Macroeconomic fundamentals and Indian stock returns: An application of ARDL approach

Mearaj ud din dar
Senior Research Fellow,
Department of commerce,
University of Kashmir,
J&K, India

Khursheed Ahmad Butt
Senior Professor,
Department of commerce,
University of Kashmir,
J&K, India

Abstract

The existence of well-developed and efficient financial markets is regarded as a prerequisite for overall economic development. The country's stock market is considered as mirror which reflects the underlying economic situation. Since stock market returns can stimulate a definite impact on the economy of the nation as a whole, it has a fundamental relationship with macro-economic variables. In this vein, the current study will examine the relationship between fundamental macroeconomic factors or forces(inflation, interest rates, money supply, real activity, exchange rates, and oil prices), and stock returns in emerging market India, on a time series data from Jan 2010 to Dec 2019 with monthly frequency. The study use autoregressive distributed lag modelling (ARDL) to establish long and short run relationship between the investigation's variables. At the first difference, the data is stationary. The study discovered stock market of India is inefficient in terms of information, as publicly available data on chosen macroeconomic indicators can be used to generate higher or superior profits.

Keywords: Emerging Stock Market, Macroeconomic Fundamentals, ARDL, Co-integration, Informationally Inefficient.

Introduction

Rapid expansion of emerging capital markets has been a watershed moment in recent financial history. Portfolio flows to emerging nations have been steadily increasing since the early 1980s, as per International Finance Corporation (IFC), and the trend has maintained despite several financial meltdowns (IFC, 2000). The considerable volatility of these markets, in comparison to more developed markets, is perhaps their most distinguishing feature (see Bekaert & Harvey, 1997). In addition, there is a lot of evidence in the literature indicating developing market are perceptive to macroeconomic news, and market players pay close attention to economic data and policy announcements. Additionally, the link between macroeconomic conditions and stock returns has been the subject of various theoretical debates.

Fama established the efficient market hypothesis in 1965, which says that stock prices include all information about macroeconomic issues and traders or investors will not be able to outperform the market and profiteer abnormally. According to EMH proposed by Fama, macroeconomic variables should have little impact on stock prices because prices already reflect or contain information about them. However, following research by Nelson (1977), Fama & Schewert (1977), Geske & Roll (1983), Mukerjee & Naka (1995), and others confirm that macroeconomic forces do impact stock price movement. However, Ross presented the essential theoretical foundation for the linking stock markets and macroeconomic variables in his famous APT model in 1976. Arbitrage pricing theory makes the assumption that returns are driven by a variety of macroeconomic variables. in the context of stock return macro dynamics (Ahmed, 2008). APT was developed as a replacement for the commonly used single factor capital asset pricing model that believes returns on assets are exclusively affected by market risk Asset returns are assumed to be determined by a variety of macroeconomic and company-specific factors in the APT model. Chen et al. (1986) concluded that diverse macroeconomic factors influenced stock returns via their impact on the discounted cash flows of the enterprise. The APT strategy aims to quantify the risk premia associated with these numerous risk factors, determine whether they are significant, and price them into stock market returns (Maysami & Koh, 2000). The present value model (PVM), which ties asset prices to future stream of cash flows and discount rate, is an alternate way to linking or correlating stock prices with macroeconomic variables. As a result, all forces affecting enterprise cash flows and discount rates to capitalise those cash flows will definitely influence stock prices.

Extensive research has been conducted to document link between macroeconomic indicators and stock market. Many academic researchers, financial and industry analysts, and practitioners have spent decades trying to establish link among macroeconomic variables and stock market movements. They have conducted a number of empirical and descriptive studies to see how macroeconomic forces affect equity prices. According to the factors, approaches, techniques, and tests employed in the numerous studies, different conclusions were drawn. Although wealth of literature is available on the link between macroeconomic variables and stocks in developed markets, there is little or no literature on the same relationship in emerging countries. "There is a considerable empirical gap in identifying macroeconomic variables that affect stock returns, and the few studies that have established such connections have tended to concentrate on developed markets" (Abugri 2008).In light of this the present study will look at how macroeconomic forces affect India's stock market.

Data description

The present work attempts to determine macroeconomic and stock market nexus in Indian context. The study will use time series data spanning a period of ten years from Ist Jan 2010 to 31Dec 2019. The data consists of the monthly closing price of major stock exchange (BSE SENSEX) of India. Variables of the study include inflation, exchange rate, interest rate, real activity, oil price and money supply. The data, operational meaning and source of data are given below in table 1. The study uses log transformed data due its very statistical features.

Table 1 Data summary

Variable	Proxy	Source	Symbol
Stock price	BSE Sensex	Yahoo finance	LnSP
Inflation	Consumer price index	Bloomberg/ OECD	LnIF
Interest rate	Key policy or bench mark interest rate	Bloomberg/ RBI	LnIT
Real activity	Index of industrial production	Bloomberg/ OECD	LnIP
Money supply	Broad money supply(M3)	Bloomberg	LnMS
Exchange rate	Real effective exchange rate	Bloomberg	LnEX
Oil price	Average spot price of Brent Blend, West Texas intermediate and Dubai Fateh	Index mundi	LnOP

Theoretical Framework

Inflation affects practically everyone on a daily basis, regardless of whether they are investors, borrowers, or lenders. Inflation raises the cost of living, causing resources to move from investment to consumption. As a result, demand for market instruments falls, resulting in a drop in stock trading activity. Inflationary pressures raise living costs and cause resources to shift from investment to consumption. As a result, demand for market instruments falls, resulting in a drop in stock trading activity. Economic tightening strategies are also used by monetary policy to respond to rising inflation rates. Inflation eventually translates into a higher nominal interest rate, which results in the lower discounted cash flows and lowering corporate earnings, which lowers stock prices.

Stock price and interest rate is negatively related. According to the hypothesis underlying the negative correlation between interest rates and stock prices, opportunity cost of maintaining cash rises due to upward shift in interest rates, leading in stock replacement for interest-bearing instruments and consequent declines in stock values. Interest rate reductions lower borrowing costs and boost investment and economic activity, causing stock prices to rise.

As an indicator of the general health of the economy industrial production affects stock values because it affects anticipated cash flows. The increase in industrial production signals economic expansion, which boosts corporate profitability, increasing the firm's present value and, as a result, increasing stock market investment, which boosts stock prices. Because increment in IPI leads to enhancement in industrial sector production, which results in increase in profit for industries and companies, the IIP and stock prices are favourably associated.

Nominal equities prices grow when money supply expands, releasing more liquidity for purchasing assets. As a result, it is reasonable to predict a positive correlation between money supply and stock price. "According to portfolio theory, an increase in the money supply may result in portfolio shifts away from non-interest bearing money assets and toward stocks" (Mohanamani & Sivagnanasithi, 2014). Additionally, upward shock to money supply may leads to surge in inflation, which enhances interest rates and a decline in stock values.

Importance of international trade in a country's economy and the magnitude of the trade balance is what dictates the effect of currency exchange rates on stock prices. Decrease in the currency value has detrimental effect on the native stock market of a country that is largely reliant on imports. Products imported become more expensive when native currency depreciates relative to the foreign currency, mainly the US dollar, rising import prices and driving investors to move capital from local assets to foreign currency assets. An increase in the value of the home currency reduces exporting enterprises' competitiveness and may depress stock prices. In contrast, if a country is excessively reliant on imports, exchange rate appreciation lowers import costs and boosts domestic stock values.

Crude oil is a crucial component of every manufacturing process. Any significant change in oil prices, it is clear, causes stock market uncertainty, it may force investors to put their investments on hold or postpone them. Additionally, rising oil prices enhances shipping / transportation costs, manufacturing, and heating, all of which influence negatively firms' earnings. Consumers' discretionary spending is also harmed by rising fuel prices, which raises concerns about inflation. As a result, when oil prices are volatile, the financial risk associated with investments increases. As a result, a spike in prices of oil enhances manufacturing cost and consequently projected cash flow, which has a favourable effect on the stock markets of oil-importing nations. As a result, an increase in global oil prices results in decreased actual economic activity across all domains, causing stock prices to plummet.

On the Karachi stock exchange, (Ali, 2014) investigated the relationship between stock market and interest rate (KSE). He discovered that the interest rate and the stock market are inversely associated using simple regression and correlation analysis methodology. He came to the conclusion that, in order to improve the economy, the authorities must keep an eye on interest rates and maintain them low.

Review of literature

(Verma & Ozuna, 2005) evaluated how Latin American markets reacted to changes in macroeconomic variables. The sensitivity of Latin American markets to macroeconomic variables was once thought to be a mystery. The stock market in Mexico has a big impact on other Latin American markets, but not the other way around.

According to the APT model, macroeconomic forces are important determinants of asset (stock) returns stock returns and are priced accordingly (Chen et al., 1986). The research studied group of macroeconomic forces in the United States to access their influence on stock returns. The research established long standing association between macroeconomic forces and stock performance. Among the important macroeconomic variables, fluctuations in the risk premium and the gap between bonds are found to be the most influential in affecting US returns.

(Hosseini & Ahmad, 2011) examined the Indian and Chinese stock market indices and concluded that crude oil prices and money supply had a favourable effect on China but a detrimental effect on India. Inflation benefited both stock indices positively. In the near run, crude oil prices benefited India significantly, while having a small and negative effect on China.

(Ahmet Büyükşalvarc, 2010) applied regression analysis on Turkish stocks and macroeconomic factors where he found most of his variables determining Turkish returns except Inflation and Gold price which had no effect on ISE-100 returns.

Between 1998 and 2008, (Hasan & Javed, 2009) established long run relationship among the macroeconomic fundamentals and stock market under a VAR frame work.

(Ratanapakorn & Sharma, 2007) also found significant impact of macroeconomic variables on stock market. Granger causality demonstrated that all macroeconomic variables investigated cause stock prices in the long run.

Using monthly data various macroeconomic indicators, (Wongbangpo & Sharma, 2002) examined the connection between stock asset returns and macroeconomic forces in the ASEAN group. There study reported both positive and negative correlations among the study variables. All the ASEAN stock indexes were positively associated with output (GNP) and adversely associated with aggregate price level.

(Kwon & Shin, 1999) investigated Korean stock market to discover how economic activities influenced stock returns. Stock prices were discovered to be in cointegration with a collection of macroeconomic forces, including foreign exchange rate, trade balance, output level, and money supply, using VECM. The study found that stock return variability is linked to macroeconomic factors. In addition, contrary to past research, the study found that economic activity lead the stock index, thus denying that stock market leads nation's economic health.

(Tripathy, 2011) stated that Indian stock market is very susceptible to changes in interest rates, currency exchange rates, and worldwide markets. The paper continued by stating that the sample stock market(India) is informationally inefficient, which suggests that investors can earn greater than normal returns by analysing historical data.

Mookerjee & Yu, 1997) analysed the monthly data to understand long-term link between four macroeconomic variables in Singapore and stock prices. They found that the money supply, both narrow and broad, had substantial long-term interactions with stock prices, but the exchange rate had no such association.

(Ray and Vani, 2003) used the VAR model to examine link between stock market and economic variables related to real activity in the Indian environment. The findings found that selected variables have a substantial impact on equity returns, whereas foreign investment and the fiscal deficit do not.

(Ibrahim & Aziz, 2003) also concluded that Malaysian market is inefficient in terms of information dissemination which means macro information can be used to earn abnormal returns.

(Singh, 2010) investigated Sensex and macroeconomic fundamentals for determining causal links between the BSE Sensex and exchange rate, WPI, and IIP. IIP and Sensex have bidirectional causality, indicating that IIP is

the significant variable. They came to the conclusion that the Indian market is somewhat informationally efficient in terms of few variables.

(Tripathi & Seth, 2014) documented strong connection among stock market indexes and macroeconomic forces. They also imply that stock price movement is caused by more than just shifting macroeconomic conditions; there are additional factors that influence stock price movement.

(Ray, 2012) found results which are perplexing and inconsistent with projections, emphasising the need for additional research in this area. The impact of inflation, foreign direct investment, and the currency rate on stock prices was determined to be minimal.

Nordin et. al. 2014 studied the performance of Malaysian stock market with reference to certain commodityprices along with interest rate and exchange rate. Employing bounds test approach, the study observed both interest rate and currency rate coefficients negative for the period of study.

On the Karachi stock exchange, (Ali, 2014) investigated the association between stock market and interest rate .He discovered that the interest rate and the stock market are inversely associated using simple regression and correlation analysis methodology. He came to the conclusion that, in order to improve the economy, the government should keep an eye on interest rates and maintain them at lower end.

(Al-abdullah, 2018), examined the economy of Jordon to investigate the impact of interest rate volatility on the stock returns.. The results indicated that one percent increase in the interest rates will result in twelve percent decline in the stock market index. Furthermore, policymakers should consider many macroeconomic indicators, particularly the interest rate, when developing and articulating various economic policies, according to the study.

Methodology

a) **Descriptive statistics:** Descriptive statistics are generated for the data in levels to get idea about basic characteristics of the data. It will provide crucial information on market risk and return patterns, as well as a normality check using the Jerque Bera statistic to determine whether or not observations are normally distributed.

b) **Unit root test:** Before moving on to the next step of the study, the time series data must be stationary, as non-stationary data will provide false and unreliable results if not addressed. Two formal tests (ADF and PP), are used to confirm if the data is steady or not. Dickey and Fuller created the ADF test (1979). ADF is based on the assumption that data contains unit root with alternate hypothesis that it is stationary. The test hypothesis is negated and stationarity of data is confirmed if the projected test statistic falls below critical value. If the test hypothesis is acknowledged, the series will be transformed to differenced one, which is also known as order of integration where d is more than one. Peter C.B Philiips and Pierre Perron created the PP exam (1988). Because the ADF test assumes that the dependent variable has no autocorrelation, PP uses lags to absorb any dynamic structure in the dependent variable, ensuring that there is no autocorrelation. The PP can handle heteroskedasticity as well as serially correlated error terms. This test corrects test statistics by altering the coefficient's t-ratio, rendering serial correlation obsolete. The test works on the same hypothesis as ADF test. Further analysis will be carried on stationary data.

c) **Correlation analysis:** A correlation test is performed between macroeconomic factors and stock index to acquire a preliminary concept of the existence of a association between selected variables. Integration of stock markets will be investigated further by correlating the returns of the sample nations. Presence of multicollineaity makes regression coefficients indeterminate, and the standard errors become infinite. Multicollinearity exists when the correlation coefficient between the independent variables surpasses the proposed rule of thumb of 0.8, making statistical inference problematic. As a result, it is recommended that variables having a high correlation coefficient be deleted or their measure changed for future study. Karl-Pearson correlation coefficients will be used in this investigation.

d) **Lag selection:** In the time series case, choosing the right lag length is crucial because once there is shock to the system or change in a particular variable, stock

markets take some time to respond which is called lag , to reflect that change. Dwtermination of proper lag length is crucial to find a solid link between the variables. The study uses AIC criterion for lag length selection.

e) **ARDL modelling:** The study will employ ARDL (autoregressive distributed lag model) technique to attain its objectives. Pesaran and Shin (1998) and Pesaran, Shin, and Smith (2001) popularised this model as a means of assessing cointegration among time series variables. ARDL is autoregressive because dependent variable is explained partly by itself in terms of its own lag and the term distributed lag means dependent variables is also explained by the successive lags of independent variables. ARDL possess certain previlage over other cointegration models. This model works regardless of the sequence in which the variables are integrated, but not more than one.This technique provides efficient results in relatively small samples (Pesaran et al 2001). Nkoro & Uko, 2016, argued that the issue of endogeneity is minimised to a great extent in case of ARDL modelling. The ARDL model to be applied for our study will be as follows:

$$\Delta LRSP_t = \alpha_0 + \sum_{i=1}^{n1} b1\ \Delta LRSP_{t-i} + + \sum_{i=1}^{n2} b2\ \Delta LOP_{t-i} + \delta_1 LRSP_{t-1} + \delta_2 LOP_{t-1} + V_t$$

The difference operator is denoted by Δ in the preceding equation, b1 and b2 denotes short run coefficients while δ1 and δ2 d denote long run coefficients. Vt is the error term. LRSP means log return of stock price of a country and LOP means log of oil price. The lag period is determined by the AIC criteria for each country. Under ARDL framework bounds test is performed to examine whether cointegration exists between the study variables. The null hypothesis of the model in case of two variables (as in our case) is b1=b2=0 where alternate hypothesis is b1≠b2≠0. The acceptance or non acceptance of null hypothesis depends upon the F statistic of the bounds test. If the F statistic surpasses the upper critical bound values, the test hypothesis is repudiated and we conclude variables have a long term association. When F statistic is underneath lower bound critical values, test hypothesis is accepted and cointegration is confirmed. When F statistic falls in between two critical bounds, the result is indeterminate. In that instance, the word "error correction" leads the long run association's decision (Shahbaz et al 2012b, Lwata et al. 2012). If the error correction term is significantly negative, the variables have a long run association.

Empirical results:

Table 2
Descriptive statistics of the variables

	LnSP	LnEX	LnIF	LnIP	LnIT	LnMS	LnOP
Mean	5.019854	4.618176	4.956483	4.744875	4.962426	5.163879	4.541851
Median	5.073601	4.631209	4.991065	4.734574	4.956568	5.198060	4.572685
Maximum	5.530197	4.703720	5.256769	4.933998	5.187092	5.603066	5.028711
Minimum	4.548383	4.482671	4.593474	4.600859	4.605170	4.605170	3.653645
Std. Dev.	0.285381	0.051264	0.185785	0.086165	0.145767	0.289200	0.340073
Skewness	0.118738	-0.531051	-0.413320	0.377125	-0.302376	-0.283466	-0.355170
Kurtosis	1.697457	2.543753	2.027531	2.065350	2.270420	1.876617	2.088271
Jarque-Bera	8.765069	6.681116	8.145149	6.491079	4.490055	7.125306	6.679162
Probability	0.012494	0.035417	0.017033	0.038948	0.105925	0.028363	0.035452

Table two presents the descriptive analysis of log of independent variables (macroeconomic variables and dependent variable (stock price) of the study. Among the variables stock price has the highest mean of 5.019854 while oil price produces the lowest mean of 4.541851. The skewness of majority of variables is negative, except stock price and inflation. Kurtosis for all the variables is well below three which suggests that distribution is platykurtic. The probability associated with jerque-bera statistic is less than 0.05 for all the variables except interest rate, which means that all the data is normally distributed. Oil price seem to have highest standard deviation while exchange rate with lowest standard deviation.

Table 3 Stationarity test of variables

	ADF (trend & intercept)		PP (trend & intercept)	
	Level	**Difference**	**Level**	**Difference**
LINEX	0.5692	0.000*	0.3812	0.000*
LINIF	0.8111	0.000*	0.8482	0.000*
LINIP	0.7648	0.0001*	0.9391	0.000*
LINIT	0.3003	0.0000*	0.4688	0.0003*
LINMS	0.1443	0.0000*	0.6837	0.0000*
LINSP	0.2162	0.0000*	0.2062	0.0000*

Table 3 displays the stationary test of the variables. It can be concluded from the table that level form of data under both the tests(ADF and PP) has p value of more than 0.05, concluding that data has a unit root. When the data is differenced, probability values of all the variables become less than 0.05 which means data attains stationarity upon differencing. Hence rest of analysis will be carried on stationary data i.e. differenced data.

Table 4 Correlation matrix of variables

	DLINSP	**DLINEX**	**DLINIF**	**DLINIP**	**DLINIT**	**DLINMS**	**DLOP**
DLINSP	1.000000						
DLINEX	0.391762	1.000000					
DLINIF	-0.127752	0.058038	1.000000				
DLINIP	0.154772	0.011142	0.007562	1.000000			
DLINIT	-0.057371	-0.03995	0.057312	0.031363	1.000000		
DLINMS	0.039808	-0.13529	0.062286	-0.01418	0.001949	1.00000	
DLOP	-0.120279	-0.09099	0.075260	0.237285	0.039495	-0.1903	1.00000

Table 4 represents the cross correlation matrix of variables of the study. From the above table, it can be concluded that none of the correlation coefficient surpasses the limit of 0.8. So there is no issue of multicollinearity among the independent variables. Further we can get the initial clues about the association among the selected variables. Interest rate, inflation rate and oil price negatively impact stock prices while IIP, exchange rate, and money supply are positively correlated.

Table 5 Lag length selection

Lag	Log L	LR	FPE	AIC	SC	HQ
0	960.2808	NA	1.24e-17	-19.06562	-18.88325	-18.99181
1	1841.590	1621.609	**7.32e-25***	**-35.71180***	**-34.25291***	**-35.12136***
2	1890.215	82.66205	7.47e-25	-35.70430	-32.96887	-34.59722
3	1921.126	48.22139	1.11e-24	-35.34252	-31.33056	-33.71881
4	1959.131	53.96671	1.48e-24	-35.12262	-29.83412	-32.98227
5	1984.963	33.06579	2.65e-24	-34.65927	-28.09424	-32.00228
6	2027.346	48.31667	3.63e-24	-34.52693	-26.68537	-31.35331
7	2068.845	41.49825	5.53e-24	-34.37689	-25.25880	-30.68664
8	2153.569	**72.86250***	4.02e-24	-35.09137	-24.69674	-30.88448

Table 5 displays the lag length selection by different criterions. As per the AIC criteria lag of one is appropriate.

Table 6 Bounds test of cointegration

F –statistic value	**2.994432**	
Significance –level	Lower Bound	Upper Bound
10%	2.53	3.59
5%	2.87	4
1%	3.6	4.9

Table 6 displays the bounds cointegration test under the frame work of ARDL. F statistic falls in between two bounds which lead to ambiguity about presence or absence of cointegration. In that case ECT is important which guides the decision of cointegration among the variables. If ECT is significantly negative, cointegration is established (Kremers et al., 1992, Banejee et al. 1998, Lwata et al. 2012).

Table 7 ARDL short run results

Variable	Coefficient	Std. Error	T statistic	P-value
D(LINIF)	-0.042652	0.305010	-0.139837	0.8891
D(LINIP)	0.368418	0.207919	-1.771930	0.0796*
D(LINIT)	0.190116	0.189869	1.001300	0.3192
D(LINMS)	-0.944549	0.494658	1.909500	0.0502**
D(LINEX)	1.402273	0.278842	5.028916	0.0000***
D(LOP)	-0.050420	0.020662	2.440237	0.0165***
CointEq(-1)	**-0.166314**	0.052193	-3.186537	0.0019***

Table 8 ARDL long run results

Variable	Coefficient	Std. Error	T statistic	P-value
LINIF	-0.800820	2.114177	-0.378786	0.7057
LINIP	2.102031	1.687649	-1.245538	0.2159
LINIT	-0.881127	0.388574	-2.267592	0.0255**
LINMS	2.046789	1.619320	1.263980	0.2092
LINEX	0.562263	1.064998	0.527948	0.0507**
LOP	-0.331178	0.157963	2.096553	0.0386**

Table 7 displays the short run results. Since ECT(error correction term) is significantly negative , confirming cointegration among the variables. IIP, money supply, exchange rate and oil price are significantly determining Indian stock price in the short run. Industrial production is having favourable effect on stock prices which is in line with the conventional theory that suggests: increase in industrial production signals economic expansion, which boosts corporate profitability, increasing the firm's present value and, as a result, increasing stock market investment, which boosts stock prices. Negative sign of money supply means that money supply increments may result in more inflation, which may result in the increment of interest rates and a decline in stock values. Because India is an import-dependent country, currency appreciation will reduce import bill, which will in turn enhance corporate profits. Oil price has negatively impacts stock price. Since oil is a major input for the industry, increasing oil prices enhance manufacturing cost resulting in the reduction of corporate profits and hence depress stock returns. Long run results as displayed in table 8 depict that in the long run oil price, exchange rate and interest rate seem to impact stock prices. From the ARDL results it can be inferred that external factors(prices of oil and rate of exchange) greatly influence Indian equity in long run and as short run as well.

Diagnostic tests:

Table 9 ARDL long run results

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.283787	Prob.	**0.1074**
Obs*R-squared	4.859721	Prob.	**0.0880**

Table 10 - Heterioscadsity test

Breusch-Pagan-Godfrey Test of Heteroscedasticity:			
F-statistic	1.073788	Prob.	**0.3878**
Obs*R-squared	8.623325	Prob.	**0.3751**
Scaled explained SS	8.005086	Prob. Chi-Square	0.4330

For the results to be reliable, it is necessary that particular model passes certain diagnostic tests. Table 8 and 9 depict that data is free from serial correlation and there is no heteroscedasticity as probability value is more than 0.05%.

Stability test:

Figure 1 CUSUM test of model stability

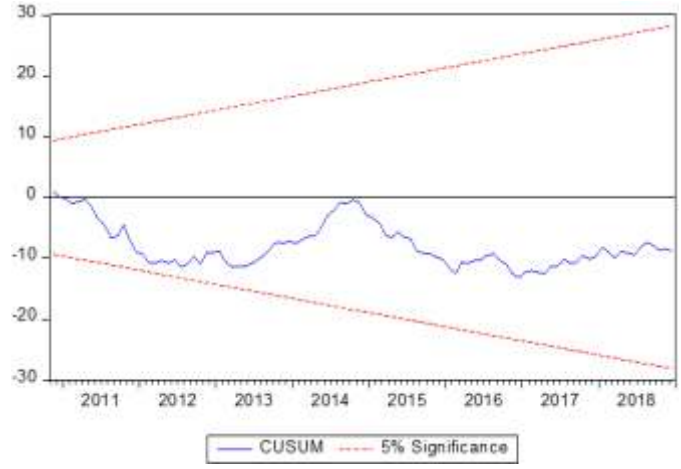
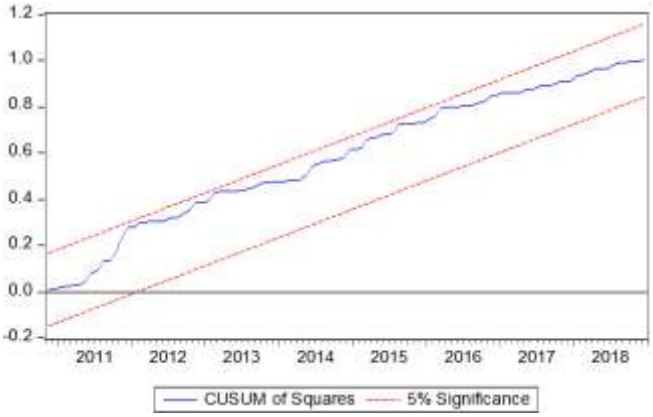


Figure 2 CUSUM of square test



Both CUSUM and CUSUM of Square tests check for both long and short run parameter estimates (Pesaran et al. (2000, 2001) in case of ARDL. Both CUSUM and CUSUM of Square plots as indicated by figure 1 and 2 show that residuals are under critical bounds of 5%, conforming that selected time series model is structrually stable.

Conclusion

In any economy, the stock market plays a vital role. A mature and sizable market is usually regarded as indicator of the economy's health and prospects, as well as a measure of local and international investors' confidence. EMH states that stock prices contain all information regarding macroeconomic issues, and traders or investors will not be able to outperform the market and profiteer abnormally. The study was conducted to examine link between stock prices and a sample of macroeconomic indicators in Indian context. The study examined macroeconomic indicators such as CP(inflation), bench mark interest rate, real activity, M3(money supply), oil prices, and exchange rates, as well as the BSE sensex, India's stock market index. Time period selected for the study is from 2010 to 2019. We employed ARDL technique of cointegration to concurrently determine the dynamic relationships amidst macroeconomic indicators and stock returns. This technique gained prominence as a cointegration technique as a result of the works of pesaran and shin, 2000.

The variables of the study are violating stationarity assumption at level form and confirm to stationarity once first differenced. Correlation analysis revealed that independent variables are free from multicolinearity. The ARDL results suggest that rate of exchange and price of oil influence stock returns contemporaneously and in long run as well, indicating Indian stock market is vulnerable to international environment. IIP, money supply, price of oil and rate of exchange are significant in the short run while interest rate, exchange rate and oil price are significantly affecting returns in long run. Error correction term was found to be 16%, indicating it would take almost 7 months for the stock market to bounce back to original equilibrium in case there is deviation or shock to the system, which raises the question of inefficiency of the Indian market. Overall, the findings imply that the Indian stock market is inefficient in terms of information dispersion, as publicly available data on macroeconomic indicators might be used to generate higher profits. Further R Square was less than 50%, which indicates that emerging market like India has a greater influence by non-fundamental elements than fundamental economic forces. The future direction in this research could be inclusion of more macroeconomic variables with larger time frame and application of advanced econometric techniques to draw conclusions.

References

- Abugri, B. A. (2008). Empirical relationship between macroeconomic volatility and stock returns : Evidence from Latin American markets. *International Review of Financial Analysis*, *17*, 396–410. https://doi.org/10.1016/j.irfa.2006.09.002

- Ahmed, S. (2008). Aggregate Economic Variables and Stock Markets in India. *International Research Journal of Finance and Economics*, *14*.
- Ahmet Büyükşalvarcı, H. A. (2010). The Causal Relationship between Stock Prices and Macroeconomic Variables: A Case Study for Turkey. *International Journal of Economic Perspectives*, *4*(4), 601–610.
- Ali, H. (2014). Impact of Interest Rate on Stock Market; Evidence from Pakistani Market. *IOSR Journal of Business and Management*, *16*(1), 64-69.
- ALJARAYESH, N. I. A., ASFOUR, L. K., & Al-ABDALLAH, S. Y. (2018). Interest rates volatility and its consequences on stock returns: The case study from Amman Stock Exchange, Jordan. *Journal of Economics Library*, *5*(2), 149-160.
- Bekaert, G., & Harvey, C. R. (1997). Emerging equity market volatility. *Journal of Financial economics*, *43*(1), 29-77.
- Chen, A. N., Roll, R., Ross, S. A., Chen, N., Roll, R., & Ross, S. A. (1986). Economic Forces and the Stock Market. *The Journal of Business*, *59*(3), 383–403.
- Fama, E. F. (1965). The behavior of stock-market prices. *The journal of Business*, *38*(1), 34-105.
- Fama, E. F., & Schwert, G. W. (1977). Asset returns and inflation. *Journal of financial economics*, *5*(2), 115-146.
- Geske, R., & Roll, R. (1983). The fiscal and monetary linkage between stock returns and inflation. *The journal of Finance*, *38*(1), 1-33.
- Hasan, A., & Javed, M. T. (2009). An Empirical Investigation of the Causal Relationship among Monetary Variables and Equity Market Returns. *The Lahore Journal of Economics*, *14*(1), 115–137. https://doi.org/10.35536/lje.2009.v14.i1.a5
- Hosseini, S. M., & Ahmad, Z. (2011). The Role of Macroeconomic Variables on Stock Market Index in China and India. *International Journal of Economics and Finance*, *3*(6), 233–243. https://doi.org/10.5539/ijef.v3n6p233
- Ibrahim, M. H., & Aziz, H. (2003). Macroeconomic variables and the Malaysian equity market A view through rolling subsamples. *Journal of Economic Studies*, *30*(1), 6–27. https://doi.org/10.1108/01443580310455241
- Iwata, H., Okada, K., & Samreth, S. (2012). Empirical study on the determinants of CO2 emissions: evidence from OECD countries. *Applied Economics*, *44*(27), 3513-3519.
- Kremers, J. J., Ericsson, N. R., & Dolado, J. J. (1992). The power of cointegration tests. *Oxford bulletin of economics and statistics*, *54*(3), 325-348.
- Kwon, C. S., & Shin, T. S. (1999). Cointegration and causality between macroeconomic variables and stock market returns. *Global Finance Journal*, *10*(1), 71–81.
- Mookerjee, R., & Yu, Q. (1997). Macroeconomic variables and stock prices in a small open economy : The case of Singapore. *Pacific-Basin Finance Journal*, *5*, 377–388.
- Maysami, R. C., & Koh, T. S. (2000). A vector error correction model of the Singapore stock market. *International Review of Economics & Finance*, *9*(1), 79-96.
- Mukherjee, T. K., & Naka, A. (1995). Dynamic relations between macroeconomic variables and the Japanese stock market: an application of a vector error correction model. *Journal of financial Research*, *18*(2), 223-237.
- Nkoro, E., & Uko, A. K. (2016). Autoregressive Distributed Lag (ARDL) cointegration technique: application and interpretation. *Journal of Statistical and Econometric methods*, *5*(4), 63-91.
- Nordin, N., Nordin, S., & Ismail, R. (2014). The impact of commodity prices, interest rate and exchange rate on stock market performance: an empirical analysis from Malaysia. *Malaysian Management Journal*, *18*, 39–52.
- Pesaran, H. H., & Shin, Y. (1998). Generalized impulse response analysis in linear multivariate models. *Economics letters*, *58*(1), 17-29.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds

testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326.

- Ratanapakorn, O., & Sharma, S. C. (2007). Dynamic analysis between the US stock returns and the macroeconomic variables. *Applied Financial Economics*, *17*(5), 369–377. https://doi.org/10.1080/09603100600638944
- Ray, Prantik and Vani, V. (n.d.). *What Moves Indian Stock Market : A Study on the Linkage with Real Economy in the Post-Reform Era*. 1–19.
- Ray, S. (2012). Testing Granger Causal Relationship between Macroeconomic Variables and Stock Price Behaviour : Evidence from India. *Advances in Applied Economics and Finance (AAEF)*, *3*(1), 470–481.
- Ritika Seth, V. T. (2014). Stock Market Performance and Macroeconomic Factors : The Study of Stock Market Performance and Macroeconomic Factors : The Study of Indian Equity Market Vanita Tripathi. *Global Business Review*, *15*(2), 291–316. https://doi.org/10.1177/0972150914523599
- Singh, D. (2010). Causal Relationship Between Macro-Economic Variables and Stock Market : A Case Study for India. *Pakistan Journal of Social Sciences (PJSS)*, *30*(2), 263–274.
- Shahbaz, M., Islam, F., & Aamir, N. (2012). Is devaluation contractionary? Empirical evidence for Pakistan. *Economic Change and Restructuring*, *45*(4), 299-316.
- Tripathy, N. (2011). Causal Relationship between Macro-Economic Indicators and Stock Market in India. *Asian Journal of Finance & Accounting*, *3*(1: E13). https://doi.org/10.5296/ajfa.v3i1.633
- Verma, R., & Ozuna, T. (2005). Are emerging equity markets responsive to cross-country macroeconomic movements ? Evidence from Latin America. *Journl of International Financial Markets, Institutions & Money*, *15*, 73–87. https://doi.org/10.1016/j.intfin.2004.02.003
- Wongbangpo, P., & Sharma, S. C. (2002). Stock market and macroeconomic fundamental dynamic interactions : ASEAN-5 countries. *Journal of Asian Economics*, *13*, 27–51.