

## **Dynamic Relationship between Interest Rate and Stock Price: Empirical Evidence from Colombo Stock Exchange**

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### **Abstract**

*This study examines the causal relationship between stock price and interest rate, using monthly data for the period from January 2007 to December 2013. All Share Price Index (ASPI) in Colombo Stock Exchange is used for the stock prices and the details on interest rate have been collected from the data released by the Central Bank of Sri Lanka. Augmented Dickey Fuller test was used to find out the stationarity of the data series and the results of the test showed that, ASPI data and the interest rate was stationary at first difference. The Granger Causality test was used to check any causal relationship between stock returns and interest rate and outcomes showed that, there is one way causal relationship between variables. That is stock returns does not Granger Cause interest rate but interest rate does Granger Cause stock returns. Finally, to check the result of the Granger Causality Test, a regression was run. The result of the regression shows that interest rate is a significant factor for stock return changes and interest rate has significant negative relationship with ASPI.*

**Keywords:** Stock Price, Interest Rate, Granger Causality, Regression

### **1. Introduction**

The impact of macroeconomic variables on stock prices has been the subject of growing theoretical and empirical investigation. The central issue in this literature is the size and nature of this impact. The economic theory suggests that stock prices should reflect expectations about future corporate performance. Thus, in order to formulate country's macroeconomic policies, the causal relations and dynamic interactions among macroeconomic factors and stock market are very important. Further, investors believe that monetary, exchange rate and interest rate policies of the country and macroeconomic events have a great influence on volatility of the stock prices which implies that macroeconomic variables can influence investors' investment decisions and motivates many researchers to observe the relationships between stock returns and macroeconomic variables. Thus detecting the association between stock prices and interest rates has become crucial for the academicians, practitioners and policy makers.

### **2. Problem Statement**

Though financial economists, policy makers and investors have long-attempted to understand dynamic interactions between interest rate and stock prices, the exact patterns of the interactions remain unclear, the nature and strength of the dynamic interactions between them is of high interest and need to be evaluated empirically. Therefore, the researcher examines the dynamic relationship between interest rate and stock prices in order to identify the impact of interest rate changes on stock prices with special reference to Colombo Stock Exchange.

“What is the relationship between interest rate and stock prices?”

### **3. Objectives of the Study**

The major objective of the study is to identify the dynamic relationship between interest rate and stock prices. The specific objectives of the study are;

- To find whether there is a positive, negative or no relation between variables.
- To investigate the co-integration between variables.
- To give practical implications.

#### **4. Significance of the Study**

Investors have a great interest in discovering interest rate changes that may help forecast stock prices. They can more appropriately manage their positions and portfolios, if they can use news on interest rate changes as a reliable indicator for where the stock price is headed. Meanwhile, policymakers pay attention to the situation of the stock market reactions on interest rate changes as a leading indicator of future stock market activity.

Investment analysts, fund managers and marginal investors can devise fundamentals based investment strategies in order to earn extra returns. It provides academic scholars with extra information on the application of methodology in order to identify the dynamic relationship between variables.

#### **5. Literature Review**

Finance theory explains interest rate as a measurement of time value of money which is one of the main determinants in stock prices. It plays a major role in any economy as a key macroeconomic variable which is defined as the cost of money. Thus, any change in interest rate can cause difficulty for the investors and can affect the profitability of firms thereby fluctuating stock prices due to any change in this variable. Sensitivity of stock prices to interest rate has theoretically and empirically explored by many researchers and a large number of studies, remarkably in many countries document that share prices are affected by interest rate changes by employing a single factor framework and multivariate approach as which are reviewed below.

Lynge and Zumwalt (1980) who found that interest rate sensitivity varied depending on the term of interest rates, namely short versus longer term interest rates and find that stock returns of banks were more sensitive than non-financial stock returns; however, there were still significant extra-market and extra-interest rate effects that are unexplained. In addition, they also found that the sensitivity of bank stock returns had changed over time.

Flannery and James (1984) examined, in more detail, the underlying factors for the sensitivity of stock returns to interest rates to understand the characteristics of banks that gave rise to this sensitivity and confirmed the negative relationship of stock returns to interest rates whether short-term or long. They asserted that the mix of assets and liabilities with respect to maturity was a key factor in explaining sensitivity of stock returns to unexpected interest rate changes.

Campbell (1985) shows that more generally the state of the term structure of interest rates predicts stock returns. Bashir and Hassan (1997) investigate the relationship between interest rate sensitivity and stock returns in the UAE providing some evidence that commercial banks stock returns are interest rate sensitive. The relationship between stock returns and interest rates in Sri Lanka is studied by Premawardane (1997) using weekly and monthly data for the period from January 1990 to December 1995. The empirical results are inconsistent with Geske and Roll (1983) and Balmash and Trivoli (1991) that stock returns have a significant positive relationship with contemporaneous and lagged one year T-bill yield, and both contemporaneous and lagged yield spread. He documents that the changes in the interest rate structure trigger delayed reactions from investors and, seem to indicate inefficiency in the process of dissemination of market information.

Hasan, Samarakoon and Hasan (2000) examine the ability of interest rates, as measured by Treasury bill rates of all three maturity periods, to track the expected monthly, quarterly and annual returns in the Sri Lankan stock market during the 1990-1997 periods. In contrast to the findings in most prior studies on foreign markets, the results of this study indicate that short-term interest rates in Sri Lanka are positively related to future returns. They are able to reliably track expected returns of all three return horizons. The effect of interest rate on future returns becomes larger and stronger with longer maturity periods and quarterly returns horizons. In addition, the explanatory power also tends to increase with return horizons, except in annual returns.

The research interest on the issue has been recently attracted more attention in the empirical literature generating a new signal of further evidence for a significant negative relationship between stock returns and interest rate changes. Bulmash and Trivoli (1991) find that the US current stock price is positively correlated with the previous month's stock price and there is a negative relationship between stock price and the Treasury bill rate. Abdullah and Hayworth (1993) observed that the US stock returns are related negatively to short and long term interest rates.

Madura and Schnusenberg (2000) examined the interaction between the bank stock returns and the US Federal Reserve discount rate and found they were negatively related.

Further, he demonstrated that the Fed rate change effect varied significantly depending on the size of banks concerned. A study based on Kuwait stock prices by Al-Qenae, Carmen and Bob (2002) made an important contribution by investigating the effect of interest rate on the stock prices during the period 1981-1997 showing that interest rate has negative and statistically significant effect on stock prices suggesting that the KSE market behave some features of semi-strong efficiency.

Gan, Lee, Yong and Zhang (2006) also suggest that there exist a long term negative relationship between stock prices and interest rate. In their study, Liu and Shrestha (2008) examine the long run relationship between interest rate and stock indices in China employing heteroscedastic cointegration analysis and finds that the long term relationship does exist between stock market and interest rates. On the contrary, Pilinkus and Boguslankas (2009) analyze the short run relationships and conclude that short term interest rates negatively influence on stock market prices.

More recently Alam and Uddin (2009) examined evidence supporting the existence of share market efficiency based on the monthly data between stock index and interest rate for fifteen developed and developing countries and for all of the countries it is found that interest rate has significant negative relationship with share price and for six countries it is found that changes of interest rate has significant negative relationship with changes of share price. They further state if the interest rate is considerably controlled for these countries, it will be the great benefit of these countries' stock exchange through demand pull way of more investors in share market, and supply push way of more extensional investment of companies.

Few studies have found the existent of long and short run link between stock prices and interest rate. Humpe and Macmillan (2007) document that there exists a long run negative association between long term interest rate and stock prices only in US, using US and Japanese data. In Singapore Maysami, Howe and Hamzah, (2004) also find a negative relationship between long term interest rate and stock returns while Nasseh and Strauss (2000) find the same relation in six developed countries. However, Ratanapakorn and Sharma (2007) in US find that the stock prices negatively related to the long-term interest rate, while a positive relationship between stock prices and the short-term interest rate is recorded.

## 6. Data and Methodology

### 6.1 Data Sources, Description and Variables

This study attempts to investigate the dynamic relationship between interest rate and stock prices in Sri Lanka. The data used in this study are sampled on a monthly basis over the period from January 2007 to December 2013. All Share Price Index (ASPI) is considered as a proxy for the stock prices.

Interest rates that are hypothesized to influence stock prices are obtained from the publications of Central Bank of Sri Lanka.

### 6.2 Development of Hypotheses

In order to find the relationship between interest rate and stock prices the following hypothesis is formed.

$$H_0: \beta_i = 0 \quad \text{Vs}$$

$$H_1: \beta_i \neq 0$$

$\beta_i$  = the coefficients of interest rate

### 6.3 Econometric Model

Different methods have been employed to test the relationships between interest rate and stock prices. Prior to deciding on the appropriate model, the stationary of the variables are tested using unit root testing. In this study Augmented Dickey Fuller test was used to investigate the stationary.

Augmented Dickey Fuller (1979) used following regression

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^m \Delta Y_{t-i} + \varepsilon_t$$

Where  $\Delta$  is the difference operator,  $\beta$ ,  $\delta$  &  $\alpha$  are the coefficient to be estimated,  $Y$  is the variable whose time series properties are examined and  $\varepsilon$  is the error term.

It is applied Granger causality test (Granger 1988) to find out any causal relationship between stock prices and interest rates. This test involves following equations

$$\Delta SP_t = \beta_0 + \sum_{i=1}^q \beta_{1i} \Delta SP_{t-i} + \sum_{i=1}^q \beta_{2i} \Delta IR_{t-i} + \varepsilon_{1t}$$

$$\Delta IR_t = \varphi_0 + \sum_{i=1}^r \varphi_{1i} \Delta IR_{t-i} + \sum_{i=1}^r \varphi_{2i} \Delta SP_{t-i} + \varepsilon_{2t}$$

Where  $SP_t$  and  $IR_t$  represent stock prices and interest rate,  $\varepsilon_{1t}$  and  $\varepsilon_{2t}$  are uncorrelated stationary random process and  $t$  denotes the time period.

Finally a regression was run to check the relationship between stock prices and interest rate, using following model,

$$Y = \alpha + \beta x + \varepsilon_t$$

It is considered as  $\alpha = 0.05$  which indicate the P value is in between 0.01 to 0.05. There 95% confidence level was expected.

### 8. Data Analysis and Discussion

At first, it is used Augmented Dickey Fuller test to find out the stationary of the data set. The results of the test are given in the Table 01 below. The data on stock returns are stationary at level in constant and constant & linear trend which reject the null hypothesis that data has a unit root. The data series on interest rate is not stationary at level but it is stationary in constant & linear trend at 10% significant level. The first difference interest rate is stationary in both the constant and constant & linear trend. So it rejects the null hypothesis that data has a unit root.

**Table 01: Unit Root Test Results**

Variables	Augmented Dickey Fuller			
	Level		First Difference	
	Constant	Constant & Linear trend	Constant	Constant & Linear trend
	Test Statistics			
Stock Price	-0.571328	-1.593510	-7.250678*	-7.212563*
Interest rate	-0.673344	-1.509168	-8.510187*	-8.466343*
	Critical Values			
1 percent	-3.511262	-4.073859	-3.512290	-4.073859
5 percent	-2.896779	-3.465548	-2.897223	-3.465548
10 percent	-2.585626	-3.159372	-2.585861	-3.159372

Notes: \* Indicates stationary at 1% level

After determining the stationary of the data set, the stationary data were used for the Granger Causality Test to find out any causal relationship between stock returns and interest rate. The result (Table 02) showed that there is one way causal relationship between stock returns and interest rate which indicates that Stock returns are not influence to the exchange rate movements but changes in interest rate does influence to the stock returns.

**Table 02: Granger Causality Test Results**

Null Hypothesis:	F-Statistic	Probability
LNASPI does not Granger Cause IR	3.01770	0.05473
IR does not Granger Cause LNASPI	3.12284	0.04966

Finally a regression was run on the relationship showed in Granger Causality test that, stock returns depends on the interest rate.

Before moving to the regression it was test the correlation between LNASPI and Interest rate. Results in Table 03 showed that correlation coefficient between two variables as ( $r = -0.80829$ ,  $p = 0.000$ ) which indicate that correlation is significantly different from zero. Also it should be noted that correlation is negative and stock prices are influenced by interest rate.

For the regression model the first difference of interest rate was taken as X and LNASPI was taken as Y. Result in the table 04 showed that a linear relationship between interest rate and ASPI is significant and it showed significant negative relationship. The results in ANOVA table indicates that the fitted model is significant as p value corresponding to F is 0.000 (<5%).

The fitted model is given by  $LNASPI = 9.336 - 0.0917 IR$

The fitted model is able to explain 65% of the variability of ASPI ( $R^2 = 65.3\%$ ).

**Table 03: Results of Correlation**

	IR	LNASPI
IR	1	-0.80829
LNASPI	-0.80829	1

**Table 04: Regression Results**

The regression equation is					
$LNASPI = 9.336 - 0.0917 IR$					
$S = 0.2796$ $R-Sq = 65.3\%$ $R-Sq (adj) = 64.9\%$					
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	1	12.0897	12.0897	154.54	0.000
Error	82	6.4150	0.0782		
Total	83	18.5047			

## 9. Conclusion

This study examined the causal relationship between interest rate and stock prices. It was used monthly data for the period begins from January 2007 to December 2013. Augmented Dickey Fuller test was used to check the stationary of the data set and Granger Causality Test was used to find out any causal relationship between interest rate and ASPI. Finally a regression was used to check the result of Granger Causality test. The results of the Augmented Dickey Fuller test showed that the first difference of the ASPI and interest rate was stationary. Using stationary data, Granger Causality test was implemented. Outcome showed that one-way causality which is stock prices does not Granger Cause interest rate but interest rate does Granger Cause stock prices. It implies that interest rate will influence for stock prices. Finally a regression was run on the stationary data to check the result came from the Granger Causality test. Result showed that, interest rate is a significant factor for stock price changes and it shows significant negative relationship between variables.

## 7. References

- Abdullah, D.A., & Hayworth, S.C. (1993), Macroeconometrics of Stock Price Fluctuations, *Quarterly Journal of Business and Economics*, Vol. 32, pp 46-63.
- Alam, M., & Uddin, G.S. (2009), Relationship between Interest Rate and Stock Price: Empirical Evidence from Developed and Developing Countries, *International Journal of Business and Management*, Vol. 4(3), pp 43-51.
- Al-Qenae, Rashid, Li, Carmen Wearing, Bob. (2002). The Information Content of Earnings on Stock Prices: The Kuwait Stock Exchange. *Multinational Finance Journal*, Vol. 6
- Bulmash, S.B., & Trivoli, G.W., (1991), Time-Lagged Interactions between Stock Prices and Selected Economic Variables, *Journal of Portfolio Management*, Vol. 17(4), pp 61–67.
- Bashir, A. and Hassan, A. (1997), Interest Rate Sensitivity and Stock Returns in the United Arab Emirates, *Journal of King Saud University*, Vol. 9, pp 79-89.
- Campbell, John. (1985) Stock Returns and the Term Structure, *Journal of Financial Economics*, Vol. 18, No. 2, June 1987, pp. 373-399.
- Flannery, M.J. & James, C.M., (1984), The Effect of Interest Rate Changes on the Common Stock Returns of Financial Institutions, *Journal of Finance*, Vol. 39, pp 1141-1154.
- Gan, C., Lee, M., Yong, H.H.A., & Jun, Z., (2006), Macroeconomic Variables and Stock Market Interactions: New Zealand Evidence, *Investment Management and Financial Innovations*, Vol. 3(4), pp 89.
- Geske, R., & Roll, R., (1983), The Monetary and Fiscal Linkage between Stock Returns and Inflation, *Journal of Finance*, Vol. 38, pp 1–33.
- Hasan, T., Samarakoon, L.P., and Hasan, S., (2000). Stock prices behaviour in a less developed market; evidence from Sri Lanka. *Journal of Applied Business Research*, Vol. 16, No.02, 15-23.
- Humpe, A., & Macmillan, P., (2007), Can Macroeconomic Variables Explain Long Term Stock Market Movements? A Comparison of the US and Japan, *Centre for Dynamic Macroeconomic Analysis Working Paper Series*, Retrieved 9, July 2009 from <http://www.st-andrews.ac.uk/economics/CDMA/papers/wp0720>.
- Liu, M. H., & Shrestha, K. M. (2008). Analysis of the long-term relationship between macro-economic variables and the Chinese stock market using heteroscedastic cointegration. *Managerial Finance*, Vol. 34(11), pp 744-755.
- Lynge, M. J., & Zumwalt, J. K. (1980). An empirical study of the interest rate sensitivity of commercial bank returns: A multi-index approach. *Journal of Financial and Quantitative analysis*, Vol. 15(03), pp 731-742.
- Madura, J., & Schnusenberg, O. (2000). Effect of Federal Reserve policies on bank equity returns. *Journal of Financial Research*, Vol. 23(4), pp 421-47.
- Maysami, R.C., Howe, L.C., & Hamzah, M.A., (2004), Relationship between Macroeconomic Variables and Stock Market Indices: Cointegration Evidence from Stock Exchange of Singapore's All-S Sector Indices. *Journal Pengurusan*, Vol. 24, pp 47-77.
- Nasseh, A. & Strauss, J., (2000), Stock Prices and Domestic and International Macroeconomic Activity: A Cointegration Approach. *The Quarterly Review of Economics and Finance*; Vol. 40(2), pp 229-245.
- Pilinkus, D. and Boguslauskas, V. (2009). The short-run relationship between stock market prices and macroeconomic variables in Lithuania: An application of the impulse response function. *Engineering Economics*, Vol. 5(65), pp 26-34.
- Premawardhana, V., (1997). The relationship between stock returns and interest rates in Sri Lanka. *Sri Lankan Journal of Management*, Vol. 3, pp 251 - 263.
- Ratanapakorn, O. & Sharma, S.C., (2007), Dynamic Analysis between the US Stock Returns and the Macroeconomic Variables, *Applied Financial Economics*, Vol. 17, pp 369–377.