INDIAN STOCK PRICE MOVEMENTS AND THE MACROECONOMIC CONTEXT – A TIME SERIES ANALYSIS

Basabi Bhattacharya, Jadavpur University
&
Jaydeep Mukherjee, Serampore College

ABSTRACT

This paper investigates the nature of the causal relationship between stock returns and macroeconomic aggregates in India. By applying the techniques of unit–root tests, cointegration and the long–run Granger non–causality test recently proposed by Toda and Yamamoto (1995), we test the causal relationships between the BSE Sensitive Index and the seven macroeconomic variables, viz., money supply, index of industrial production, national income, rate of inflation, real effective exchange rate, foreign exchange reserves and trade balance using monthly data for the period 1992-93 to 2000-01. The major findings are that here is no causal linkage between (i) stock returns and money supply, index of industrial production and national income for the domestic sector and (ii) stock returns and real effective exchange rate, foreign exchange reserves and trade balance for the external sector. However, a bi-directional causality exists between stock return and rate of inflation.

Keywords: Macroeconomic Aggregates, Stock Price return, Granger Causality, Toda and Yamamoto causality test, and Efficient Market Hypothesis.

I. INTRODUCTION:

A very important aspect of contemporary financial analysis is the relationship between stock price movements and variations in macroeconomic aggregates. As different from earlier periods of history, a significant feature in the financial history of the world is that there has occurred a growing importance of capital markets all over standing parallel to the money markets. Correspondingly new financial markets are being flooded with new financial instruments, financial institutions and a surge of investors. Along with this the decade of late 1980's and early 1990's have witnessed a major attitudinal shift in policy towards globalization and liberalization world over. This has created a very close and frequent interaction between the domestic and foreign sectors of the countries.

In view of these developments, it has become imperative to study the movements of stock returns as well as that of the macroeconomic aggregates both domestic and foreign. This is because the stock market is the most sensitive segment of the economy. The macroeconomic events working on the investors' psychology affect their buy sell decision rules. This results in stock price changes, which in turn work on the macroeconomic aggregates. The crucial question here is how instantaneously this information are transmitted to the investors and market analysts at large and reflected in the stock prices. This brings us to the issue of stock market efficiency. The interactions taking place over time, analysis of which necessitates a suitable time series analysis.

The purpose of the present paper is to examine the interaction between the stock price and the macroeconomic aggregates, both domestic and foreign sector, in the context of the Indian economy for the decade of 1990's, being the one that witnessed commencement of economic liberalization. The analysis of the interrelationship runs in terms of Efficient Market Hypothesis. The Efficient Market Hypothesis (semi-strong form), states that in a semi strong efficient market, everyone has perfect knowledge of all publicly available information and these are fully reflected in stock prices. Otherwise, the market participants are able to develop profitable trading rules and the stock market will not channel financial resources to the most productive sectors.

The use of Granger Causality Test in examining market informational efficiency has recently been found unable to capture many of the time series properties. This paper makes use of the most recently available econometric technique, as proposed by Toda and Yamamoto (1995), which overcomes the technical problems associated with the traditional Granger Causality test. The contribution of this paper lies first of all, in focusing on stock market efficiency with respect to macroeconomic fundamentals rather than identifying the determinants of equity returns as in most of the studies and secondly in applying the Toda and Yamamoto causality technique which is superior to traditional Granger Causality Test.

A survey of the existing literature including empirical evidences on the nature of causal relationships between macroeconomic aggregates and stock prices is conducted in Section II. Section III discuses the methodology employed and presents the variables and data descriptions. Section IV analyses the empirical results followed by concluding observation in Section V.

II. THE PRESENT STATE OF ART:

In recent times, studies on the relationship between macroeconomic variables and national stock market have been the cornerstone of most economic literature. Among the many macroeconomic variables, the relationship between money supply and stock prices has been widely studied because of the belief that money supply changes have important direct effects through portfolio changes, and indirect effects through their effect on real economic activity, which in turn is postulated to be the fundamental determinant of stock prices. Despite extensive investigations, the precise nature of the relationship between money supply and the stock market remains ambiguous. Early studies by Palmer (1970) and Sprinkel (1971) have indicated that money supply leads stock prices. This was further supported by Malliaris and Urrutia (1991), in their recent study on United States. On the other hand, the evidence that stock market leads money supply was found by Cooper (1974) and Rozeff (1974) and, more recently, by Thornton (1993) in his study on United Kingdom. Fung and Lie (1990) showed that Taiwan's stock market is closely related with money supply, which is further supported by Lin (1993) who found that the growth in money supply can be used to predict the Taiwanese stock market. Lin's work also pointed out that both the Korean and Singaporean markets are closely related with money supply, but with a different result. In the former, money supply leads the stock market, but for the latter, stock market leads the money supply. In another study, Ho (1983) found that money supply is useful in predicting stock markets in Hong Kong, Japan, the Philippines, Australia and Thailand.

Apart from money supply, the importance of other macroeconomic variables such as inflation, national output, industrial production etc. has been pointed out by Fama (1981). Inflation rate is an important element in determining stock returns due to the fact that during the times of high inflation, people recognize that the market is in a state of economic difficulty. People are laid off work, which could cause production to decrease. When people are laid off, they tend to buy only the essential items. Thus production is cut even further. This eats into corporate profits, which in turn makes dividends diminish. When dividends decrease, the expected return of stocks decrease, causing stocks to depreciate in value. Fama (1981), Geske and Roll (1983), James et. al. (1985) and Stulz (1986) all attempt to explain the negative association between stock returns and inflation. Malliaris and Urrutia (1991) observed that the performance of the stock market might be used as a leading indicator for real economic activities in the United States. For the United Kingdom, Thornton (1993) also found that stock returns tend to lead real income. In related works, Chang and Pinegar (1989) and Chen et. al. (1986) also concluded that there is a close relationship between stock market and domestic economic activity.

During the last decade and a half, the relationship between stock prices and external sector macro variables like exchange rate, foreign exchange reserves and value of trade balance has also been recognized. Early studies (Aggarwal, 1981; Soenen and Hennigar, 1988) in the area of exchange rates – stock prices considered only the correlation between the two variables. Theory explained that a change in the exchange rates would affect a firm's foreign operation and overall profits. This would, in turn, affect its stock prices. The nature of the change in stock prices would depend on the multinational characteristics of the firm. Conversely, a general downward movement of the stock market will motivate investors to seek better returns elsewhere. This decreases the demand for money, pushing interest rates down, causing further outflow of funds and hence depreciating the currency. While the theoretical explanation was clear, empirical evidence was mixed. Aggarwal (1981) found a significant positive correlation between the US dollar and US stock prices while Soenen and Hennigan (1988) reported a significant negative relationship. Soenen and Aggarwal (1989) found mixed results among industrial countries. Ma and Kao (1990) attributed the differences in results to the nature of the countries i.e. whether the countries were export or import dominant. Morley and Pentecost (2000), in their study on G-7 countries, argue that the reason for the lack of strong relationship between exchange rates and stock prices may be due to the exchange controls that were in effect in the 1980s.

For the Indian Economy, work in this area has not progressed much. Abhay Pethe and Ajit Karnik (2000) have investigated the inter – relationships between stock prices and important macroeconomic variables, viz., exchange rate of rupee vis - a -vis the dollar, prime lending rate, narrow money supply, and index of industrial production. The analysis and discussion are situated in the context of macroeconomic changes, especially in the financial sector, that have been taking place in India since the early 1990s. Chakradhara Panda and B. Kamaiah (2001) investigated the causal relations and dynamic interactions among monetary policy, expected inflation, real activity and stock returns in the post liberalization period, using a vector – autoregression (VAR) approach. There are some other related studies though not specifically focused to this aspect.

The main purpose of the present study is to complement the existing literature on the stock market – macroeconomic nexus in two respects. First, is to determine whether stock returns are a leading indicator for future economic activity. In India, certain quarters of the population believe that the improvement in the performance of the stock markets will result in an improvement in the economy measured by the positive growth in the gross national product. However, whether stock markets lead or lag economic activity is an empirical question. Secondly, the more recent developments in econometrics on the properties of time series has enabled researchers to investigate the relationship between integrated economic variables with ease and can provide precise estimates, in the sense that spurious regression problems can be avoided.

III. METHODOLOGY AND DATA SOURCES:

Recent developments in the time series analysis have suggested some improvements in the standard traditional Granger test (1969) to test for the causal relationship between variables. The traditional test is fraught with many complications when there are stochastic trends and cointegration in the system, and the F – test is not valid unless the variables in levels are cointegrated (Toda and Phillips 1993). Tests for cointegration and cointegrating ranks have also been developed, viz., error correction model due to Engle and Granger (1987) and the vector autoregression error correction model due to Johansen and Jesulius (1990). Unfortunately, as pointed out by Toda and Yamamoto, (1995) and Zapata and Rambaldi, (1997), these tests are cumbersome and unless so-called sufficient cointegration rank conditions are met, the chi-square statistics for weak exogeneity tests regarding the error correction terms may be invalid and thus any causal inference in the Granger sense is unwarranted.

Secondly, the results of Granger causality are very sensitive to the selection of lag length. If the chosen lag length is less than the true lag length, the omission of relevant lags can cause bias. If the chosen lag length is more, the irrelevant lags in the equation cause the estimates to be inefficient. To deal with this problem, Hsiao (1981) has developed a systematic autoregressive method for choosing optimal lag length for each variable in an equation. This method combines Granger causality and Akaike's Final Prediction Error (FPE), defined as the (asymptotic) mean square prediction error.

Toda and Yamamoto Version of Granger Causality:

Toda and Yamamoto (1995) proposed a simple procedure requiring the estimation of an 'augmented' VAR, even when there is cointegration, which guarantees the asymptotic distribution of the MWald statistic. This method is applicable "whether the VAR's may be stationary (around a deterministic trend), integrated of an arbitrary order, or cointegrated of an arbitrary order" (Toda and Yamamoto: *Journal of Econometrics 66, 1995*, pp. 227). This procedure has two important advantages over the standard causality tests. First, it conducts Granger causality tests with allowance for the long-run information often ignored in systems that requires first differencing and pre-whitening.[2] Secondly, this methodology is useful because it bypasses the need for potentially biased pre-tests for unit roots and cointegration, common to other formulations such as the vector error correction model.

All one needs to do is to determine the maximal order of integration d_{max}, which we expect to occur in the model and construct a VAR in their levels with a total of ($k + d_{max}$) lags. Toda and Yamamoto point out that, for d=1, the lag selection procedure is always valid, at least asymptotically, since $k \geq 1$ =d. If d=2, then the procedure is valid unless k=1. Moreover, according to Toda and Yamamoto, the MWald statistic is valid regardless whether a series is I (0), I (1) or I (2), non-cointegrated or cointegrated of an arbitrary order.

In order to clarify the principle, let us consider the simple example of a bivariate model, with one lag (k=1). That is,

$$x_t = A_0 + A_1 x_{t-1} + e_t \quad \text{---} \ (1)$$

or more fully,

$$\begin{bmatrix} x_{1t} \\ x_{2t} \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \alpha_{11}^{(1)} & \alpha_{12}^{(1)} \\ \alpha_{21}^{(1)} & \alpha_{22}^{(1)} \end{bmatrix} \begin{bmatrix} x_{1,t-1} \\ x_{2,t-1} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \text{------------------} \ (2)$$

where $E(e_t) = E\begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} = 0 \quad \text{and} \quad \mathrm{E}(\mathrm{e}_t e_t^{/}) = \Sigma$

To test that x_2 does not Granger cause x_1, we will test the parameter restriction $\alpha_{12}^{(1)}$=0. If we assume that x_{1t} and x_{2t} are not integrated of same order, then a standard F-test is not valid. Suppose x_{1t} is I (0) and x_{2t} I (1). So d_{max} =1. Following Dolado and Lutkepohl (1996), we test

$\alpha_{12}^{(1)}$=0 by constructing the usual Wald test based on least squares estimates in the augmented model:

$$\begin{bmatrix} x_{1t} \\ x_{2t} \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \alpha_{11}^{(1)} & \alpha_{12}^{(1)} \\ \alpha_{21}^{(1)} & \alpha_{22}^{(1)} \end{bmatrix} \begin{bmatrix} x_{1,t-1} \\ x_{2,t-1} \end{bmatrix} + \begin{bmatrix} \alpha_{11}^{(2)} & \alpha_{12}^{(2)} \\ \alpha_{21}^{(2)} & \alpha_{22}^{(2)} \end{bmatrix} \begin{bmatrix} x_{1,t-2} \\ x_{2,t-2} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \text{------------------ (3)}$$

The Wald statistic will be asymptotically distributed as a Chi Square, with degrees of freedom equal to the number of "zero restrictions", irrespective of whether x_{1t} and x_{2t} are I (0), I (1) or I (2), non-cointegrated or cointegrated of an arbitrary order.

In this study, we used monthly data series for eight variables for the period April 1992 to March 2001. For stock return we use the monthly averages of BSE Sensitive Index (base: 1978-79=100). The average rate of inflation based on wholesale price index (base: 1993-94=100) has been used as a proxy for the price level. As for income variable, since GNP series is available only annually, the Gandolfo's (1981) technique has been used to interpolate monthly data series from annual observations. The other macroeconomic variables that we have included in our study are the money supply (M3), the index of industrial production, the indices of Real Effective Exchange Rate (REER) of the Indian Rupee (36-country bilateral weight with base 1985=100), the foreign exchange reserves (in rupees crores) and the value of trade balance (in rupees crores). The data have been compiled from Handbook of Statistics on Indian Economy, Reserve Bank of India (RBI) and various issues of RBI Bulletin.

IV. Empirical Results:

As our first step, we have determined the order of integration for each of the eight variables used in the analysis. Using the standard Augmented Dickey Fuller unit root test analyzed in the earlier section, we have tested on both the levels and the first differences of the series. The results are shown in Table 1 and Table 2.

Table 1: Results for the Dickey Fuller unit root test for the stock price return and seven macroeconomic variables in levels

Variables	Constant, No trend	Constant, With trend
Stock Return	-2.0562	-2.9462
Money Supply	4.8467***	1.1482***
Index of Industrial Production	0.035003***	-3.3110***
National Income (GNP)	0.30488***	-3.7070***
Rate of Inflation	-8.2659	-11.470
Exchange Rate	-2.1276	-2.8818
Foreign Exchange Reserves	1.9149	-1.0918
Value of Trade balance	-2.6239	-3.4710

Note: Asterisk (***) denotes statistically significant at 10% level

Table 2: Results for the Dickey Fuller unit root test for the stock price return and four macroeconomic variables in first differences

Variables	Constant, No trend	Constant, With trend
Stock Return	-3.7766***	-3.7553***
Rate of Inflation	-4.7586***	-4.7189***
Exchange Rate	-4.1759**	-4.1598**
Foreign Exchange Reserves	4.7586**	-4.7189**
Value of Trade Balance	-4.2478**	-4.1369**

Note: Asterisk (**) and (***) denote statistically significant at 5% and 10% level

Clearly the results suggest that macroeconomic variables such as money supply, index of industrial production and national income are stationary, that is, integrated of order 0. On the other hand, stock return and the remaining macroeconomic variables viz. rate of inflation, exchange rate, foreign exchange reserves and value of trade balance are characterized as integrated of order 1, that is, first differencing will render the series stationary.

Having determined that d_{max}=1, we then proceed in estimating the lag structure of a system of VAR in levels and our results indicate that the optimal lag length based on Akaike's FPE (using Hsiao's optimal lag technique discussed in the previous section) is 2, that is, k=2. We then estimate a system of VAR in levels with a total of (d_{max}+k=3) lags.

$$\begin{bmatrix} SP_t \\ MS_t \\ IIP_t \\ NI_t \\ INF_t \\ REER_t \\ FR_t \\ NX_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} SP_{t-1} \\ MS_{t-1} \\ IIP_{t-1} \\ NI_{t-1} \\ INF_{t-1} \\ REER_{t-1} \\ FR_{t-1} \\ NX_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} SP_{t-2} \\ MS_{t-2} \\ IIP_{t-2} \\ NI_{t-2} \\ INF_{t-2} \\ REER_{t-2} \\ FR_{t-2} \\ NX_{t-2} \end{bmatrix} + A_3 \begin{bmatrix} SP_{t-3} \\ MS_{t-3} \\ IIP_{t-3} \\ NI_{t-3} \\ INF_{t-3} \\ REER_{t-3} \\ FR_{t-3} \\ NX_{t-3} \end{bmatrix} + \begin{bmatrix} e_{sp} \\ e_{ms} \\ e_{iip} \\ e_{ni} \\ e_{\inf} \\ e_{reer} \\ e_{fr} \\ e_{nx} \end{bmatrix} \text{------------- (4)}$$

where, SP = Stock return,
MS = Money supply,
IIP = Index of industrial production,
NI = National income,
INF = Rate of inflation
REER = Real Effective Exchange Rate,
FR = Foreign Exchange Reserves
NX = Value of Trade Balance

The system of equations is jointly estimated as a "Seemingly Unrelated Regression Equations" (SURE) model by Maximum Likelihood and MWALD test statistic is computed. The results of the MWALD test statistic as well as its *p*-values are presented in Table 3.

Table3: Results of Long Run Causality following Toda-Yamamoto (1995) Procedure

Null Hypothesis	MWALD statistics	*p*-values
Stock price versus money supply (MS)		
Stock price does not *Granger cause* money supply	0.8726351	0.67281
Money supply does not *Granger cause* stock price	0.6249120	0.71324
Stock price versus index of industrial production (IIP)		
Stock price does not *Granger cause* IIP	1.4269931	0.57363
IIP does not *Granger cause* stock price	2.8649372	0.24672

Stock price versus national income (NI)		
Stock price does not *Granger cause* national income	1.3247913	0.43715
National income does not *Granger cause* stock price	0.3479623	0.34192
Stock price versus rate of inflation (INF)		
Stock price does not *Granger cause* rate of inflation	9.6294367*	0.00471
Rate of inflation does not *Granger cause* stock price	11.5865965*	0.00313
Stock price versus exchange rate (REER)		
Stock price does not *Granger cause* REER	1.3247893	0.51341
REER does not *Granger cause* stock price	2.3479713	0.28943
Stock price versus foreign exchange reserves (FR)		
Stock price does not *Granger cause* FR	2.7195343	0.25172
FR does not *Granger cause* stock price	1.0659473	0.41934
Stock price versus value of trade balance (NX)		
Stock price does not *Granger cause* NX	0.0654973	0.86412
NX does not *Granger cause* stock price	0.4217983	0.45701

Note: Asterisk (*) denotes statistically significant at 1% level

The test results in Table 3 suggest that we fail to reject the null hypothesis of *Granger non-causality* from stock price returns to money supply, index of industrial production, national income, exchange rate, foreign exchange reserves and value of trade balance as well as the null hypothesis of *Granger non-causality* from money supply, index of industrial production, national income, exchange rate, foreign exchange reserves and value of trade balance to stock price return even at 10% level of significance. The results suggest that the BSE Sensitive Index neither leads these macroeconomic variables nor they lead the BSE Sensitive Index. This implies that the stock market cannot be used as a leading indicator for future growth in money supply, index of industrial production, national income, exchange rate, foreign exchange reserves and value of trade in India. Our result also suggests a bi-directional causality between stock return and the rate of inflation, thus implying that the market informational efficiency hypothesis can be rejected for BSE Sensitive Index with respect to the rate of inflation.

V. Concluding Observations:

The main objective of the present paper is to determine the lead and lag relationships between the Indian stock market and seven key macroeconomic variables. We endeavor to investigate the question: Can the Indian stock market act as a barometer for the Indian economy? This is of course an empirical question. To test this hypothesis, we employ the methodology of *Granger non-causality* recently proposed by Toda and Yamamoto (1995) for the sample period April 1992 to March 2001. In this study, the BSE Sensitive Index was used as a proxy for the Indian stock market return. The seven important macroeconomic variables included in the study are broad money supply M3, national income (gross national product at constant prices), index of industrial production, and the rate of inflation for the domestic sector and real effective exchange rate, foreign exchange reserves and trade balance for the external sector.

The results are summarized as follows. There is no causal linkage between (i) stock prices and money supply, index of industrial production and national income for the domestic sector and (ii) stock prices and real effective exchange rate, foreign exchange reserves and trade balance for the external sector. However, a bi-directional causality exists between equity return and the rate of inflation.

The results suggest that the Sensitive Index of the Bombay Stock Exchange has already incorporated all past and current publicly available information on all the variables under consideration, except rate of inflation. The stock market is informationally inefficient with respect to rate of inflation. Therefore, abnormal profits may be obtained consistently by using information on the changes in this variable. Rejecting the hypothesis will suggest that certain policies need to be formulated and implemented to improve the performance of the market. The result of a bi-directional causality between stock prices and rate of inflation can be reconciled with the non-result for the relation between stock prices and money supply by the following argument. The monetary policy controls the rate of inflation over the long run, prices of long-term assets reflect agents' expectations about the course of short-term interest rates, and nominal long-term returns of assets should contain an inflation premium.

The results need to be interpreted in the light of the following developments. First, most of the earlier studies that analyzed the nature of the causal relationship between macroeconomic aggregates and stock prices have employed the traditional Granger – causality test. Since it is now recognized that the conventional procedure may be inadequate, conclusions based on such an approach may yield misleading inferences. So we have employed the recently developed long–run Granger non–causality test proposed by Toda and Yamamoto (1995) in our study. Secondly, although our data set is from April 1992, the full–fledged financial sector reforms in India have come to operate only after 1995. But since then sufficient efforts are being taken to improve the market efficiency by introducing a package of measures to liberalize, regulate and develop the security market. In fact, the landscape of the Indian stock market has witnessed a sea change in terms of technology and market practices. Following the commissioning of the NSE in June 1994, National Securities Depository in November 1996, a screen based, anonymous, order-driven online dematerialized trading is the order of the day coupled with improved risk management practices for clearing and settlement. Further, for a sufficient period of time the financial sector in India has remained dominated by the banking sector through which the changes in money supply and also exchange rates primarily operate. In this context, the relationship between money supply and stock prices that we obtained in our result is not very surprising. Last but not the least, stock market in India is still in a transitory phase. If this result is also arrived at for subsequent periods, then it may be concluded that Indian stock market is approaching towards informational efficiency at least with respect to the six macroeconomic variables, viz. money supply, national income, index of industrial production, real effective exchange rate, value of trade balance and the foreign exchange reserves.

References:

Abdalla, I. S. A. and Murinde, V., "Exchange Rate and Stock Price Interactions in Emerging Financial Markets: Evidence on India, Korea, Pakistan, and Philippines", *Applied Financial Economics*, Vol. 7, 1997, 25-35.

Aggarwal, R., "Exchange rates and stock prices: A study of the US capital markets under floating exchange rates", *Akron Business and Economic Review*, Vol. 12, 1981, 7-12.

Ajayi, R.A., Friedman, J. and Mehdian, S.M., "On the Relationship between Stock Returns and Exchange Rates: Tests of Granger Causality", *Global Finance Journal*, Vol. 9, 1998, 241-51.

Bahmani-Oskooee, M.and Sohrabian, A., "Stock Prices and the Effective Exchange Rate of the Dollar", *Applied Economics*, Vol. 24, 1992, 459 – 464.

Banerjee, A., Dolado, J.J., Hendry, D.F. and Smith, G.W., "Exploring equilibrium relationship in econometric through static models: Some Monte Carlo evidence", *Oxford Bulletin of Economics and Statistics*, Vol. 48, 1986, 253-277.

Bertalanffy, L.Von, General Systems theory- Foundations and Applications, Allen Lane, London, 1971.

Chang, E. C. and Pinegar, J. M., "Seasonal Fluctuations in Industrial Production and Stock Market Seasonals", *Journal of Financial and Quantitative Analysis*, 1989, 59-74.

Chen, N.F., Roll, R. and Ross, S.A., "Economic forces and the stock market", *Journal of Business*, Vol. 59, 1986, 383-403.

Choudhry, T, "Stochastic trend in stock prices: Evidence from Latin American markets", *Journal of Macroeconomics*, Vol. 19, 1997, 285-304.

Cooper, R.V.L, "Efficient capital markets and the quantity theory of Money", *Journal of Finance*, Vol. 29, 1974, 887-908.

Dickey, D.A. and Fuller, W.A., "Distribution of the Estimation for Autoregressive Time series with a Unit Root", *Journal of American Statistical Association*, Vol. 79, 1979, 355-367.

Engle, R.F., and Granger, C.W.J., "Cointegration and error correction: Representation, estimation and testing", *Econometrica*, Vol. 55, 1987, 251-276.

Fama, E., "Stock returns, real activity, inflation and money", *American Economic Review*, Vol. 71, 1981, 545-564.

Fung, H. G. and Lie, C. J., Stock Market and Economic Activity: A Causal Analysis, In: Rhee, S. L., Chang, R. P. (Eds.), Pacific-Basin Capital Markets Research, North-Holland, Amsterdam, 1990.

Gandolfo, G., Qualitative Analysis and Econometric Estimation of Continuous Time Dynamic Models, North-Holland, Amsterdam, 1981.

Geske, R., and Roll, R., "The fiscal and monetary linkage between stock returns and Inflation", *Journal of Finance*, Vol. 38, 1983, 1-33.

Granger, C.W.J., "Investigating causal relations by econometric models and cross-spectral methods", *Econometrica*. Vol. 37, 1969, 428-438.

Habibullah, M.S., and Baharumshah, A.Z., Testing for informational efficient market hypothesis: The case for Malaysian stock market. In: Habibullah, M.S., Baharumshah, A.Z. (Eds.), Issues on Monetary and Financial Economics: Studies on Malaysian Economy, 2000.

Habibullah, M.S., and Baharumshah, A.Z., "Money and stock prices in Malaysia: An empirical investigation", *Malaysian Management Journal*, Vol. 3, 1999, 13-37.

Habibullah, M.S., and Baharumshah, A.Z., Money supply-stock market nexus in Malaysia: Do changes in broad money M3 affect stock prices?", *Asian Economies*, Vol. 27, 1998, 56-73.

Habibullah, M.S., and Baharumshah, A.Z., "Money, output and stock prices in Malaysia: An application of the cointegration tests", *International Economic Journal*, Vol. 10, 1996, 121-130.

Ho, Y.K., "Money supply and equity prices: An empirical note on Far Eastern countries", *Economics Letters*, Vol. 11, 1983, 161-165.

Hsiao, C., "Autoregressive Modeling and Money-Income Causality Detection", *Journal of Monetary Economics*, 1981, 85-106.

Ibrahim M., "Cointegration and Granger Causality Tests of Stock Price and Exchange Rates Interactions in Malaysia", *ASEAN Economic Bulletin*, Vol. 17, 2000, 36 – 46.

James, C., Koreisha, S., and Partch, M., "A VARMA Analysis of the Causal Relations among Stock Returns, Real Output and Nominal Interest Rates", *Journal of Finance*, Vol. XL, 1985, 1375-1384.

Johansen, S., "Statistical analysis of cointegration vectors", *Journal of Economic Dynamics and Control*, 12, 1988, 231-254.

Johansen, S. and Juselius, K., "Maximum likelihood estimation and inference on cointegration-with application to the demand for money", *Oxford Bulletin of Economics and Statistics*, Vol. 52, 1990, 169-210.

Kremers, J.J.M., Ericsson, N.R. and Dolado, J.J., "The power of cointegration tests", *Oxford Bulletin of Economics and Statistics*, Vol. 54, 1992, 325-348.

Lazlo, E., The Systems View of the World, Braziller, New York, 1972.

Lin, S.M., Stock returns and money supply: A comparison among three Asian newly industrialised countries. In: Wong, K.A., Koh, F., Lim, K.G. (Eds), Proceedings of the Third International

Conference on Asian-Pacific Financial Markets, National University of Singapore, Singapore, 1993.
Ma, C. K. and Kao, G. W., "On Exchange Rate Changes and Stock Price Reactions", *Journal of Business Finance & Accounting*, Vol. 17, 1990, 441-449.
Malliaris, A.G., and Urrutia, J.L., "An empirical investigation among real, monetary and financial variables", *Economics Letters*, Vol. 37, 1991, 151-158.
Mok, H.M.K., "Causality of interest rate, exchange rate and stock prices at stock market open and close in Hong Kong", *Asia Pacific Journal of Management*, Vol. 10, 1993, 123-143.
Morley, B. and Pentecost, E.J., "Common Trends and Cycles in G-7 Countries Exchange Rates and Stock Prices", *Applied Economic Letters*, Vol. 7, 2000, 7-10.
Palac-McMiken, E.D., "An examination of ASEAN stock markets: A cointegration approach", *ASEAN Economic Bulletin*, Vol. 13, 1997, 299-311.
Palmer, M., "Money supply, portfolio adjustments and stock prices", *Financial Analyst Journal*, Vol. 26, 1970, 19-22.
Panda, C. and Kamaiah, B., "Monetary policy, Expected Inflation, real Activity and Stock Returns in India: An Empirical Analysis", *Asian – African Journal of Economics and Econometrics*, Vol. 1, 2001, 191-200.
Pethe, A., and Karnik, A., "Do Indian Stock Markets Matter? Stock Market Indices and Macro-Economic Variables", *Economic and Political Weekly*, Vol. 35, 2000, 349-356.
Phillips, R. C. B. and Perron, P., "Testing for a Unit Root in Time Series Regression", *Biometrika*, 1988, 335-346.
Reserve Bank of India, Handbook of Statistics on Indian Economy, R.B.I., Mumbai, 2001.
Rozeff, M.S., "Money and stock prices: Market efficiency and the lag effect of monetary policy", *Journal of Financial Economics*, Vol. 1, 1974, 245-302.
Soenen, L.A. and Hennigar, E.S., "An Analysis of Exchange Rates and Stock Prices: The US Experience between 1980 and 1986", Akron Business and Economic Review, Vol. 19, 1988, 71-76.
Soenen, L.A. and Aggarwal, R., Financial Prices as Determinants of Changes in Currency Values, Paper presented at the 25th Annual Meetings of Eastern Finance Association, Philadelphia, 1989.
Sprinkel, B.W., Money and Markets: A Monetarist View, Richard D. Irwin, Homewood, IL, 1971.
Stulz, Rene M., "Asset Pricing and Expected Inflation", *Journal of Finance*, Vol. 44, 1986, 1115-1153.
Thornton, J., "Money, output and stock prices in the UK: Evidence on some (non) relationships", *Applied Financial Economics*, Vol. 3, 1993, 335-338.
Toda, H.Y. and Yamamoto, T., "Statistical inference in vector autoregressions with possibly integrated processes", *Journal of Econometrics*, Vol. 66, 1995, 225-250.
Zapata, H.O. and Rambaldi, A.N., "Monte Carlo evidence on cointegration and causation", *Oxford Bulletin of Economics and Statistics*, Vol. 59, 1997, 285-298.

Author Profile:

Dr. Basabi Bhattacharya earned her Ph.D at Jadavpur University, Kolkata, India in 1996. Currently she is a professor of Economics at Jadavpur University and Convener, Financial Thrust Area, Centre for Advanced Studies, Department of Economics, Jadavpur University.

Mr. Jaydeep Mukherjee earned his M.A. in Economics at Jadavpur University, Kolkata, India in 2000. Currently he is a lecturer of Economics at Serampore College, Serampore, West Bengal, India.