INTER-SECTORAL LINKAGES AND RISK DIVERSIFICATION IN THE KUALA LUMPUR STOCK EXCHANGE

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ABSTRACT

This empirical study shows that risk reduction through sectoral portfolio diversification is not effective in the long run as the major sectors of the KLSE appear to share a common stochastic trend in the long run, meaning that they tend to move together in the long run. The reduction of risk, however, seems to be possible in the short run, as non-systematic shocks generated in one sector might not be propagated simultaneously to another sector when there is no direct causal effect from the shocked sector to the other. Even though these sectors might be causally linked indirectly through a third sector, this kind of indirect link usually exhibits some lags in time, and thus allows investors, who monitor trading closely with rational expectation, to make quick adjustments. Among the various sectors in the KLSE, the Industrial Products, Finance and Property are the three leading sectors that exhibit direct causal effect on many other sectors.

INTRODUCTION

Most research work on portfolio management has emphasized the benefits of diversification by containing an optimal number of securities in the portfolio. However, there is a lack of consensus over the portfolio diversification across different sectors within a stock market. Whether risk reduction could be optimally achieved through investing in securities from various sectors within a market could be important to investors in their decision-making, especially the retailers. Some retailers in emerging markets, for example the Kuala Lumpur Stock Exchange (KLSE), do not trade internationally, and thus cannot reduce their risk through international risk diversification. The risk-reduction benefits, however, could be accomplished for this group of investors if diversification across different sectors within the market is meaningful.

The study of modern portfolio theory dates back to the work initiated by Markowitz (1952). Since his analysis, a number of researchers have attempted to measure the rate at which risk-reduction benefits are realized as the number of securities in a portfolio is increased. Among others, Evans and Archer (1968) have modelled risk in terms of the portfolio's standard deviation, and they suggested that for a randomly selected and equally weighted portfolio, there is very little risk reduction to be obtained from expanding a portfolio beyond eight to ten securities. Bird and Tippett (1986) subsequently derived an exact parametric relationship between size and standard deviation and demonstrated that the functional form used by Evans and Archer (1968) was mis-specified. Their empirical work indicated that risk-reduction benefits

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would be achieved by expanding the size of the portfolio beyond the level suggested by Evans and Archer (1968), Poon et al. (1992) using a different approach to examine the issue of portfolio diversification. They produced a series of graphs to present a visual analysis of this important issue. Their results show that there are opportunities for reducing risk by increasing the portfolio size beyond ten.

Besides obtaining an optimal number of stocks in the portfolio, many investors also believe that a substantial advantage in risk reduction and potential gain could be obtained through portfolio diversification in both domestic common stocks and foreign securities. This, therefore motivated many studies on diversification across national boundaries to reduce portfolio risk, among others, Koch and Koch (1991), Cheung and Ho (1991), Cheung and Mak (1992), Kok and Goh (1994), Masih and Masih (1997), and Chan et al. (1997). Most of these studies employed the cointegration approach to examine the long-run co-movement of the stock markets. The empirical findings of these studies have shown that stock indices are not cointegrated internationally, and only a small fraction of national systematic risk elements is transmitted abroad. Thus, according to the findings, risk reduction through international portfolio diversification seems to be effective in the long run.

To date, however, not much work has been done on portfolio diversification across various sectors in a stock market. This paper makes several contributions to this line of investigation. First, we examine the possibility of risk reduction in portfolio investment in the long run in terms of market efficiency across sectors vis-à-vis the non-existence of common stochastic trends among the eight major sectors in the KLSE. Second, we investigate the short-run dynamic causal linkages among the sectors to explore whether risk reduction via portfolio diversification within a market is possible in the short run; and third we identify the leading sectors of the market. The eight major sectors included in this study are the Industrial Products, Consumer Products, Construction, Trading & Services, Finance, Property, Mining and Plantation from the Main Board of the KLSE.

The long-run equilibrium relationships among the sectors are examined by conducting the Johansen and Juselius (1990) multivariate cointegration test under the framework of vector autoregressive (VAR) model. If the sectoral indices are cointegrated, then risk reduction via portfolio diversification in terms of sectors will not be effective in the long run. The short-run dynamic linkages among the sectors, which are determined under the Granger-causality analysis in the environment of vector error-correction model (VECM), are used to investigate the possibility of short-term risk reduction through sectoral diversification. This analysis will also enable us to identify the leading sector in the market. In this study, the leading sector is referred to as a sector that Granger-leads the highest number of other sectors. The most influential sector, on the other hand, is referred to as a sector that can have the greatest impact on other sectors. This sector can be identified through the impulse response function, which measures the intensities of responses to shocks in one sector by other sectors during the post-sample period.

The rest of this paper is organized as follows. The next section briefly describes the structure of KLSE and its various sectors. The third section explains the methodology employed and the collection of the data, the forth section presents the estimated results, and the final section summarizes and concludes the discussion.

KUALA LUMPUR STOCK EXCHANGE

The Kuala Lumpur Stock Exchange (KLSE) plays a vital role in the economic development of Malaysia. It is a central market place that facilitates effective mobilization of both domestic and foreign funds in promoting the national goal of industrialization, wealth creation and public share ownership. The KLSE is governed by a sound regulatory framework, which promotes fair and open price formation, provides for investors' protection and ensures prompt and reliable information disclosure and dissemination.

In 1992, trading on the KLSE was fully computerized with the full implementation of the system on Computerized Order Routing and Execution (SCORE). The implementation has eliminated the need for a trading floor at the Exchange's premises. Current transactions are facilitated through the Exchange's 57 member stock-broking companies located all over the country.

Companies in the KLSE are either listed on the Main Board or Second Board of the Exchange. Companies listed on the Main Board are required to have a minimum paid-up capital of RM 60 million, with at least 25% of the issued and paid-up capital in the hands of a minimum number of public shareholders holding not less than 1,000 shares each. Companies listed on the Second Board, on the other hand, need to have a minimum paid-up capital of RM 40 million, with at least 25% of the issued and paid-up capital in the hands of a minimum number of 750 public shareholders holding not less than 1,000 shares each. As at 4th October, 1999, there was a total of 746 companies listed on the KLSE, with 462 companies listed on the Main Board and 284 companies listed on the Second Board[1].

Companies on both Main and Second Board are classified into a range of diverse sectors reflecting their core business. The sectors include the Consumer Products, Industrial Products, Construction, Trading & Services, Infrastructure, Finance, Hotels, Plantation and Property. The movements of these sectors are represented by the time series of their respective sectoral indices, which were computed based on the stringent guidelines of 1985, where the component companies were selected under a rigorous screening conducted by a committee of competent professional bodies and academicians. These indices thus could be considered as unbiased and reliable yardsticks to gauge the changes and developments in the sectors as well as in the market.

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[1] *This information was provided by the KLSE on 4th October 1999.*

DATA COLLECTION AND METHODOLOGY

The data used in this study are the weekly stock indices of the eight sectors on the main board of the KLSE, namely, the Consumer Products, Industrial Products, Construction, Trading & Services, Finance, Property, Mining and Plantation collected from the KLSE Daily Dairy and The Star daily newspapers. These data are collected on Wednesday to avoid the opening effect on Monday and the closing effect on Friday. The sample period covers September 1993 to July 1998, with a total of 257 data points. Weekly data are employed as they are more responsive to the volatile nature of the market and are able to capture more information than the monthly, quarterly or annually data.

The long-run relationships between the sectors are investigated by the Johansen-Juselius (1990) multivariate cointegration method. The short-run relationships, on the other hand, are analyzed by the Granger-causality analysis within the vector error-correction model (VECM). Before conducting the cointegration analysis the order of integration of each series is determined by both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. The maximum likelihood multivariate cointegration test is then utilized to determine the number of linearly independent cointegrating vectors in the system. The cointegration approach is set up as a vector autoregression (VAR) of non-stationary time series:

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \mu + \Theta t + \varepsilon_t , \qquad (1)$$

where $\Pi = -\left(I - \sum_{i=1}^{k} \Pi_i\right)$, and $\Gamma_i = -\left(I - \sum_{i=1}^{k} \Pi_j\right)$, for $i = 1, ..., k-1$.

where X_t is a vector of p variables (or p KLSE sectoral indices in this study), μ are the intercepts, t are deterministic trends and ε_t is a vector of Gaussian random variables. The coefficient matrix Π, also referred to as the long-run impact matrix, contains information about the stationarity of the sectoral indices and the long-run relationship amongst them. The rank(r) of the matrix determines the number of cointegrating vectors in the system. If Π is of full rank, or $r = p$, then all sectoral indices in X_t are themselves stationary with no common stochastic trend or long-run relationship existing amongst them. On the other hand, if Π is a null matrix, or $r = 0$, then cointegration is not present and the sectoral indices in X_t are non-stationary. In the latter case, Equation (1) is equivalent to the usual VAR model in first differences. For the case when $0 < r < p$, then there are r linear combinations of sectoral indices in X_t that are stationary. This is an indication that the sectoral indices are cointegrated in the long run with r cointegrating vectors. In other words, these indices possess a long-run equilibrium relationship, and are moving together in the long run. The Π matrix can be factored as $\Pi = \alpha\beta^T$, where the α matrix contains the adjustment coefficients and the β matrix contains the cointegrating vectors. Johansen and Juselius approach uses two likelihood ratio statistics, the trace and the maximum eigenvalue statistics, to test for the possible number of cointegrating vectors in the system. Critical values for these statistics are tabulated in Osterwald-Lenum (1992). The optimal lag structure of the system is determined by minimizing the Final Prediction Error (FPE) criterion suggested by Akaike (1971).

If cointegration is detected among the sectoral indices, then the short-run Granger-causality analysis on these indices must be conducted in a vector error-correction model (VECM) to avoid problem of misspecification (see Granger 1988)[2]. Otherwise, the analysis may be conducted as a standard vector autoregressive (VAR) model[3]. The direction of Granger-causal effect running from one sector to another in the KLSE can be detected using the vector error-correction model (VECM) derived from the long-run cointegrating vectors. The VECM model employed for the testing of Granger-causality across various sectors in the KLSE can be represented by

$$X_t = \begin{bmatrix} \Delta x_{1t} \\ \Delta x_{2t} \\ \vdots \\ \Delta x_{pt} \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \vdots \\ \alpha_p \end{bmatrix} + \begin{bmatrix} \beta_{11}(L)\ \beta_{12}(L) \ldots \beta_{1p}(L) \\ \beta_{21}(L)\ \beta_{22}(L) \ldots \beta_{2p}(L) \\ \vdots \\ \beta_{p1}(L)\ \beta_{p2}(L) \ldots \beta_{pp}(L) \end{bmatrix} \begin{bmatrix} \Delta x_{1t} \\ \Delta x_{2t} \\ \vdots \\ \Delta x_{pt} \end{bmatrix} + \begin{bmatrix} \gamma_1 z_{1,t-1} \\ \gamma_2 z_{2,t-1} \\ \vdots \\ \gamma_p z_{p,t-1} \end{bmatrix} + \begin{bmatrix} \Phi(L)\ 0 \ldots\ 0 \\ 0\ \Phi(L)\ 0 \ldots 0 \\ \vdots \\ 0 \ldots\ 0\ \Phi(L) \end{bmatrix} \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \vdots \\ \varepsilon_{p,t} \end{bmatrix} \qquad (2)$$

where X_t is an $(p \times 1)$ vector of sectoral indices in the system, α's represent a vector of constant terms, β's are estimable parameters, Δ is a difference operator, L is a lag operator, $\beta(L)$ and $\Phi(L)$ are finite polynomials in the lag operator, z_{t-1}'s are error-correction terms, and ε_t's are disturbances.

The *F*-test on each of the explanatory variable (in first differences) and its lags in each equation in the VECM indicates the "short-run" causal effect running from that explanatory variable to the dependent variable of the equation[4]. For example, if the *F*-statistic of the Industrial sector (as a explanatory variable in the equation) is significant at a 5% level (i.e. $H_0: \beta_i(L) = 0$, for i = Industrial sector, is rejected at a 5% significance level), and the Trading Services sector is the dependent variable of the equation, then we can say that there is a causal effect running from the Industrial sector to the Trading Services sector. In other words, the Industrial sector leads the Trading Services sector. Besides the detection of the short-run causal effects, the VECM model also allow us to examine the effective adjustment towards equilibrium in the long run through the significance or otherwise of the *t*-test of the lagged error-correction terms (ECT) of the equation.

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[2] *If the variables in a system are cointegrated, then the short-run analysis of the system should incorporated the error-correction term (ECT) to model the adjustment for the deviation from its long-run equilibrium.*

[3] *When an ECT is added to the vector autoregressive model (VAR), the modified model is referred to as the vector error-correction model (VECM). VECM is thus a special case of VAR.*

[4] *The coefficients of the explanatory variables are estimated as a system under the VECM setting. However, the Granger-causality F-test for each explanatory variable and its lags is conducted by an equation-by-equation basis.*

The *F*- and *t*-tests on VECM may be interpreted as within-sample causality tests (see Masih and Masih, 1996). The results only indicate the Granger-exogeneity or endogeneity of the dependent variable within the sample period. They do not provide information regarding the relative intensities of the Granger-causal chains amongst the sectors beyond the sample period. In order to analyze the dynamic properties and the intensities of impacts from one sector to another in the KLSE during the post-sample period, the impulse response functions (IRFs) are computed.

The IRFs trace the dynamic effects of a one standard deviation shock to one sector on current and future values of all the other sectors in the system during the post-sample period. These responses are usually represented by graphs. In this setting, the response of a variable to a particular shock is divided by the standard deviation of its residual variance, so that all responses are in fractions of standard deviations[5].

ESTIMATED RESULTS

Before the cointegration analysis is conducted to determine the integration among the sectoral indices of the KLSE, the unit root property of the indices is checked by running the Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. All series have been log-transformed before the analysis to avoid problems of heteroscedasticity. The test results reported in Table 1 indicate that the null hypothesis of a unit root could not be rejected for all the indices in their level form. This hypothesis, however, is rejected for their first differences, meaning that all the variables are integrated of the same order, I(1). Since all the variables are integrated of the same order, it is thus meaningful for us to proceed with the Johansen and Juselius (1990) multivariate cointegration test on these series to determine their long-run equilibrium relationships.

The multivariate cointegration technique developed by Johansen and Juselius (1990) is employed to the system of eight variables, which are integrated of order one (as reported in Table 1). The uniform lag structure of the system is set up through the Likelihood Ratio test[6].

Table 1: Unit Root Results

Variable	ADF Test		PP Test	
	Constant without trend	Constant with trend	Constant without trend	Constant with trend
		Levels		
Industrial	0.7180(14)	0.4752(14)	0.6148(1)	-0.0745(1)
Trading	1.1394(14)	0.3387(14)	1.6446(1)	-0.5291(1)
Property	1.7519(14)	0.3387(14)	1.6446(1)	-0.5291(1)
Plantation	-0.9771(14)	-1.7796(14)	-2.4632(1)	-2.1559(1)
Mining	-0.1111(14)	-1.4415(14)	-0.3158(1)	-2.0826(1)
Finance	0.6813(16)	0.4043(16)	0.9307(1)	0.0331(1)
Consumer	-0.4963(15)	-0.3445(15)	-0.5059(1)	-0.5986(1)
Construction	0.7134(12)	0.2668(12)	1.2838(1)	0.2271(1)

[5] *See Enders (1995) for further reading on IRF.*
[6] *See Sims' (1980) for the detailed discussion on the modified version of the likelihood ratio test.*

		First Differences		
Industrial	-4.2144(14)*	-4.7847(14)*	-15.558(1)*	-16.012(1)*
Trading	-3.5852(14)*	-3.8849(14)*	-17.072(1)*	-17.475(1)*
Property	-4.1579(14)*	-4.7033(14)*	-13.525(1)*	-13.934(1)*
Plantation	-5.3887(15)*	-5.5958(15)*	-13.165(1)*	-13.405(1)*
Mining	-5.3115(15)*	-5.3185(15)*	-12.410(1)*	-12.594(1)*
Finance	-3.4596(15)*	-4.0049(15)*	-14.436(1)*	-14.957(1)*
Consumer	-4.0616(15)*	-4.2757(15)*	-14.881(1)*	-15.160(1)*
Construction	-3.5738(14)*	-4.3910(14)*	-14.938(1)*	-15.489(1)*

Notes: The null hypothesis is that the series contains a unit root. The (*) indicates the rejection of the null hypothesis at a 5% significance level. The critical values for the rejection are –2.86 for models without a linear trend (indicated as constant without trend, meaning that besides the variables, a constant term is included), and –3.41 for models with a linear trend (indicated as constant with trend, meaning that besides the variables, a constant term and a linear trend term are included). These values are provided by the SHAZAM output based on MacKinnon (1991). The figures in parentheses are the optimal lag lengths.

The result of the multivariate cointegration test presented in Table 2 indicates that one of the null hypotheses, namely, the null hypotheses of zero cointegrating vector is rejected based on the 95% critical value, meaning that the eight sectoral indices are cointegrated with at least one cointegrating vectors, and are moving together in the long run. Both the maximum eigen value test and the trace test yield identical results.

Table 2 : Johansen's Test for Multiple Cointegrating Vectors

H_0	Maximum Eigenvalue (95% level)	Critical Value	Trace (95% level)	Critical Value
$r = 0$	56.96*	54.17	188.18*	174.88
$r \leq 1$	47.39	48.57	131.23	140.02
$r \leq 2$	31.79	42.67	83.83	109.18
$r \leq 3$	23.51	37.07	52.04	82.23
$r \leq 4$	14.47	31.00	28.53	58.93
$r \leq 5$	7.45	24.35	14.05	39.33
$r \leq 6$	6.26	18.33	6.60	23.83
$r \leq 7$	0.34	11.54	0.34	11.54

Notes: r indicates the number of cointegrating vectors. The (*) indicate rejection at the 95% critical values.

Vector Error-Correction Modeling (VECM) is important to systems which exhibit cointegrating vectors. The error-correction term (ECT) which measures the adjustment of the system from the short-term deviation back to its long-run equilibrium must be included in the setting up of the Granger-causality test to avoid misspecification and omission of important constraints. The error-correction terms can be consistently obtained from the corresponding lagged residuals of the cointegration regression (See Charemza and Deadman, 1992).

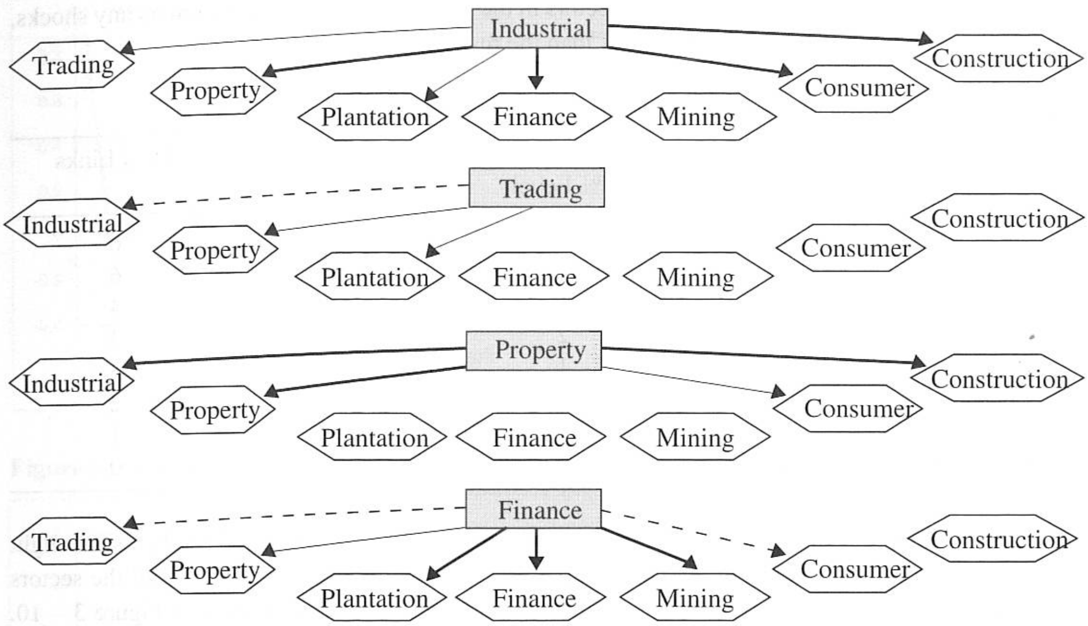
Table 3 reports the Granger-causality result based on VECM with optimal uniform lag structure, which is determined by the Likelihood ratio test (see Hamilton, 1994). It is as expected that all the error-correction terms (as indicated by their t-statistics) are significant indicating that the system is always adjusting toward its equilibrium path. The estimated results of short-run causality are summarised as follows: (i) The Industrial Products sector leads all other sectors at either a 1% or 5% significance level, except for the Mining sector; (ii) The Trading sector leads the Property and Plantation sectors at a 5% level, and the Industrial Products sector at a 10% level; (iii) The Property sector leads the Industrial Products, Trading and Construction sectors at a 1% level, and the Consumer Products sector at a 5% level; (iv) The Finance sector causes the Industrial Products, Plantation and Mining sector at a 1% level, the Property at a 5% level, the Trading and Consumer Products at a 10% level; (v) The Mining sector leads the Consumer Products sector at a 1% level, Finance at a 5% level and Construction at a 10% level; (vi) The Consumer Products sector causes the Property and Construction sectors at a 1% level; (vii) The Construction sector leads the Mining sector at a weak 10% level, and (viii) The Plantation sector does not cause any of the other seven sectors. These inter-sectoral causal linkages are summarised in Figures 1 and 2.

Table 3: Granger Causality Results based on Vector Error-Correction Model

Dependent Variable	Independent Variable F-statistics (Significant Level)								t-statistics
	ΔInd	ΔTra	ΔPro	ΔPlan	ΔFin	ΔMin	ΔCon	ΔCst	ECT_{t-1}
ΔInd	-	0.0509*	0.0001***	0.2182	0.0001***	0.1880	0.2266	0.2549	-5.3276***
		(2)	(5)	(3)	(3)	(3)	(5)	(5)	
ΔTra	0.0233**	-	0.0002***	0.5633	0.0893*	0.2039	0.1189	0.1775	-4.0161***
	(1)	(3)	(1)	(1)	(1)	(1)	(1)	(4)	
ΔPro	0.0089***	0.0648**	-	0.2882	0.0256**	0.8098	0.0012***	0.9509	-4.2237***
	(2)	(1)	(2)	(1)	(5)	(1)	(3)	(1)	
ΔPlan	0.0151**	0.0154**	0.8965	-	0.0077***	0.1487	0.4441	0.4289	-4.5626***
	(4)	(1)	(1)	(5)	(1)	(4)	(1)	(1)	
ΔFin	0.0006***	0.9274	0.0825	0.8779	-	0.0233**	0.4153	0.0950*	-4.6157***
	(2)	(2)	(1)	(1)	(4)	(3)	(1)	(1)	
ΔMin	0.1548	0.6045	0.8375	0.5534	0.0022***	-	0.3533	0.6639	-3.1767***
	(5)	(1)	(1)	(1)	(4)	(2)	(5)	(1)	
ΔCon	0.0097***	0.2803	0.0191**	0.3928	0.0559*	0.0037***	-	0.1003	-4.3898***
	(1)	(1)	(2)	(1)	(1)	(3)	(5)	(3)	
ΔCst	0.0045***	0.1672	0.0001***	0.2838	0.1111	0.0939*	0.0066***	-	-4.9801***
	(3)	(3)	(4)	(1)	(1)	(4)	(3)	(5)	

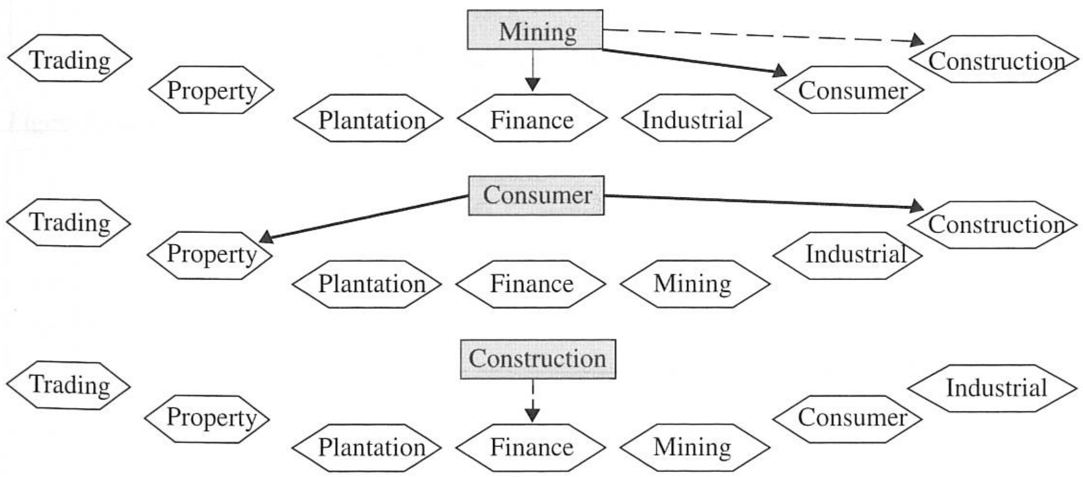
Notes: The F-statistic tests the joint significance of the lagged values of the independent variables, and t-statistic tests the significance of the error correction term (ECT). The asterisks indicate the following levels of significance: *10%, **5% and ***1%. The abbreviations ΔInd, ΔTra, ΔPro, ΔPlan, ΔFin, ΔMin, ΔCon, and ΔCst represent the first differences of the respective indices, namely the Industrial Products, Trading and Services, Property, Plantation, Finance, Mining, Consumer Products and Construction.

Figure 1: Sectoral Causal linkages in the KLSE
(Leading Sector: Industrial Products, Trading, Property and Finance)



Unidirectional causal effect at
1% significance level
5% significance level
10% significance level

Figure 2: Sectoral Causal linkages in the KLSE
(Leading Sector: Mining, Consumer Products, Construction)



Unidirectional causal effect at
1% significance level
5% significance level
10% significance level

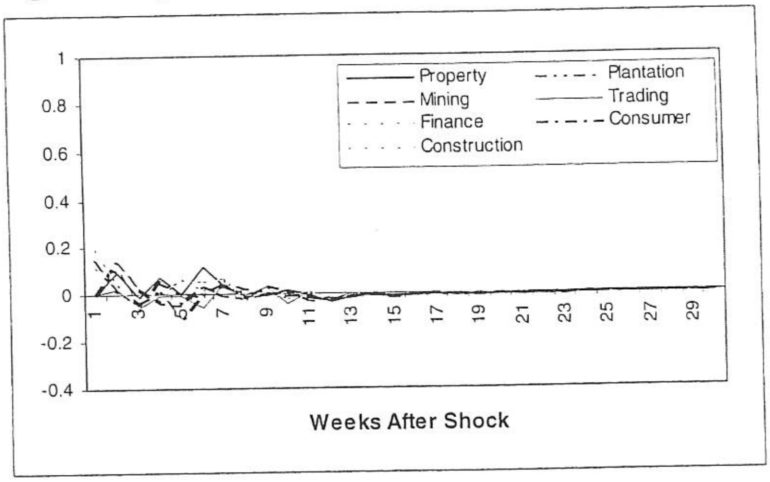
Based on the above causality analysis, we could rank the sectors according to their influences on other sectors. The ranking presented in Table 4 indicates that the Industrial Product and Finance Sectors are the two most dominant leading sectors in the KLSE. If the market encounters any shocks, these two sectors will then to response faster than the rest of the sectors.

Table 4: The Ranking of Sectors According to the Numbers of Causal Links

Stock Sector	No. of Causal Links			Total Links
	1% Level	5% Level	10% Level	
Industrial	4	2	0	6
Finance	3	1	2	6
Property	3	1	0	4
Trading	0	2	1	3
Mining	1	1	1	3
Consumer	2	0	0	2
Construction	0	0	1	1
Plantation	0	0	0	0

After the in-sample analysis, the impulse response function (IRF) is employed to shed some light on the dynamics of the market in the post-sample period[7]. The impulse responses of all the sectors to a one-standard-deviation shock in one of the sectors in the system are plotted in Figure 3 – 10. Comparing across all the IRF plots, shocks in the Trading sector seem to exert the most impact on the other sectors – a one-standard deviation shock in the Trading sector will induce high responses of about |0.9| standard deviation from other variables during the first week of the post-sample. Shocks in the Property and Construction sectors, on the other hand, receive moderate responses from other sectors (about |0.3| to |0.4| standard deviation). Shocks in the other five sectors – the Industrial Products, Plantation, Mining, Finance, Consumer Products and Construction are weakly responded to by other sectors in the system. In general, all shocks tend to stabilise after about 12 weeks or 3 months in the post-sample period.

Figure 3: Responses to Shock in the Industrial Products Sector



[7] *The ordering of the variables in IRF is based on the ranking in Table 4.*

Figure 4: Responses to Shock in the Trading & Services Sector

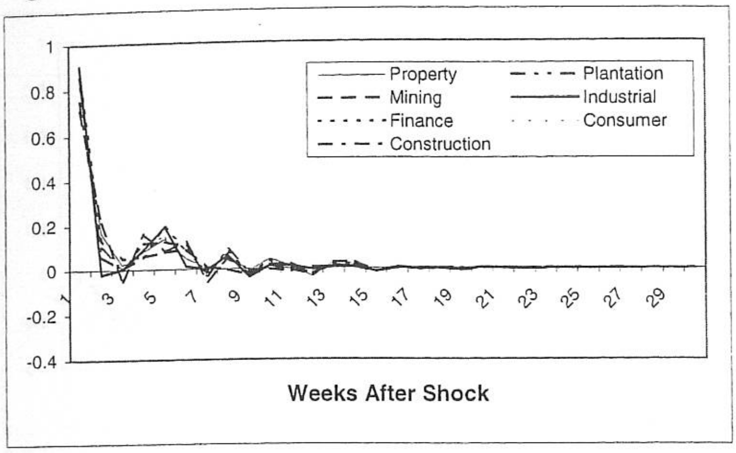


Figure 5: Responses to Shock in the Property Sector

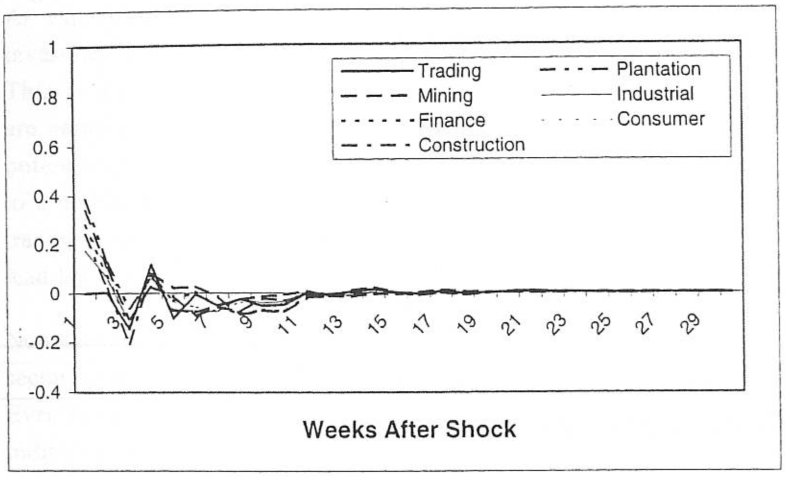


Figure 6: Responses to Shock in the Plantation Sector

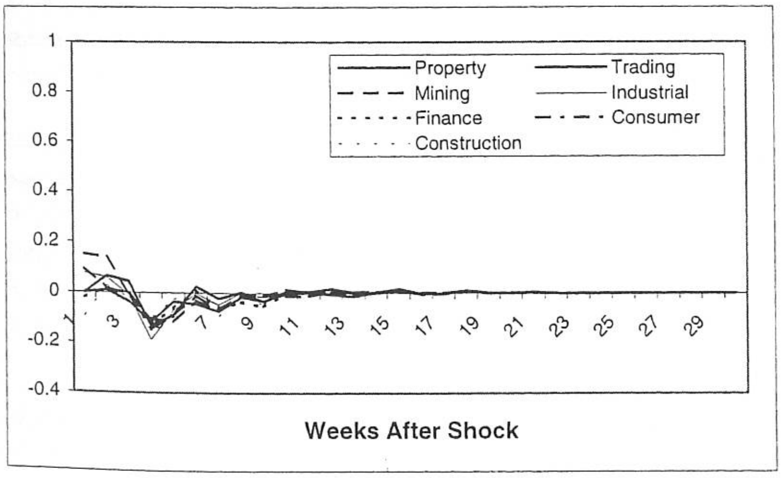


Figure 7: Responses to Shock in the Mining Sector

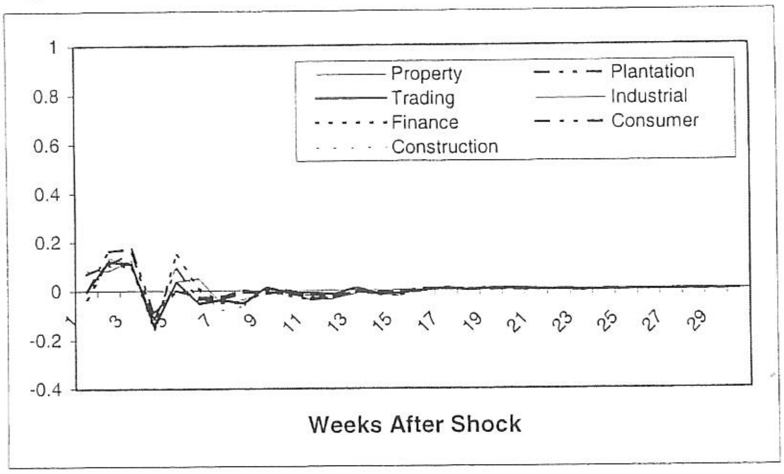


Figure 8: Responses to Shock in the Finance Sector

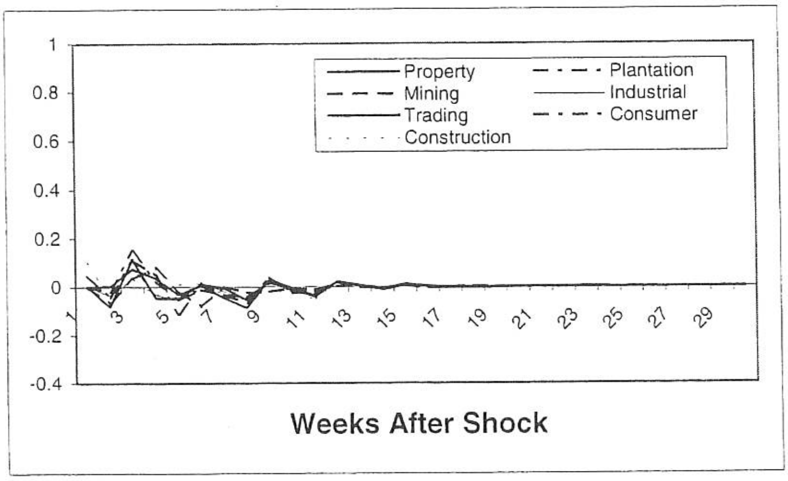


Figure 9: Responses to Shock in the Consumer Products Sector

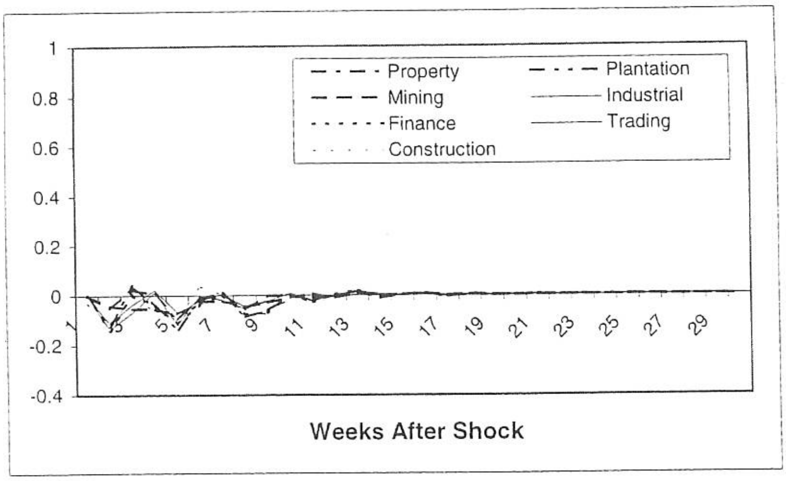
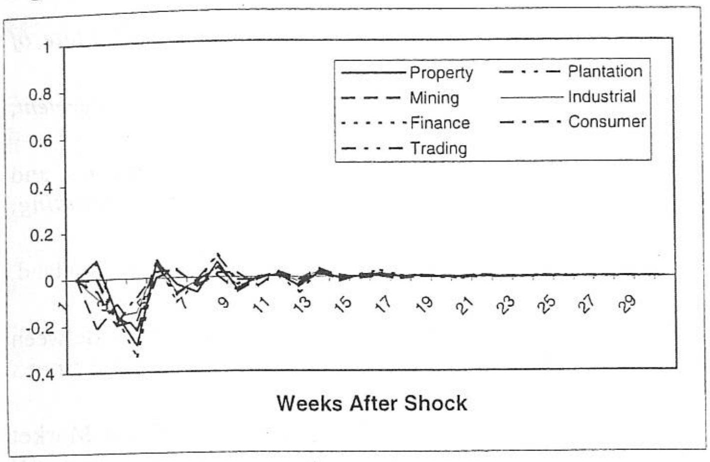


Figure 10: Responses to Shock in the Construction Sector



CONCLUSION

As expected, our empirical estimated results support the impossibility of reducing portfolio investment risk through diversification across different sectors within the KLSE in the long run. This is due to the fact that the sectoral stock prices, as indicated by the sectoral indices, are cointegrated, and tend to move together in the long run. However, the risk reduction and potential gain via portfolio diversification across sectors in the KLSE seems to be possible to a certain degree in the short run[8]. This can only be viable if investors could monitor their trading closely with rational expectation based on the information set provided by the short-run lead-lag dynamic linkages among the sectors.

Non-systematic shocks generated in one sector might not propagate simultaneously to another sector in the short run if there is no causal effect running from the shocked sector to the other. Even though these sectors might be causally linked indirectly through a third sector, this kind of indirect impact usually exhibits some lags in time, which thus allow investors, who monitor trading closely with rational expectation, to make quick adjustments. Systematic risks that affect all sectors in the market simultaneously, of course, can never be minimised through this kind of portfolio diversification within the market. This category of risk could only be minimised through diversification among international markets, in particular a blend of developed and emerging markets.

In this study, the Industrial Products, Finance and Property are identified as the three leading sectors in the KLSE. This implies that changes in economic activities will be transmitted to these sectors first, and the effects will then be passed down to other sectors through internal linkages in the market. The Trading & Services sector, on the other hand, is detected as the most influential sector. Any impact generated from this sector will be strongly responded to by the rest of the sectors.

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[8]*In this context, the long run refers to a period of a few months whereas the short run means a few weeks.*

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