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Macroeconomic variables and stock prices in emerging economies: A panel analysis

Raghutla CHANDRASHEKAR
Central University of Tamil Nadu, India
chandrashekareco@gmail.com
P. SAKTHIVEL
Sastra University, Tamil Nadu, India
sakthivel@mba.sastra.edu
T. SAMPATH
Telangana University, India
sampatheco@gmail.com
Krishna Reddy CHITTEDI
University of Hyderabad, Telangana, India
krc@uohyd.ac.in

Abstract. *This study aim to explore the role of the macroeconomic variables and stock prices for emerging economies perspective. Further, the study examines the association between the macroeconomic variable and stock prices across the panel of India and Brazil. The study utilizes monthly data from 2000M1-2016M08. We employ various panel econometric techniques. The findings confirm that the long run relationship between variables and unidirectional causality. The results also reveal that GDP, inflation, exchange rate, interest rate and stock prices play an important role in economic development.*

Keywords: macroeconomic variables, stock prices, panel analysis.

JEL Classification: E00, E44.

1. Introduction

The stock market has become an important indicator of the performance of the emerging economies over the few decades. However, the working of the stock market has become a vital subject for investment professionals, academics, and monetary policymakers. The stock market works with the sentiments of participants, which depend on several factors, making it a very sensitive segment of the economy. Globalization and financial sector reforms have added to the sensitivity by increasing determinants of the stock market movement manifold (Panda, 2008). The framework of economic policies started changing from 1985, with a shift towards market-oriented policies. This has been referred to as the process of economic liberalization. As parts of this initiative, a number of policy changes have been instituted that has gradually shifted control of resources allocation from the government to the markets. These measures, elimination of prices controls and elimination of government control on the exchange rate have had a major impact on the emerging market countries corporate sector and on the evaluation of traded securities. These changes have had the most important effects that have directly affected the stock market.

The present study focus on the association between the stock prices and macroeconomic variables in the prospective of emerging countries. Both variables are depends on present market condition due to the instability of the open economy. This implies that change in aggregate macroeconomic activities will be strongly influence the changes in stock price occurring. In both financial crisis and global economic has stimulated investigation about the relationship between the macro-economy and financial markets. Although, economists would agree that financing decision explore along with the study of the behavior of financial markets are within the sphere of finance. The macroeconomic emphasize of analyzes the behavior of the aggregate or entire economy. While the uncertainty is play a crucial role in each of these areas, Thereby, there is sophisticated empirical evidence in the finance literature that positive uncertainty shocks can predict a slowdown of economic activities. However, the literature does not establish whether this association is stable over time. In this study investigating monthly data from the beginning of 1994: M1 to 2016: M6. We analysis that macroeconomic variables response to changes in stock market prices from our sample period. To investigates this issue especially, we important to explore such unparalleled macroeconomic response pattern.

Given this background, the present paper aims to investigate the impact of stock prices on macroeconomic variables in two emerging economies. More specifically, best of our knowledge, no study so far has examine the relationship between stock prices and macroeconomic variables in two emerging countries. Therefore, the study key findings add to the literature in terms identifying the role of key macroeconomic variables on stock prices. More specifically, it will be important for the policy makers to know to what extent increases output, increases interest rate impact on stock prices and depreciation in exchange rate impact on stock prices. These findings will assist the policy makers to take additional initiatives to promote the key macroeconomic variables to stock market without harming the economic development in those economies.

The remainder of the paper structure is organized as follows. Section 2 discusses the review of the literature. Section 3 documents the data empirical methodology. Section 4 reports results and discussion. Finally, section 5 provides conclusion and remarks of the study.

2. Literature review

Stock market through increases investment may transfer the technology; it leads the innovative production process, increases export and managerial skill to the host economies. Given that, the stock market can have a positive impact on economic output, increases interest rate and depreciation in the exchange rate can have a positive impact on stock prices. Which may then may have a considerable effect on stock market. For instance, Tripathi and Kumar (2016) documented that stock returns and money supply has a positive impact on GDP in BRICS during 1995 Q1 to 2014 Q4. Authors also find interest rate, the rate of exchange rate, and rate of inflation has a negative impact on stock returns. Mohapatra and Rath (2015) examine the relationships between stock prices and key macroeconomic variables in three emerging countries namely such as India, Brazil, and China during from 2000-2012. The results reveal unidirectional causality from interest rate to stock prices; exchange rate to stock prices; exchange rate to inflation; exchange rate to interest rate; inflation to interest rate and long-run unidirectional causality between all the four selected macroeconomic variables and stock prices. However, Tripathi and Kumar (2014) find that inflation has no long-run impact on stock returns in 5 emerging market economies, spanning the period March 2000 to September 2013. Most recently, Riadh El Abed (2017) report that interest rate, inflation rate, and FDI has a positive impact on stock prices in the both short run as well as long run and exchange rate has a significantly negative impact on stock prices in the short run in two emerging countries during 1995:Q1 to 2015:Q1. Further, they document that monetary aggregate has a negative impact on stock prices in the long run.

Similarly, macroeconomic variables may affect negatively or positively stock market via inflation, exchange rate, interest rate and output. Investment increases additional source of funding for economic activities. Therefore, macroeconomic variables may play a major role in the stock market. Tripathi and Kumar (2014) find that unidirectional causality between stock returns and inflation rate, GDP growth rate, exchange rate and money supply in BRICS. Pethe and Karnik (2000) explored the relationship between stock prices and macroeconomic variables in India, during April 1992 to December 1997. Their find no long run relationship between stock prices and macroeconomic variable. Bhattacharya and Mukherjee (2002) investigated the relationship between stock prices and macroeconomic aggregates in India, spanning from April 1990 to March 2001. They find no causal linkage between stock prices and foreign exchange reserves, real effective exchange rate, and trade balance. Sangeeta Chakravarty (2006) examine the causal relationship between macroeconomic variables and stock prices in India during April 1991 to December 2005. Author report that unidirectional causality from money supply to stock prices. Furthermore, document that no unidirectional causality running between stock price and inflation, index of industrial production. Robert (2008) document that exchange rate and the oil price has no significant impact on the stock market in BRIC economies. Further author finds

bidirectional causality stock prices and rate of inflation in India during 1992-1993 to 2000-2001. Ahmed (2008) state that macroeconomic variable has a significant impact on the stock market in India during the period 1995:03 to 2007:03. A very recent study by Jamaludin et al. (2017) investigate the effect of macroeconomic variables and stock market returns in a panel of 3 nations. Authors make use of panel least square regression econometric techniques and monthly data from January 2005 to December 2015. Their findings confirm that the stock market returns has a positive impact on both interest rate and inflation, and stock market returns has an insignificant impact on money supply in Singapore, Malaysia, Indonesia economies, respectively.

Authors suggest that the macroeconomic variables in emerging countries has not reached at the level. Macroeconomic variables where it can effectively impact its adverse effect on the environment. It is clear from the existing literature that there is no research, which investigates the role of the stock market and key macroeconomic variables in major emerging market economies.

3. Data and empirical methodology

Nature of data and measurement

This present study uses monthly data for two emerging nations, spanning the period from 2000M1-2016M08. The selection of data samples are based on the availability; we selected the two emerging nations such as Brazil and India. To meet the study objective, we collect the time series data on stock prices (SP), index of industrial production (IIP) proxy for GDP, consumer price index proxy for rate of inflation (INF), and lending rate (LR) proxy for interest rate, real effective exchange rate (REER) proxy for exchange rate. We obtained data from the World Development Indicators (WDI) online database. We considered variables are converted into natural logarithms (LN) (see Chandrashekar et al., 2018; Ummalla and Chandrashekar, 2015). Because before the empirical investigation begin to avoid the problems related to the selected data measurement.

3.1. Econometric methodology

To examine the interaction between the stock prices, index of industrial production, consumer price index, lending rate, and real effective exchange rate. We frame the following equations:

$$SP_{it} = f(IIP_{it}, INF_{it}, REER_{it}, LR_{it}, e_{it})$$

$$\ln SP_{it} = \beta_{1i} \ln IIP_{it,} + \beta_{2i} \ln INF_{it} + \beta_{3i} \ln REER_{it} + \beta_{4i} \ln LR_{it} + e_{it}$$

Where, SP, IIP, CPI, REER, and LR represent for stock prices, index of industrial production, consumer price index, lending rate, and real effective exchange rate, respectively. Similarly, countries which are selected and time period are indicated by the subscripts i (i = 1, …, N) and t (t = 1,…, T), respectively. While e_{it}, is denote the residuals which are represent deviations from the long-run equilibrium relationships.

As the given, nature of our panel data first step of the empirical analysis, we make use of the two-panel unit root tests to investigate the order of integration across the variables under study. For instance, we determine selection of econometric models employed the Levin, Lin, and Chu (LLC) (2002) test for common unit root process, while I'm, Pesaran, and Shin (IPS) (2003) test for an individual unit root process to investigated. For both LLC and IPS tests, the null hypothesis of a unit root is tested as against the alternative hypothesis of no unit root. If all the sample variables are integrated in the same order, i.e., I (1), then LLC, IPS tests indicates that all the sample variables are nonstationary at levels of data and stationary at their I(1) first-order differentials. Further, this findings suggest that these sample variables, as a group, which may have a positive cointegration equilibrium relationship in the long-run.

Therefore, to employs the long run cointegration relationship between variables of the equation (1), for this purpose, we test the Fisher-type panel cointegration test, the model based on the methodology which is suggested by Maddala and Wu (1999). This model has been developed and using by the Johansen (1991) framework. According to Maddala and Wu (1999), Fisher-type panel cointegration test performs better than the other panel cointegration tests. Because of which are based on the Engle-Granger two-step procedure. Pioneer researchers (e.g., Alam and Paramati, 2015; Alam et al., 2017; Paramati et al., 2017; Kutan et al., 2017). Moreover, these authors suggest that Fisher-type panel cointegration test provides, reliable findings on the long-run association among the variables.

Further, we aim to find out the long run stock price, economic growth, inflation, exchange rate and interest rate; we estimate a single cointegration model based on the equations (1) in the model. For the estimation of long-run elasticities, we are employing dynamic ordinary least squares (DOLS) framework. Finally, we aim, to examine the direction of the short run panel causality among stock price, economic growth, inflation, exchange rate and interest rate are using a model that supports the existence of heterogeneity across the cross-sections variables. We employ this test based on Dumitrescu and Hurlin (2012) approach. This test requires sample variables to be stationary for which propose; we converted all the variables into first differenced. The null hypothesis of no causality in any cross-section is tested against the alternative hypothesis of causality at least for some cross-sections. The suitable lag length criteria for this test is selected based on the Schwarz information criterion (SIC).

3.2. Descriptive statistics

Table 1. *Descriptive statistics of the variables, 2000M1-2016M08*

variables	SP	INF	IIP	LR	REER
Mean	9.884	4.472	4.414	3.127	4.419
Std. Dev.	0.891	0.324	0.250	0.739	0.181
Skewness	-0.457	0.100	-0.844	0.111	-1.119
Kurtosis	2.342	1.803	2.795	1.213	3.843
Jarque-Bera	21.160	24.540	48.185	53.999	95.379
Sum.	3953.621	1788.860	1765.702	1251.125	1767.738

Note: The growth rates were calculated using natural logarithm data.

Table 1 provides panel descriptive statistics, namely standard deviation, skewness, kurtosis, mean and Jarque-Bera for selected nations. Mean for the most of variables in the panel are positive including stock returns of sample countries. The negative skewness coefficients are the panel of stock returns, industrial production, and real exchange rate indicates that the frequency distribution of real value of these variables is fat-tailed or left skewed. However, positive skewness coefficient for inflation and interest rate implies frequency distribution is right-skewed. The kurtosis value exceeds more than three which the distribution of returns is leptokurtic. Jarque-Bera test statistics show that rejects the null hypothesis of a normal distribution for the most of series.

4. Results and discussion

4.1. Order of integration of the variables

To check stationary process of each variables as follows, Im, Pesaran, and Shin (2003) and Levin, Lin and Chu (2002) panel unit root tests were used. The panel unit root tests helps to combine both time series data as well as cross-sectional data which leads to improve power of test. The result of panel unit root tests is presented in Table 2. The result shows that all log variables of stock prices, inflation, industrial production, real exchange rates and interest rate were nonstationary at the level form. In other words, all variables are panel contain unit root since null hypothesis is accepted in all cases. However, all variables are integrated order of one and have a possible cointegrating relationship to be investigated by Johansen-Fisher panel co-integration test.

Table 2. *Panel unit root tests results*

Variable	Level				First difference			
	LLC test		IPS test		LLC test		IPS test	
	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.
SP	0.585	0.720	0.737	0.769	-23.688***	0.000	-19.089***	0.000
IIP	4.588	1.000	2.299	0.989	-3.513***	0.000	-2.604***	0.004
INF	0.019	0.508	2.786	0.997	-9.414***	0.000	-11.750***	0.000
REER	0.018	0.507	-0.676	0.249	-24.153***	0.000	-17.871***	0.000
LR	2.512	0.994	0.946	0.828	-23.565***	0.000	-18.909***	0.000

Note: *** indicate the rejection of the null hypothesis of a unit root at the 1% significance levels.

4.2. The Johansen-Fisher panel long-run equilibrium relationship.

The non-stationarity series are used to examine the presence of the long run relationship between stock prices, inflation, industrial production, real exchange rates and interest rate. For this purpose, the study is applied Johansen-Fisher panel co-integration test. The results are reported in Table 3; the results reveal that both trace and maximum-eigen value statistics have rejects null hypothesis no long-run equilibrium relationship among variables. Also panel co-integration test exhibit trace and maximum-eigen value statistics identify two co-integration vectors. It implies that the all variables are co integrated and move together in the long run. In other words presence of long-run equilibrium exists among stock prices, inflation, industrial production, real exchange rates and interest rate in selected countries namely India and Brazil.

Table 3. *Johansen-Fisher panel cointegration test*

Hypothesized: No. of CE(s)	trace test	Prob.	max-eigen test	Prob.
None	46.23***	0.000	45.26***	0.000
At most 1	12.27	0.015	11.49	0.021
At most 2	4.202	0.379	3.682	0.450
At most 3	2.596	0.627	2.459	0.651
At most 4	2.724	0.605	2.724	0.605

Note: *** indicates the rejection of the null hypothesis of no cointegration at the 1% significance level.

4.3. The long-run elasticities of stock prices

Once cointegration is confirmed, long-run elasticities of stock prices, inflation, industrial production, exchange rates and interest rate are investigated by use of panel dynamic ordinary least squared (DOLS) method. The panel regression results are presented in Table 4. The result reveals that most of the key macroeconomic variables had a positive and significant impact on stock prices when the study conducts analysis those two countries as a group. This shows that industrial production, and exchange rate positivity affecting stock prices. However, inflation and interest rate has no significant impact on stock prices.

Table 4. *Panel data analysis of long-run stock prices elasticities*

Variable	Coefficient	t-statistics
Dependent variable: Stock Price		
IIP	1.179***	5.687
INF	0.446	2.530
REER	0.633***	3.511
LR	0.070	0.413
R-squared	0.442	

Note: *** indicate the significance level at the 1% level.

4.4. The direction of causality

The heterogeneous panel causality test is used to investigate the short-run relationship between stock prices, inflation, industrial production, real exchange rates and interest rate. Table 5 provides result of panel causality test. Its shows unidirectional causality from stock returns to inflation, industrial production, interest rate and real exchange rates. On the other hand, reverse causality is not found from those variables to stock returns. The existence of short-run relationship among those variables in selected countries namely India and Brazil.

Table 5. *Heterogeneous panel causality test*

Null Hypothesis:	Zbar-Stat.	Prob.
INF does not homogeneously cause SP	0.705	0.480
SP does not homogeneously cause INF	3.432	0.000***
IIP does not homogeneously cause SP	0.227	0.820
SP does not homogeneously cause IIP	8.916	0.000***
LR does not homogeneously cause SP	0.079	0.936
SP does not homogeneously cause LR	3.486	0.000***
REER does not homogeneously cause SP	-0.438	0.661
SP does not homogeneously cause REER	14.402	0.000***

Note: *** indicate the significance levels at the 1%.

5. Concluding remarks

The relationship between stock prices and macroeconomic variables has received high attention from regulators, investors, and academicians because it has wide implications for hedging and speculation. This study empirically investigates the relationship between key macroeconomic variables and stock prices of selected countries namely India and Brazil. We used Monthly data on stock prices, inflation, industrial production, real exchange rates are taken from January 2000 to August 2016. Both short and long-run equilibrium relationship is examined by panel Granger causality test and Johansen-Fisher panel co-integration test. The empirical results suggest that presence of long-run equilibrium among the stock prices, inflation, industrial production, real exchange rates and interest rate of selected countries namely India and Brazil. The result from dynamic ordinary least squared (DOLS) method reveals that most of key macroeconomic such as stocks prices and the exchange rate is positive and statistically significant. This result is emphasize with the result of Mohapatra and Badri (2015). Industrial production positive effect on stocks prices, this empirical result is consistent with the result of Mohapatra and Badri (2015). Other variables had positively impacts on stock prices but statistically insignificant. Moreover, empirical result from panel Granger causality test shows that the existence of unidirectional causality from stock returns to interest rate, this result is consistent with the result of Mohamed et al. (2011). Stock returns to exchange rates; those empirical results is consistent with the results of Abdalla and Murinde (1997), Mohamed et al. (2011), Tripathi and Kumar (2015). Stock returns to industrial production, those empirical result is emphasize with the result of Fama (1981), Tripathi and Kumar (2015). Stock returns to interest rate, this empirical result is underline with the result of Fama (1981). Finally, those variables are follows unidirectional causality stock returns to inflation, industrial production, interest rate and real exchange rates.

Given these findings, we argue that the interaction between index of industrial production, inflation, exchange rate, and interest rate have a significant role in stock prices. Hence, GDP economic growth (index of industrial production (IIP)) positively impact on stock returns, because of stock returns as any increase favorable affects on demand. Increasing inflation rate negatively impact on stocks returns, because of inflation rate as increases input cost. Increasing interest rate many ways to attract the investors to invest in stocks markets, it will give a required rate of returns. Both interest rate and inflation rate are causes raise in financial costs. Moreover, a depreciation (Increasing) in the exchange rate can be favorable for an economy. Thus, the exchange rate can positively impact on stock returns.

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