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# Macroeconomic Variables impact on Stock Prices in a BRIC Stock Markets: An Empirical Analysis

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**Abstract**

The study investigates the nature of the causal relationships between stock prices and the key macro economic variables in BRIC countries. The empirical evidence shows that long-run and short-run relationship exists between macro economic variables and stock prices, but this relationship was not consistent for all of the BRIC countries. The policy implication of the above is that the BRIC stock markets are not responsive to changes in a majority of macroeconomic factors in spite of the sizable proportion of stock market capitalization as a share of the country's GDP.

**Keywords:** Stock prices; Macroeconomic variables; ARDL cointegration

## Introduction

The security price movements are closely related to economic activity level. According to the Efficient Market Hypothesis (EMH) [1], an efficient capital market is one in which stock prices change rapidly as the new information becomes available [2]. Several studies have found a correlation between changes in world economy and macro economic variables. These studies also suggest that the movement of stock market indices is highly sensitive to the changes in the fundamentals of the economy and to the changes in the expectation about future prospects [3]. Stock price fluctuations are as old as the stock market themselves. And yet those prices are essential factors in investment decisions, which are fundamental to the economy. Corporate investment is much more volatile than aggregate gross domestic production (GDP), and it appears to be an important driver of economic fluctuations [4].

In Volume II of the 'Treatise', Keynes described most of people as being too timid, greedy, impatient or nervous about their investments to take long views. There is also the element of 'animal spirits'. Keynes' [5] explains the behaviour of people while making investments, especially in the stock market. He said that investors are taken away usually by their "animal spirits" and "herd mentality" for investing in the stock market. People work and invest on the basis of their "instinct" which is by and large formed by the economic and social and political environment around them. Hence one cannot even rule out the role of economic activities and information fed to the market completely. It is admitted by the economists also in a very hushed manner that it is not that the real value of our output has gone down but just the "animal spirits" have been dimmed and our expectations that stock markets are overvalued compared to the historic period and considering of further rise in real value seems to be unlikely. And any economy needs these "animal spirits" or the optimistic attitude along with the calculated risks and investments to come out and excel and progress. This was also supported by Taleb [6] and Akerlof [4] and Shiller studies [7]. "The Keynesian beauty contest is the view that much of investment is driven by expectations about what other investors think, rather than expectations about the fundamental profitability of a particular investment. Keynes' points are relevant in the context of modern literature on stock markets in developing economies. Most of the studies in the area have been conducted for developed economies though recent literature deals with emerging markets.

Empirical researchers have tried to identify determinants of stock prices. The studies on stock prices are mainly twofold. First, contemporary financial theory asserts that stock prices are closely related to the movements of macro variables [8,9]. This is because the stock prices reflect fundamental information about the macro economy. The relations between exchange rate movements and stock prices are based on the rise in the domestic interest rate that leads to capital inflows and makes the exchange rate appreciate. This currency appreciation has a negative effect on stock prices of export dominant industries because of reduction in exports, while currency appreciation boosts the stock market (positive effect on stock prices) for import of dominant industries due to increase in imports. The weakness of Rupee has cascading effect on equity returns of investors who buy stocks with dollars. In the absence of full convertibility, Foreign Institutional Investors (FII) has to convert their dollars into rupees to buy stocks here and do the reverse while selling. FII investments bring in global liquidity into the equity markets and raise the price-earnings ratio and thereby reduce the cost of capital domestically. FII Investment inflows help supplement domestic savings and smoothen inter-temporal consumption. Numerous studies have been conducted in developed capital markets with regard to the relationship between stock prices and interest rates. The results of most of the studies suggest that stock and bond returns are predictable and that one can be used to forecast the other. In general, whenever the interest rate on treasury securities rises, investors tend to switch out of stocks, causing stock prices to fall.

Therefore, the identifying factors that affect stock prices is an imperative task on various counts. Another approach to explain the stock prices is to assume the relationship between stock prices in one market or a group of markets and international economic environments such as stock prices and inflation and interest rates in other related economies including developed markets. All the above considerations motivated to conduct this research study in the Indian context.

## Nature of Data

The study investigates the nature of the causal relationships between stock prices and the key macro-economic variables in India for the period April, 1994 to July, 2010 using monthly data. The data was collected for India from www.rbi.org.in. We have taken this period, as

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stock market reforms in India gained momentum after 1994 and many regulatory changes were introduced (stock exchanges have introduced online trading and set up clearing houses/ corporations. A depository has become operational for scripless trading and the regulatory structure has been overhauled with most of the powers for regulating the capital market vested with the SEBI. The variables identified for the study have been derived from both theory and practice. In this study we have used major macroeconomic indicators such as Money supply (M3), Real Effective Exchange Rate (REER), Index of Industrial Production (IIP), Foreign Institutional Investment (FIIs), Call Money Rate (CM), Wholesale Price Index (WPI), Gold Prices (GP), and Bombay Stock Exchange (BSE) Sensex in India. Gold price is included in the model as an additional variable, to examine whether gold price contains any additional significant information about price movements. Since gold is an important saving instrument in India, and is very often used as a hedge against inflation, it is expected that gold may be looked upon as alternative asset for those holding idle money, for speculative purposes.

In case of Brazil, it is used in the monthly averages of the Sao Paulo Stock Exchange, Bovespa index as a measure of stock prices and macro variables such as the Index of Industrial Production (as a proxy for the GDP), Real Effective Exchange rate (as a proxy for Exchange rate), Wholesale Price index, Treasury Bill Rate (as an interest rate (TB)), and M3 (money supply) considered for the analysis. Monthly data series for the period from April 1994 to July 2010 is used in this study.

For China, the Index of Industrial Production (as a proxy for the GDP), Real Effective Exchange rate (as a proxy for Exchange rate), Lending rate (as an interest rate (LR)) and monthly averages of the Shanghai Stock Exchange (SSE) and Composite index is taken as a measure for stock prices. Monthly data series for the period from August 1995 to July 2010 is used in this study.

For Russia, the Index of Industrial Production (as a proxy for the GDP), Real Effective Exchange rate (as a proxy for Exchange rate), Interbank Rate (as an interest rate), M2 (money supply) are taken as a measure of stock prices. The Russian Trading System (RTS) index (Russian Trading System Stock Exchange) was considered to examine the relationship between stock price and macro economic variables during December 1996 to July 2010.

The data was collected for Brazil, China and Russia from the International Financial Statistics (IFC). The stock price indices, representing different countries, are selected based on the importance of index. Due to data constraints we need to drop some important variables (For Ex: gold prices, FIIs and WPI) and the actual period of study also differs for different countries, based on the availability of the data.

## Empirical Methodology

Autoregressive distributed lag (ARDL) approach and Toda and Yamamoto Granger causality test have been applied to explore the long-run and short-run relationships. Cointegration and error-correction approaches are used in this study to examine the short-run and long-run relationship macroeconomic variables and stock prices. There are many techniques available in economic literature to investigate cointegration relationship among macroeconomic variables. For bivariate analysis, Engle-Granger [10], and Fully Modified Ordinary Least Square (FMOLS) procedure of Phillips and Hansen [11] have been prominent. For multivariate cointegration, the techniques of Johansen [12]; Johansen and Juselius [13]; and Johansen's [14] have been popular. In the present study, the auto regressive distributed lag (ARDL) approach to cointegration, developed by Pesaran et al. [15] has been used. This approach, also known as the ARDL bounds the test approach, which is preferred over other conventional cointegration tests, as it has several advantages over other conventional tests [16].

Investigation of a cointegration relationship using the ARDL approach does not necessitate testing for a unit root. But this is on account of the fact that bound test is based on the assumption of variables being I(0) or I(1). Therefore, the implementation of unit root tests for the ARDL approach might still be necessary in order to ensure that none of the variables are integrated of order two [I(2)] or beyond. To that end, we apply different unit root tests to both real effective exchange rate and nominal exchange rate. The standard augmented Dickey Fuller (ADF) and Phillips Perron (PP) unit root tests have been criticized for its low power in distinguishing between unit root and a near unit root process [17]. Therefore, we have also performed Kwiatkowski, Phillips, Schmidt and Shin (KPSS) [18] unit root test, as it is more powerful and reliable for small sample data sets as in our study.

## Empirical Results and Analyses

Prior to the testing of cointegration, we conducted a test of order of integration for each variable using Augmented Dickey-Fuller Test (ADF), Phillips-Perron Test (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. The results on variables at level are given in Table 1, which on the whole shows that the variables under study may be considered integrated of order one, i.e., I(1) with a very few exceptions, such as call money rates and the FIIs for India. However, note that in these two cases also, all the three tests fail partially; for example, both the ADF and PP tests without intercept and constant; and the KPSS test with intercept. With our preliminary conclusion that the variables in general are integrated, we consider that the tests in the first difference of the variables (Table 2) confirm that all the variables are I(1) and both the ADF and PP tests are rejecting the unit root null and the KPSS tests fail to reject the stationarity null in contrast to all the variables in all the test formulations.

### Auto Regressive Distributed Lag model (ARDL) analysis

In order to implement the ARDL test, we have to determine the appropriate lags as the results are very sensitive to the lag length. To ensure comparability of results for different lag lengths, all estimations were computed over the same sample period and so lag order of 1 is selected based on the lowest value of the Akaike Information Criterion.

After deciding the optimal lag order, the results of F-statistics are reported in Table 3. The calculated F-statistics for joint significance are all above the upper bound critical value at 5% level of significance in the case of all the four countries considered. These results are tentatively confirming the existence of long-run equilibrium relationship among the variables used for all the individual BRIC Stock markets.

We further probe into the long run and the short run dynamics. The results of the long run coefficients are presented in Table 4. For India, it is evident from the table that the coefficient of Foreign Institutional Investment (FIIs) is significant at 5% indicating the existence of long run relationship between Sensex and FIIs. Similarly, Money Supply (M3), and inflation (WPI) coefficients are significant at 5% while and coefficient of Gold prices is significant at 10% level. It implies that money supply, inflation and gold prices have the long-run relationship with the Sensex. In other words, the results indicate that FIIs, Money Supply, Inflation and Gold Prices are the only macroeconomic variables which affect the Sensex in the long run. The results facilitate the investors in taking informative and effective investment decisions by estimating the expected trends of the important macro variables. Similarly, the

| | Augmented Dickey-Fuller Test | | | Phillips-Perron Test | | | KPSS Test | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | **I*** | **IC**** | **WIC***** | **I*** | **IC**** | **WIC***** | **I*** | **IC**** |
| **a) India** | | | | | | | | |
| Call money rates | -2.89* | -8.15* | -1.34 | -7.39* | -8.73* | -2.41 | 0.88 | 0.08* |
| WPI | 1.5 | -0.97 | 4.74 | 1.66 | -0.68 | 6.3 | 1.72 | 0.42* |
| IIP | -2.24 | -2.46 | 0.66 | -2.27 | -2.42 | -0.96 | 1.59 | 0.11 |
| Sensex | -1.8 | -1.81 | -1.19 | -1.9 | -2.04 | -1.24 | 1.27 | 0.33 |
| Nifty | -0.27 | -2.29 | 1.19 | -0.19 | -2.22 | 1.23 | 1.4 | 0.33 |
| Gold prices | 3.13 | 0.57 | 4.14 | 4.16 | 1.14 | 4.42 | 1.29 | 0.40* |
| M3 | 0.83 | -1.66 | 2.79 | 1.03 | -1.73 | 2.79 | 1.73 | 0.22 |
| FIIs | -4.99* | -11.59* | -4.31* | -11.85* | -12.22* | -11.19* | 0.6 | 0.04* |
| REER | -3.20** | -3.13** | -0.16 | -3.04** | -2.95 | -0.18 | 0.26 | 0.1 |
| **b) Brazil** | | | | | | | | |
| REER | -1.54 | -1.44 | 0.25 | -1.35 | -1.21 | 0.28 | 0.39 | 0.36 |
| IIP | -1.17 | -3.57* | 1.42 | -1.15 | -3.82* | 1.46 | 1.66 | 0.17 |
| M3 | -1.67 | -6.23* | 3.97* | -4.13* | -13.35* | 3.83 | 1.73 | 0.24 |
| TBRATE | -1.53 | -3.52* | -0.96 | -1.54 | -3.87* | -0.96 | 1.44 | 0.06* |
| WPI | -0.88 | -3.98* | 1.51 | -3.67* | -7.48* | 2.14 | 1.73 | 0.28 |
| Bovespa | -1.83 | -4.26* | 1.39 | -2.26 | -4.30* | 1.68 | 1.62 | 0.11 |
| **c) China** | | | | | | | | |
| REER | -1.95 | -1.96 | 1.02 | -1.78 | -1.82 | 1.1 | 0.25 | 0.2 |
| IIP | -3.53* | -3.72* | -0.59 | -10.07* | -10.32* | -0.66 | 0.42 | 0.15 |
| LR | -2.67 | -2.03 | -2.14 | -2.57*** | -1.96 | -2.04 | 0.84 | 0.34 |
| SSC | -1.87 | -2.12 | 0.76 | -1.95 | -2.36 | 0.65 | 0.98 | 0.11 |
| Composite | | | | | | | | |
| **d) Russia** | | | | | | | | |
| REER | -1.19 | -2.59** | 0.36 | -1.09 | -2.32 | 0.47 | 1.02 | 0.17 |
| IIP | -0.88 | -2.98** | 1.17 | -1.42 | -4.63* | 1.17 | 1.5 | 0.19 |
| IBR | -2.93 | -3.52* | -1.67 | -2.7 | -3.5 | -1.5 | 0.9 | 0.3 |
| M2 | -1.6 | -0.67 | 1.89 | -1.27 | -0.48 | 7.26 | 1.58 | 0.2 |
| RTS | -1.1 | -2.59** | 0.32 | -1.23 | -2.34 | 0.46 | 1.27 | 0.13 |

Note: * With Intercept ** with Intercept and Trend *** without Intercept and Trend
**Test critical values for ADF and PP test:**
* Indicates the level of significance at 1 %. (-3.431833),
** indicates the level of significance at 5 % (-2.862081)
*** Indicates the level of significance at 10%, (-2.567101).
**Asymptotic critical values for KPSS test:**
*Indicates the level of significance at 1 %. (0.739000),
** indicates the level of significance at 5 % (0.463000)
*** Indicates the level of significance at 10%, (0.347000). (Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1))

**Table 1:** Unit Roots Tests Results at levels (Macro Variables and Stock prices).

Central bank (Reserve bank of India) should consider that significant impact of money supply on stock prices. According to efficient market hypothesis, stock markets respond to the arrival of new information which comes randomly. Hence, macroeconomic policies should be designed to provide stability to the stock market. Due to increase in the volume of foreign institutional investment (FII), inflows in recent times have led to concerns regarding the volatility of these flows and its impact on the stock markets. The significant relationship between Sensex and FIIs calls for a policy regulation on FIIs. Traditionally equities have been regarded as a good hedge against inflation because of the fact that equities are claimed against physical assets whose real returns should remain unaffected by inflation. Investors need to know whether equities can serve as a hedge against inflation. If a company is able to sustain its profit margin despite high inflation, then the stock price is likely to hold. If the high inflation sustains, at some stage it will lead to a chain reaction across the economy, pushing up interest rates and even affecting demand. An increase in interest rates will push up borrowing costs for corporate while lower demand will hurt growth in revenues. This is likely to impact sentiment for the stock market as a whole. Traditionally, gold has been more attractive than bank deposits, stocks and bonds. In developing countries, people have often trusted gold as a better investment. According to Opdyke [19], the international investors sought a safe haven investment as gold during the global recession in the history. Moreover, during the global financial instability gold may pull the interest of investors, because there will be a little chance of getting better returns in the stock investments due to fragile economic and financial positions in the global economy.

In the case of Brazil, only the Treasury bill rate (TBR) has impact on Bovespa. It means that interest rates (TBR) have an impact on stock prices, especially in the long run. Zhou [20] found that long-term interest rate explains a major part of the variation in price-dividend ratios and suggests that the high volatility of the stock market is related to the high volatility of long-term bond yields and may be accounted for by changing forecasts of discount rates. While in the case of China, no variable appears to be significant. In Russia, the only variable namely, Index of Industrial production has impact on Russian stock market at 10 percent level. The Index of industrial production, which has been taken as a proxy of national income, should increase the corporate earnings enhancing the present value of the firm and it also increases the national disposable income, which should lead to more retail investment in the stock market. The opposite will cause a fall in the stock market. As we mentioned earlier, due to data constraints we had to drop some important variables (For Example: gold prices, FIIs and WPI etc.). In this scenario, empirical results are not unexpected for China and Russia, as other macroeconomic variables may have a major

| | Augmented Dickey-Fuller Test | | | Phillips-Perron Test | | | KPSS Test | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | **I*** | **IC**** | **WIC***** | **I*** | **IC**** | **WIC***** | **I*** | **IC**** |
| **a) India** | | | | | | | | |
| Call money rates | -13.04* | -13.02* | -13.07* | -25.07* | -25.05* | -25.14* | 0.04* | 0.02* |
| WPI | -8.44* | -8.64* | -5.11* | -8.61* | -8.73* | -7.03* | 0.14* | 0.05* |
| IIP | -6.12* | -5.30* | -5.42* | -14.17* | -14.27* | -14.20* | 0.21* | 0.10* |
| Sensex | -4.70* | -4.56* | -4.78* | -4.63* | -4.56* | -4.72* | 0.15* | 0.12* |
| Nifty | -10.64* | -10.69* | -10.55* | -10.64* | -10.68* | -10.60* | 0.17* | 0.04* |
| Gold prices | -13.05* | -13.83* | -12.53* | -13.04* | -13.91* | -12.61* | 0.13* | 0.10* |
| M3 | -10.45* | -10.51* | -1.96* | -14.02* | -14.23* | -7.25* | 0.18* | 0.09* |
| FIIs | -12.05* | -12.12* | -12.09* | -102.71* | -102.51* | -101.36* | 0.10* | 0.09* |
| REERE | -11.72* | -11.72* | -11.75* | -11.68* | -11.69* | -11.71* | 0.08* | 0.04 |
| **b) Brazil** | | | | | | | | |
| REER | -10.99* | -11.01* | -11.01* | -10.89* | -10.91* | -10.91* | 0.19* | 0.08* |
| IIP | -14.36* | -14.33* | -14.26* | -14.37* | -14.33* | -14.26* | 0.02* | 0.02* |
| M3 | -12.29* | -12.12* | -5.41* | -18.69* | -18.97* | -12.98* | 0.61* | 0.22* |
| TBRATE | -14.70* | -14.66* | -14.68* | -14.70* | -14.66* | -14.68* | 0.03* | 0.03* |
| WPI | -9.68* | -9.39* | -9.59* | -13.41* | -12.80* | -11.62* | 0.21* | 0.10* |
| Bovespa | -10.14* | -10.08* | -9.42* | -9.64* | -9.45* | -9.17* | 0.14* | 0.07* |
| **c) China** | | | | | | | | |
| REER | -10.10* | -10.07* | -10.04* | -10.02* | -9.99* | -10.01* | 0.15* | 0.15* |
| IIP | -11.87* | -11.82* | -11.90* | -39.33* | -39.16* | -39.27* | 0.08* | 0.07* |
| LR | -11.15* | -11.35* | -10.94* | -11.24* | -11.37* | -11.17* | 0.38* | 0.12* |
| SSC composite | -10.60* | -10.59* | -10.56* | -10.97* | -10.95* | -10.96* | 0.07* | 0.05* |
| **d) Russia** | | | | | | | | |
| REER | -9.52* | -9.55* | -9.54* | -9.50* | -9.49* | -9.52* | 0.13* | 0.06* |
| IIP | -4.32* | -3.82* | -3.55* | -17.07* | -18.00* | -16.79* | 0.05* | 0.04* |
| IBR | -13.46* | -13.42* | -13.49* | -15.24* | -15.20* | -15.19* | 0.07* | 0.05* |
| M2 | -3.53* | -4.05* | -4.71* | -13.44* | -13.54* | -11.12* | 0.20* | 0.16* |
| RTS | -9.42* | -9.40* | -9.42* | -9.44* | -9.41* | -9.45* | 0.06* | 0.06* |

Note: * With Intercept ** With Intercept and Trend *** Without Intercept and Trend
**Test critical values for ADF and PP test:**
* Indicates the level of significance at 1 %. (-3.431833),
** indicates the level of significance at 5 % (-2.862081)
*** Indicates the level of significance at 10%, (-2.567101).
**Asymptotic critical values for KPSS test:**
*Indicates the level of significance at 1 %. (0.739000),
** indicates the level of significance at 5 % (0.463000)
*** Indicates the level of significance at 10%, (0.347000). (Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1))

**Table 2:** Unit Roots Tests results in the First difference (Macro variables and Stock prices).

| Variables | Computed F -Statistics | Inference |
|---|---|---|
| **India** | | |
| SENSEX, FIIS, REER, CALLMON, WPI, IIP, GOLD, M3 | 8.180* | Cointegrated |
| **Brazil** | | |
| REER, IIP, M3, TBRATE AND WPI | 6. 174* | Cointegrated |
| **China** | | |
| REER,IIP, LR and SSC composite | 4. 166* | Cointegrated |
| **Russia** | | |
| REER, IIP, M2, IBR and RTS | 5. 148* | Cointegrated |

Note: Pesaran et al., the critical values are estimated with the assumption of unrestricted intercept term with no trend.
*Indicates the level of significance at 10%, (2.72 -2.72)
**indicates the level of significance at 5% (3.23-4.35)
***indicates the level of significance at 1%. (4.29 - 5.61) (Pesaran tabulated lower and upper band values are given parentheses).

**Table 3:** F- Statistics of Cointegration between Macro Variables and Stock Prices.

role in the determination of stock price expectations.

In order to capture the short-run dynamics of the model, error correction mechanism was applied and the results are reported in the Table 5. The ECM coefficient estimated in the model shows how quickly/ slowly variables return to their equilibrium values. The ECM coefficients should be statistically significant with a negative sign. The results show that the ECM term, has negative sign and is statistically significant at 5 percent level, ensuring that long-run equilibrium can be attained in the case of India and Brazil only. The magnitude of the coefficient of the ECM term suggests that adjustment process is highly significant for India and quite moderate for Brazil. Thus, about 84 percent of disequilibrium of the previous month shock is adjusted back to equilibrium in the current month for India and about 9 percent for Brazil. The ECM term of China and Russia are not statistically significant, which shows that the macro economic variables do not have impact on stock prices even in the short-run. Perhaps, the omitted variables may have had some say on the result. Remember we have already mentioned the data limitation problems in the case of these two countries. Further research into the relationship between these (for example: gold prices, FIIs and WPI etc.) macroeconomic variables and stock prices is thus warranted.

Finally, to ascertain the goodness of the fit of the selected ARDL model, the stability and the diagnostic tests are conducted. Table 6 shows that, the models of diagnostic test statistics in genral fulfils the conditions of no specification errors, structural stability, normality of residuals and homoskedasticity at 5% level. However, that the serial correlation tests are only marginally significant (not significant at 10 percent level) except for India.

The structural stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ). Figures 1-8, present

| **ARDL(1,0,0,0,0,0,0)***: India | | | |
|---|---|---|---|
| **Regressor** | **Coefficient** | **Standard Error** | **t-Ratio [Prob]** |
| REER | -0.081 | 0.073 | -1.102 [.272] |
| IIP | -0.004 | 0.010 | -0.426 [.670] |
| M3 | 3.076 | 1.493 | 2.060 [.041] |
| WPI | -0.698 | 0.326 | -2.139 [.034] |
| CM | -0.010 | 0.014 | -0.718 [.474] |
| GP | -0.015 | 0.009 | -1.714 [.088] |
| FIIS | 0.015 | 0.006 | 2.550 [.012] |
| CONSTANT | -4.4 | 2.319 | -1.897 [.059] |
| **ARDL(1,1,0,1,0,0)*: Brazil** | | | |
| REER | 0.538 | 0.539 | 0.998 [.319] |
| IIP | -3.425 | 3.201 | -1.070 [.286] |
| M3 | 0.626 | 0.615 | 1.018 [.310] |
| WPI | 0.830 | 1.179 | 0.704 [.482] |
| TBRATE | -0.964 | 0.467 | -2.063 [.040] |
| CONSTANT | 7.990 | 13.553 | 0.589 [.556] |
| **ARDL(1,0,0,0)*: China** | | | |
| REER | -7.015 | 11.084 | -0.632 [.528] |
| IIP | -1.239 | 1.418 | -0.874 [.383] |
| LR | -0.675 | 1.491 | -0.452 [.651] |
| CONSTANT | 42.584 | 55.456 | 0.767 [.444] |
| **ARDL(1,1,0,1,0,0)*: Russia** | | | |
| IIP | 6.207 | 3.386 | 1.833 [.069] |
| REER | -0.964 | 2.416 | -0.399 [.690] |
| M2 | -0.254 | 0.427 | -0.594 [.553] |
| IBR | -0.146 | 0.249 | -0.586 [.558] |
| CONSTANT | -16.878 | 9.332 | -1.808 [.072] |

*ARDL model selected based on Akaike Information Criterion; the significant lag lengths are given in brackets.

**Table 4:** Estimated Long Run Coefficients between Macro Variables and Stock Prices.

| **ARDL(1,0,0,0,0,0,0)*: India** | | | |
|---|---|---|---|
| **Regressor** | **Coefficient** | **Standard Error** | **t-Ratio [Prob]** |
| dREER | -0.068 | 0.063 | -1.088 [.278] |
| dIIP | -0.004 | 0.008 | -0.427 [.670] |
| dWPI | -0.589 | 0.285 | -2.066 [.040] |
| dM3 | 2.597 | 1.296 | 2.004 [.046] |
| dCM | -0.009 | 0.012 | -0.713 [.476] |
| dGP | -0.013 | 0.007 | -1.774 [.078] |
| dFIIS | 0.013 | 0.005 | 2.401 [.017] |
| dCONSTANT | -3.714 | 2.001 | -1.856 [.065] |
| ecm(-1) | -0.844 | 0.078 | -10.836 [.000] |
| **ARDL(1,1,0,1,0,0)*: Brazil** | | | |
| dREER | 0.463 | 0.123 | 3.744 [.000] |
| dIIP | -0.295 | 0.193 | -1.529 [.128] |
| dM3 | 1.469 | 0.217 | 6.744 [.000] |
| dTBRATE | -0.083 | 0.033 | -2.473 [.014] |
| dWPI | 0.071 | 0.088 | 0.804 [.422] |
| dCONSTANT | 0.688 | 0.963 | 0.714 [.476] |
| ecm(-1) | -0.086 | 0.035 | -2.415 [.017] |
| **ARDL(1,0,0,0)*: China** | | | |
| dREER | -0.121 | 0.115 | -1.054 [.293] |
| dIIP | -0.021 | 0.012 | -1.753 [.081] |
| dLR | -0.011 | 0.027 | -0.418 [.676] |
| dCONSTANT | 0.736 | 0.523 | 1.407 [.161] |
| ecm(-1) | -0.017 | 0.015 | -1.104 [.271] |
| **ARDL(1,1,0,1,0,0)*: Russia** | | | |
| dIIP | 0.438 | 0.228 | 1.914 [.057] |
| dREER | 0.944 | 0.295 | 3.193 [.002] |
| dM2 | -0.017 | 0.031 | -0.576 [.565] |
| dIBR | -0.010 | 0.018 | -0.558 [.577] |
| dCONSTANT | -1.191 | 1.047 | -1.137 [.257] |
| ecm(-1) | -0.070 | 0.043 | -1.620 [.107] |

*ARDL model selected based on Akaike Information Criterion

**Table 5:** Error Correction Representation for the BRIC Stock Markets.

| **Country** | | **India** | | **Brazil** | | **China** | | **Russia** | |
|---|---|---|---|---|---|---|---|---|---|
| **Item** | **Test Applied** | $\chi^2$ **-value** | **Prob** | $\chi^2$ **-value** | **Prob** | $\chi^2$ **-value** | **Prob** | $\chi^2$ **-value** | **Prob** |
| Normality | test of skewness and kurtosis | 1.07 | 0.30 | 1.56 | 0.21 | 0.51 | 0.475 | 0.64 | 0.42 |
| Serial correlation | Lagrange multiplier test | 10.37 | 0.58 | 19.65 | 0.07 | 20. 58 | 0.069 | 18.98 | 0.08 |
| Heteroscedasticity | White test | 0.12 | 0.72 | 0.18 | 0.66 | 0.13 | 0.71 | 3.56 | 0.08 |
| Functional Form | Ramsey's RESET test | 2.39 | 0.11 | 17.68 | 0.19 | 7.60 | 0.102 | 27.66 | 0.09 |

**Table 6:** Diagnostic Tests.

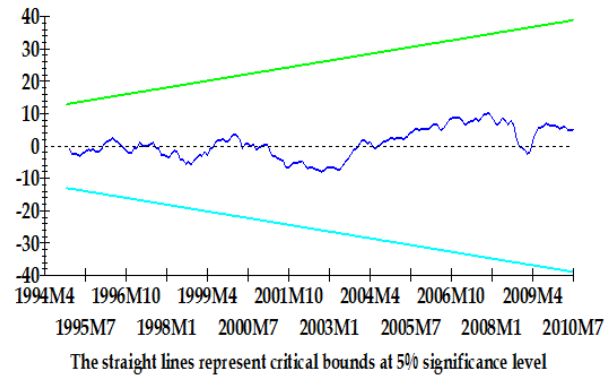


**Figure 1:** Plot of cumulative sum of recursive residuals of India.

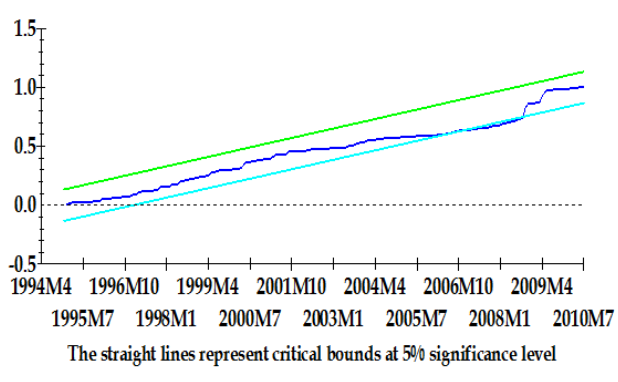


**Figure 2:** Plot of cumulative sum of squares of recursive residuals of India.

plots of both the CUSUM and CUSUMSQ test statistics that fall inside the critical bounds of 5% significance; the stability tests further confirm the stability of the estimated coefficients.

## Conclusion

This study examines the relationship between the stock prices and

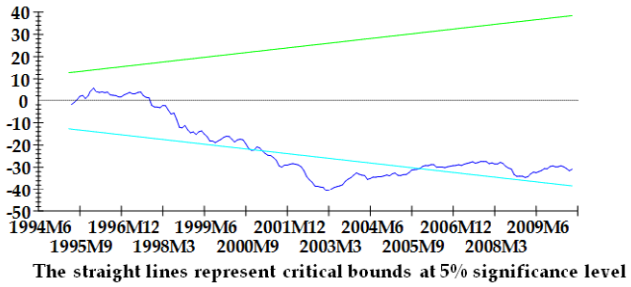


**Figure 3:** Plot of cumulative sum of recursive residuals in Brazil.

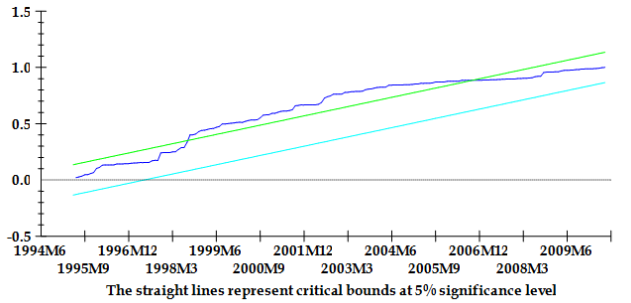


**Figure 4:** Plot of cumulative sum of squares of recursive residuals in Brazil.

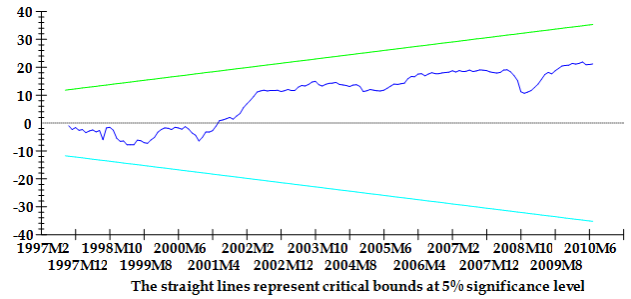


**Figure 5:** Plot of cumulative sum of recursive residuals in Russia.

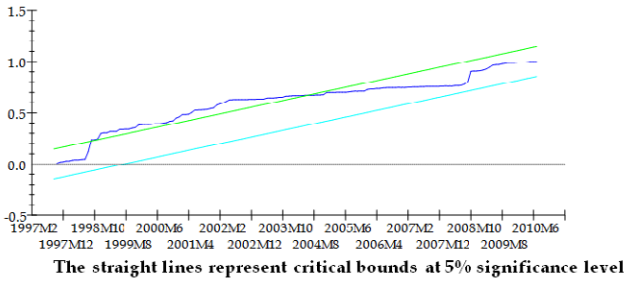


**Figure 6:** Plot of cumulative sum of squares of recursive residuals in Russia.

the macroeconomic variables in the BRIC economies. The empirical evidence shows that long-run and short-run relationship exists between macro economic variables and stock prices, but this relationship was not consistent for all of the BRIC countries. These results reveal that identification of direction of relationship between the macroeconomic variables and stock market behaviour facilitates the investors in taking

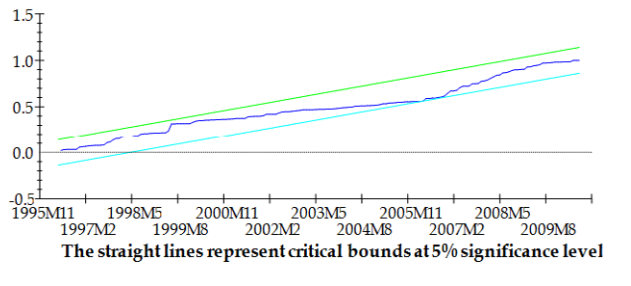


**Figure 7:** Plot of cumulative sum of squares of recursive residuals in China.

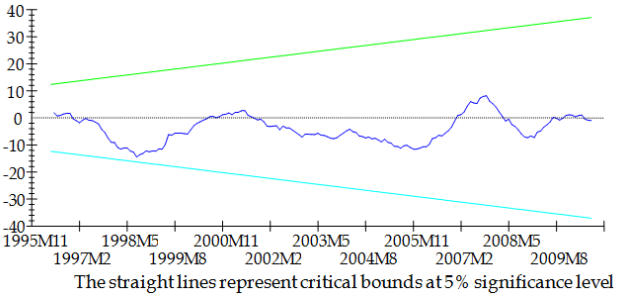


**Figure 8:** Plot of cumulative sum of recursive residuals in China.

effective investment decisions as by estimating the expected trends in the macro economic variables and can allocate their resources more efficiently. The policy implication of the above is that the BRIC stock markets are not responsive to changes in a majority of macroeconomic factors in spite of the sizable proportion of stock market capitalization as a share of the country's GDP.

Shiller [7], Thaler [21] and Akerlof et al. [4] argued that 'market psychology (speculation)' plays a significant role in the pricing of assets. In addition, Brock [22] observed in that financial markets cannot be attributed completely to the economic fundamentals, but that the 'psychological state of the market' may lead to sudden, large changes in stock prices triggered by news about changes in fundamentals of the economy. It means that stock market is influenced by speculative trading-buying stocks only because stock prices are expected to rise in near future, with the intention of selling quickly to realize capital gains. Hence, predicting stock prices and returns via changes in the macroeconomic performance becomes precarious and this affects economic forecast, planning and growth. Stock market investors will have to decide whether the value of their shares is driven primarily by the rational estimation of future corporate earnings or macroeconomic fundamentals or whether speculative manias drive the value of their investments. This in turn suggests that the theories of Keynes, Galbraith and Shiller can provide valuable guidance to investors in this era. It may be suspected that the BRIC Stock markets might be sensitive to global macroeconomic factors or other salient issues in the BRIC countries environment, which of course warrants further investigation.

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