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An empirical investigation into causal relationship between gross fixed capital formation and stock price in India

Sarbapriya Ray

Shyampur Siddheswari Mahavidyalaya, Dept. of Commerce, University of Calcutta, India

Email address

sarbapriyaray@yahoo.com

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Abstract

The causal connection among different macroeconomic variables and stock prices are crucial in the formulation of a country's macroeconomic policy and has long been a debatable issue. This article examines the effect of gross fixed capita formation (GFCF) on stock prices (SP) as well as causal connection between gross fixed capital formation and stock prices. The cointegration test confirmed that gross fixed capital formation and stock prices are cointegrated indicating an existence of long run equilibrium relationship between the two as confirmed by the Johansen cointegration test results. The Granger causality test finally confirmed the presence of uni-directional causality which runs from stock price to gross fixed capital formation but not vice-versa.

Keywords

Stock Price, India, Gross Fixed Capital Formation, causality, Cointegration

1. Introduction

The causal connection among macroeconomic variables like foreign direct investment, inflation, money supply, GDP growth, oil price and gross fixed capital formation etc. and stock prices are crucial in the formulation of a country's macroeconomic policy. The Securities and Exchange Board of India (SEBI) as an authorized body regulates and monitors the operations of stock exchanges, banks and other financial institutions. On the other hand, the growth of a country is directly interrelated to the economic state of affairs of the said country which consists of various variables like GDP, Foreign Direct Investment. Inflation, Interest rate, Money supply, Exchange rate and many others which are considered to be the spine of any economy. The movements in the stock prices are affected by changes in those fundamentals of the economy and the expectations about future prospects of these fundamentals. Over a last couple of decades, the interaction of share price and the macroeconomic variables has been a subject of interest among academicians and practitioners. The performance of Indian stock market is predisposed by a

sequence of above mentioned macroeconomic indicators which is assessed to determine the Indian stock market efficiency with a view to bestow new approach to the foreign investors as well as policy makers, traders, domestic investors and academic researchers.

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perception formation is а Capital used in macroeconomics, national accounts and financial economics and seldom used in corporate accounts. Generally, gross fixed capital formation is defined as fixed assets accumulation. It is a definite statistical concept used national accounts statistics, econometrics and in macroeconomics. In that sense, it refers to a measure of the net additions to the (physical) capital stock of a country (or an economic sector) in an accounting interval, or, a measure of the amount by which the total physical capital stock increased during an accounting period. In a much broader sense, the term "capital formation" has recently been used in financial economics to refer to savings drives, setting up financial institutions, fiscal measures, public borrowing, development of capital markets, privatization of financial institutions, and development of secondary markets. In this usage, it refers to any method for increasing the amount of capital owned or under one's control or any method in utilizing or mobilizing capital resources for investment purposes. Gross fixed capital formation via fixed assets accumulation can be increased by bonds financing and equity financing. Corporate houses finance their assets by floating their shares in stock market. As a result, supply of shares increase which cause to decline share prices. Economic theory suggests that increase in Gross fixed capital formation cause to decline share prices in short run but in long run production is increased which cause to raise share prices.

In view of the above discussion, the objective of the study is to investigate the effect of gross fixed capita formation (GFCF) on stock prices (SP) as well as causal connection between gross fixed capital formation and stock prices.

2. 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 data used in this research is secondary data. The empirical investigation considers NSE (Nifty) share price indices as proxy for Indian stock prices. One macro economic variable - gross fixed capital formation (GFCF) has been construed as capital stock formation .All data have been collected from Handbook of Statistics on Indian Economy, 2011-12.

2.1. Research Question

The research question is: Is there a relationship between stock prices and gross fixed capital stock in perspective of India?

2.2. Research Hypothesis

The paper is based on the following hypotheses for testing the causality and co-integration between SP and GFCF in India

 H_0 : There is no causality between stock price (SP) and gross fixed capital stock(GFCF) in India.

 H_1 : There is bi-directional causality between stock price(SP) and gross fixed capital stock(GFCF).

 H_2 : There is unidirectional causality between stock price(SP) and gross fixed capital stock(GFCF).

 H_3 : there exists a long run relationship between stock price(SP) and gross fixed capital stock(GFCF).

A bivariate regression model is designed to test the effects of macroeconomic variable like gross fixed capital formation on the stock prices in Indian context.

$$SP_t = \beta + GFCF_t + \mu_t$$
 (1)

$$\beta$$
 and $\mu > 0$

 μ_t is the error term assumed to be normally, identically

and independently distributed. where, SPt and GFCFt show the stock prices and gross fixed capital formation in India at a particular time respectively while μ_t represents the "noise" or error term; β represents the intercept and represent the slope and coefficient of regression. The coefficient of regression, indicates how a unit change in the independent variable (gross fixed capital formation) affects the dependent variable (stock prices). The error, μ_t , is incorporated in the equation to cater for other factors that may influence SP. The validity or strength of the Ordinary Least Squares method depends on the accuracy of assumptions. In this study, the Gauss-Markov assumptions are used and they include that the dependent and independent variables (SP and GFCF) are linearly corelated, the estimators (β and μ) are unbiased with an expected value of zero i.e., E $(\mu_t) = 0$, which implies that on average the errors cancel out each other. The procedure involves specifying the dependent and independent variables; in this case, SP is the dependent variable while GFCF the independent variable.

But it depends on the assumptions that the results of the methods can be adversely affected by outliers. In addition, whereas the Ordinary Least squares regression analysis can establish the dependence of either SP on GFCF or vice versa; this does not necessarily imply direction of causation. Stuart Kendal noted that "a statistical relationship, however, strong and however suggestive, can never establish causal connection." Thus, in this study, another method, the Granger causality test, is used to further test for the direction of causality.

2.3. 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 $t\neq$ 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:

$$\Delta y_{t} = \beta_{1} + \beta_{1} t + \alpha y_{t-1} + \gamma \sum_{t=1}^{H} \Delta y_{t-1} + \varepsilon_{t}.$$
(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 H₀; $\alpha = 0$ versus H₁: $\alpha < 0$. 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 $\delta = 0$ in $\Delta y_t = \delta y_{t-1} + u_t$ 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 v_t might have a higher order of autocorrelation than is admitted in the test equation making yt-1 endogenous and thus invalidating the Dickey-Fuller t-test. Whilst the augmented Dickey-Fuller test addresses this issue by introducing lags of Δy_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.

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:

$$Y_t = X_t \beta + \varepsilon \tag{3}$$

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

$$LM = T^{-2} \sum_{i=1}^{T} S(t)^{2} / f_{0}$$
(4)

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.

2.4. Cointegration Test (Johansen Approach)

Cointegration, an econometric property of time series variable, is a precondition for the existence of a long run or equilibrium economic relationship between two or more variables having unit roots (i.e. Integrated of order one). The Johansen approach can determine the number of co-integrated vectors for any given number of non-stationary variables of the same order. Two or more random variables are said to be cointegrated if each of the series are themselves non – stationary. This test may be regarded as a long run equilibrium relationship among the variables. The purpose of the Cointegration tests is to determine whether a group of non – stationary series is cointegrated or not.

Having concluded from the ADF results that each time series is non-stationary, i.e it is integrated of order one I(1), we proceed to the second step, which requires that the two time series be co-integrated. In other words, we have to examine whether or not there exists a long run relationship between variables (stable and non-spurious co-integrated relationship). In our case, the mission is to determine whether or not gross fixed capita formation (GFCF) and stock prices (SP) variables have a long-run relationship in a bivariate framework. Engle and Granger (1987) introduced the concept of cointegration, where economic variables might reach a long-run equilibrium that reflects a stable relationship among them. For the variables to be cointegrated, they must be integrated of order one (nonstationary) and the linear combination of them is stationary I(0).

The crucial approach which is used in this study to test r cointegration is called the Johansen cointegration approach. The Johansen approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order.

2.5. Granger Causality Test

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

Granger causality test is a technique for determining whether one time series is significant in forecasting another (Granger. 1969). Gross fixed capita formation (GFCF) and stock prices (SP) are, in fact, interlinked and co-related through various channel. There is no theoretical or empirical evidence that could conclusively indicate sequencing from either direction. For this reason, the Granger Causality test was carried out on GFCF and SP.

The spirit of Engle and Granger (1987) lies in the idea that if the two variables are integrated as order one, I(1), and both residuals are I(0), this indicates that the two variables are cointegrated. The Granger theorem states that if this is the case, the two variables could be generated by a dynamic relationship from SP to GFCF and, vise versa.

Therefore, a time series X is said to Granger-cause Y if it can be shown through a series of F-tests on lagged values of X (and with lagged values of Y also known) that those X values predict statistically significant information about future values of Y. In the context of this analysis, the Granger method involves the estimation of the following equations:

If causality (or causation) runs from GFCF to SP, we have:

$$dSP_{it} = \eta_i + \Sigma \alpha_{11} dSP_i, \quad _{t-1} + \Sigma \beta_{11} dGFCF_i, \quad _{t-1} + \epsilon_{1t} \quad (5)$$

If causality (or causation) runs from SP to GFCF, it takes the form:

$$dGFCF_{it} = \eta_i + \Sigma \alpha_{12} d GFCF_i,$$

$$_{t-1} + \Sigma \beta_{12} dSP_{i,t-1} + \lambda ECM_{i,t} + \varepsilon_{2t}$$
(6)

where, SP $_t$ and GFCF $_t$ represent stock prices and gross fixed capital formation respectively, ε_{it} is uncorrelated stationary random process, and subscript t denotes the time period. Therefore, it is assumed that the disturbance terms ε $_{1t}$ and ε_{2t} are uncorrelated. In equation 5, failing to reject: H₀: $\alpha_{11} = \beta_{11} = 0$ implies that gross fixed capital formation does not Granger cause stock prices. On the other hand, in equation 6, failing to reject H₀: $\alpha_{12} = \beta_{12} = 0$ implies that stock price does not Granger cause gross fixed capital formation.

The decision rule: From equation (5), d GFCF _{it-1}Granger causes dSP_{i t} if the coefficient of the lagged values of GFCF as a group (β_{11}) is significantly different from zero based on F-test (i.e., statistically significant). Similarly, from equation (6), dSP_{i,t-1} Granger causes d GFCF _{i t} if β_{12} is statistically significant.

3. 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 included in the sample were having larger dispersion level of different independent variables under our study across time series.

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	2.96211	4.980999	0.082869	21
GFCF	95915.0	69120.00	274563.0	24293.00	75433.31	1.270778	3.312984	5.737783	0.056762	21

Asterisk (*) denotes that the null of normality was rejected at 10% significance level. Source: Author's own estimate

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. On the whole, the distribution shows positive skewness which indicates flatter tails than the normal distribution. Kurtosis value of all variables also shows data is not normally distributed because values of kurtosis are deviated from 3. The gross fixed capital formation variable undertaken into the study show playticurtic distribution (kurtosis>3) but stock price 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 variables like SP and GFCF are lower than 0.10 which implies that variables under our consideration are normally distributed.



Figure-1: Trend in Movement of Stock Price in India

Figure-1 and 2 show upward trend of stock price and gross fixed capital formation 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.



Figure-2: Trend in Gross Fixed Capital Formation in India

In the two diagrams-fig: 1 and fig: 2, we found a favourable effect of gross fixed capital formation on stock price diagrammatically which supports our assumption. Gross fixed capital formation depicts gradual upward trends throughout our study period, 1990-91 to 2010-11 and upward trend became steeper after 2005-06, simultaneously; stock price reflects, more or less, gradual upward movements and trend became steeper especially after 2005-06.

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.						
С	-5106.963	9821.906	-0.519956	0.6191						
GFCF	0.008713	0.029362	0.296738	0.7753						
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.

ADF Test														
Macro	Levels							First Differences						
economic	Intercept			Intercept&Trend			Intercept			Intercept	Intercept&Trend			
Stock Prices	Lag0	Lagl	Lag2	Lag0	Lag1	Lag2	Lag0	Lagl	Lag2	Lag0	Lagl	Lag2		
GFCF	1.89	1.10	0.413	0.068	-0.261	-0.745	-2.92	-1.68	-1.28	-3.64	-2.29	-1.66		
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

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

Ho: series has unit root; H1: series is trend stationary

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. The Durbin-Watson statistic (D-W Statistic) being less than 2 (1.936619) suggests that there is no auto-correlation among residuals.

Simply, regression result suggests that gross fixed capital formation(GFCF) has insignificant positive effect on stock prices in India.

Table 3&4 present the results of the unit root test. The results show that all the variables of our interest, namely GFCF and 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.

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

					F	PP Test							
Macro	Levels							First Differences					
economic	Intercept			Intercept&Trend			Intercept			Intercept&Trend		end	
Stock Prices	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lag1	Lag2	Lag0	Lagl	Lag2	
GFCF	1.89	1.77	1.65	0.068	-0.027	-0.13	-2.92	-2.87	-2.93	-3.64	-3.62	-3.65	
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			
10%	-2.6502				-3.2677		-2.6552			-3.2762			

Source: Author's own estimate

Ho: series has unit root; H₁: series is trend stationary

*MacKinnon critical values for rejection of hypothesis of a unit root.

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

Table 5. Unit root test through Kwiatkowski, Phillips, Schmidt and Shinn(KPSS) test.	
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KPSS- Exchange rate													
Exchange	KPSS level						KPSS First Difference						
rate	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	
GFCF	1.4785	0.8263	0.6076	0.4206	0.2348	0.1742	0.6436	0.4875	0.3915	0.1571	0.1425	0.1286**	
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

In contrast, the null hypothesis under the KPSS test states that there exist a stationary series.

Ho: series is trend stationary ; H1: 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 thwart 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 nonstationarity. 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.

What we have found in table-5 is that that each series is first difference stationary at 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 co integration 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)].

After establishing the time series properties of the data, the test for presence of long-run relationship between the variables using the Johansen and Juselius(1992) LR statistic for cointegration was conducted. The crucial approach which is used in this study to test cointegration is called the Johansen cointegration approach. The Johansen approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order. The results reported in table 6 suggest that the null hypothesis of no cointegrating vectors can be rejected at the 5% level of significance. It can be observed from the Likelihood Ratio (L.R.) that we have one co-integration equations. In other words, there exist a single linear combinations of the variables.

Table 6. Johansen Cointegration Tests.

Hypothesized N0. Of CE (s)	Eigen value	Likelihood Ratio	5% critical value	1% critical value	
None *	0.588037	18.46323	15.41	20.04	
At most 1	0.081421	1.613626	3.76	6.65	

Ho: has no co-integration; H1: has co-integration

*(**) denotes rejection of the hypothesis at 5%(1%) significance level L.R. test indicates 1 cointegrating equation(s) at 5% significance level Test assumption: Linear deterministic trend in the data

The normalized cointegrating equation is

$$SP = -16.597 GFCF (-12.7947)$$
(7)

Log likelihood= -374.6709

The Normalized cointegration equation reveals that there is a negative relationship between gross fixed capital formation (GFCF) and stock price(SP).

An examination of the result in the normalized cointegrating equation (7) shows that gross fixed capital formation in India contributes positively to stock prices in the long-run. Interestingly, this result is impressive because 16% change in gross fixed capital formation leads to about one percent change in stock price in the opposite direction, over the long-run horizon. This of course is highly significant judging from the t-statistic.

Table 7. Granger Causality test.

Pairwise Granger Causality Tests											
Lags: 2											
	Obs.	F-Statistic	Probability								
SP does not Granger Cause GFCF	19#	5.79019	0.01471*	Reject							
GFCF does not Granger Cause SP		2.08820	0.16082	Accept							

Source: Author's own estimate.

Observations. after lag.

*(**) Indicates significant causal relationship at 5 (10) significance level. The null hypotheses of the Granger-Causality test are:

H0: $X \neq Y$ (X does not granger-cause Y).

H1: X ≠Y (X does Granger-cause Y).

The results of pair wise granger causality between stock price (SP) and gross fixed capital formation (GFCF) are contained in Table 7.We have found that for the Ho of "SP does not Granger Cause GFCF", we reject the Ho since the F-statistics are rather larger and most of the probability values are lesser than 0.1 at the lag length of 2 but for Ho of "GFCF does not Granger Cause SP", we cannot reject the Ho since the F-statistics are rather comparatively smaller and most of the probability values are more than 0.1 at the lag length of 2. Therefore, we accept Ho of "GFCF does not Granger Cause SP". Therefore, in a nut shell, we conclude that SP Granger Causes GFCF but GFCF does not granger Causes SP.It means that causality flows from stock price to gross fixed capital formation but not vice versa.

The results showed in the table 7 point out that there may have significant unidirectional causal relationship between gross fixed capital formation and share price in India which flows from share price to gross fixed capital formation but not vice versa.

4. Conclusion

The paper investigates the short run as well as long run causal relationship between gross fixed capital formation and stock prices in India using annual data over the period 1990-91 to 2010-11. The unit root properties of the data were examined using the Augmented Dickey Fuller test (ADF), Phillips-Perron (PP) Test and KPSS test after which the cointegration and causality tests were conducted. The major findings obtained from the above mentioned tests show the following:

- The unit root test clarified that each series- gross fixed capital formation and stock prices- is first difference stationary at 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 stationary test at the one, five and ten percent levels. Therefore, the series of both variables of our consideration-GFCF and SP, namely, gross fixed capital formation and stock prices are found to be integrated of order one using the KPSS tests for unit root.
- The cointegration test confirmed that gross fixed capital formation and stock prices are cointegrated, indicating an existence of long run equilibrium relationship between the two as confirmed by the Johansen cointegration test results.
- The Granger causality test finally confirmed the presence of uni-directional causality which runs from stock price to gross fixed capital formation but not vice-versa.
- Regression result suggests that gross fixed capital formation has positive but insignificant effect on stock prices in India.

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