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DO STOCK PRICES RESPOND TO GDP GROWTH IN INDIA?

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ABSTRACT:

The article tries to examine the effect of GDP growth on the stock prices in India using annual data from 1990-91 to 2010-11. A bivariate regression model is designed to examine the effects of GDP growth on the stock prices and granger causality test is conducted to examine whether there exist any causal linkage between stock prices and GDP growth. Granger causality test confirms that there is unidirectional causality between stock price and gross domestic product running from GDP growth to stock price in India. The regression results of the study indicate that gross domestic product positively influence stock prices in India.

Key words: Granger Causality, Regression Model, Gross domestic product, Stock Prices, India.

INTRODUCTION

There exists controversy of whether stock market is associated with economic growth or the stock market can be served as the economic indicator to predict future. Stock markets play a very vital function in the financial sector of each and every economy. An efficient capital market persuades economic growth and prosperity by stabilizing the financial sector and providing a significant investment avenue that contributes to attract domestic and foreign capital. In an efficient capital market, stock prices adjust swiftly according to the new information available. As a result, the stock prices reflect all information about the stocks. The stock prices reflect expectations of the future performances of corporate houses. As a result, if stock prices reflect these assumptions in reality, then it should be used as a major indicator for the economic activities.

On the other hand, GDP growth rate is considered as a leading indicator of macroeconomic performance. It also has a major impact on the unemployment rates, consumer price index (CPI) and other measures of an economy's condition. As a result, people relate many things in the market to GDP, and intuitively believe that a market with a higher GDP growth rate will give a higher stock market price vis-à-vis stock market return . It seems logical that when an economy is growing, companies within it are more likely to have higher profits as well as higher stock prices, then the stock market should be bullish in those times. In the long-run, countries with a higher GDP growth rate may have lower annualized stock market returns and lower stock prices than countries with lower GDP growth rate. Consequently, for clarifying the relationship between GDP growth rate and stock market, and help people focus on the right factors when making investment decisions, and create real value for investors, this subject matter is worth studying and may create real value for investors.

Changes in information about the future course of real GDP may cause prices to change in the stock market. The rationalization for the linkage between the stock market and real GDP growth is that changes in stock prices will reduce firms' asset positions and affect the cost

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of their borrowing. When it costs more for firms to borrow money, they borrow and invest less, and when firms invest less, real GDP growth slows. According to this view—referred to by some as *balance-sheet effects* and others as the *credit channel*—stock prices will change because of changes in real economic conditions or some other factor, but the credit channel may impact the severity and length of recessions.

The aim of the study is to examine the effect of Gross domestic product (GDP) growth on stock prices as well as causal relationship between GDP growth and stock prices in India.

The remainder of the paper is organized as follows: section 2 explains the data and methodology; Section 3 analyses the empirical results; the conclusion is presented in section 4.

METHODOLOGY AND DATA:

The empirical investigation is carried out using annual data ranging from 1990-91 to 2010-11 which covers 21 annual observations. The empirical investigation considers BSE (Sensex) share price indices as proxy for Indian stock prices. We have taken one macro economic variable –gross domestic product into our study to observe its effect on stock prices. All data have been collected from Handbook of Statistics on Indian Economy,2011-12 .

A bivariate regression model is designed to test the effects of macroeconomic variables on the stock prices as follows:

$$SP_t = \alpha + \beta GDP_t + \mu_t \text{-------------------------(1)}$$

2.1. Unit root test:

When dealing with time series data, a number of econometric issues can influence the estimation of parameters using OLS. Regressing a time series variable on another time series variable using the Ordinary Least Squares (OLS) estimation can obtain a very high R^2, although there is no meaningful relationship between the variables. This situation reflects the problem of spurious regression between totally unrelated variables generated by a non-stationary process. Therefore, prior to testing and implementing the Granger Causality test, econometric methodology needs to examine the stationarity; for each individual time series, most macro economic data are non stationary, i.e. they tend to exhibit a deterministic and/or stochastic trend. Therefore, it is recommended that a stationarity (unit root) test be carried out to test for the order of integration. A series is said to be stationary if the mean and variance are time-invariant. A non-stationary time series will have a time dependent mean or make sure that the variables are stationary, because if they are not, the standard assumptions for asymptotic analysis in the Granger test will not be valid. Therefore, a stochastic process that is said to be stationary simply implies that the mean [(E(Y_t)] and the variance [Var (Y_t)] of Y remain constant over time for all t, and the covariance [covar (Y_t, Ys)] and hence the correlation between any two values of Y taken from different time periods depends on the difference apart in time between the two values for all t≠s. Since standard regression analysis requires that data series be stationary, it is obviously important that we first test for this requirement to determine whether the series used in the regression process is a difference stationary or a trend stationary.

We also use a formal test of stationarity, that is, the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test. To test the stationary of variables, we use the Augmented Dickey Fuller (ADF) test which is mostly used to test for unit root. Following equation checks the stationarity of time series data used in the study:

$$\Delta y_t = \beta_1 + \beta_1 t + \alpha y_{t-1} + \gamma \sum_{t=1}^{n} \Delta y_{t-1} + \varepsilon_t \text{------(2)}$$

Where ε_t is white nose error term in the model of unit root test, with a null hypothesis that variable has unit root. The ADF regression test for the existence of unit root of y_t that represents all variables at time t. The test for a unit root is conducted on the coefficient of y_{t-1} in the regression. If the coefficient is significantly different from zero (less than zero) then the hypothesis that y contains a unit root is rejected. The null and alternative hypothesis for the existence of unit root in variable y_t is H_0; $\alpha = 0$ versus H_1: $\alpha < 0$. Rejection of the null hypothesis denotes stationarity in the series.

If the ADF test-statistic (t-statistic) is less (in the absolute value) than the Mackinnon critical t-values, the null hypothesis of a unit root can not be rejected for the time series and hence, one can conclude that the series is non-stationary at their levels. The unit root test tests for the existence of a unit root in two cases: with intercept only and with intercept and trend to take into the account the impact of the trend on the series.

The PP tests are non-parametric unit root tests that are modified so that serial correlation does not affect their asymptotic distribution. PP tests reveal that all variables are integrated of order one with and without linear trends, and with or without intercept terms. Phillips–Perron test (named after Peter C. B. Phillips and Pierre Perron) is a unit root test. That is, it is used in time series_analysis to test the null hypothesis that a time series is integrated of order 1. It builds on the Dickey–Fuller test of the null hypothesis δ = 0 in Δ $y_t = \delta y_{t-1} + u_t$, here Δ is the first difference operator. Like the augmented Dickey–Fuller test, the Phillips–Perron test addresses the issue that the process generating data for y_t might have a higher order of autocorrelation than is admitted in the test equation - making y_{t-1} endogenous and thus invalidating the Dickey–Fuller t-test. Whilst the augmented Dickey–Fuller test addresses this issue by introducing lags of Δ y_t as regressors in the test equation, the Phillips–Perron test makes a non-parametric correction to the t-test statistic. The test is robust with respect to unspecified autocorrelation and heteroscedasticity in the disturbance process of the test equation.

Table:1: Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Obs.
SP	6471.571	3977.00	18605.00	1050.00	5272.65	1.192805	2.962116	4.980999	0.082869	21
GDP	2312386	1864300	4877842	1083572	1211777	0.882719	2.377670	3.066057	0.215881	21

Source: Author's own estimate

The KPPS (1992) Test is based on the residuals (ε_t) from an ordinary least square regression of the variable of interest on the exogenous variable(s) as follows:

$$Y_t = X'_t \beta + \varepsilon_t \qquad (3)$$

where Y_t is the variable of interest (real exchange rate) and X_t is a vector of exogenous variable(s). The Lagrange Multiplier (LM) statistic used in the test as follows:

$$LM = T^{-2} \sum_{i=1}^{T} S(t)^2 / f_0 \qquad (4)$$

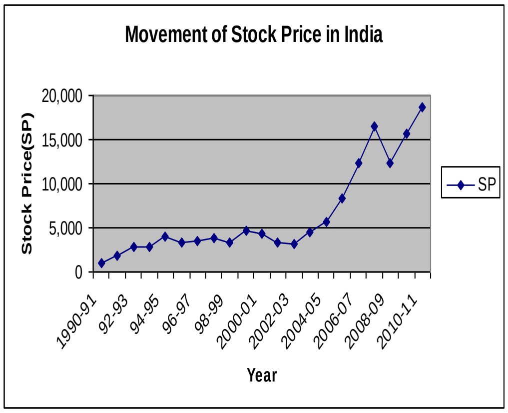

Figure-1
Source: Own pictorial presentation from tabulated data.

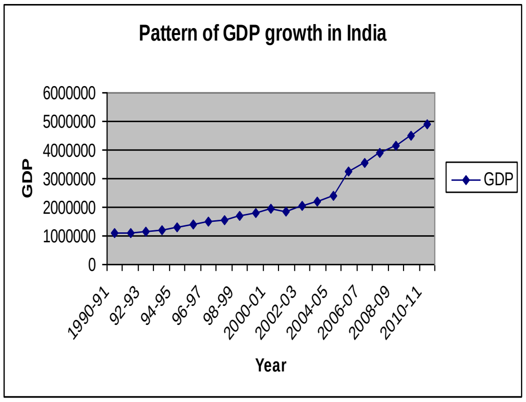

Figure-2
Source: Own pictorial presentation from tabulated data.

where T is the sample size, S(t) is the partial sum of residuals which is calculated as $S(t)=\sum_{i=1}^{t} S_r$. Here ε_t is the estimated residual from (3.1). f_0 is an estimator of the residual spectrum at frequency zero. This statistic has to be compared with KPSS et al. (1992) critical values.

forecasting models. Historically, Granger (1969) and Sim (1972) were the ones who formalized the application of causality in economics. Granger causality test is a technique for determining whether one time series is significant in forecasting another (Granger, 1969). The standard Granger causality test (Granger, 1988) seeks to determine whether past values of a variable helps to predict

Table:2 : Regression results

Dependent Variable: SP
Method: Least Squares
Sample: 1990-91 to 2010-11
Included observations: 21

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-5106.963	9821.906	-0.519956	0.6191
GDP	0.005840	0.003469	1.683258	0.1462

R-squared	0.982818	Mean dependent var	6471.571
Adjusted R-squared	0.950907	S.D. dependent var	5272.653
S.E. of regression	1168.253	Akaike info criterion	17.19913
Sum squared resid	9553704.	Schwarz criterion	17.89548
Log likelihood	-166.5908	F-statistic	30.79954
Durbin-Watson stat	1.936619	Prob(F-statistic)	0.000067

Source: Author's own estimate

Table:3: Unit Root Test: The Results of the Augmented Dickey Fuller (ADF) Test for Level &First differences with an Intercept and Linear Trend

GDP and Stock Prices	**ADF Test**											
	Levels						**First Differences**					
	Intercept			**Intercept&Trend**			**Intercept**			**Intercept&Trend**		
	Lag0	**Lag1**	**Lag2**	**Lag0**	**Lag1**	**Lag2**	**Lag0**	**Lag1**	**Lag2**	**Lag0**	**Lag1**	**Lag2**
GDP	2.79	1.96	1.34	-0.394	-0.406	-0.574	-2.92	-1.66	-1.23	-4.22	-2.70	-2.19
SP	0.643	0.801	1.06	-0.919	-0.761	-0.591	-4.21	-2.89	-1.69	-4.64	-3.56	-2.34
Critical Values												
1%	-3.8067			-4.5000			-3.8304			-4.5348		
5%	-3.0199			-3.6591			-3.0294			-3.6746		
10%	-2.6502			-3.2677			-2.6552			-3.2762		

Source: Author's own estimate

2.2. Granger causality test:

Causality is a kind of statistical feedback concept which is widely used in the building of

changes in another variable. The definition states that in the conditional distribution, lagged values of Y_t add no information to explanation of movements of X_t beyond that provided by lagged values of X_t itself (Green, 2003). We should take note of the fact that the Granger causality technique measures the information given by one variable in explaining the latest value of another variable. In addition, it also says that variable Y is Granger caused by variable X if variable X assists in predicting the value of variable Y. If this is the case, it means that the lagged values of variable X are statistically significant in explaining variable Y. The null hypothesis (H_0) that we test in this case is that the X variable does not Granger cause variable Y and variable Y does not Granger cause variable X. In summary, one variable (X_t) is said to granger cause another variable (Y_t) if the lagged values of X_t can predict Y_t and vice-versa.

ANALYSIS OF RESULT:

Table 1 presents descriptive statistics for the variables used in our estimate. Summary statistics in table 1 include the mean and the standard deviation, minimum and maximum value for the period 1990-91 to2010-11.The mean, median, maximum, minimum and standard deviation can determine the statistical behaviour of the variables. The relatively higher figure of standard deviation indicates that the data dispersion in the series is quite large. This finding suggests that almost all the years

Table:4 : Unit Root Test: The Results of the Phillips-Perron (PP) Test for Level &First differences with an Intercept and Linear Trend

PP Test												
Macro economic variables and Stock Prices	**Levels**						**First Differences**					
	Intercept			**Intercept&Trend**			**Intercept**			**Intercept&Trend**		
	Lag0	**Lag1**	**Lag2**	**Lag0**	**Lag1**	**Lag2**	**Lag0**	**Lag1**	**Lag2**	**Lag0**	**Lag1**	**Lag2**
GDP	2.79	2.84	2.83	-0.394	-0.376	-0.387	-2.92	-2.85	-2.91	-4.22	-4.22	-4.22
SP	0.643	0.812	1.047	-0.919	-0.854	-0.726	-4.20	-4.21	-4.19	-4.64	-4.65	-4.72
Critical Values												
1%	-3.8067			-4.5000			-3.8304			-4.5348		
5%	-3.0199			-3.6591			-3.0294			-3.6746		
2 10%	-2.6502			-3.2677			-2.6552			-3.2762		

Source: Author's own estimate

Table:5: Unit root test through Kwiatkowski, Phillips, Schmidt and Shinn(KPSS) test

KPSS- Exchange rate												
Exchange rate	**KPSS level**						**KPSS First Difference**					
	Without Trend			**With trend**			**Without Trend**			**With trend**		
	Lag 0	**Lag 1**	**Lag 2**	**Lag 0**	**Lag 1**	**Lag 2**	**Lag 0**	**Lag 1**	**Lag 2**	**Lag 0**	**Lag 1**	**Lag 2**
GDP	1.8684	1.0171	0.7278	0.4785	0.2691	0.1985	0.8620	0.6600	0.5325	0.0718	0.0758	0.0764***
SP	1.5618	0.8863	0.6498	0.4002	0.2385	0.1816	0.2836	0.2987	0.3277	0.0642	0.0756	0.0948***

Source: Author's own estimate

Table:6 :Granger Causality test

Pairwise Granger Causality Tests Lags: 2				
	Obs.	**F-Statistic**	**Probability**	
SP does not Granger Cause GDP	19	1.00680	0.39037	Accept
GDP does not Granger Cause SP		6.37625	0.01075 *	Reject

Source: Author's own estimate

included in the sample were having larger dispersion level of dependent and independent variable under our study across time series.

Asterisk (*) denotes that the null of normality was rejected at 10% significance level.

All the variables are asymmetrical. More specifically, skewness is positive for the series, indicating the flat tails on the right-hand side of the distribution comparably with the left-hand side. Kurtosis value of all variables also shows data is not normally distributed because values of kurtosis are deviated from 3. Two variables under our consideration show playtikurtic distribution (kurtosis<3).

The Jarque-Bera test, a type of Lagrange multiplier test, was developed to test normality of regression residuals. The Jarque-Bera statistic is computed from skewness and kurtosis and asymptotically follows the chi-squared distribution with two degrees of freedom. While testing for normality, it was found that Jarque-Bera statistics where p values for variable like SP, is lower than 0.10 which implies that variable-stock price(SP) under our consideration is normally distributed but GDP values are not normally distributed about its mean and variance .Figure-1 and 2 show upward trend of stock price and GDP growth over our study period. Stock market shows declining trend since 2007-08 to 2009-10 perhaps due to worldwide recession as a result sub-prime lending crisis in USA.

Explanatory power of the models as indicated by R^2 (multiple coefficient of determination) and adjusted R^2 is fairly good. The model explains around 95% of the variation in the dependent variable. The Durbin-Watson statistic ranges in value from 0 to 4. A value near 2 indicates non-autocorrelation; Values approaching 0 indicate positive autocorrelation and values toward 4 indicate negative autocorrelation. The Durbin-Watson statistic (D-W Statistic) being less than 2 (1.936619) suggests that there is no auto-correlation among residuals.

According to the test results, gross domestic product (GDP) has positive effect on stock prices 10% significant level. The effect of GDP growth on stock prices is statistically significant with the appropriate sign. This means that economic growth via GDP growth augments liquidity flow in the economy eligible for making demand of stock which allow stock price to rise.

ADF tests specify the existence of a unit root to be the null hypothesis.

Ho: series has unit root; H_1: series is trend stationary

PP tests specify the existence of a unit root to be the null hypothesis.

Ho: series has unit root; H_1: series is trend stationary

Table 3&4 present the results of the unit root test. The results show that all the variables of our interest, namely, GDP, SP did not attain stationarity after first differencing, I(1), using both ADF and PP test. The augmented Dickey Fuller test and Phillips-Perron (P-P) test fail to provide result of stationary at first difference at all lag differences. The results indicate that the null hypothesis of a unit root can not be rejected for the given variable as none of the ADF value and PP value is not smaller than the critical t-value at 1%,5% and 10%level of significance for all variables and, hence, one can conclude that the variables are not stationary at their levels and first differences both in ADF and PP test. In contrast, the null hypothesis under the KPSS test states that there exist a stationary series.

Ho: series is trend stationary; H_1: series is non stationary.

Note:

1) 1%, 5% and 10% critical values for KPSS are 0.739, 0.463 and 0.347 for *without trend.*

2) 1%, 5% and 10% critical values for KPSS *with trend* are 0.216, 0.146 and 0.1199.

3) *, **, *** denotes acceptance of the null hypothesis of trend stationarity at the 1%, 5%, and 10% significance levels, respectively.

4) The null hypothesis of stationarity is accepted if the value of the KPSS test statistics is less than it is critical value.

5) † the null of level stationarity is tested.

To avoid the low power in the standard unit root tests, the newly developed KPSS test is applied to test the null of stationary real exchange against the alternative of non-stationarity. The results of applying the KPSS test on these variables show strong evidence of stationarity since the null of stationarity is accepted at the 1, 5 and 10 percent significance level. An inspection of the figures reveals in table-5 that each series is first difference stationary at all 1%,5% and 10% level using the KPSS test. However, the ADF and PP test result are not as impressive, as all the variables did not pass the differenced stationarity test at the one, five and ten percent levels. We, therefore, rely on the KPSS test result as a basis for a cointegration test among all stationary series of the same order meaning that the two series are stationary at their first differences [they are integrated of the order one i.e I(1)].

Observations after lag.

*(**) Indicates significant causal relationship at 5 (10) significance level.

The results of pairwise granger causality between stock price (SP) and one macro economic variable –gross domestic product (GDP) are contained in Table 6. There exist unidirectional causality between stock price(SP) and gross domestic product(GDP).We reject null hypothesis- 'GDP does not Granger Cause SP' which indicates that granger causality exists between gross domestic product and stock prices which is unidirectional running from GDP growth to stock prices. It indicates that GDP growth causes stock prices to move in upward direction but not vice versa.

CONCLUSION:

The key objective of the present study is to explore the impact of GDP growth on the stock prices in India using annual data from 1990-91 to 2010-11. The results shows that series of variables used are not stationary at levels but at first difference.

Our estimates of bivariate Granger causality indicate that there is unidirectional causality between stock price (SP) and gross domestic product (GDP) running from GDP growth to stock price. It is an indication that economic growth via GDP growth influences stock prices favourably. The regression result of the study also confirms that gross domestic product positively influences stock prices in India.

Based on the result of uni-directional causality, we can sum up:

- From the above analysis, we can infer that economic growth through GDP growth can predict the future stock prices in India.
- Investors can make their portfolio for future viewing GDP growth pattern.
- Future economy can be formed by simply looking at the value of GDP growth as GDP growth can predict stock price.

Potential researchers can investigate the effect of macroeconomic variables on stock prices using alternative methodologies and daily or weekly data .They can use the longer time horizon, larger sample sizes with greater numbers of sectors using other macroeconomic and non-macroeconomic variables.

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