

The Impact of Macro-Economic Variables on Stock Market Performance; Evidence From Sri Lanka

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Abstract

Investigations of relationship between macro-economic factors and performance of stock markets at many emerging economies including that of Sri Lanka are relatively limited on one hand and required to be repeated as the underlying economic settings of such economies have rapidly changed over the years. Post war economic context and subsequent macro-economic revitalizations in Sri Lanka influenced the performance of capital market of Sri Lanka and hence the investigations on ‘how does and at what extent the Sri Lankan stock market responds to such macroeconomic developments?’ is an important empirical question. This study thus investigates the relationships between the All share price index of Colombo stock exchange and five macroeconomic variables, namely, Gross domestic product (GDP), Inflation proxied by wholesale price index(WPI) , Interest rate (IR), Balance of payment (BP) and Exchange rate (ER) over the period from 1980 to 2012. Ordinary Least Square (OLS) is used to estimate the parameters of the regression model, with the application of linear, linear- log, log- log and log- linear data transformation for choosing the appropriate model fitting the data. The serial correlation problem was tested using Durbin-Watson statistics. In this study, Durbin-Watson statistics of the log-log model, which had the highest R^2 of 82%, was 1.88 confirming that there was no serial correlation issue. The analysis reveals that macroeconomic variables and the stock market index (All share price index) in Sri Lanka are significantly related. It is observed that the stock market index significantly positively relates to GDP, ER and IR while it negatively relates to inflation proxied by wholesale price index of Sri Lanka. The Balance of payment is found to be insignificant in determining the stock market performance in Sri Lanka

Keywords: macro-economic variables, stock market, Colombo Stock Exchange, All share price index, Sri Lanka

INTRODUCTION

The stock market mobilizes capital for corporate sector, the engine of economy, on one hand and on the other it offers national and international, individual and institutional investors alternative investment options for maximizing their return and wealth. The investors are cautious in the performance of stock market so that they are prudent in their investment decisions. Performance of stock market is normally measured in terms of some composite market index. The composite market indices are often considered to signal historical current and potential performance of the respective stock markets. Though there have been numerous attempts to develop and stabilize the stock markets, the emerging economies are characterized as the most volatile stock markets (Engel and Rangel, 2005). Moreover, the stock markets of emerging economies are likely to be sensitive to various such factors as changes in the level of economic activities, political and international economic environment and also related to the changes in other macroeconomic factors.(Naik and Padhi, 2012).Investors hence tend to evaluate the

macroeconomics factors that would potentially significant in determining the capital market behavior.

The Arbitrage Pricing Theory (APT) is often sought to provide theoretical background to explain the relationship between stock prices and macroeconomic factors (see. Ross, 1976; Chen et al., 1986). Driven by the theoretical background, there are various empirical investigations that concluded that macroeconomic factors are connected to stock prices or stock market behavior. However, the finding is not similar in all jurisdictions. Rather, there exist notable disparities in the direction of movement and strength of relationship between stock market indices and macro-economic factors. Naik and Padhi, (2012) thus observe that the relationship of some macro factors could vary from market to market; may change in different sample periods and also in different frequency of the data thereby more in-depth studies are needed to understand the macroeconomic variables that might influence the stock market. Therefore, the impact of economic factors on stock

market behavior remains for a long period as a matter of debate amongst economists, academicians and professionals,

Though interest in investing in emerging markets has grown considerably over the past decade (Menike, 2006) while investigations of relationship between macro-economic factors and performance of stock markets at many emerging economies are relatively limited and thereby growing. Menike, 2006 also claims that although most of the studies were carried out in emerging market contexts recently, there is only a little number of studies in emerging Sri Lankan Stock Market such as of Samarakoon, (1996,1998,1998), Nimal, (1997), Premawardhana (1997), Samarakoon et al. (2000).

PROBLEM STATEMENT

Sri Lanka's capital market has undergone tremendous changes after the adoption of liberalization policy and it has been becoming more open to international investors especially in the contexts of post war economy and subsequent macro-economic revitalizations in Sri Lanka. These macro-economic developments arises a fundamental research question in the backdrop of Arbitrage Pricing Theory (APT) and the theory of efficient markets hypothesis (EMH), whether stock prices in CSE reflected to such macro-economic developments in Sri Lanka.

Though there are empirical studies in Sri Lanka investigating the impact of macroeconomic factors on stock prices or stock market behavior, the findings may differ when it is repeated with different sample periods and also in different frequency of the data as observed Naik and Padhi, (2012). Therefore, the investigations on 'how does and at what extent the Sri Lankan stock market responds to such macroeconomic developments?' still remains an open empirical question. Understanding the macroeconomic variables that could impact the Sri Lanka stock market index, with the recent data can be useful for investors, traders as well as the policy makers for being prudent on their economic decisions and actions.

RESEARCH OBJECTIVE

The goal of this study therefore is to test whether the macro-economic factors in Sri Lanka explain the behavior of the All Share Price Index (ASPI), which remains as a composite index of Colombo Stock Exchange (CSE) for a long period of time. The study uses annual data for recent 32 years from 1980 to 2012 to investigate the relationship between stock prices and five macroeconomics variables namely, Gross domestic product (GDP), Inflation proxied by wholesale price index(WPI) , Interest rate (IR), Balance of payment (BP) and Exchange rate (ER) of Sri Lanka.

It is expected that the finding of this study would contribute to potential local and foreign investors to make optimal economic decisions when macro-economic forces vary. This study would also assist the policy makers to prudently manage the macroeconomic forces to optimize the performance of Sri Lanka's capital market. The findings in this study would also extend the existing literature on relationship between macro-economic factors and capital market by providing another latest empirical evidence from an emerging economy.

REVIEW OF LITERATURE

An exhaustive review of literature on the impact of macro-economic fundamentals over the stock market behavior is not within the scope of this research. However, the review of literature to follow will mainly concern on some recent findings on the subject under investigation in certain emerging economies.

Pal & Mittal (2011) investigated the long run relationship between two Indian capital markets and some such macroeconomic factors as interest rates, inflation, and exchange rate and gross domestic savings using quarterly data from January 1995 to December 2008 and with the help of unit root test, co integration and error correction mechanism. They found that the inflation rate have the significant impact on both capital markets whereas interest rate and foreign exchange rate have an impact on one capital market. It was also found that Gross domestic saving was insignificant explaining both markets. Naik and Padhi, (2012) also studied the relationships between the Indian stock market index (BSE Sensex) and five macroeconomic variables, namely, industrial production index, wholesale price index, money supply, treasury bills rates and exchange rates over the period 1994–2011 with application of Johansen's co-integration and vector error correction model to explore the long-run equilibrium relationship between stock market index and macroeconomic variables. The analysis reveals that macroeconomic variables and the stock market index are co-integrated and, hence, a long-run equilibrium relationship exists between them. It was found that the stock prices positively relate to the money supply and industrial production but negatively relate to inflation. The exchange rate and the short-term interest rate are found to be insignificant in determining stock prices. Sulaiman et.al, (2009) studies the impact of macroeconomics variables on Stock Prices in Karachi Stock Exchange. They investigated the relationship with respect to foreign exchange reserve, foreign exchange rate, industrial production index (IPI), whole sale price index (WPI), gross fixed capital formation (GFCF) and broad money M2 from 1986 to 2008. The result shows that foreign exchange rate and foreign exchange reserve are significantly affecting the stock prices, while other variables like

IPI and GFCF are insignificantly in explaining stock prices. Aurangzeb (2012) attempted to identify the factor affecting performance of stock market in selected three South Asian countries namely, Pakistan, India and Sri Lanka using the data from the period of 1997 to 2010. Regression results indicate that foreign direct investment and exchange rate have significant positive impact on performance of stock market in South Asian countries while; interest rate has negative and significant impact on performance of stock market in South Asia. Results also indicate the negative but insignificant impact of inflation on stock market performance in South Asia. Ahmed and Imam (2007) investigated the relationship between stock market and different macroeconomic variables such as money supply, treasury bill rate, interest rate, GDP, industrial production index using series of tests such as unit roots, co integration, and vector error correction models with the monthly data set for the period of July 1997 to June 2005 and found that generally there exists no long run relationship between stock market index and macroeconomic variables but interest rate change or T-bill growth rate may have some influence on the market return.

Chen, et al (1986) examined the effect of selected macroeconomic variables on stock market returns. They took short and long term interest rates; expected and unexpected inflation, industrial production and the spread between high and low grade bonds. The data during the period from 1953 to 1972 was taken and applied 12 cross sectional regression. The study found that some of these macroeconomic variables such as industrial production and changes in risk premium have significant impact on stock returns.

Fang and Miller (2002) identifies the effect of volatility in Korean foreign exchange market on Korean stock market with the GARCH-M model and the daily data of those variables from 3rd of January 1997 to 21st of December, 2000 and they found out that the Korean foreign currency market impacts in three different ways on the stock market where the exchange rate negatively affect stock market returns while the depreciation volatility positively affects these returns. They also claim that stock market return volatility responds to exchange rate depreciation volatility. Bilson et al. (2001) tested whether local macroeconomic variables (money supply, goods prices and real activity) have explanatory power over stock returns in 20 exchange emerging markets for the period 1985-1997. The results indicate that the exchange rate variable is clearly the most influential macroeconomic variable, and money supply has greater importance. Ibrahim & Aziz (2003) explore the relationship between four macroeconomic variables and Kuala Lumpur Composite Index (KLCI) through co integration and vector auto regression model. They employ the monthly data of their variables. Selected

macroeconomic variables were real output, inflation rate, money supply and exchange rate from 1977 to August 1998. The study found that there exists a short term as well as a long term relationship between the macroeconomic variables and the KLCI. They further found that two variables such as exchange rate and money supply were negatively associated with the stock prices while the other two positively impacted on the index.

Geetha et al. (2011) the evidence from Malaysia, United States and China where they found that there is long run relationship between expected and unexpected inflation with stock returns but there is no short run relationship between these variables for Malaysia and US while it exists for china. Maysamiet al. (2004) examined the long-term equilibrium relationships between selected macroeconomic variables and the Singapore stock market index (STI), as well as with various Singapore Exchange Sector indices which are the finance index, the property index, and the hotel index. The study concludes that the Singapore's stock market and the property index form co integrating relationship with changes in the short and long-term interest rates, industrial production, price levels, exchange rate and money supply. Al-Khazali (2003) investigated the generalized Fisher hypothesis for nine equity markets in the Asian countries as Australia, Hong Kong, Indonesia, Japan, South Korea, Malaysia, the Philippines, Taiwan, and Thailand and rejected the generalized Fisher hypothesis in all countries. The results of the VAR model indicate inflation does not appear to explain variation in stock returns; stock returns do not explain variation in expected inflation. The stochastic process of the nominal stock returns could not be affected by expected inflation. The study fails to find either a consistent negative response of stock returns to shocks in inflation or a consistent negative response of inflation to shocks in stock returns in all countries. Momani and Alsharari (2012) studied the impact of macroeconomic factors on the stock prices at Amman Stock Market of Jordan covering the periods of 1992- 2010. The macroeconomic factors were namely interest rate, national product, money supply and industrial product index. The results showed a significant statistical impact on share prices, but when each factor was examined with the indices, they found that the interest rate has a statistically significant impact on the prices of the shares in Amman Financial Market, and the effect was negative on behalf of the index and the sectors index. The other variable, which had a significant impact, was the production index where its impact was negative for general and sectors index except the insurance sector, which had a positive impact. Al-Rjoub (2003) investigated the effect of unexpected inflation on stock returns in five Middle East countries as Bahrain, Egypt, Jordan, Oman, and Saudi Arabia and reported that there is a

negative and strongly significant relationship between unexpected inflation and stock returns in the countries under investigation. Similarly, Coleman and Agyire-Tetty (2008) explored the impact of some macroeconomic variables on the performance of Ghana Stock Exchange with the help of quarterly time series data for the period from 1991 to 2005 by using co integration and error correction model. The findings revealed a weak effect of Treasury bill rates and on the other hand market take time to respond in inflation scenario.

Rjoub et al 2009 investigate the performance of the arbitrage pricing theory (APT) in the Istanbul Stock Exchange (ISE) on a monthly basis, for the period January 2001 to September 2005 with six pre-specified macroeconomic variables which are: the term structure of interest rate, unanticipated inflation, risk premium, exchange rate and money supply and unemployment rate. They used OLS technique observed that there are some differences among the market portfolios and showed that there are significant differences among market portfolios against macroeconomic variables through the variation of R^2 . Hussainey and Ngoc (2009) investigate the effects of macroeconomic indicators (the interest rate and the industrial production) on Vietnamese stock prices using monthly time series data covering the period from January 2001 to April 2008. They provide the empirical evidence that there are statistically significant associations among the domestic production sector, money markets, and stock prices in Viet Nam. Another novel finding that they claim is that the US macroeconomic fundamentals significantly affect Vietnamese Stock prices. They also showed that the influence of the US real sector is stronger than that of the money market.

Gupta and Reid (2013) explore the sensitivity of industry-specific stock returns to monetary policy and macroeconomic news. The paper looks at a range of industry-specific South African stock market indices and evaluates the sensitivity of these indices to various unanticipated macroeconomic shocks. The results from the event study revealed that with the exception of the gold mining index, where the consumer price index (CPI) surprise plays a significant role, monetary surprise is the only variable that consistently negatively affects the stock returns significantly, both at the aggregate and sectoral levels. In addition, the CPI and Producer price index (PPI) surprises also affect aggregate stock returns significantly. However, the effects of the CPI and PPI surprises are quite small in magnitude and are mainly experienced at shorter horizons immediately after the shock. Ali (2011) investigates the direction of the causal relationship between stock prices in Dhaka Stock Exchange (DSE) and thirteen macroeconomic aggregates such as the thirteen macroeconomic variables, viz., consumer price index, deposit interest

rate, foreign exchange rate, export payment, gross domestic product, investment, industrial production index, lending interest rate, broad money supply, national income deflator, foreign remittances and total domestic credit. The study employed unit-root tests, cointegration and the long-run Granger causality test for monthly data for the period 1987 to 2010 and found that DSI in any way do not granger cause CPI, deposit interest rate, export receipt, GDP, investment, industrial production index, lending interest rate and national income deflator. But unidirectional causality is found from DSI to broad money supply and total domestic credit. In addition bi-directional causality is also identified from DSI to exchange rate, import payment and foreign remittances.

Premawardhana (1997) found a negative relationship between stock returns and interest rates in Sri Lanka while in contrast Hassan et al. (2000) found a positive relationship between such variables. Menike (2006) investigated the effect of macroeconomic variables on stock prices in Sri Lankan stock market using monthly data for the period from September 1991 to December 2002. The study used employed multivariate regression where eight macroeconomic variables were regressed against each individual stock. The results indicate that higher explanatory power of macroeconomic variables is high in explaining stock prices of most of the stock listed in CSE. The study held that inflation rate and exchange rate react mainly negatively to stock prices there also prevails a negative effect of Treasury bill rate implying that whenever the interest rate on Treasury securities rises, investors tend to switch out of stocks causing a fall in stock prices. However, lagged money supply variables were held not to have a strong prediction of the movements of stock prices. Wickremasinghe (2011) examined the long run relationship between Sri Lankan capital markets (CSE) and six macroeconomic variables such as three month fixed deposit rate, consumer price index, US stock market index, narrow M1 and GDP of Sri Lanka. They use the monthly data from January 1985 to December 2004 and with the help of unit root test, co integration, variance decomposition and error correction mechanism they found out that there exists a short term and a long term relationship between stock prices and macroeconomic variables. Results of this study also suggest that there exist a Bi-directional relationship between stock market index and fixed deposit rate, stock prices and US Share price and GDP while remaining variables which are consumer price index, M1 and exchange rate also have casual bi-directional relationship. Results of variance decomposition suggest that GDP and M1 play an important role in longer horizon to forecast variance in stock prices.

DESIGN AND METHODOLOGY

The study covers the periods from 1980 to 2011 and employs time series data. Data relevant to this study was collected from such secondary sources as Central Bank Annual Reports 1977 – 2012, and Economic and Social Statistics in Sri Lanka 1990 - 2012. Correlation and Multiple Regression techniques were primarily employed for investigating the relationship between the variables under study. Ordinary Least Square (OLS) method is used to estimate the parameters of the regression model. Data analysis was performed with aid of E-views, Excel, and Minitab statistical software. The general relationship between All share price index (ASPI), the dependent variable and such macro-economic factors, the independent variables as Gross Domestic Product (GDP), Interest Rate (IR), Weighted Price Index (WPI), Exchange Rate (ER) and Balance of Payment (BP) can be represented by a general linear regression model (1) as below.

$$Aspi_t = \alpha + \beta_1 Gdp + \beta_2 Wpi + \beta_3 Er + \beta_4 Bp + \beta_5 Ir + ei \quad (1)$$

In order to choose the best regression model that fits to this time series data, Linear – Log and Log – Log and *log-linear* models as represented respectively in mode(2), (3) and (4) were also regressed and compared.

$$Aspi_t = \alpha + \beta_1 Log Gdp + \beta_2 Log Wpi + \beta_3 Log Er + \beta_4 Log Bp + \beta_5 Log Ir + ei \quad (2)$$

$$Log Aspi_t = \alpha + \beta_1 Log Gdp + \beta_2 Log Wpi + \beta_3 Log Er + \beta_4 Log Bp + \beta_5 Log Ir + ei \quad (3)$$

$$Log Aspi_t = \alpha + \beta_1 Log Gdp + \beta_2 Log Wpi + \beta_3 Log Er + \beta_4 Log Bp + \beta_5 Log Ir + ei \quad (4)$$

The best model was selected based on model selection statistics namely Adjusted (R^2), the Estimated F statistics (F), Durbin-Watson statistic (DW) and Variance Inflation Factor (VIF). Table 01 summarizes such key statistics of each model regressed.

Table 1: Key statistics of ASPI models

Models	P	F	DW	VIF	R-Sq (adj) %
<i>linear</i> $Aspi_t = \alpha + \beta_1 Gdp + \beta_2 Wpi + \beta_3 Er + \beta_4 Bp + \beta_5 Ir + ei$	0.000	9.02	0.709135	1.2-2.6	56.4%
<i>linear-log</i> $Aspi_t = \alpha + \beta_1 Log Gdp + \beta_2 Log Wpi + \beta_3 Log Er + \beta_4 Log Bp + \beta_5 Log Ir + ei$	0.020	4.35	1.81076	1.3-5.6	51.2%
<i>log-log</i> $Log Aspi_t = \alpha + \beta_1 Log Gdp + \beta_2 Log Wpi + \beta_3 Log Er + \beta_4 Log Bp + \beta_5 Log Ir + ei$	0.000	15.60	1.88439	1.3-5.6	82.0%
<i>log-linear</i> $Log Aspi_t = \alpha + \beta_1 Gdp + \beta_2 Wpi + \beta_3 Er + \beta_4 Bp + \beta_5 Ir + ei$	0.000	27.38	0.928762	1.2-2.6	81.0%

Where, GDP = gross domestic product, IR= interest rate, WPI =wholesale price index which proxies inflation, ER= exchange rate, BP=balance of payment.

RESULTS AND DISCUSSION

Accordingly, *log-log* model was found to be relatively sound in consideration of model selection statistics of Adjusted (R^2), the estimated F statistics (F), Durbin-Watson statistic (DW) and Variance inflating factor (VIF). Regression results of Log-Log model are presented in Table 02.

Table 2: Regression Results (Log-Log Model)

$$Log Aspi_t = \alpha + \beta_1 Log Gdp + \beta_2 Log Wpi + \beta_3 Log Er + \beta_4 Log Bp + \beta_5 Log Ir + ei$$

	Coefficient	t-value	Probability (p)
α	-3.416	-2.43	0.033**
<i>Log GDP</i>	1.5196	2.41	0.035**
<i>Log WPI</i>	-0.4788	-1.93	0.080*
<i>Log ER</i>	1.9777	4.28	0.001***
<i>Log BP</i>	0.0768	0.63	0.540
<i>Log IR</i>	1.8059	2.25	0.046**

* Significant at the alpha value of 10%

** Significant at the alpha value of 5%

*** Significant at the alpha value of 1%

Where, GDP = gross domestic product, IR= interest rate, WPI =wholesale price index which proxies inflation, ER= exchange rate, BP=balance of payment.

Accordingly, ER is positively and significantly correlated with the estimated coefficient of 1. 9777

indicating that 1% increase in ER will increase ASPI by 1. 9777, which is relatively higher in magnitude of impact and in terms of level of statistical significance ($p= 0.001$) as compared to other macro-economic factors under this study. The GDP is positively and significantly associated with ASPI with the estimated coefficient of 1.5196 and the p-value of 0.035 whereas IR is also positively and significantly associated with ASPI with the estimated coefficient of 1.8059 and the p-value of 0.046. Meanwhile, WPI is negatively and significantly associated with ASPI with the estimated coefficient of -0.4788 and the p-value of 0.080 while BP is not significant in the model. Therefore in general, it is found that macroeconomic factors significantly influence the movement of ASPI, the all share price index, the prominent parameter of Colombo Stock Exchange.

The direction of movement of ASPI on the account of macroeconomic variables in this research can be related to the empirical findings in other jurisdictions. The evidence confirms that ASPI appears to react negatively to rising wholesale price index, the measure for inflation. This finding is consistent with that of *Inter alia* Naik and Padhi, (2012), Pal & Mittal (2011), Menike (2006) ,Al-Rjoub (2003), Panayotis et al. (1996).The exchange rate is another macroeconomic variable that critically underpin stock

market performance. This research found a significant and positive relationship between ASPI and ER. This finding goes with that of *Inter alia* Aurangzeb (2012), Pal & Mittal (2011), Suleiman et.al, (2000) and Aggarwal (1981). ASPI has reacted positively to rising of interest rate. This is in contrary to the majority-held view that stock market price declines on the face of increased interest rate as the investors would switch their investments on treasury bills and fixed interest carrying investment options. Yet, Hasan et al. (2000) found a positive relationship between interest rate and stock return.

CONCLUSION

The findings of the study confirm that there exists a strong causality between macro-economic factors and stock market performance in Sri Lanka. The present study therefore confirms the beliefs that macroeconomic factors continue to affect stock prices and the capital market performance. The improvement of performance of Colombo stock exchange is not thus possible without a favorable macro-economic performance. It is therefore recommended that in order to maximize the performance of stock market prudently managed macroeconomic policies are necessary in which inflation rate is thoroughly monitored and maintained at a reduced value as much as possible. Upward movement of GDP, Exchange rate and Interest rate may lead to better performance of ASPI of CSE. However, the limitations of the study should not be overlooked. The present study is limited to only five selected macroeconomic variables and 32 years of time series data. Inclusion of more variables with a longer time period may improve the results. A logical extension of the study can be done by incorporating more macro-economic variables and other indices of CSE.

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