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Long Run Cointegration between Sector-Specific Indices and Macroeconomic Fundamentals

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ABSTRACT

This paper has analysed the dynamic reactions between sector-specific indices of Bursa Malaysia and macroeconomic variables. This study shows that stock prices and macroeconomic variables tend to evolve as well as elaborate together in the long run. This study has identified various trends of responses among the sector-specific indices towards the innovation in macroeconomic variables. The share prices respond intensively to a shock in GDP in the long run particularly KLSECON, KLSEIND and KLSEFIN. The variances of share prices explained by innovation in GDP remain substantial for more than 20% in the long run for KLSECON and KLSEPROP. INFL has been identified to contribute great shock in KLSEFIN during short run and the share prices shocks for KLSEPROP towards innovation in INFL decrease in the long run. Furthermore, KLSEIND responds intensively to a shock in INFL and the effect has remained substantial in the long run. The innovation in INT has also contributed to great impact on the share prices especially KLSEFIN and KLSEIND during short run. KLSEIND has shown consistent responses to one standard deviation shock in INT for most of the quarters in this study. The results suggest that unanticipated changes in macroeconomic variables lead to similar patterns in some of the sector-specific indices with the effects differing mainly in term of the magnitude as well as the persistent of the responses that occur following the shocks.

Keywords: *Bursa Malaysia, sector-specific indices, macroeconomic variables*

Introduction

The issue of macroeconomic variables having significant influence on the share prices is still varies among researchers particularly in Asian emerging market including stock market in Malaysia (Muzafar and Ahmad, 1996; Praphan and Subhash, 2002; Mazhar, 2003; Sharkas, 2004). It seems that the influence of productivity level, inflation rates and interest rates towards share prices of

different sectors of equity market is unclear. Therefore, some reliable explanations from certain studies are needed to analyse how the macroeconomic variables can explain the share prices movement especially in the long run. The interaction among the variables should be analysed in various horizon to confirm the stability of the relationship. Furthermore, several studies have been conducted on asset allocation and style selection in global equity market (Griffin and Karolyi, 1998; Capaul, 1999; Griffin, 2002). These studies conclude that region allocation, industry sector allocation and small-cap-big-cap allocation explain stock market returns since the equity allocation decisions provide diversification in most of the investment activities. Most of these studies are concerned with the efficient portfolio investment strategies without considering the effect of the macroeconomic variables on the share prices in different sectors or industries. They focus on the methods in selecting the stocks in the equity portfolio investment.

The above situation contributes to the idea of focusing this study in analyzing the dynamic reactions between the sector-specific indices of stock market and the changes in macroeconomic fundamentals in developing economies particularly Malaysia in more comprehensive approach. The analysis based on individual sector instead of the aggregate stock market is significant to be considered since most of the investors are more particular in analysing the movement of the stock market prices. The effect of macroeconomic changes to the sector-specific returns may not be identical (Geske and Roll 1983; Chen, Roll and Ross, 1986; Mukherjee and Naka, 1995; Nasseh and Strauss, 2000; Hope and Kang, 2005) due to underlying differences in market and industrial characteristics if the aggregate stock market index is considered in the analysis. This study provides market participants information on how the share prices from various sector-specific indices perform. This allows the formation of an optimum portfolio investment. Therefore, comprehensive analyses have been carried out regarding the sector-specific stock prices movements in response to the changes in macroeconomic fundamentals. The existence of the cointegrating vectors and causal effect between each sector-specific indices of Bursa Malaysia and macroeconomic fundamentals has been observed. The magnitude and the persistence of the contribution of macroeconomic innovation to the variation in all sector-specific indices are well documented at different horizon by using IRFs and VDCs.

Problem Statement

The previous studies have focused on the relationship between stock returns and fundamental economic activities in developed markets and less in developing economies. The results indicate the significant effect on the share prices by the changes in the macroeconomic condition. The various patterns of the share

prices reactions are due to different expectation among the investors towards the future cash flow as well as different level of the discount rate for their investment. However, the aspect of different effects on sector-specific by the changes in macroeconomic fundamentals has not been discussed in most of the previous studies. The emphasis on sector-specific indices in the analysis is still lacking. Most of the previous studies are applying aggregate stock market index instead of sector-specific indices to analyse the dynamic relation between the macroeconomic variables and stock prices. This aspect should be seriously considered because the changes in macroeconomic variables could contribute to greater influence on certain sector as compared to the others in the overall stock market. It is expected that the changes in macroeconomic variables would generate different effect on different sector-specific stock returns. In other words, the effects may vary among different sectors in terms of magnitude and persistence.

Scope of Study

This study examines the long-run dynamic interaction between sector-specific indices of Bursa Malaysia and macroeconomic variables. It also measures the magnitude and persistence of the responses in sector-specific indices due to innovation in macroeconomic fundamentals. The proxies for the stock prices are the sector-specific indices for some sectors of Bursa Malaysia as referred to Industrial Product, Construction, Properties and Finance. Following Chen, Roll and Ross (1986), Mukherjee and Naka (1995), Muzafar and Ahmad (1996) and Ibrahim (2005), this study selects 3 macroeconomic variables namely Gross Domestic Product (GDP) for real industrial production, Consumer Price Index (CPI) for inflation rates and Government Treasury Bills for interest rates (INT). The data are quarterly spanning from 1992 to 2004. All of the data have been obtained from Data Stream.

Literature Review

A study on the relationship between macroeconomic variables and stock market performance has been analyzed by using Johansen's (1991) vector error correction model (VECM) to investigate the existence of the cointegration between Tokyo Stock Exchange (TSE) index and Japanese macroeconomic variables (Mukherjee and Naka, 1995). There exists a cointegrating relationship and that stock prices contribute to this relation. The exchange rate and industrial production have been found to have positive relationship with the TSE. Besides that, the relation between TSE and inflation is negative. The result for Japanese money supply also shows positive effect on stock prices via augmented corporate

earnings overpowers its negative effect resulting from increased inflation. However, the results are mixed for the relation between the TSE and interest rates. Nasseh and Strauss (2000) explore the relationships between the share prices and domestics and international macroeconomic variables in France, Germany, Italy, Netherlands, Switzerland and the U.K. The study indicates a strong relationship between the variables in all of the countries. The researchers have utilized the cointegration test and the results indicate that the industrial production significantly explain the long term movement of the share prices. The effect of industrial production on the share prices has also been observed in all of the countries except Germany. The cointegration test shows long-run relationship between share prices and macroeconomic activities in Europe. He concludes that the share prices will be influenced by production, interest rates, business expectations and the consumer price index.

In Malaysian context, there are some well-cited works on the dynamic interaction between macroeconomic fundamentals and stock prices such as Muzafar and Ahmad (1996), Tan and Ahmad, (1999), Ibrahim and Hassanuddeen (2003), Mazhar (2003) and Ming (2003). Muzafar and Ahmad (1996) analyze whether the macroeconomic variables represented by money supply and output level are significant in estimating the movement of the stock prices in Malaysia. They have applied the monthly based data in the analysis by considering the stock price indices, money supply and output. It is found that the stock price indices and macroeconomic variables especially money supply and national output are not cointegrated. Another study focuses on the dynamic causal chain among macroeconomic fundamentals and stock prices in Malaysia (Tan and Ahmad, 1999). Specifically, they observe that money supply has significantly influenced the output level as well as the stock prices in the short term. Furthermore, the money supply and the stock price own lagged are the main causes that contribute to the variation in stock prices and not the real output or interest rates.

Cointegration and VARs techniques have also been employed to investigate the interactions among the macroeconomic variables namely industrial production, money supply, the price level and the exchange rate with the stock prices in Malaysia (Ibrahim and Hassanuddeen, 2003). Their analysis reveals the existence of dynamic linkages and causal relation between the Malaysian stock market and macroeconomic variables. Mazhar (2003) has supported the findings by considering the short-run (dynamic) and the long-run (equilibrium) relationship between stock returns of Bursa Malaysia and macroeconomic variables. The results reveal the existence of stable long-run (cointegrating) relationship between macroeconomic variables and the stock returns in Malaysia.

Research Methodology

Quarterly time series data of macroeconomic variables and stock market performance have been obtained from the Data Stream and various publications of Bursa Malaysia as well as Bank Negara Malaysia for the period from 1992 to 2004. The macroeconomic variables have been represented by real economic activity (quarterly gross domestic product), interest rate (3-months T-Bills) and inflation rate (consumer price index). For the stock market performance, the stock market indices of Bursa Malaysia have been employed (Industrial, Finance, Properties and Construction). Augmented Dickey-Fuller test (Dickey-Fuller 1981) has been utilized in verifying the order of integration of each of the series involved. The study would then employ Johansen (1988) maximum likelihood estimation procedure for cointegration testing purpose, which test whether the linear combination of the series is cointegrated or not. The dynamic interaction between the stock prices in each sector of Bursa Malaysia and the macroeconomic factors from various horizon has been analyzed using vector error correction model (VECM), impulse response functions (IRFs) as well as variance decompositions (VDCs) tests. Impulse responses trace out the responsiveness of the stock market indices (various sectors) to shocks to each of the variables in the system particularly from the changes in macroeconomic variables. So, for each variable from each equation, a unit shock is applied to the error and the effects upon the system over time will be identified. In other words, this study utilizes the IRFs in order to analyze the effect of a shock on one of the variables in the rest of the variables in the system. In addition, variance decomposition (VDCs) has also been applied for examining system dynamics. This analysis gives the proportion of the movements in the sector-specific indices that are due to their own shocks, versus shocks to the other macroeconomic variables. The variance decomposition analysis decomposes the forecast error variance for stock prices (sector-specific indices) into components accounted for by innovation of all variable in the system especially the macroeconomic fundamentals. Therefore, IRFs and VDCs analyses explain the variation in stock prices as represented by sector-specific indices in various horizons as well as measures the volatility of the indices due to changes in the macroeconomic fundamentals. Hence, the extent of shock in macroeconomic activities forecast future movements in stock prices has been examined. The normality aspect of the variables has also been considered in data analysis based on certain values of mean, median, standard deviation, skewness of the distributions, kurtosis as well as Jarque-bera. In addition, a number of diagnostic tests have been conducted in identifying the problems of misspecification, multicollinearity and heteroscedasticity in each system.

Empirical Results

Descriptive Statistics

Table 1 and 2 provides the summary statistics for all the variables in the first differences. The mean and median values of every dependent variable are much closer to each other. However, the values are quite dispersed as represented by the standard deviation values. On the other hand, the skewness of the distributions are considered approximately normal as closer to zero. The kurtosis values seem not more than 3 which show distributions are normal except for KLSEFIN which has slightly higher than 3. The Jarque-bera values have also indicated that the distributions of all the dependent variables are normal.

Table 1 : Descriptive Statistics of All Dependent Variables from 1992 to 2004

	KLSECON	KLSEFIN	KLSEIND	KLSEPROP
Mean	5.4651	8.6985	7.3256	7.0209
Median	5.3346	8.7609	7.3691	6.7846
Maximum	6.3746	9.3300	7.7553	8.0241
Minimum	4.5647	7.7215	6.5661	6.2294
Std. Dev.	0.4703	0.3314	0.2504	0.6212
Skewness	0.2499	-0.8886	-0.6495	0.4035
Kurtosis	1.9103	3.9322	3.4119	1.5000
Jarque-Bera	2.6947	7.5510	3.4822	5.4398
Probability	0.2599	0.0229	0.1753	0.0659

Table 2: Descriptive Statistics of All Independent Variables from 1992 to 2004

	GDP	INFL	INT
Mean	24.6157	1.0616	1.3549
Median	24.6384	1.1939	1.1217
Maximum	24.8922	1.7228	2.1838
Minimum	24.2663	0.1823	0.6729
Std. Dev.	0.1513	0.4177	0.4044
Skewness	-0.3386	-0.5722	0.3369
Kurtosis	2.5870	2.2689	1.5586
Jarque-Bera	1.1796	3.4578	4.7472
Probability	0.5544	0.1775	0.0931

Table 2 shows the mean and median values of every independent variable are much closer to each other. The values of the data are not widely dispersed as represented by the standard deviation values and the skewness of the distributions is considered approximately normal. All of the kurtosis values for the independent variables indicate not more than 3 that representing the normal

distributions of the data. The normal distribution of the independent variables has also being supported by Jarque-bera values that indicate distributions are normal.

Unit Root Test

The researchers first conduct the ADF unit root test to establish the order of integration for the three macroeconomic variables as represented by real gross domestic product, inflation rate and interest rate as well as four indices of Bursa Malaysia namely KLSE Construction, KLSE Industrial, KLSE Property and KLSE Finance. Table 3 shows the results of the test for presence of a unit root in the first differences by using log first difference. In other words, the test for a unit root in the first difference series indicates strong rejection of the null hypothesis in almost all the series. The ADF test fails to reject the null hypothesis in the log level but reject the same null hypothesis in the log first difference of the series. Most of the series are significance at the level of 1% and 5%. As a result, all of the time series used in this study are integrated of order 1, or $I(1)$.

Table 3: Augmented Dickey-Fuller Test : Probability in ( ) and t-statistics in [ ]

Variable	Lag length (based on AIC/ SIC)	First differences
GDP	4	(0.0334)**/ [-3.1008]
INF	0	(0.000)***/ [-6.2006]
INT	3	(0.0066)***/ [-3.7300]
KLSECON	3	(0.0019)***/ [-4.2201]
KLSEIND	3	(0.0115)**/ [-3.5258]
KLSEPROP	3	(0.0035)***/ [-3.9631]
KLSEFIN	3	(0.0054)***/ [-3.8055]

Notes: (1) *** and ** denote significance at the 1% and 5% level respectively

Johansen Cointegration Test

The results of the Johansen cointegration tests in terms of the Maximum Eigenvalue based on lag K = 4 are reported in Table 4. The researchers are quite convinced that the lag 4 is the most appropriate lag based on the preliminary analysis for lag 1 to 4 using Johansen Cointegration test. Since the frequency of the data is based on quarterly basis, the researchers have decided to have lag 4 as the basis for the cointegration analysis. Generally, the results show strong and significant long-run relationship among stock prices and GDP, inflation rate as well as interest rate. Two cointegrating vectors are found for the period of study that refers to the series of *KLSECON GDP INFL INT* and *KLSEPROP GDP INFL INT*. Meanwhile a unique cointegrating vector exists for the other series namely *KLSEIND GDP INFL INT* and *KLSEFIN GDP INFL INT*. The

Table 4: Johansen Cointegration Test *(Lag interval in first differences : 4)*

Hypothesized No. of Cointegrations	Max-Eigen Statistic	Probability
Series: KLSECON GDP INFL INT		
None***	60.0349	0.0000
At most 1*	20.2652	0.0657
At most 2	8.0594	0.3727
Series: KLSEIND GDP INFL INT		
None***	45.2357	0.001
At most 1	17.8963	0.1338
At most 2	11.6829	0.1231
Series: KLSEPROP GDP INFL INT		
None***	34.9799	0.0047
At most 1*	19.3299	0.0877
At most 2	10.7165	0.1690
Series: KLSEFIN GDP INFL INT		
None***	33.7268	0.0072
At most 1	18.1229	0.1253
At most 2	12.1828	0.1039

Notes: (1) ***, ** and * denotes rejection of the hypothesis at the 1%, 5% and 10% level

cointegrating vectors among the variables seem to be obvious in the series of *KLSECON GDP INFL INT and KLSEPROP GDP INFL INT*. It indicates all the stock market indices in this study are having significant relationship with the other three macroeconomic variables (GDP, interest rate and inflation rate) at least 1 cointegrating relationship (significant at 1% and 10% levels). The results provide support to the theoretical analysis that the real economic activities, stock price, interest rate and inflation rate are linked in the long run.

Interrelationship between Stock Prices and Macroeconomic Variables

Since most of the time series of macroeconomic variables are non-stationary, vector error correction model (VECM) enables us to study the equilibrium relationship within the system of equations. Table 5 reports the model's estimates. The VEC model's specification forces the long-run behaviour of the endogenous variables to converge to their cointegrating relationships, while accommodating short-run dynamics. The researchers find that the Malaysian stock market is cointegrated with the three macroeconomic variables namely GDP, inflation rate and interest rate. Since all the variables for the period of study are cointegrated, the vector error correction model can be established. The estimated models are reported in Table 5. The results clearly show significant error correction terms for all the independent variables in each equation for interest rate and GDP in

Table 5: The Vector Error Correction Model: t-statistics in [ ]

Cointegration Equation	Dependent		Independent GDP	INFL	INT
CointEq1	**KLSECON**	**[1.0974]**	[-1.9412]	[0.6713]	[-3.0415]
CointEq2	**KLSEIND**	**[0.1497]**	[-2.1685]	[0.6220]	[-2.7104]
CointEq3	**KLSEPROP**	**[-0.5027]**	[-1.4505]	[0.6948]	[-2.5183]
CointEq4	**KLSEFIN**	**[1.4426]**	[-2.3805]	[0.3036]	[-2.6207]

equation 2 and 4. The error correction terms for inflation rate (all equations) and GDP (equation 1 and 3) are not significantly adjusted to the disequilibrium level. The results in Table 5 show that GDP (equation 2 and 4) and interest rate adjust significantly to disequilibrium in the period of study.

From the above relations, the researchers find that there are negative relationships between stock prices and GDP. All of the four models show negative relations between stock prices and GDP. The same relationship has also been identified between stock price and the growth level of the industrial production (George and Evangelia, 2001). In other words the growth in industrial production reacts negatively to stock prices. This situation could explain the negative relationship between the variables. The most important finding is that an increase in industrial production does not necessarily lead to a higher level of real stock prices. On the other hand, the relationship between stock prices and interest rates is negative. This study finds a robust negative relation between stock prices and interest rate as represented by all of the four models in Table 5. Mazhar (2003) has also conducted a study on long-run (cointegrating) relationship between macroeconomic variables and stock prices of Bursa Malaysia. His findings show a negative relationship between interest rate and the stock returns. This finding is also consistent with the result documented by Fama and Schwert (1977), Geske and Roll(1983), Chen, Roll and Ross (1986), Al-Sharkas (2004) and Praphan and Subhash (2002). However, the relationship between stock prices and inflation rate is found to be positive as shown in Table 5. The same finding has been observed between stock prices and inflation rate with positive relations as documented by Mazhar (2003) who analyzes the short-run (dynamic) and the long-run (equilibrium) relationship between stock returns of Bursa Malaysia and macroeconomic variables. The results reveal the existence of stable long-run (cointegrating) relationship between macroeconomic variables and the stock returns. A positive relationship between inflation and the stock prices is also detected from his study.

Impulse Response Functions and Variance Decompositions

It is expected from this study that different sectors might respond to shock differently based on direction of the responses, magnitude of the effect and

persistence of the shock according to various horizon. There are four sectors of Bursa Malaysia that have been analyzed namely construction (KLSECON), Industrial Product (KLSEIND), Properties (KLSEPROP) and Finance (KLSEFIN) in relation to dynamic reaction towards changes in gross domestic product (GDP), inflation (INFL) and interest rates (INT). The impulse response functions and variance decompositions analyses have been conducted in order to study the dynamic relation between share prices based on various sectors and macroeconomic variables. The findings reveal different responds of share prices from various sectors towards innovation in macroeconomic variables as well as to one standard deviation shock in either share prices themselves or among the macroeconomic fundamentals

Table 6, 8, 10 and 12 show the responses of share prices to a one-standard deviation shock in share prices themselves, GDP, INFL and INT. The share prices seem to be sensitive to shocks from the share prices themselves particularly KLSEFIN and KLSEIND. All of the share prices in this study indicate great responses to the innovation in themselves during the first 5 quarters. In addition, Table 7, 9, 11 and 13 indicate the decomposition of the forecast error variance (FEV) of share prices due to a shock in share prices themselves. It shows the variances in share prices as represented by the Bursa Malaysia indices are mainly attributed to share prices themselves for more than 90% in the short run and the FEV of the indices has been observed to decrease as the horizon lengthens. The share prices respond intensively to a shock in GDP in the long run particularly KLSECON, KLSEIND and KLSEFIN (refer to Table 6, 8, 10 and 12). The variances of share prices explained by innovation in GDP remain substantial for more than 20% after 10 quarters for KLSECON and KLSEPROP. INFL has been identified to contribute great shock in KLSEFIN during the initial 5 quarters. The share prices shocks for KLSEFIN and KLSEPROP towards innovation in INFL decrease in the long run. Furthermore, KLSEIND responds intensively to a shock in INFL and the effect has remained substantial after 5 quarters. The innovation in INT has also contributed to great impact on the share prices especially KLSEFIN and KLSEIND during quarter 5 to quarter 15. KLSEIND has shown consistent responses to one standard deviation shock in INT for most of the quarters in this study. Meanwhile, INT seems to generate less shock to KLSECON as compared to KLSEPROP particularly in the short run. Impulse response analyses also reveal that INFL, GDP and INT seem to generate less shock to the share prices of the four identified sectors except for the GDP during quarter 5.

The FEV of the INFL due to a shock in all of the four indices remain large from quarter 5 to quarter 15 (refer to Table 7, 9, 11 and 13). More than 20% of FEV for INFL could be explained by innovation in KLSECON. However, the FEV for all the indices have declined as the horizon approaching quarter 48. The information concerning the FEV of share prices for every sector due to a shock in GDP, INFL and INT and vice versa are shown in Table 7, 9, 11 and 13. It is

Table 6: Impulse Response Analysis (KLSECON, GDP, INFL & INT)

Horizons	Response of share prices (to one standard deviation shock in)			
	KLSECON	GDP	INFl	INT
5	22.7445	-15.1074	-4.5399	-0.5522
10	-0.8115	-18.4845	0.4000	0.6457
15	-2.5349	-17.3312	-0.5351	6.3958
30	-0.5183	-23.4138	-1.4649	11.2990
48	-0.4476	-34.9726	-1.9853	16.5127
Horizons	Response of macroeconomics variables (to one standard deviation shock in share prices)			
	GDP	INFl	INT	
5	5.35E+08	0.2735	0.1971	
10	2.11E+08	0.2758	0.2616	
15	1.01E+08	0.1738	0.1583	
30	0.84E+08	0.0466	0.0320	
48	1.00E+08	0.0219	0.0056	

Table 7: Variance Decomposition Analysis (KLSECON, GDP, INFL & INT)

Horizons	Forecast error variance of KLSECON (explained by innovations in)			
	KLSECON	GDP	INFl	INT
5	92.3950	4.2902	2.4837	0.8312
10	78.7845	18.3095	2.1099	0.7961
15	68.8733	27.7799	1.8420	1.5047
30	43.9345	47.0345	1.2899	7.7412
48	22.8271	63.5411	0.8024	12.8294
Horizons	Forecast error variance of macroeconomic variables (explained by innovations in KLSECON)			
	GDP	INFl	INT	
5	9.2933	31.6970	9.3415	
10	6.8689	37.1564	24.1490	
15	4.4998	26.0063	28.2500	
30	1.6204	7.6675	28.3087	
48	0.6251	2.5079	27.8920	

clearly indicated that the variance in all of the indices have been identified to increase to innovation in INT as the horizon lengthens. It is found that the variance of KLSEIND explained by innovation in INT remain large in the long run which accounted for more than 15%. However, the FEV of KLSEPROP, KLSEFIN and KLSECON can be attributed to innovation in INT for less than

Table 8: Impulse Response Analysis (KLSEIND, GDP, INFL & INT)

Horizons	Response of share prices (to one standard deviation shock in)			
	KLSEIND	GDP	INFl	INT
5	105.0126	-6.9066	-0.2833	-46.8453
10	34.5189	-11.7998	30.6264	-59.6440
15	8.5017	0.8923	35.6218	-47.9049
30	12.3751	31.1929	29.8816	-46.9478
48	12.0219	50.7574	33.8699	-64.1697

Horizons	Response of macroeconomics variables (to one standard deviation shock in share prices)		
	GDP	INFl	INT
5	6.55E+08	0.1869	0.1013
10	4.63E+08	0.2186	0.2206
15	2.27E+08	0.1890	0.1639
30	1.42E+08	0.1356	0.0560
48	1.95E+08	0.1303	0.0476

Table 9: Variance Decomposition Analysis (KLSEIND, GDP, INFL & INT)

Horizons	Forecast error variance of KLSEIND (explained by innovations in)			
	KLSEIND	GDP	INFl	INT
5	94.0643	0.3008	2.3939	3.2409
10	82.3778	0.7157	3.4239	13.4826
15	73.1473	0.7310	6.4184	19.7034
30	57.4090	3.4944	11.5937	27.5029
48	39.5043	11.7826	13.1665	35.5467

Horizons	Forecast error variance of macroeconomic variables (explained by innovations in KLSEIND)		
	GDP	INFl	INT
5	9.8202	14.4108	5.8955
10	10.4270	20.8814	13.0296
15	7.9505	18.2776	18.3408
30	4.0256	9.3130	19.4694
48	2.5385	5.0312	18.0389

Table 10: Impulse Response Analysis (KLSEPROP, GDP, INFL & INT)

Horizons	Response of share prices (to one standard deviation shock in)			
	KLSEPROP	GDP	INFl	INT
5	142.6301	-80.0945	-7.0434	-28.2088
10	50.6013	-113.9821	17.1388	-8.6255
15	17.6720	-97.8371	19.3478	26.4362
30	21.0178	-61.1915	11.3206	42.3747
48	18.3675	-49.9387	10.2289	30.5248
Horizons	Response of macroeconomics variables (to one standard deviation shock in share prices)			
	GDP		INFl	INT
5	3.32E+08		0.1620	0.0242
10	1.79E+08		0.1838	0.1782
15	-0.78E+08		0.1528	0.1722
30	-1.77E+08		0.0538	0.0784
48	-2.37E+08		-0.0235	0.0425

Table 11: Variance Decomposition Analysis (KLSEPROP, GDP, INFL & INT)

Horizons	Forecast error variance of KLSEPROP (explained by innovations in)			
	KLSEPROP	GDP	INFl	INT
5	93.0117	4.5505	1.8079	0.6300
10	76.9746	20.3610	1.4894	1.1750
15	65.8702	31.0765	1.7236	1.3297
30	51.9156	39.8158	1.9403	6.3283
48	45.6663	43.1656	1.9980	9.1700
Horizons	Forecast error variance of macroeconomic variables (explained by innovations in KLSEPROP)			
	GDP		INFl	INT
5	2.7825		11.4655	6.7201
10	2.8586		16.1307	9.8483
15	2.0382		14.4270	15.3007
30	1.3735		6.8022	18.7294
48	1.3581		2.8893	17.9130

Table 12: Impulse Response Analysis (KLSEFIN, GDP, INFL & INT)

Horizons	Response of share prices (to one standard deviation shock in)			
	KLSEFIN	GDP	INFl	INT
5	521.4246	-23.9770	-70.0161	-137.8920
10	34.7108	-52.7726	46.5718	-201.8767
15	-76.2967	-9.2811	48.5916	-101.8184
30	6.5995	34.6874	15.3788	-31.9408
48	2.8507	43.2541	19.9279	-49.4787

Horizons	Response of macroeconomics variables (to one standard deviation shock in share prices)		
	GDP	INFl	INT
5	6.48E+08	0.1523	0.1021
10	3.99E+08	0.1645	0.2207
15	1.10E+08	0.1244	0.1395
30	0.46E+08	0.0719	0.0341
48	0.94E+08	0.0587	0.0255

Table 13: Variance Decomposition Analysis (KLSEFIN, GDP, INFL & INT)

Horizons	Forecast error variance of KLSEFIN (explained by innovations in)			
	KLSEFIN	GDP	INFl	INT
5	95.6782	0.4374	2.8342	1.0503
10	90.8867	0.7202	2.6258	5.7673
15	88.4215	0.7989	2.8464	7.9332
30	87.5549	1.0287	3.0225	8.3940
48	86.3035	1.5857	3.1050	9.0058

Horizons	Forecast error variance of macroeconomic variables (explained by innovations in KLSEFIN)		
	GDP	INFl	INT
5	9.0720	8.7238	6.6314
10	9.5506	13.3072	13.2636
15	6.7232	11.0298	17.1149
30	3.0471	4.5775	17.0587
48	1.6660	2.0448	15.7327

13% for most of the quarters. Furthermore, the FEV of the GDP that explained by innovation in share prices of all the four sectors have been found to decrease for less than 10% towards the end of the horizon. Substantial portion of FEV for INFL has been identified during the first 15 quarters for share prices innovation of KLSECON and KLSEIND which accounted for more than 15%. Finally, the FEV of INT due to a shock in share prices remains large for KLSECON (more than 20%) and slightly less for KLSEIND. KLSEPROP as well as KLSEFIN. The FEV of INT has also found to be less at the beginning of the horizon due to shock in share prices from all sectors.

Conclusion

Most of the previous studies have shown that macroeconomic variables and the aggregate stock market index are found to be cointegrated in the long run. However, the studies have not seriously considered the dynamic reaction between different sectors indices and the innovations of macroeconomic variables. The information on the dynamic relationship between stock prices of various sectors and the changes in macroeconomics fundamentals could be identified by applying aggregate stock market index of each sector as the proxy in the analysis (Domac, 1999; Bundoo, 2000; Dijk and Keijzer, 2004). The sectors are different in terms of nature, environment as well as its own structure (Griffin, 2002). Therefore, the analysis of the dynamic reaction between sectors and innovations in macroeconomic fundamentals by applying the sector-specific indices are considered limited and this situation motivates the researcher into this study. This study has identified long run relationships between sector-specific indices and macroeconomic variables. The existence of cointegrating vectors among the variables of sector-specific indices and macroeconomic variables have been found. The causal relation between the macroeconomic fundamentals and stock market performance are unidirectional as well as bidirectional. The cointegrating relationships between the variables have been found to be significant in explaining long run movement in share prices as well as macroeconomic fundamentals towards the adjustment of disequilibrium. In addition, the differential effects of the macroeconomic variables shocks on share prices as represented by sector-specific indices of Bursa Malaysia particularly on the magnitude as well as the persistence of the responses in different sectors have also been analyzed. The share prices of KLSECON, KLSEIND and KLSEFIN respond to a shock in GDP in the long run. The innovation in GDP contributes to the variances of share prices in KLSECON and KLSEPROP for more than 20% in the long run. INFL has been identified to contribute great shock in KLSEFIN in the short run. However, the share prices shocks for KLSEFIN and KLSEPROP decrease in the long run as response towards innovation in INFL. Substantial response of KLSEIND to a shock in INFL has continued as horizon lengthen. Great shock

can also be observed on the share prices of KLSEFIN and KLSEIND as response to the innovation in INT at the beginning of the horizon. The innovation in INT seems to have minimal shock on the share prices of KLSECON and KLSEPROP. The results from this study provide the fact that some sectors seem to be affected by innovation in macroeconomic variables as referred to the magnitude and the persistence of the response in different sectors. The result also shows that the movement of share prices of KLSECON, KLSEIND, KLSEPROP and KLSEFIN are explained by innovation in macroeconomic variables (production level, interest rates as well as inflation rate).

Although this study has significant implications on the magnitude of the impact as well the persistent of the responses that occur following the shocks of macroeconomic variables on the sectoral indices of the Malaysian stock market, the analysis could be enhanced by considering more macroeconomic variables such as money supply, exchange rate, oil prices and trade balance. It is also suggested that more sector-specific indices of the Malaysian stock market to be included in the analysis in order to obtain comprehensive findings.

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