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The Effect of Macroeconomic Variables On Stock Returns on Dhaka Stock Exchange

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ABSTRACT: This article investigates the effects of macroeconomic variables of treasury bill interest rate and industrial production on stock returns on Dhaka Stock Exchange for the period between January 2000 and February 2007 on the basis of monthly time series data using Autoregressive Integrated Moving Average (ARIMA) model. The paper has taken the overall market stock returns as an independent variable. It does not consider the stock returns of different companies separately. Though the ARIMA model finds a positive relationship between Treasury bill interest rate and industrial production with market stock returns but the coefficients have turned out to be statistically insignificant.

Keywords: Stock Returns; Macroeconomic Variables; Autoregressive Integrated Moving Average.
JEL Classifications: D11; E32; E37; G12; G32

1. Introduction

The relation between macroeconomic variables and stock return is being continuously studied by different academic, economists and practitioners (e.g., Chen et al, 1986; Mukherjee and Naka, 1995; Mayasmi and Koh, 2000; Kown and Shin, 1999; Cheung and Ng, 1998; Gjerde and Saettem, 1999) over the last few decades. It is often believed that the stock return is determined by a number of fundamental macroeconomic variables such as interest rate, industrial production and inflation rate[1]. And a good number of studies have captured the effects of macroeconomic variables on stock returns for different countries. Existing theories offer different models that make available framework for examining the relationship between stock return and macroeconomic variables[2].

The most common approach of linking macroeconomic variables with stock return is through arbitrage pricing theory (APT) developed by Ross (1976) where multiple risk factor can describe stock return. Chen et al., (1986) used some macroeconomic variables to explain stock return in the US stock market and found industrial production, changes in risk premium and changes in term structure were positively related with the expected stock return but the anticipated and unanticipated inflation rate were negatively related to the expected stock return.

Another alternative but not inconsistent way of examining the effect of macroeconomic variables on stock return is the co-integration analysis. For example, Mukherjee and Naka (1995) used Johansen co-integration test in the Vector Error Correction Model and found Japanese stock market to be co-integrated with six macroeconomic variables such as exchange rate, money supply, inflation rate, industrial production, long term government bond rate and the short term call money rate. The findings of the long term coefficients of the macroeconomic variables are consistent with the hypothesized equilibrium relationships. Moreover, Mayasmai and Koh (2000) used Johansen co-integration test in the Vector Error Correction Model and found Singapore stock market to be co-integrated with five macroeconomic variables.

[1] See Fama (1981); Mukherjee and Naka (1995); Chung and Tai (1999); Gay (2008), Christphoer et al., (2006).
[2] Two theories are available in literature explaining the effects of macroeconomics variables on stock: Arbitrage Pricing Theory and Discounted Cash Flow or Present Value Theory. See Humpe and Macmillan (2007).

Kown and Shin (1999) used Engle-Granger co integration and Granger causality test from the Vector Error Correction Model (VECM) and noticed the Korean stock market to be co integrated with a set of macroeconomic variables. Cheung and Ng (1998) used Johansen's co integration technique with quarterly data from Canada, Germany, Italy, Japan and the US and concluded that there were long term co-movements between the national stock index and some specific macroeconomic variables such as real oil price, real consumption, real money supply and real GNP in those five countries. Furthermore, the authors found that the stock indices were related to changes in macroeconomic variables.

The aim of this paper is to examine if the time series analysis of stock market indices of Dhaka stock exchange is explained by corresponding macroeconomic variables of interest rates and industrial production. If so, how significant are the relationships and how can they be described? To answer these questions, this study will examine monthly averages of respective stock market indices, treasury bill interest rate and industrial production between January 2000 and February 2007. The Box Jenkins Autoregressive Integrated Moving Average (ARIMA) time series process will be applied to determine the relationship between the dependent variable(stock return) and independent variables (industrial production and interest rate). The remainder of this paper is set out as follows: The next section will provide a theoretical framework of the topic. In section 3, we will provide a brief overview of the relavent and the data sources and the methodology used in the present study. Section 4 discusses the econometric results and section 5 concludes the paper with some appropriate policy recommendations.

2. Theoretical Framework

The share market is a place where the shares of different companies are bought and sold. According to Galbraith (1955) "the stock market is but a mirror which provides an image of the underlying or fundamental economic condition". The stock market is often regarded as the barometer of the economic condition of a state. As per the efficient market hypothesis the price of shares in the stock market should reflect all available information[3]. So as the industrial production will rise, the price of shares should rise. In this article the effect of industrial production on the share prices is assumed to be positive. Though some researchers have already proved this positive relationship between industrial production and stock price, this paper focuses on analyzing the said relationship for a new set of data.

The interest rate is the price of money a lender earns by lending his money to the borrower. The interest earning is considered as the earnings from alternative source of investment. As the interest rate rises, people tend to divert their money from share market to banks[4]. Thus the price of share is supposed to fall. Gjerde and Saettem(1999) report a negative relationship between interest rate and stock returns. This article will also verify the relationship between stock returns and treasury bill interest rate using a set of data on Bangladesh economy and its major stock market namely Dhaka stock exchange.

3. Literature Review

Economists and financial specialists have examined the relationship between macroeconomic variables and stock returns in various ways for different countries for different time periods. One important way in this regard is from asset pricing approach which uses the Arbitrage Pricing Theory (APT) to address the question of whether risk associated with particular macroeconomic variable is reflected in expected asset return. According to Chen et al., (1986) economic variables have a systematic consequence on stock market returns because economic forces affect the discount rates, the ability of firms to generate cash flows and future dividend payments. It is through this mechanism that

[3] Efficient market hypothesis states that share price adjust to all information, both private and public, very quickly and no excess returns can be earned on share prices. Fama (1965) defines "efficient market as a market where there are large numbers of rational, profit-minimisers actively competing, with each trying to predict future market values of individual securities, and where important current information is almost freely available to all participants".

[4] Balance portfolio theory asserts that an investor distributes his capital among different securities so that the marginal returns from different securities are equal (See Lipsey and Crystal, 2011).

macroeconomic variables become part of risk factors in equity markets. They (1986) tested using the APT the sensitivity of macroeconomic variables to stock returns and found a strong relationship between stock returns and macroeconomic variables of short term and long term interest rates, expected and unexpected inflation rate and industrial production growth. Similar to Chen et al., (1986), Hamoa (1988) examined if found relationship between macroeconomic variables and stock return are still applicable in Japanese market but his findings are consistent with Chen et al., (1986) apart from industrial production appearing insignificant. Poon and Taylor (1991) in line with the Chen et al., (1986) studied the United Kingdom market. Their results show that macroeconomic variables do not appear to affect share returns in the United Kingdom as they do in the US. Poon and Taylor (1991) suggests that either different macroeconomic factor has an influence on share returns in the United Kingdom or the methodology employed by Chen, Roll and Ross is inefficient. The authors reemphasize the importance of representing only the unexpected component of share returns and macroeconomic variables in the model and argue that Chen et al., (1986) outcome may be an example of a spurious regression. The authors use an ARIMA model to examine their data and use the residuals from the model as innovations.

Recently empirical models without any specific theoretical structure were used in a more pragmatic way to the two way relationship between share prices and macroeconomic variables (Groenwold, 2004). Particularly one of the popular models in this area is the Vector Autocorrelation (VAR) model. Lee (1992) is the pioneer of the VAR model to the relationship between macroeconomic variables and stock returns. In this line the more recent example is found in Cheung and Ng (1998) and Gjerde and Saettem (1999). Hondroyiannis and Papapetrou (2001) examined whether the movements in the indicator of the economic activity affected the stock return for Greece. The study performed a VAR analysis to study the dynamic interaction among indicators of economic activity using the monthly data for the period 1984-1999 for Greece. The major findings of the research is that the domestic market economic activity affects the performance of the domestic stock market and all macroeconomic activity taken into consideration are important in explaining stock price movements. Wongbangpo and Sharma (2002) tested the relationship between the stock returns for the ASEAN-5 countries of Indonesia, Malaysia, the Philippines, Singapore and Thailand and five macroeconomic variables. By observing both short and long run relationship between respective stock indices and macroeconomic variables of gross national product, the consumer price index, the money supply, the interest rate, the exchange rate they found that in the long-run all five stock price indices were positively related to growth in output and negatively related to the aggregate price level. But a long term negative relationship between stock prices and interest rates was observed for the Philippines, Singapore and Thailand and was found positive for Indonesia and Malaysia.

An increase in interest rate would raise the required rate of return and the share price would decrease with the increase in the interest rate because an increase in interest rate would raise the opportunity costs of holding cash and the trade offs to holding other interest bearing securities would lead to a decrease in share price. French et al., (1987) have theoretically shown that stock returns respond negatively to both long term and short term interest rates. However, Allen and Jagtianti (1997) pointed out that the interest rate sensitivity to stock returns has decreased dramatically since the late 80s and early 90s because of the invention of interest rate derivative contracts used for hedging purposes. Furthermore, Bulmash and Trivoli (1991) found that there was a negative relationship between stock prices and the Treasury bill rate. Gjerde and Saettem (1999) and Achsani and Strohe (2002) examined small market and concluded that stock returns responded negatively to changes in interest rate. Kandir (2008) investigated the role of macroeconomic factors in determining the stock price in Istanbul Stock Exchange for the time period July 1997-june 2005. He used a stock portfolio rather than the single stock. Empirical analysis have found a significant effect of interest rate in determining stock returns while the industrial production have turned out to be insignificant in influencing the stock return in Istanbul Stock Exchange.

Gay (2008) investigated the time series relationship between stock market index prices and the macroeconomic variables of exchange rate and oil price for four emerging economies using Box-Jenkins ARIMA model and observed no significant relationship between exchange rate and oil price on stock market index price in any of the four countries.

4. Methodology

The empirical question in this study is to find out the relationship between the dependent variable (stock returns) and independent variables (treasury bill rate and industrial production).The Box-Jenkins ARIMA model used to describe the relationship will use the moving average at the one month MA (1), three month MA (3) and six month MA (6) for the lagged dependent of stock market price and two explanatory variables of treasury bill rate and industrial production. Given monthly data for three important macroeconomic variables of stock return, Treasury bill rate and industrial production for the time period to which have provided 86 observations per variable have been used in the present analysis.

This paper hypothesizes a positive relationship between the industrial growth and stock return and a negative relation between stock return and treasury bill rate. The Box-Jenkins time series modelling process requires discrete time series data which is equally spaced over time with no missing values and stationary in the mean, variance and auto covariance. Using the Augmented -Dicky-Fuller and Phillips-Perron tests the level data were found non-stationary. After converting this data set to first order differences they were found to be stationary as the first order differencing removed any stochastic trend, with the variable series exhibiting a constant mean. And finally for testing the causality test, Box-Jenkins Autoregressive Integrated Moving Average model was applied.

5. Econometric Results

Reasonably the aim of this time series analysis is to forecast the future effect of the independent variables on the stock returns and for this the time series data have to possess the feature of stationary. The visual plot of the data may be the first step in analyzing the feature of time series data. The visual description of the time series of stock returns, treasury bill rate and industrial production indicates that they seem to trend downward first and then upward though the trend is not smooth. Furthermore, the autocorrelation functions of the time series up to 40 lags in their level form bear the striking feature that these correlograms start at a very high value and tape off very slowly. Even at lag 25 the autocorrelation coefficients still remain sizable for all variables. This type of pattern clearly indicates of the presence of nonstationarity in the time series. The most popular method of determining the stationarity of a particular time series is the Augmented Dickey-Fuller test. The null hypothesis of the test is that the time series possess unit root meaning the time series are nonstationarity. The results of Augmented Dickey-Fuller test are presented in the table 1 in a concise way.

Table 1. Augmented Dickey-Fuller Unit Test Results for level forms of time series data

Variables	Test statistics	1% critical vaule	5% critical value	10% critical value
Spm (stock returns)	-0.893	-3.531	-2.902	-2.586
Tb (treasury bill)	-1.377	-3.531	-2.902	-2.586
ip (industrial production)	-2.383	-3.531	-2.902	-2.586

As per the results of Augmented Dickey-Fuller test, the test statistics for all the variables are smaller than the critical values at 1%,5% and 10% level of significance meaning that the data have unit root. One alternative method of detecting stationarity namely Phillips_Perron test was also used to decide whether the time series possess the feature of non stationarity. The results of Pperron test is also presented in the table 2 in a concise way.

Table 2. Perron unit root test results for level form of time series

Variables	Test statistics	1% critical value	5% critical value	10% critical value
spm	-1.937	-19.530	-13.580	-10.910
tb	-3.232	-19.530	-13.580	-10.910
ip	-6.615	-19.530	-13.580	-10.910

The result of Perron test of unit root also confirms the presence of nonstationarity feature in the time series data. The results of different types of test ensure the presence of nonstationarity in the given time series that goes with the common perception about the nature of time series data. Thus all macroeconomic data are regarded as I(1)in the subsequent tests. In such a situation the application of regression analysis on the time series data will give us a spurious result with very high R^2 and low value of Durbin-Watson d. This sort of regression results is quite misleading specially in inferring anything from sample time series analysis.

By taking the first order difference for all three variables, let us see what is happening with the time series data. The graphs of three macroeconomic variables in their first differencing form and their correlograms (figure 1, 2 and 3) indicate that the first order differences of all macroeconomic variables taken into consideration in the analysis are stationary. For being certain, the result of Augmented Dickey-Fuller and Phillips-Perron unit root tests for first differencing of time series are presented in the table 3 and 4 and in a concise manner.

Table 3. Augmented Dickey-Fuller unit root test results for first differencing time series

Variables	Test statistics	1% critical value	5% critical value
spm	-9.494	-3.532	-2.903
tb	-5.761	-3.532	-2.903
ip	-13.578	-3.532	-2.903

Table 4. Phillips-Perron unit root test results for first differencing time series

Variables	Test statistics	1%critical value	5% critical value
spm	-93.464	-19.530	-13.580
tb	-51.049	-19.512	-13.572
ip	-100.570	-19.512	-13.572

The results of both Augmented Dickey-Fuller and Phillips-Perron unit root test for first order differencing time series show that at 1% and 5% level of significance the critical values for all the macroeconomic variables in their first differencing form are smaller than their respective test statistics meaning that the null hypothesis cannot be accepted at this particular level of significance. So, therefore it can be concluded that the macroeconomic variables in their first differencing form are stationary in nature. And we can use them for further analysis specially for inferring about the future behaviour of our stock returns with the changes in Treasury bill interest rate and industrial production.

Having got the first differencing of the time series stationary, the effects of treasury bill interest rate and industrial production have been examined by applying the Box-Jenkins ARIMA model with MA(1), MA(3) and MA(6) the results of them are provided in the table 5.

Table 5. Results of Box-Jenkins ARIMA

Coefficients	MA(1)	MA(3)	MA(6)
constant	4.320	4.413	5.534
MA	MA(1)=-0.0907	MA(3)=0.2895	MA(6)=0.1769
Treasury bill interest rate	327.402	324.022	265.272
Industrial production	25 .6755	24.054	28.723
Number of observation	85	85	85

The results of ARIMA (0,0,1), ARIMA (0,0,3) and ARIMA (0,0,6) reveal that the both treasury bill interest rate and industrial production have positive affect on stock returns but these affects are statistically insignificant at 5% level of significance. The positive relationship between interest rate and stock returns does not go along with our hypothesis the result is not statistically significant.

The multiple regression also supports the results found by ARIMA model but with a very low R^2 value. The R^2 value was just 0.054 meaning that a good number of influential variables are not included in the model

Figure 1. Correlogram of spm

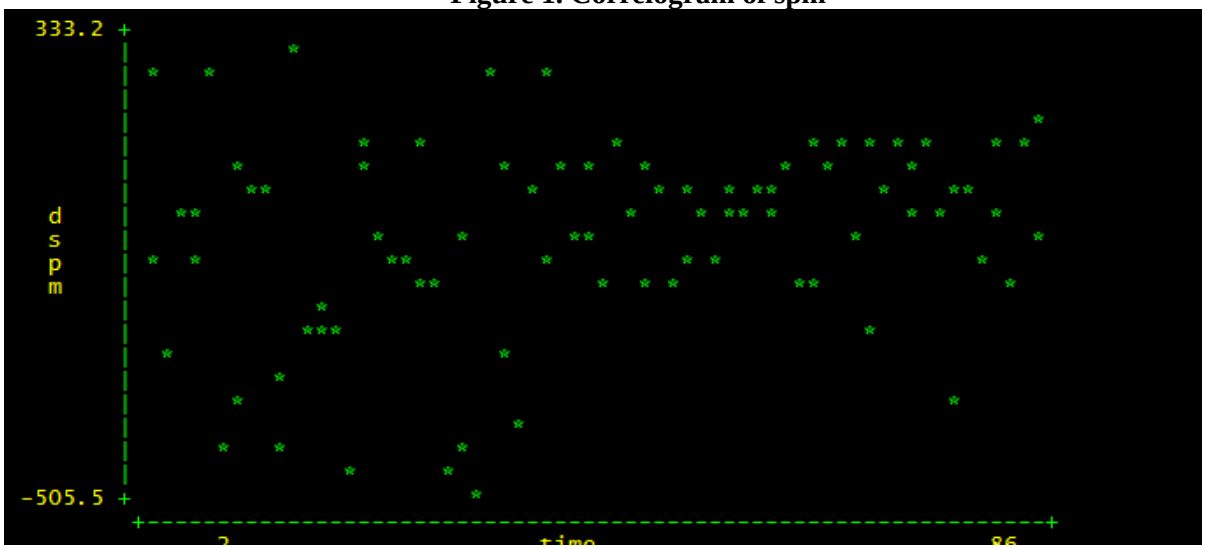


Figure 2. Correlogram of tb

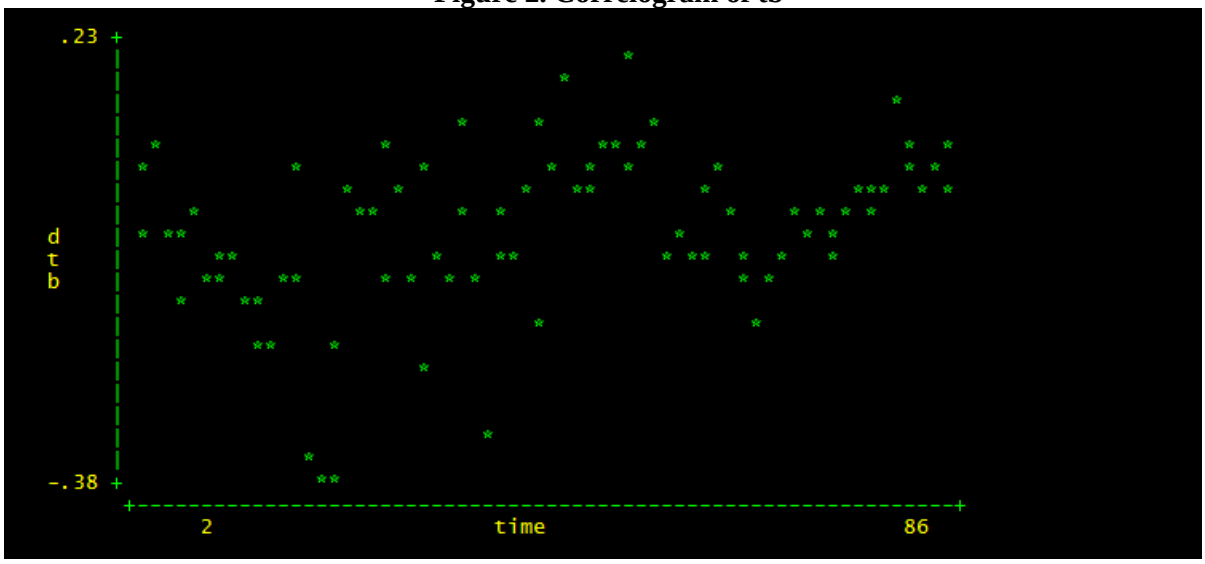
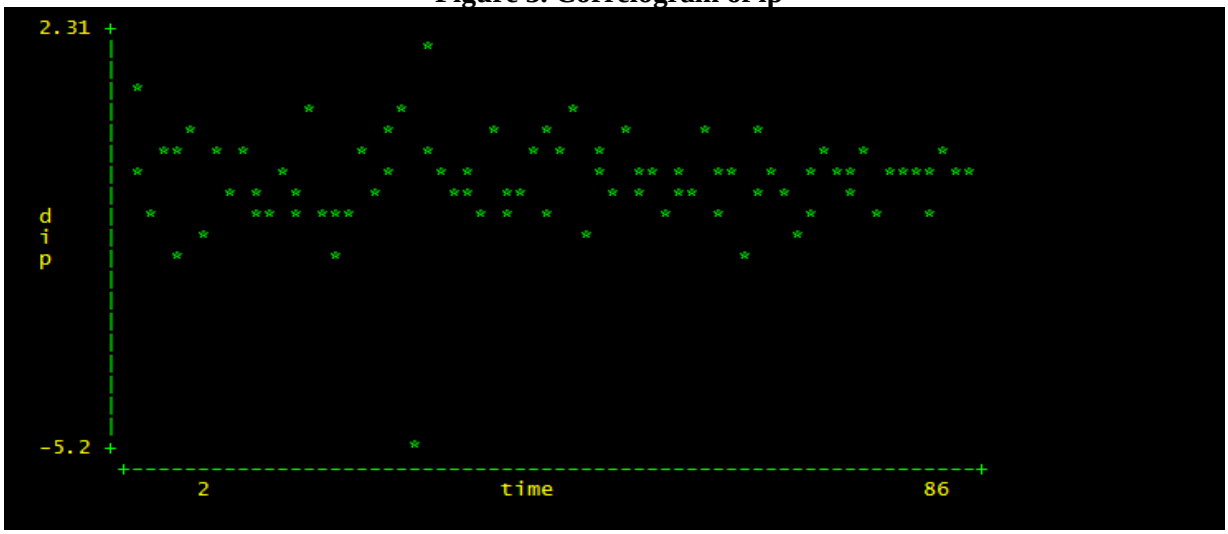


Figure 3. Correlogram of ip



6. Conclusion

The affects of treasury bill interest rate and industrial production on stock returns were found statistically insignificant. This result was expected because a good number of macroeconomic variables(such as inflation rate, exchange rate, balance of trade and consumer price index) influential in determining the value of stocks were absent in the model. Further study might examine the effects of different variables on the determination of stock returns.

There have been found positive relationship between industrial production and the stock return but the coefficient of industrial production is not statistically significant. Mukherjee and Naka (1995), Gjerde and Saettem (1999), Ibrahim and Aziz (2003) have found industrial production statistically significant in influencing the stock price in the market. The effect of interest rate on stock return have been found inconsistent with the existing literature. Gjerde and Saettem (1999) observed negative relationship between interest rate and market stock index.

Although the independent variables of both treasury bill interest rate and industrial production were tested in this article, still the effect of an inexhaustible number of macroeconomic variables on the market stock index remains unexplored for different countries. Further research into this area may prove significant in explaining the effect of treasury bill interest rate and industrial production.

References

Achsani, N., Strohe, H.G. (2002). Stock Market Returns and Macroeconomic Factors: Evidence from Jakarta Stock Exchange of Indonesia 1991-2001. Universitat Potsdam, Wirtschaftsund Sozialwissenschaftliche, Fakultat, Discusion Paper.

Allen, L., Jagtiani, J. (1997). Risk and Market Segmentation in Financial Intermediaries' Returns. Journal of Financial Services Research, 12, 159-173.

Bulmash, S.B., Trivoli, G.W. (1991). Time-lagged Interactions between Stock Prices and Selected Economic Variables. Journal of Portfolio Management, 17(4), 61–71.

Chen, N.F., Roll, R., Ross, S. (1986). Economic Forces and the Stock Market. Journal of Business, 59(3), 83-403.

Cheung, Y.W., Ng., L.K. (1998). International Evidence on the Stock Market and Aggregate Economic Activity. Journal of Empirical Finance, 5, 281–296.

Christphoer, G., Lee, M., Yong H.A. and Zhang. J. (2006). Macroeconomic Variables And Stock Returns Interactions: New Zealand Evidence. Investment Management and Financial Innovation, 3(4), 89–101.

Chung, S K., Tai, S.S, (1999). Cointegration and Causality between Macroeconomic Variables and Stock Market Returns. Global Finance Journal, 10, 71–81.

Fama, E.F. (1965). Random Walks in Stock Market Prices. Financial Analyst Journal, 21(5), 1965-1974.

Fama, E.F. (1981). Stock Returns, Real Activity, Inflation and Money. American Economic Review, 71(4), 545–65.

French, K.R., Schwert, G.W., Stambaugh, R.E. (1987). Expected Stock Return and Volatility. Journal of Financial Economics, 19, 3–29.

Galbraith, J.K. (1955). The Great Crash. Penguin Books Paperback Edition, 1988.

Gay, D. (2008). Effects of Macroeconomic Variables on Stock Market Returns for Emerging Economies: Brazil, Russia, India and China. International Business and Economic Research Journal, 7(3), 1-8.

Gjerde, O., Saettem, F. (1999).Causal Relations Among Stock Returns and Macroeconomic Variables in a Small, Open Economy. Journal of International Financial Markets, Institutions and Money, 9, 61-74.

Groenwold, N. (2004). Fundamental Share Prices and Aggregate Real Output. Applied Financial Economics, 14, 651-661.

Hamao, Y. (1988). An Empirical Investigation of the Arbitrage Pricing Theory. Japan and the World Economy, 1, 45-61.

Hondroyiannis, G., Papapetrou, E. (2001). Macroeconomic Influences on the Stock Market. Journal of Economics and Finance, 25, 33-49.

Humpe, A., Macmillan, P. (2007). Can Macroeconomic Variables Explain Long Term Stock Market Movements? A Comparison of the US and Japan. CDMA Working Paper No: 07/20.

Ibrahim, H.M., Aziz, H. (2003). Macroeconomic Variables and the Malaysian Equity Market: A View Through Rolling Subsamples, Journal of Economic Studies, 3(1), 6–27.

Kwon, C.S., Shin. T.S. (1999). Co-intergation and Causality between Macroeconomic Indicators and Stock Exchange Prices. Global Financial Journal, 10(1), 71–81.

Kandir, S.Y. (2008). Macroeconomic Variables, Firm Characteristics and Stock Returns: Evidence from Turkey. International Research Journal of Finance and Economics, 16, 5–45.

Lee, B.S. (1992). Causal Relationship Among Stock Returns, Interest Rates, Rear Activity, and Inflation. Journal of Finance, 47, 1591–1603.

Lipsey, R., Crystal, A. (2011). Economics, 12th Edition, Oxford University Press.

Maysami, R.C., Koh, T.S. (2000). A Vector Error Correction Model of the Singapore Stock Market. International Review of Economics and Finance, 9, 79–96.

Monthly Reviews of Dhaka Stock Exchange, January 2000-Feb 2007.

Mukherjee, T., Naka, A. (1995). Dynamic Linkage Between Macroeconomic Variables and the Japanese Stock Market: An Application of a Vector Error Correction Model. Journal of Financial Research, 18, 223–37.

Poon, S., Taylor, S.J. (1991). Macroeconomic Factors and the UK Stock Market. Journal of Business and Accounting, 18(5), 619–636.

Ross, S.A. (1976). The Arbitrage Theory of Capital Asset Pricing. The Journal of Economic Theory, 13, 341–360.

Wongbangpo, P., Sharma, S.C. (2002). Stock Market and Macroeconomic Fundamental Dynamic Interactions: ASEAN–5 Countries. Journal of Asian Economics, 13, 27–51.