Macro-economic Influences on the Stock Market: Evidence from an Emerging Market in South Asia

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Abstract

This study examines the influence of macro-economic variables on stock market equity values in Sri Lanka. We use the Colombo all share price index to represent the stock market and (i) the money supply, (ii) the treasury bill rate (as a measure of interest rates), (iii) the consumer price index (as a measure of inflation) and (iv) the exchange rate as macro-economic variables. We analyse monthly data for the above variables for the 17-year period from 1985:1 to 2001:12 employing a battery of tests, which include unit roots, cointegration, vector error correction models (VECM), impulse response functions (IRFs) and variance decompositions (VDCs). These tests examine both long-run and short-run relationships between the stock market index and the economic variables. The VECM analyses provide some support for the argument that the lagged values of macro-economic variables such as the consumer price index, the money supply and the treasury bill rate have a significant influence on the stock market. The treasury bill rate demonstrates the strongest influence on price changes compared to other variables. However, the share price index does not have any influence on macro-economic variables except for the treasury bill rate. Both VDC and IRF analyses revealed that shocks to economic variables explained only a minority of the forecast variance error of the market index; these effects did not persist for very long.

JEL Classification: G15

Key Words: Macro-economic variables; stock returns; cointegration; causality

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I. Introduction

Numerous empirical studies conducted in developed markets provide substantial evidence in support of the argument that share returns fluctuate with changes in macro-economic variables. Accordingly, aggregate equity prices are expected to have a strong relationship with macro-economic variables. The argument suggests that the intrinsic value of equity shares depends on the present value of dividends which is distributed out of company earnings; these profits are influenced by real economic activities and therefore there should be a relationship between economic fundamentals and share prices. Shiller (1981) and Leroy and Porter (1981) demonstrate that the macro-economic variables may affect the discount rate and the ability of the firm to generate cash flows – two fundamental variables which determine the intrinsic value of equities in discounted cash flow (DCF) models. Flannery and Protopapadakis (2002) believe that macro-economic variables are excellent candidates for determining returns, because changes in these measures will affect firms' cash flows and influence the risk-adjusted discount rate. Ultimately, it is argued that returns on shares reflect underlying real economic activity; therefore, in the long run one would expect to observe a relationship between macroeconomic activity and equity returns (Patro *et al.*, 2002)

The hypothesis that changes in macro-economic variables have a pervasive impact on asset prices has been subjected to extensive research. Early US studies of Lintner (1973), Oudet (1973), Bodie (1976), Nelson (1976), Jaffe and Mandelker (1977) and Fama and Schwert (1977), which examined whether the financial assets were hedges against inflation, have all reported a negative relation between stock returns and changes in the general price level[1]. Fama (1981) documented evidence of a strong positive relationship between equity returns and real economic activities such as industrial production, capital expenditures and GNP. Chen *et al.* (1986), who built on Fama's investigation, tested whether a set of macro-economic variables explained unexpected changes in equity returns. They documented evidence that the economic variables such as industrial production, changes in

[1] The majority of these studies tested the Fisher hypothesis which predicts a positive relationship between expected nominal returns and expected inflation. Their findings were inconsistent with the Fisher hypothesis. However, Firth's (1979) UK study arrived at the opposite conclusion observing a positive relationship between nominal stock returns and inflation.

the risk premium and twists in the yield curve are significant factors in explaining stock returns. Pearce and Roley (1985) also found that unexpected announcements in monetary policy had a significant influence on stock prices while Jain (1988) noted that announcements about money supply and consumer price index are significantly associated with stock price changes. Castanias (1979) related macro-economic announcements to the variability of daily stock returns while Huang and Kracaw (1984) observed a significant linkage between the volatility of a stock index and the GNP. Similar evidence for other developed market can also be found in finance literature. For example, Darrat (1990), employing multivariate Granger causality tests on Canadian data, found that fiscal policy moves exerted a significant lagged effect on the stock market. Cheung and Ng (1998), using data for Canada, Germany, Italy, Japan and the USA, investigated the relationship between national stock market indices and country-specific aggregate economic variables. They concluded that changes in stock market indices were typically cointegrated with a country's aggregate real economic activity such as, its oil price, consumption, money stock and output.

A small but growing literature has focussed on the relationship between macro-economic variables and equity returns in emerging stock markets. For example, Harvey (1995a, 1995b) examined the influence of a set of global variables in explaining the cross-sectional variation in the returns of 21 emerging stock markets over the period 1976-92. He concluded that the influence of world equity market returns, the return on foreign exchange index, oil prices, world industrial production and the world inflation rate were insufficient to characterise the returns available in emerging markets. This conclusion was supported by a more recent study by Fifield *et al.* (2002). They discovered that a mix of local (GDP, inflation, money and interest rates) and world (industrial production and inflation) economic variables could only explain up to 14.6 per cent of the variance of monthly returns for a sample of 13 emerging stock markets for the period 1987-96[2].

Even though researchers have documented a great deal of evidence that fundamental economic activities in developed countries are strongly linked to stock market returns, it is unclear whether such a relationship exists for emerging stock markets in less developed countries. Compared to their developed market counterparts, these stock exchanges are smaller in size and relatively illiquid. In addition, the economies in these countries may be influenced to a far greater extent by global economic indicators rather than domestic economic measures. Further, the growing influence of foreign investors in these markets following their opening up to international investment inflows

may weaken any link between national economic variables and share returns. In this context, the movements in leading developed capital markets may exert a significant influence on the behaviour of stock returns in these small markets. As many of these markets have very short histories of organised share trading, the perceptions of investors may be different from those in developed markets. Therefore, the behaviour of market prices in these countries may not be tied to economic fundamentals; rather the stock prices may be driven by the speculative activities of irrational investors. Gunasekarage and Power (2001) provide convincing evidence that such investors in South Asian capital markets can earn excess returns by employing technical trading rules; the study reveals that the fixed length moving average rule generates excess returns of 4.70 per cent for Sri Lankan investors, 9.81 per cent for Bangladesh investors and 8.60 per cent for Pakistan investors.

The objective of this study is to investigate the relationship between macro-economic variables and the stock prices in Sri Lanka. Since adopting an open economic policy in 1977, the government of Sri Lanka has taken a number of steps to liberalise and develop the financial sector in an attempt to maximise its contribution towards the economic development of the country[3]. As a result of these radical changes and other concessions given to equity investors, the stock market in Sri Lanka - Colombo Stock Exchange (CSE) – attracted the attention of both local and foreign investors and grew rapidly in the recent decades. However, published literature on this market is hard to find as it has not received a great deal of attention among academic researchers. In this context, it is important to examine the economic role of the CSE. Such an examination is also important with respect to regulatory changes and policy making decisions about the future of the stock market.

The remainder of the article is organised as follows: In section II we provide a brief summary on the historical development and the performance of the stock market in Sri Lanka. Section III explains the data used in the study and the methodology employed. The findings of the study are discussed in section IV followed by the conclusion given in the last section.

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[2] The results of Spyrou (1997) were much more encouraging in that local variables such as domestic inflation and domestic savings seemed to explain the returns earned in both Asian and Latin American emerging markets.

[3] They include the relaxation of the exchange controls, the opening up of the banking sector to foreign investors, repeal of the business acquisition act and the privatisation of government owned business enterprises.

II. History and Performance of the Colombo Stock Exchange

Share trading in Sri Lanka dates back to 1896, the year in which Colombo Brokers Association (CBA) commenced dealing in the shares of limited liability companies that were involved in the plantation business. These share trading activities became more formalised in 1984 when the CBA established a public trading floor introducing an 'open outcry system'. After going through a number of organisational and regulatory changes such as amalgamating with the Stock Brokers Association (SBA), joining the International Federation of Stock Exchanges[4], establishing a regulator for the capital market through the enactment of the Securities Council Act No. 36 of 1987 and the introduction of new trading floor rules and conditions of sale, the name of the stock exchange was changed to the Colombo Stock Exchange (CSE) in 1990. This renaming was followed by a number of government initiatives to liberalise investment in the stock market. They include the abolition of 100 per cent transfer of property tax on share purchases by non nationals, the relaxation of exchange controls on inward remittances for share purchases and outward remittances of surpluses on dealings in listed shares, the abolition of wealth tax on listed company shares and the abolition of capital gains tax on shares.

Over past two decades, the CSE has recorded a remarkable rate of growth in its trading activities. Some statistics relating to the past performance of the market are provided in Table 1. According to this table, during the decade ending 1995, CSE grew rapidly recording a tenfold increase in its market capitalisation and an exponential growth in annual trading value. The number of listed companies has also shown a significant rise during this period. However, during the five-year period ending 2000, the market has been stagnant probably due to the effect of Asian financial crisis and global events. The table also reveals that the market capitalisation of the CSE is relatively low compared to the GDP of the country. By international standards, it is still a very small market; it constitutes less than 1 per cent to the world's market capitalisation.

In the 1990s the government relaxed exchange control regulations in order to encourage foreign participation in the share market. Non-resident individuals, regional funds and companies incorporated outside Sri Lanka were allowed to invest in Sri Lankan equities and repatriate proceeds through a special bank account called 'Share Investment External Rupee Account' (SIERA) which was not subjected to exchange control regulations. Except for a few categories of

[4] The CSE was admitted as the 52nd member of the World Federation of Stock Exchanges in 1998.

companies, foreign investors were permitted to invest up to 100 per cent in the equity capital of local firms. These measures provided attractive investment opportunities to foreign investors and enhanced foreign participation in the trading of equity shares; for example, during the five-year period ending 2001, more than 33 per cent of the average annual turnover of securities was attributed to dealings by foreign investors. In the context of regional and global integration, the CSE plays a pivotal role among South Asian emerging capital markets as a founder member and the vice president of the South Asian Federation of Exchanges (SAFE)[5].

III. Data Collection and Research Methodology

a. Data Collection

This study uses both macro-economic variables and market index data for the period from 1985:1 to 2001:12. The year 1985 was selected as the start of the sampling period as it was preceded by new legislations for share trading activities in the CSE. Another reason for the choice of this time span is the data availability; the main source of data used to collect monthly share index values is Datastream and it does not provide price information prior to 1985. We used monthly values of the All Share Price index (*SPI*) for the 17-year period to represent aggregate equity returns of the market. This is a capital weighted index which covers all traded securities and thus indicates the price fluctuations of all listed companies. The information on the following macro-economic variables was also obtained from the monthly reviews of the Central Bank of Sri Lanka: (1) M1 representing the money supply (*MS1*), (2) the three-month treasury bill rate (*TBR*) representing the interest rate, (3) the consumer price index (*CPI*) representing the rate of inflation and (4) the exchange rate between US dollar and Sri Lankan rupee (*EXR*) representing the foreign exchange rate. These economic variables were selected on the following grounds: Money supply represented by M1 provides a measure of liquidity in the economy and any change in money supply should therefore have an impact on the investment decisions of the individual investors. The treasury bill rate acts as the rate of return offered by the risk-free asset and the shifting of funds between risky equity and risk-free assets by portfolio managers is significantly influenced by the movements of this rate. The rise (fall) in inflation reduces (increases) the purchasing power of investors and thus

[5] SAFE consists of 17 stock exchanges from Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka. The formation of SAFE in 2000 is considered to be an important milestone in the march of South Asian capital markets towards regional and global integration.

should have an impact on equity investment decisions of local investors. Finally, the rise (fall) in exchange rate makes Sri Lankan equity cheaper (expensive) for foreign investors and therefore, fluctuations in exchange rate should have an impact on equity investment decisions of foreign investors. These variables represent only a subset of economic variables used in previous studies. But, these were the only variables with sufficient observations available to the authors for the time period under study. For example, even though we wanted to include variables such as industrial production and GNP, the non-availability of these data on a monthly basis prevented us from bringing them into the analyses. Further, the trade balance (which represents the cash flow of the economy) could not also been used as it had negative values which created estimation problems for the analysis. In addition to the Sri Lankan macro-economic variables mentioned, the S&P 500 composite price index was employed as a proxy for external factors in our models; the literature suggests that the US market poses a significant influence on most of the markets in the world[6,7].

Some descriptive statistics for these variables are provided in table 2. An analysis of this table reveals that these variables are not normally distributed. The non-normal behaviour observed in many macro-economic variables is not surprising as the money supply and consumer price index increased continuously during the period of examination while the Sri Lankan currency depreciated against the US dollar over the 17-year time span[8]. Also, the SPI experienced a number of upward and downward trends over the same period (see Figure 1). A strong correlation is evident between the SPI and the macro-economic variables with the exception of TBR; the correlation between the Sri Lankan price index and the US index is also fairly strong indicating the importance of including US index as a control variable in the analysis. As expected there is a strong correlation between money supply and the consumer price index and between money supply and the exchange rate.

[6] See, for example, Eun and Shin (1989), Cheung and Mak (1992), Arshanapalli and Doukas (1993), Gjerde and Saettem (1995), Liu and Pan (1997), Maish and Maish (1997), Meric and Meric (1997) and Janakiramanan and Lamba (1998). These studies further reveal that Japan, the second largest equity market in the world, has only a little influence on other markets while the UK market has some influence on the capital markets in Japan, Australia, Hong Kong and Canada. On the basis of these findings, we decided to have only US market index in our analyses.

[7] We also analysed a number of world economic indicators such as Brent Crude oil Price Index, World Consumer Price Index and World Industrial Production together with Nikkei 225 Price Index and World Stock Price Index in our pre-tests but these variables were found to make no influence on the share price index of Sri Lanka.

[8] During this 17-year period CPI and MS1 increased by 377.48 per cent and 617.09 per cent respectively while Sri Lankan rupee depreciated by 252 per cent against the US dollar.

b. Research Methodology

The principal method employed to analyse the time series behaviour of the data involves cointegration and the estimation of a Vector Error Correction Model (VECM). This has become a well-established methodology when testing the long run relationships among variables; therefore, the methodological aspects directly relevant to this study are only briefly explained and interested readers are referred to the relevant literature for a detailed explanation of the approach[9].

The first step of this process involves a test for stationarity; the order of integration of the variables is estimated. For this purpose, we employ Augmented Dickey-Fuller (ADF) and Phillips-Perron tests for unit roots. Once the order of integration of each variable has been determined, we perform the cointegration analysis to determine whether the time series of these variables display a stationary process in a linear combination. For this purpose, the Johansen (1991) method of multivariate cointegration is employed. A finding of cointegration implies the existence of a long term relationship between the market index and the macro-economic variables. If there is at least one cointegrating relationship among the variables, then the causal relationship among these variables can be determined by estimating the VECM.

Once the VECM model is estimated, we employ two short-run dynamic analyses: Impulse Response Functions (IRFs) and Variance Decompositions (VDCs). Both allow us to investigate the behaviour of an error shock to each variable on its own future dynamics as well as on the future dynamics of the other variables in the VECM system. The IRFs show impulse responses of the i^{th} variable in the VECM system to the time paths of its own error shock against error shocks to the other variables in the system; plotting the IRFs is a practical way to visualize the response. The VDCs demonstrate the proportion of the movement of the n-step ahead forecast error variance of the i^{th} variable in the system attributable to its own error shock as opposed to error shocks to the other variables in the system.

We incorporate the US stock index as a proxy variable for external influences in our model. Since we expect the US stock market to have an effect on the Sri Lankan stock market, but not the reverse, we include it as a dummy variable. This allows us to trace out any effect that the US stock market has on the Sri Lankan stock market, but not vice versa. Adopting the same reasoning, we

[9] See, for example, Lin and Swanson (1993), Cheung and Ng (1998) and Kassimatis and Spyrou (2001).

technically can not incorporate the US stock index in the analyses of impulse response functions and variance decompositions.

IV. Results

The results of ADF test for each of the logged values of the variables (*LSPI*, *LCPI*, *LMS1*, *LEXR*, *LTBR* and *LUSA*) in levels and first differences are reported in Table 3; the second column reports the results when a constant (a_0) term is only included in the ADF model as a deterministic regressor while the third column shows the results when both a constant term (a_0) and a time trend (t) are incorporated in the model. The fourth column of table 3 reports Phillip-Perron statistics. In table 3, both ADF and Phillip-Perron tests consistently suggest that the share price index, consumer price index, money supply, exchange rate and the US price index are integrated of order one, I(1), whereas the treasury bill rate is integrated of order zero, I(0). According to Hansen and Juselius (2002), to find cointegration between nonstationary variables, at least two variables of all variables included in the cointergration system have to be I(1). Our findings are consistent with this requirement.

The results of Johansen's multivariate cointegration tests are reported in Table 4. Banerjee et al. suggest that the number of cointegrating vectors generated by Johansen approach may be sensitive to the number of lags in the Vector Auto Regression (VAR) model. Hence, in this study, we use Schwartz Bayesian Criterion (SBC) to determine the optimum lag length of the model. The optimum lag length suggested by SBC was 4. The *trace* statistics together with their associated critical values suggest that at least one long-run equilibrium relationship can be detected between Sri Lankan stock prices and macro-economic variables. For example, the value of $?_{trace}$ under the null of $r = 0$ at 85.27 is higher than the 5 per cent critical value from *Osterwald-Lenum* (1992). However, for all other values of r the $?_{trace}$ measure is less than the critical value allowing us to reject the hypothesis of more than one cointegrating vectors. The alternative measure used to identify the number of cointegrating vectors is $?_{max}$. Even though non of these values are significant at the 5 per cent level, the $?_{max}$ value of 33.38 under the alternative hypothesis of $r ? 1$ is significant at the 10 per cent level. The overall results, therefore, indicate that there is at least one cointegrating relationship among these variables.

Since the market index and macro-economic variables have at least one cointegrating vector, it is reasonable to assume that they move together in the long-run equilibrium path. Therefore, the causal relationship between the market index and macro-economic variables was examined using the VECM specification. The results for this estimation are reported in Table 5. The results provide some support for the argument that the lagged values of changes in macro-economic variables Granger cause variations in the share price index for Sri Lanka. In Panel A, the CPI coefficient is negative, on average, and it is statistically significant at lag 3 indicating a negative influence of the rate of inflation on the stock prices. This is consistent with the early evidence of a negative relation between inflation and stock returns (Lintner, 1973; Oudet, 1973; Bodie, 1976; Nelson, 1976; Jaffe and Mandelker, 1977; and Fama and Schwert, 1977). The MS1 coefficient is positive and significant at lag 1; growth in money supply appears to exert a positive impact on share prices. The TBR coefficients are consistently negative and two of them are strongly significant. The negative impact of TBR on stock prices is expected as rising interest rates provide risk-free investment opportunities to investors, especially if stock returns are not attractive. The coefficient for the US index is positive and statistically significant at lag 1 indicating that equity returns for this developed country influence the returns earned on the Colombo stock exchange. The exchange rate does not seem to have any influence on stock prices. This is surprising as the local currency has been subjected to devaluation throughout this period which provided attractive investment opportunities in the share market to foreign investors. The limited participation of foreign investors in share trading activities of the Colombo stock exchange may be the reason for the absence of any relationship. In Panel B of the same table we report the results relating to reverse causality from the market index to economic variables. It is clear that the market index does not exert any lagged influence on macro-economic variables except TBR. The negative bilateral relationship observed between the treasury bill rate and the stock index may indicate that the local investors employ a market timing strategy and shift their funds between the risk free asset and risky securities using their predictions about the movements of the returns on these two assets.

To give some more detailed insight into the findings of VAR model, the variance decomposition and impulse response functions were estimated. The results of the variance decomposition analysis are reported in Table 6. The reported figures indicate the percentage of movement in the i^{th} variable that can be attributed to its own shock and the shocks to the other variables in the system. These are provided for five different lagged time horizons: one month, five months, ten months (short run), twenty months and twenty four months (long run). The results tend to support the argument that the movements in the SPI can be explained by some of the macro-economic variables analysed. In the

first month, 100 per cent of the variability in the SPI is explained by its own shocks while after five months (two years) 85.61 (85.28) per cent of the variability is explained by its own innovations, 1.82 (2.05) per cent by the shocks of CPI, 5.45 (5.49) per cent by money supply, 2.12 (2.13) per cent by the exchange rate and 5.00 (5.05) per cent by the interest rate. Consistent with the findings of the VAR model, among four macro-economic variables, money supply and the treasury bill rate explain the highest percentages of the movements in price index.

The impulse response functions provide an alternative way to look at the findings of the variance decomposition analysis. Figure 2 provides these functions for the variables analysed in the study. Unexpected changes in the CPI have a large negative impact on stock prices, even though this occurs after an initial positive impact. Variations in the money supply have a positive impact on the dependent variable while the treasury bill rate generates a negative impact on the SPI. The conclusion to emerge from the VDC and IRF analyses is that only a minority of the forecast variance error of the market index is explained by the shocks to macro-economic variables. Further, these effects appeared to be immediate and do not persist for a long period.

V. Conclusion

Employing Johansen's methodology of multivariate cointegration analysis on monthly time-series data, this study examined the dynamic interrelations between macro-economic variables and the stock market index in Sri Lanka. Variables such as the money supply, the treasury bill rate, the consumer price index and the exchange rate were used to represent economic forces while the all share price index was used to represent the stock market. The US stock price index was used to capture the influence of developed markets.

The main findings revealed that there was a long run equilibrium relationship between the stock prices and some macro-economic variables. According to the VECM model estimated in the study, the rate of inflation, the money supply and the treasury bill rate were found to exert a significant lagged influence on the stock market index. The VDC analyses revealed that a major proportion of the variability in the market index was explained by its own innovations while only a minority was explained by macro-economic variables. This may be because the macro-economic variables used in this study represent only a subset of variables available in studies of developed markets. Future studies may benefit by integrating other variables such as industrial production, a broader measure of money supply and a long-term interest rate into their analyses. Nevertheless, the IRF function

revealed that whatever effects that the macro-economic variables had on the stock market index were immediate.

The causal influence from macro-economic variables to the Sri Lankan market index which is observed in this study has to be interpreted in conjunction with the socio-economic climate prevailed in the country during the period of this study. As already mentioned, organised share trading in Sri Lanka is relatively recent and the market is both small and illiquid compared to stock exchanges in developed countries. So, the trading strategies of speculative investors may be expected to exert a greater influence on market prices than macro-economic fundamentals. Also, Sri Lanka experienced political and economic uncertainty in many years of the study due to the civil unrest that prevailed in the south of the country during late 1980s and the escalation of war between the armed forces and northern rebels. An examination of the movements in the share prices index in Figure 1 revels a number of upward/downward movements in the market which were associated with these events; for example, the decline that occurred between 1988 and 1990 may be attributable to the uncertainty created by civil unrest which prevailed in the South of the country at that time. On the other hand, the bull market period between 1994 and 1997 was also associated with a period of political uncertainty in the country; this period coincided with a number of political assassinations (including the president of Sri Lanka whose government took radical steps to libaralise stock market investment), the change of the government which introduced open market system and ruled the country for 17 years and the breakdown of peace negotiations with northern rebels.

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Table 1
Historical Performance of the CSE

Performance Indicator	1985	1990	1995	2000
Market Capitalisation (Mn)	10,000	36,880	106,869	88,800
Annual Turnover (Mn)	72	1,563	11,249	11,049
No. of Listed Companies	171	175	226	239
Market Capitalisation as a % of GDP	6.16	11.40	15.35	7.07
Market Capitalisation as a % of World Market Capitalisation	0.0078	0.0097	0.0112	0.0033

Note: *The table provides statistics relating to market capitalisation, annual turnover, number of listed companies, the market capitalisation as a percentage of the GDP and the market capitalisation as a percentage of world market capitalisation. The market capitalisation and turnover figures are provided in local currency (Sri Lankan Rupees). Data source: Emerging Stock Markets Factbook, International Finance Corporation.*

Table 2
Descriptive Statistics

Variable	**Code**	**Mean**	**STD**	**Min**	**Max**	**Kurt**	**Skew**	***JB*-Stat**
Share Price Index	*LSPI*	5.99	0.70	4.57	7.23	-1.04	-0.57	19.92**
Consumer Price Index	*LCPI*	4.39	0.52	3.51	5.20	-1.26	-0.19	14.64**
Money Supply	*LMS1*	10.84	0.59	9.72	11.71	-1.13	-0.32	14.42**
Exchange Rate	*LEXR*	3.84	0.35	3.28	4.53	-0.92	0.13	7.70*
Treasure Bill Rate	*LTBR*	2.55	0.24	1.39	3.07	3.22	-1.22	138.28**
The US share price index	*LUSA*	6.23	0.62	5.18	7.33	-1.11	0.31	13.65**
Correlation Matrix	*LSPI*	*LCPI*	*LMS1*	*LEXR*	*LTBR*	*LUSA*		
LSPI	1.00							
LCPI	0.78	1.00						
LMS1	0.79	0.99	1.00					
LEXR	0.69	0.97	0.96	1.00				
LTBR	0.38	0.45	0.43	0.47	1.00			
LUSA	0.64	0.96	0.95	0.94	0.35	1.00		

***Note**: LSPI, LCPI, LMS1, LEXR, LTBR and LUSA denote the log values of share price index, consumer price index, money supply, exchange rate, treasury bill rate and the US share price index respectively. The table contains the following descriptive statistics: mean, standard deviation (STD), minimum (Min.), maximum (Max.), Kurtosis (Kurt.) skewness (Skew.) and Jarque-Bera statistic (JB-Stat). An $^{*(**)}$ denotes statistical significance at 5 per cent (1 per cent) level.*

Table 3
The ADF and Phillip-Perron tests for Unit Roots

Variable	Augmented Dickey-Fuller		Phillip-Perron
	$t_{constant}$	$t_{constant+trend}$	($t_{constant+trend}$)
Level			
LSPI	-1.912	-1.292	-1.301
LCPI	-0.808	-1.611	-2.645
LMS1	-2.739	-0.412	-1.724
LEXR	0.095	-3.243	-0.303
LTBR	-3.146*	-3.816*	-4.386**
LUSA	-1.071	-1.957	-1.792
First Difference			
DLSPI	-10.673**	-10.788**	-10.09**
DLCPI	-5.282**	-5.366**	-10.53**
DLMS1	-7.065**	-3.702*	-15.62**
DLEXR	-14.156**	-14.125**	-14.05**
DLUSA	-14.235**	-14.225**	-14.27**

***Note**: LSPI, LCPI, LMS1, LEXR, LTBR and LUSA denote the log values of share price index, consumer price index, money supply, exchange rate, treasury bill rate and the US share price index respectively. The ADF critical values for t-statistics at 5% and 1% levels for the model with the constant are -2.88 and -3.46 respectively, whereas for the model including both constant and time trend are -3.43 and -3.99 respectively. The tabulated critical values for the Phillip-Perron unit root tests are not reported. An $^{?\,(??)}$ indicates statistical significance at the 5 % (1%) level.*

Table 4
Multivariate Cointegration Tests Using Johansen's Method

Null	Alternative	? trace	Critical Values	
			5%	1%
r = 0	*r* ? 1	85.27**	75.328	82.969
r ? 1	*r* ? 2	51.89	54.347	60.054
r ? 2	*r* ? 3	24.86	35.068	40.198
r ? 3	*r* ? 4	6.73	20.168	24.988
r ? 4	*r* ? 5	0.74	9.094	12.741
Null	**Alternative**	? max	**Critical Values**	
			5%	**1%**
r = 0	*r* = 1	33.38	34.397	39.672
r ? 1	*r* = 2	27.03	28.167	33.121
r ? 2	*r* = 3	18.13	21.894	26.409
r ? 3	*r* = 4	5.99	15.752	19.834
r ? 4	*r* = 5	0.74	9.094	12.740

Note: *r denotes the number of cointegrating relationships. An * (**) denotes rejection of the hypothesis at the 5 % (1%) level. The critical values for the above statistics are obtained from Osterwald-Lenum (1992). The optimal lag length of the vector autoregression (VAR) for testing the cointegration is four.*

Table 5
Causal Effect between Share Price Index and Macro-economic Variables

Panel A: The Effects of Macroeconomics Variables on the Share Price Index

Lag(*n*)	Dependent variable					
	$DLSPI_{t-n}$	$DLCPI_{t-n}$	$DLMS1_{t-n}$	$DLEXR_{t-n}$	$DLTBR_{t-n}$	$DLUSA_{t-n}$
1	0.251	-0.136	0.470	0.170	-0.078	0.231
	(3.503)**	(-0.420)	(2.432)*	(1.649)	(-2.026)*	(2.214)*
2	0.035	0.480	-0.072	-0.150	-0.113	-0.007
	(0.470)	(1.459)	(-0.372)	(-1.752)	(-2.967)**	(0.062)
3	0.025	-0.669	0.251	0.143	-0.041	0.091
	(0.339)	(-2.113)*	(1.289)	(1.574)	(-1.265)	(0.855)

Panel B: The Effect of the Share Price index on the Macro-economics Variables

	Dependent variable				
	$DLSPI_t$	$DLCPI_t$	$DLMS1_t$	$DLEXR_t$	$DLTBR_t$
$DLSPI_{t-1}$	0.251	-0.020	0.017	-0.028	-0.679
	(3.503)**	(-1.348)	(0.624)	(-0.489)	(-4.265)**
$DLSPI_{t-2}$	0.035	0.016	0.016	-0.002	0.150
	(0.470)	(1.059)	(0.541)	(-0.036)	(0.901)
$DLSPI_{t-3}$	0.025	0.015	-0.024	0.029	-0.082
	(0.339)	(0.989)	(-0.848)	(0.491)	(-0.506)

Note: *DLSPI, DLCPI, DLMS1, DLEXR, DLTBR and DLUSA denote the first differences of the log values of share price index, consumer price index, money supply, exchange rate, treasury bill rate, and the US share price index respectively. The numbers in parentheses are t-statistics. An ? (??) denotes statistical significance at the 5 % (1%) level.*

Table 6
Variance Decomposition

Panel A: Percentage of the movement in the $DLSPI_t$ explained by shocks to

Lags(*n*)	$DLSPI_{t-n}$	$DLCPI_{t-n}$	$DLMS1_{t-n}$	$DLEXR_{t-n}$	$DLTBR_{t-n}$
1	100.00%	0.00%	0.00%	0.00%	0.00%
5	85. 61%	1.82%	5.45%	2.12%	5.00%
10	85.30%	2.03%	5.49%	2.13%	5.05%
20	85.28%	2.05%	5.49%	2.13%	5.05%
24	85.28%	2.05%	5.49%	2.13%	5.05%

Panel B: Percentage of a shock to $DLSPI_{t-n}$ explaining movements in

Lags(*n*)	$DLSPI_t$	$DLCPI_t$	$DLMS1_t$	$DLEXR_t$	$DLTBR_t$
1	100.00%	0.01%	0.32%	3.98%	0.00%
5	85. 61%	1.68%	1.07%	4.61%	6.95%
10	85.30%	1.78%	1.10%	4.70%	6.99%
20	85.28%	1.79%	1.10%	4.70%	6.99%
24	85.28%	1.79%	1.10%	4.70%	6.99%

Note: *DLSPI, DLCPI, DLMS1, DLEXR and DLTBR denote the first differences of the log values of share price index, consumer price index, money supply, exchange rate and treasury bill rate respectively.*

Figure 1: The Behaviour of Share Price Index (SPI) during the Examination Period

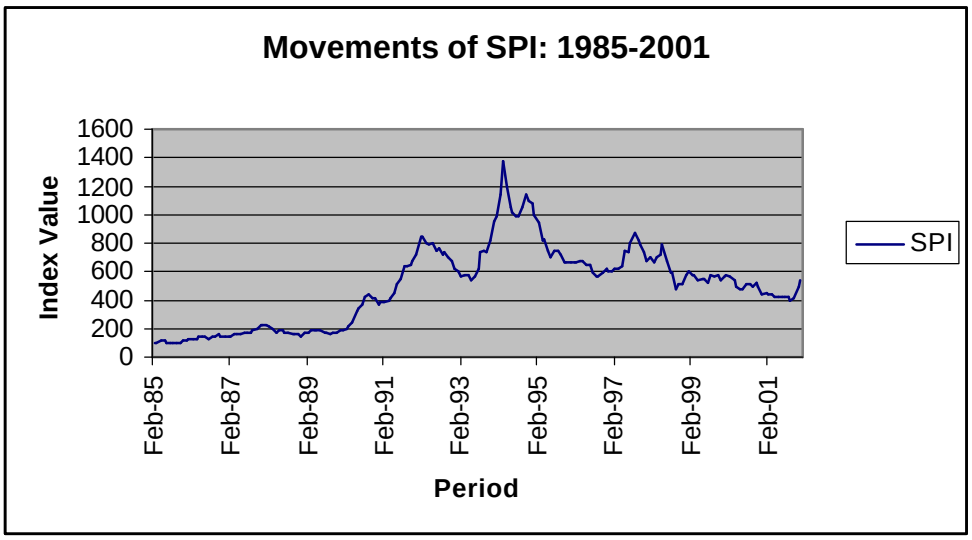

Figure 2: Impulse Response Function

Responses of *DLSPI* to shocks in all variables **Responses of all variables to a shock in D*LSPI***