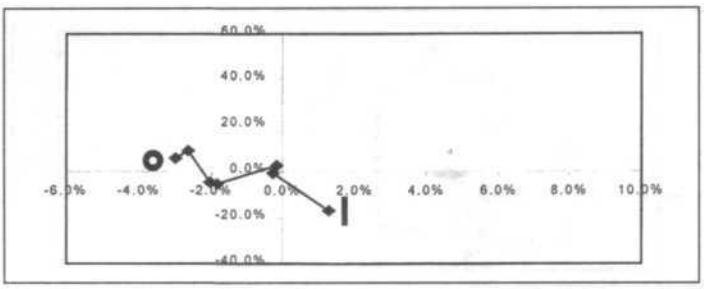
APPENDIX 7
HLB Growth Fund (HLB Growth)



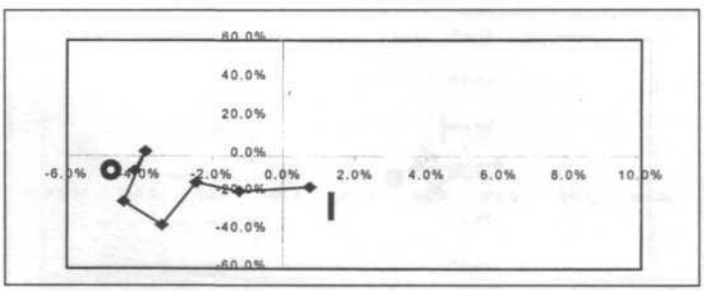
APPENDIX 8
KLMF Industry Fund (KLMF Growth)



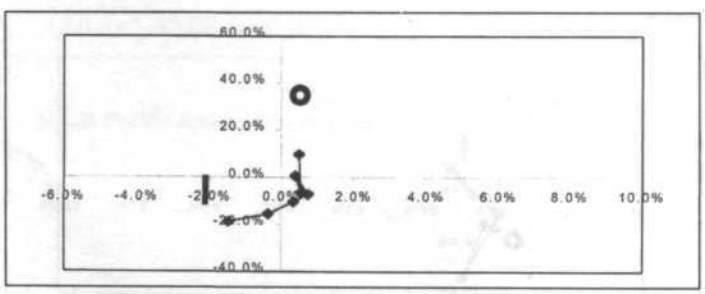
APPENDIX 9
KLMF Industry Fund (KLMF Industry)



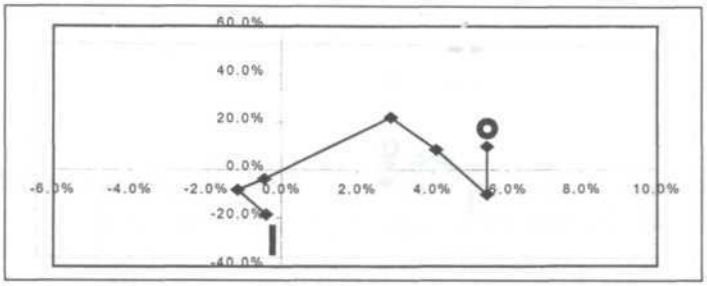
APPENDIX 10
KLMF Aggressive Growth Fund (KLMF AGrowth)



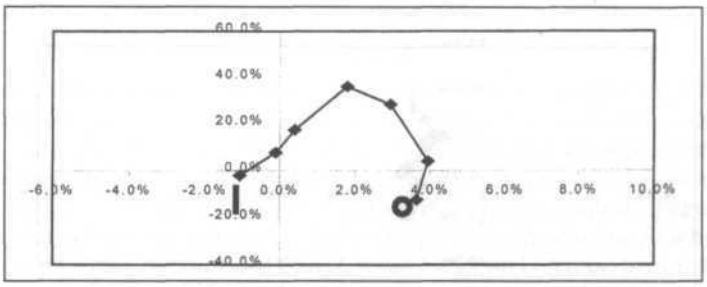
APPENDIX 11
KLMF Regular Saving (KLMF RSaving)



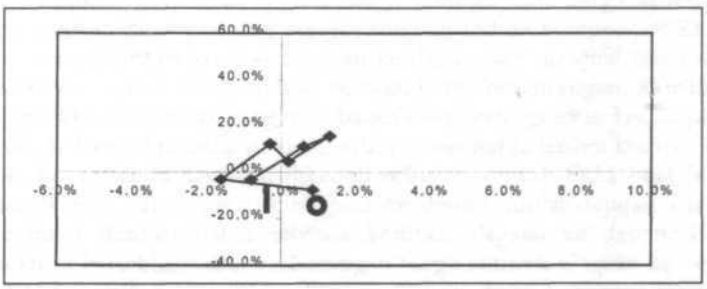
APPENDIX 12
ASM Premier Fund



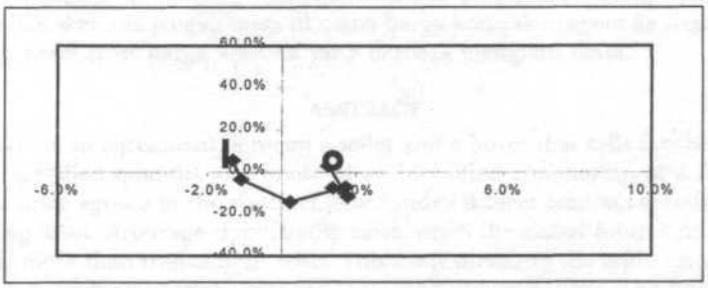
APPENDIX 13
ASM First Public Fund (ASM FPF)



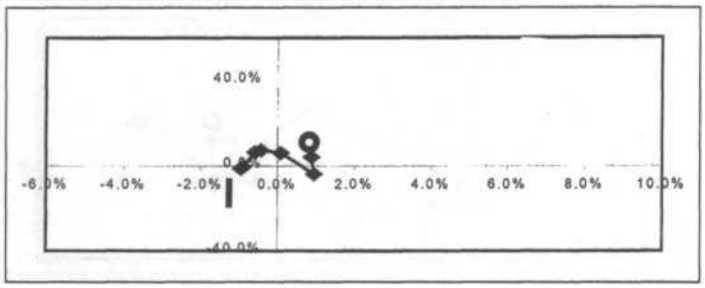
APPENDIX 14
MBF Growth Fund (MBF Growth)



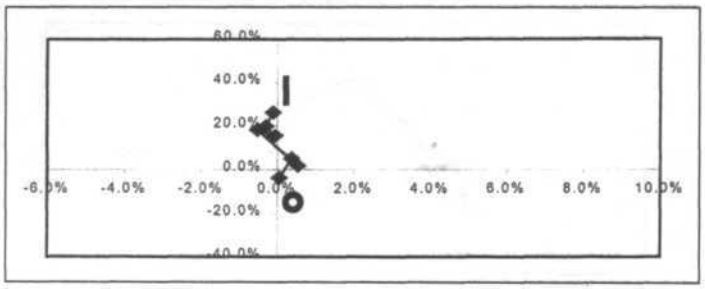
APPENDIX 15
OSK–UOB Equity Trust (OSK Equity)



APPENDIX 16
Pacific Pearl Fund (Pacific Pearl)



APPENDIX 17
RHB Capital Fund (RHB Capital)



APPENDIX 18
SBB Premium Capital Fund (SBB PCapital)

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Price Efficiency of Stock Index Futures Contracts: Are There Any Arbitrage Opportunities?

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Keywords: Stock index futures, price efficiency, arbitrage, short-selling

ABSTRAK

Kontrak niagaan ke depan adalah perjanjian antara pembeli dan penjual sesuatu komoditi yang menetapkan harga, kuantiti dan kualiti komoditi tersebut dan masa bila urus niaga ini akan berlaku. Aset atau komoditi yang terlibat dalam kontrak niagaan ke depan indeks saham ialah seratus saham-saham indeks komposit Bursa Saham Kuala Lumpur (BSKL). Salah harga kontrak boleh berlaku apabila terdapat perbezaan ketara antara harga kontrak niagaan ke depan di pasaran dengan harga kontrak niagaan ke depan yang sepatutnya atau harga sebenar yang dinilai dengan menggunakan kaedah "Cost and Carry". Salah harga ini boleh berbentuk harga berlebihan atau harga berkurangan. Harga kontrak niagaan ke depan berlebihan berlaku apabila harga pasaran kontrak melebihi harga sebenar dan kos urus niaga. Harga berkurangan berlaku apabila harga pasaran kontrak niagaan ke depan adalah kurang dari harga sebenar dan kos urus niaga. Salah harga kontrak niagaan ke depan memberi peluang kepada pelabur untuk meraih keuntungan dengan memperbetulkan perbezaan antara harga pasaran dan harga sebenar, iaitu dengan menjual kontrak niagaan ke depan dan membeli saham indeks komposit BSKL apabila berlaku harga berlebihan dan membeli kontrak niagaan ke depan dan menjual (atau menjual pendek) saham-saham indeks komposit BSKL apabila berlaku harga berkurangan. Aktiviti pembetulan ini dikenali juga sebgai aktiviti arbitraj, yang membantu mempertingkatkan kecekapan harga kontrak niagaan ke depan. Kajian ini menilai peluang arbitraj atas harga harian kontrak bulanan niagaan ke depan indeks komposit BSKL, atau dikenali sebagai kontrak FKLI bagi jangka masa 1996 hingga 1999. Kecekapan harga kontrak niagaan ke depan dinilai dengan kaedah ralat piawai antara harga pasaran dengan harga sebenar kontrak niagaan ke depan. Penemuan kajian menunjukkan adanya berlebihan dan berkurangan harga kontrak niagaan ke depan, tetapi tidak ada aktiviti arbitraj untuk menyatukan harga sebenar dengan harga pasaran kontrak. Ini kemungkinan, di antara faktor lain, kerana pelabur tidak boleh menjual pendek saham-saham indeks komposit BSKL apabila berlakunya berkurangan dalam harga kontrak niagaan ke depan. Penemuan juga menunjukkan perubahan harga kontrak niagaan ke depan tidaklah berekanada tetapi berubah mengikut masa yang menyebabkan ada jangka masa yang menunjukkan harga kontrak berlebihan dan ada jangka masa di mana harga kontrak niagaan ke depan berkurangan, menepati tahap kecekapan harga kontrak yang berbeza mengikut masa.

ABSTRACT

A futures contract is an agreement between a seller and a buyer that calls for the seller to deliver to the buyer a specified quantity and grade of an identified commodity, at a fixed time in the future, and at a price agreed in the contract. Stock index futures contract specify an equity index as the underlying asset. Arbitrage opportunity exists when the actual futures price deviates from the fair price by more than transactions costs. This study measures the arbitrage opportunities on the daily FKLI contracts price from calendar years 1996 through 1999. The pricing efficiency of the futures contracts was determined by the standard error between the closing actual and theoretical fair values for each month FKLI futures contract, where the theoretical value was estimated using the cost-of-carry model. The findings show that the actual futures prices do not converge towards theoretical prices with the passage of time. Arbitrage opportunities are

consistently available for traders who have full use of proceeds. One crucial assumption driving this result is the ability to sell short the cash index (or a subset of stocks in the KLSE CI). The results also reveal that the stock index futures contract pricing is not monotonic but rather varies over time with periods of both greater and lesser efficiency.

INTRODUCTION

A futures contract is an agreement between a seller and a buyer that calls for the seller to deliver to the buyer a specified quantity and grade of an identified commodity, at a fixed time in the future, and at a price agreed in the contract. All futures contracts are traded on designated futures exchanges. Futures markets had their start in agriculture, with the introduction of commodity futures contracts that provided farmers, distributors, and processors of agricultural products to shift the price risk of their output to speculators. Financial futures contracts based on financial instruments as the underlying asset were first introduced in 1972 with the introduction of currency futures traded on the International Monetary Market. In 1975 the Chicago Board of Trade pioneered trading in interest rate futures and the stock index futures were introduced in 1982 on the Kansas City Board of Trade (KCBT).

Stock index futures contract specify an equity index as the underlying asset. It is an agreement between a seller and a buyer to respectively deliver and take delivery of a basket of shares that makes up the index, at an agreed price at a specific future date. However, these contracts are usually cash-settled avoiding the need to deliver all the shares that make up the underlying stock index.

Stock index futures contracts provide financial executives and money managers' a risk management tool to reduce potential losses on a cash position.

Futures provide a more effective and flexible alternative to adjusting the returns and risk characteristics of a cash position. For example, using either betas or portfolio analysis only allows the investor limited flexibility in changing the amount of risk in the portfolio. Moreover, betas and portfolio risk measures change over time. It also provides speculators a degree of leverage that typically is not available with other instruments and allow speculators to change their risk profiles.

Besides helping to hedge risk and alter the risk profile of a cash portfolio, stock index futures contracts also perform the price discovery function. That is the stock index futures contract prices reflect the combined views of a large number of buyers and sellers as to the current supply/demand situation and the relationship of prices 12 to 18 months hence. It is an expression of opinions concerning today's expectations about the level of market or stock index performance at some point in the future. As conditions change, opinions change and prices of futures contracts also change. The expected changes in futures prices become important inputs for market participants in making effective hedging and speculative decisions.

Besides the hedging and speculation, stock index futures can be used for arbitrage activities. Arbitrage is risk-free and costless activity that aligns the fair price of a futures contract with the current price of the contract in the market. The logic underlying index arbitrage is that the theoretical futures price should equal that of a portfolio of stocks composing the index plus the net cost of carrying the stocks until delivery. If the futures price exceeds the price of the portfolio by the net cost of carry, it would be profitable for the arbitrager to buy the index portfolio and sell futures against it. If the futures price were less than the price of portfolio and the costs, it would be profitable for the arbitrager to buy the futures contract and sell the index portfolio. Such actions force the futures price back toward the fair price. The buying of the futures contracts is usually done in anticipation of share price increase and selling in anticipation of share price decrease. However, expectations can be wrong, and if expectations are wrong then the selling of the underlying shares (in case of buying the futures contracts when they are undervalued) and buying the underlying shares (when the futures contracts are sold when they are overvalued) will generate some gains to buffer losses. Without arbitrage, the futures price could deviate significantly from the fair price, causing hedgers to avoid using futures markets because of poor hedging results and the uncertainty of the pricing process.

The pricing of futures contracts and arbitrage between futures and cash are closely

related concepts. The fair price of a futures contract is determined by a pricing model that incorporates the value of the underlying cash asset, the time to expiration of the futures contract, the cost of financing the cash position, the cash inflows of the asset, and any special characteristics of the futures contract at expiration. In perfect markets – that is, when transactions costs and tax effects are not relevant – the actual futures price equals the fair price. Real futures markets are not perfect and there will always be opportunities to arbitrage the differences in the fair and actual prices of futures contracts and in the process aligning these prices, while earning arbitrage profits. The research issue addressed in this paper is whether arbitrage opportunities exists on the FKLI contracts and whether the futures market is price efficient over time.

THE MALAYSIAN STOCK INDEX FUTURES CONTRACTS

In Malaysia, the stock index futures contracts were introduced on the Kuala Lumpur Options & Financial Futures Exchange ("KLOFFE") on 15 December 1995. Since June 2001, KLOFFE is observed under the MDEX a Malaysian Derivatives Market. The contracts also recognized that FKLI futures contract are based on the 100 Kuala Lumpur Stock Exchange Composite Index (KLSE CI) stocks. Contract specifications of the FKLI futures call for delivery of a basket of shares, which makes up the KLSE CI. However, the contracts are always cash-settled. Cash settlement means that at the time of delivery, the seller of the futures contract does not have to deliver to the buyer the 100 KLSE CI shares, but rather will exchange cash equal to the difference between the price of the index in the futures contract and the price of the underlying index at the time of delivery. The underlying cash "value" of the contract is determined by multiplying the Index by value 100. The minimum change (tick) in the Index is 0.1, which is worth RM10. A change of one index point is worth RM100 (that is 100 x1.0).

OBJECTIVE

Futures contracts traded on the KLOFFE should reflect the actual worth of the asset in a future period. Theoretically, the futures price should equal the cash price of the asset (KLSE CI) plus the transaction costs. Arbitrage exists when the actual futures price deviates from the fair price by more than transactions costs. When sufficiently large profits above the risk-free return exist, arbitragers step in and buy the lower-priced security (the cash asset) and sell the higher priced security (the futures contract). Such actions force the futures price back toward the fair price. Profits are realised by unwinding the positions when the prices of the securities get properly aligned. Without arbitrage, the futures price could deviate significantly from the fair price, causing hedgers to avoid using futures markets because of poor hedging results and the uncertainty of the pricing process. This study measures the arbitrage opportunities on the daily FKLI contracts price from calendar years 1996 through 1999. To test the pricing efficiency of the futures contracts, the standard error between the closing actual and theoretical fair values for each month FKLI futures contract for the same period. The measurement period for each contract was the 18-22 tracking days when the contract was the spot month. The spot month contract has, so far, been the most liquid, making this period the most appropriate for measuring market efficiency. If the FKLI futures market becomes more price efficient, the standard errors should decline over time, implying lesser opportunities for arbitrage.

MODEL SPECIFICATION

The cost of carry model explains the relationship between the cash asset price and futures price. It shows the relationship created between these markets when an arbitrager buys the cash asset now, holds and finances the asset with borrowed funds for the life of the futures contract, and then delivers the cash asset into the futures contract when the futures expire. The fair futures price calculated by the cost of carry model for stock index futures must consider the dividends received from holding the stocks in the index that is,

$$P_{FAIR} = P_C (1 + i)^t - D \qquad (1)$$

where

P_{FAIR} = the fair futures price for a stock index
P_C = the current value of the underlying cash stock index
i = the financing rate of interest or equivalent investment return desired

D = the Ringgit dividend amount in index points received on the stocks in the index from now until the expiration of the futures contract

t = number of days until expiration of the futures divided by 365

Equation (1) illustrates both the relationship between the futures and current cash values and the net difference between the financing (or opportunity) costs and the income received.

The Ringgit dividend, D, must be recalculated whenever a stock in the index pays its dividend or a firm alters its dividend. The model shows that the effect of receiving dividends over the life of the futures contract is to lower the futures price. This relationship occurs because (a) the dividends received reduce the net funds needed to finance the cash position and (b) a purchase of the futures contract is an alternative to holding the cash stocks, but a long position in futures does not provide any income from dividend payments.

The continuous time equivalent to the above cost of carry equation is used frequently, since only the dividend yield rather than the frequency changing total Ringgit dividends are needed for its calculation:

$$P_{FAIR} = P_C \, e^{(i - d)t} \qquad (2)$$

where d = the dividend yield on the stock index
If one has only the dividend yield, then an alternative to using Equation (2) is to convert the yield to Ringgit dividends, as shown in Equation (3)

$$D = d \, P_C \, t \qquad (3)$$

Note that Equation (1) provides the most accurate calculation of the effects of dividends and therefore is employed in many of the arbitrage computer models.

Equations (1) and (2) and Example 1 illustrate both the relationship between the futures and current cash index values and the net difference between the financing costs and the dividend income received. In particular, the larger the difference between i and d, the larger the price difference between P_{FAIR} and P_C. In addition, the larger the value of t, the larger the price difference between the futures and cash index values.

Example 1 also illustrates that Equations (1) and (2) used for determining the fair futures price, $P_{FAIR,}$ can provide slightly different values. Which equation the trader employs depends on the trader's beliefs concerning which equation best describes the cash flow process.

When the actual stock index futures price differs from the cost of carry forward price by more than transactions costs, arbitrage opportunity is created. Equation (1) can be expressed to include transactions costs to define the arbitrage opportunities for stock index futures:

$$P_C \, (1 + i)^t - D + T < P_F < P_C \, (1 + i)^t - D - T \qquad (4)$$

or more compactly as

$$P_{FAIR} + T < P_F < P_{FAIR} - T \qquad (5)$$

with T being the total transactions costs.

DATA

The data on the closing FKLI futures contracts prices was obtained from KLOFFE. The closing KLSE CI values and 90-days Malaysian T-bills rate were obtained from Bank Negara Malaysia. The dividend yield values for the KLSE CI was obtained from the *Investor's Digest*. The risk-free rate was the yield of the 3-months Treasury Bills security maturing nearest to the expiration date of each contract. The data was collected for a 4-year period from February 1996 to December 1999.

FINDINGS

The fair value of futures prices is calculated using a cost-of-carry model (Equation 1). The extent of deviation of the market price of futures contract (FKLI) from their fair values is defined as a percentage of futures market premium over futures fair values, π, as,

$$\pi = \ln (P_F / P_{FAIR})$$

where,

π is the percentage premium of the FKLI price over fair value

P_F is the FKLI price and

P_{FAIR} is the FKLI fair value as implied from the KLSE CI price

EXAMPLE-1 : Determining the Fair Value of a Stock Index Futures Contract

The following values represent actual stock market values:

KLSE CI	319.72
3-months T-bill yield	6.59%
Dividend yield on the Index stocks	3.02%
Days until expiration of the futures	84

Using these data, the fair price is calculated as follows:

$$P_{FAIR} = P_C\, e^{(i-d)t}$$
$$P_{FAIR} = 319.72\, e^{(0.0659-0.0302)(84/365)}$$
$$= 319.72\, e^{0.0082159}$$
$$= 322.36$$

Equation (1) can also be used to calculate the fair price if the dividend yield first is converted to total Ringgit dividends (or if the total Ringgit dividends expected over the life of the futures contract are added up separately for the individual stocks). Equation (3) is employed to convert dividend yields to dollar dividends:

$$D = d\, P_C\, t$$
$$D = (0.0302)(319.72)(84/365) = 2.222$$

Then one is able to calculate the fair price as follows:

$$P_{FAIR} = P_C\,(1+i)^t - D$$
$$P_{FAIR} = 319.72\,(1+0.0659)^{84/365} - 2.222$$
$$= 322.23$$

Notice that the two calculated values for the fair futures price differ slightly. There are two reasons for this. Most important, Equation (1) calculates the dividend value in index points, whereas Equation (2) uses the dividend yield. Moreover, the first formulation uses discrete compounding, whereas the second employs continuous compounding.

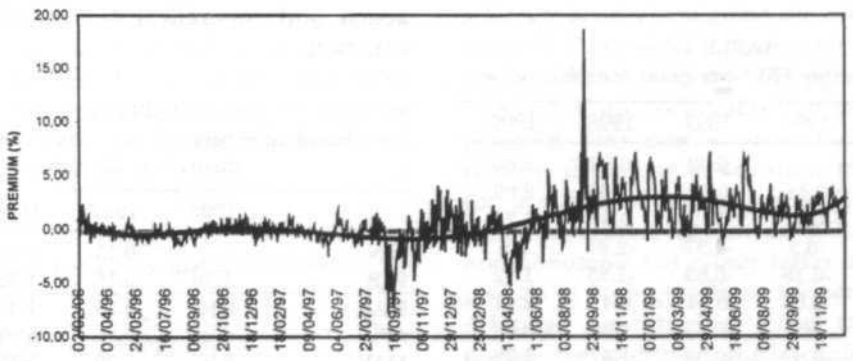

Fig. 1: Plots of future premium over the period

Fig. 1 plots the percent of mispricing of each contract on a daily basis. This percent is the difference between the actual and theoretical price expressed as a percent of the theoretical price. The plot shows considerable deviation of FKLI prices from fair value during the crisis period, from September 1997 onwards. The September 1997 contract was undervalued by as much as 7.86% at the beginning of the financial crisis. By contrast, the September 1998 contract was overpriced by 18.67% and this was the month when Malaysia implemented the capital and exchange controls. Overall, the 1996 contracts traded approximately at fair value compared to contracts in the later years (September 1997 onwards).

Fig. 2 shows the distribution of the futures premium, p over the fair value. The frequency of distribution is positively skewed indicating more numerous positive and persistent premiums compared to negative premium. This means, on average, the futures contracts are overpriced,

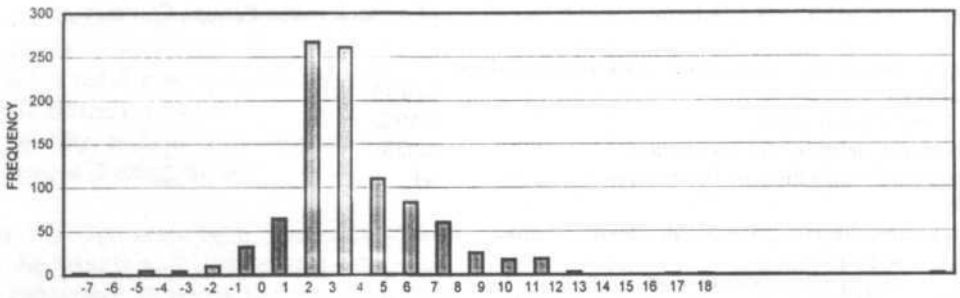

Fig. 2: Distribution of the FKLI premium over fair value

that is market price of futures contracts is higher than their fair price.

Table 1 shows that the FKLI futures for year 1996 and 1997 were undervalued by 0.14% and 0.42% respectively. Ignoring transaction costs, there were a long futures arbitrage opportunities in both years. Profits from long futures arbitrage is generated when the actual futures price is less than the fair price plus transactions cost which is usually a constant for stock index futures contracts. The way to implement the arbitrage is to buy the undervalued futures and sell the KLSE CI shares (assuming that short selling of shares is allowed).

TABLE 1
Average monthly FKLI premium over fair value

	1996	1997	1998	1999
JAN		0.02	0.09	3.36
FEB	0.54	0.04	-0.31	2.09
MAR	-0.02	0.19	0.37	1.24
APR	-0.3	-0.37	-2.21	2.6
MAY	-0.18	-0.85	-1.55	1.72
JUN	-0.65	0.14	0.48	2.01
JUL	-0.3	-0.37	1.55	3.02
AUG	-0.82	-0.39	1.67	1.76
SEP	-0.33	-3.21	4.06	1.26
OCT	0.21	-1.54	3.98	1.21
NOV	0.27	0.16	3.09	2.22
DEC	0.09	1.09	3.37	2.04
AVERAGE	-0.14	-0.42	1.22	2.04

For the year 1998 and 1999, the FKLI futures were overvalued by 1.22% and 2.04% respectively. Since the actual futures price is greater than the fair price, selling the higher-priced futures contract and purchasing shares of the KLSE CI index generates an arbitrage profit. This represents a short futures arbitrage opportunity.

To test the pricing efficiency of the futures contracts or in other words the gradual convergence of the market price to the fair price of futures contracts, the standard error between the closing actual and theoretical fair values for each month FKLI futures contract was estimated and the results are summarized in Table 2. If the FKLI futures market is getting more efficient, then there should be a narrowing of the difference in the market and fair price of futures contract (also indication of active arbitrage activity) indicated by declining values of standard errors over time. Fig. 3 plots the monthly standard errors between the closing actual and theoretical fair value of futures contracts.

TABLE 2
Standard errors of the actual closing and theoretical fair value

	1996	1997	1998	1999
JAN		0.15	2.54	19.06
FEB	1.30	0.15	1.33	8.21
MAR	0.09	0.19	1.40	4.77
APR	0.21	0.32	8.92	9.29
MAY	0.27	1.20	5.19	8.42
JUN	0.58	0.65	1.53	5.80
JUL	0.21	0.57	6.42	17.60
AUG	0.98	2.35	5.12	4.88
SEP	0.39	16.86	41.34	3.20
OCT	0.16	5.57	24.08	2.52
NOV	0.22	2.35	13.19	6.09
DEC	0.37	4.52	17.54	5.87
AVERAGE	0.44	2.91	10.72	7.97

Table 2 and Fig. 3 show that the standard errors are not declining but rather increasing over the period of analysis suggesting that the pricing efficiency of FKLI futures contract has declined over time. This also implies lack of

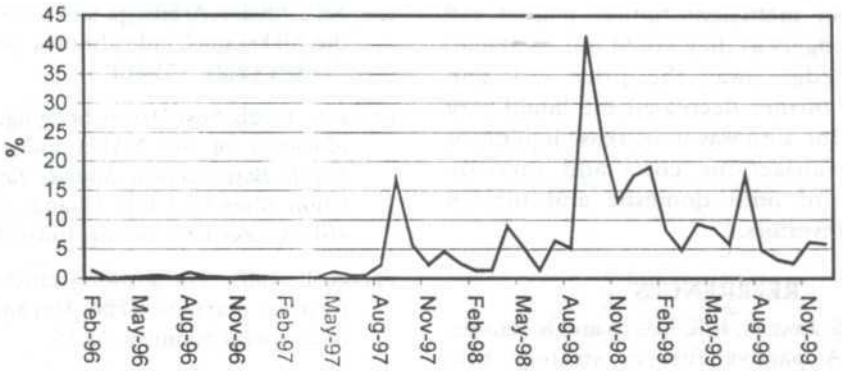

Fig. 3: Standard error between the closing actual and theoretical fair value

active arbitrage activity to correct the differences between actual and fair price of futures contracts. This also implies that the futures market creates more opportunities for speculating rather than hedging; as it is difficult for hedgers to use the inefficiently priced futures contract to cover their price risk.

A regression analysis between the theoretical and actual value of futures contracts confirms a positive and significant relationship with 99.78% of the variation in the theoretical value explained by the changes in the actual value of the futures contract.

Details of the regression analysis are summarized in Table 3. The positive relationship is vital for hedgers to construct an effective hedge to cover the price risk on their cash portfolio.

TABLE 3
Relationship between actual and fair prices

Mean, P_F	825.6531
Mean, P_{FAIR}	822.0683
a	-14.4293
b	1.0131
r	0.9989
R^2	0.9978
t	661.9527
n	965

CONCLUSION

Arbitrage activity on the stock index futures contracts links the cash stock market to the stock index futures market. Arbitrages ensure that futures market values do not diverge too much from fair values, and arbitrage profits are created if the divergence exceeds the costs of transactions. This implies a predictable positive relationship between cash and futures prices, which is vital to hedgers to hedge the price risk of their cash portfolios using stock index futures.

This study provides some preliminary evidence of the efficiency of the FKLI stock index futures based on the simple "cost-of-carry" model. The findings suggest that the actual futures prices do not converge towards theoretical prices with the passage of time. This pricing inefficiency might be due to the infancy of FKLI futures market and immaturity of the arbitrage activity in aligning the cash and futures markets. This implies that arbitrage opportunities are consistently available (though do not seem to be taken up) for traders who have full use of proceeds. One crucial assumption driving this result is the ability to sell short the cash index (or a subset of stocks in the KLSE CI). The results also reveal that the stock index pricing is not monotonic but rather varies over time with periods of both greater and lesser efficiency. Arbitrage opportunities exists when risk-free profits are possible, which occurs when the futures and market prices deviate by more than transactions costs. Usually in developed markets, arbitrage opportunities are available to insiders and are quickly exploited thereby increasing the pricing efficiency of futures markets. Therefore, stock index arbitrage is a self-regulating mechanism that increases the price efficiency of the futures markets. However, the findings of this study show a continuous inefficiency of the futures market and thereby existence of arbitrage opportunities for traders. This implies that our futures market requires greater liquidity to enable arbitragers to correct any mispricing and consequently increase price efficiency of futures

contracts. An inefficient futures market will deter away hedgers as they would not be able to effectively hedge away the price risk and consequently further decreased the liquidity of the market. One sure way to increase liquidity is to reduce transactions costs and increase participation of both domestic and foreign institutional investors.

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Subject Index for Volume 8 Nos. 1 and 2, 2000

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Preparation of Manuscript

Typing and Paper
The manuscript should be typed double spaced on A4 paper with 4cm margins on all sides. it should be limited to 25 pages including tables, illustrations and references.

Title page
The title of the paper, name of author and full address of the institution where the work was carried out should appear on this page. A short title not exceeding 60 characters should be provided for the running headlines.

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Keywords
About six to ten keywords are required and these should be placed directly above the abstract.

Tables
Tables should be typed on separate pages and numbered using Arabic numerals. Each table should be referred to in the text, has a brief title and include explanatory notes, if necessary, below it. Vertical rules should not be used. Footnotes in tables should be designated by symbols or superscript small italic letters. Tables should conform to page size.

Equations
These must be clearly typed, triple-spaced. They should be identified by numbers in square brackets placed flush with the right margin.

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Illustrations including diagrams and graphs are to be referred to in the text as 'figures' and photographs as 'plates' and numbered consecutively in Arabic numerals. All photographs (glossy black and white prints) should be supplied with appropriate scales.

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Citations to the literature in the text should to be indicated by the author's name and year of publication in parentheses, e.g. (Barnett and Lewis 1982). If an author is quoted in the text, the year of publication should immediately follow in parentheses. e.g. Barnett and Lewis (1982) state that "....." Citation of a particular page follows the date and is preceded by a comma, e.g. Humphrey 1990, p. 26-27.

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Chapter in Edited Book
Zahid Emby. 1990. The Orang Asli Regrouping Scheme-converting swiddeners to commerical farmers. In *Margins and Minorities - The Peripheral Areas and Peoples of Malaysia*, ed. V. T King & M.J.G. Parnwell, p. 94-109. Hull: Hull University Press.

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