Research Article
Capital Formation and Inflation on Economic Growth in India: A Causality Analysis

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Abstract: Capital Formation is a prerequisite for economic growth of a country. This study aims at studying the relationship of Capital formation, Inflation (WPI) on economic development in India. The data for analysis on the above variables have been extracted for a period from 1950-51 to 2011-12 from the RBI data warehouse were analyzed using Unit Root, Co integration and Causality tests.

Keywords: Capital formation, causality test, cointegration test, Gross Domestic Product (GDP) unit root test, Inflation (WPI)

INTRODUCTION

Capital formation is based on capital accumulation capabilities and capital expansion which are key factors for economic development of a country. The rate of change in expansion of the economic situation of a country largely depends upon capital formation and the ability to cater to the requirements of funding development projects. The importance of capital generation in securing an accelerated rate of economic growth can hardly be overemphasized. The fundamental cause for the low national income and per capita income of the developing nations like India is the low rate of capital formation. This essentially shows a positive association between economic growth and capital formation and especially, the latter as a function of the former. It is debated that economic liberalization has pushed Indian economy in fast rate of prosperity and growth. Thus, it would be logical to study the long run co-movement between capital generation and economic development in India during the year 1950-51 to 2011-12 (covering the pre- and post-liberalization period). During initial years after independence, the GDCF as a percentage.

GDP at current prices in India was at its lowest at 9.3% in 1950-51. This is regarded as a curse of British rule to India. The most surprising achievement was that this lowest rate of gross domestic capital formation could be made about doubled to 17.0% in 1966-67 due to the successful implementation of the strategies of five-year plans. However, the first decline in gross domestic capital formation was observed in 1968-69 to the level 13.8%. The gross domestic capital formation crossed a level of 21% in the year 1978-79. An adverse performance period was again observed when gross domestic capital formation started deteriorating. It was 20.4% in 1979-80 which further decreased to 19% in 1980-81. It had again declined to 18.23% in 1983-84 followed by a temporary increase to 19.1% in 1985-86. And, from this year to 1990-91, the efficiency of gross domestic capital formation, although was on a positive trend, showed a very slow growth. The gross domestic capital formation reached 26.8% in 1990-91. In the year 1991 India witnessed the implementation of the much awaited economic reforms, well known as New Economic Policies, to improve the macro-economic scenario of the country, both from the domestic and global perspective. These reforms took nearly four years to pull gross domestic capital formation to its previous level of 25.8% in the year 1995-96. Thereafter, the growth rate of GDCF as percentage of GDP at current prices was neither steady nor firm until it reached 26.9 in the year 2003-04. Since then it showed a substantial increase and reached the level of 38% in 2007-08. But in 2008-09 the GDCF as a percentage of GDP declined to 34% which may be due to global recession. However the GDCF witnessed an increase to 36.8% in 2010-11 and a decline in 2011-12.

Though it is clear from Fig. 1 that the GDCF as a% of GDP is on the increasing trend, the short term and the long term dynamics with which they converge with each other is not very much apparent. Economists believe that the current rate of capital formation is still far below to reach economic growth rate of the country a double digit figure. Based on this background, the current study attempts to examine the long-run relationship between Capital formations, Inflation in terms WPI on economic growth in India during the year 1950-51 to 2011-12.

LITERATURE REVIEW

Capital accumulation has long been considered as a key factor to the economic growth. The literature on the
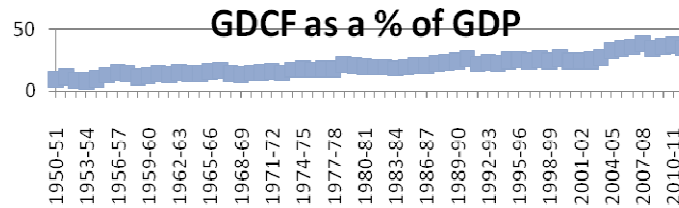
Fig. 1: Gross domestic capital formation as a percent of GDP at factor cost and at current prices (1950-51 to 2011-12) (www.rbi.org)

East Asian miracle in the 1990s (Young, 1995; Krugman, 1994; World Bank, 1993), as well as more recent studies on the Chinese economy (Ding and Knight, 2008a; Kuijs, 2005), all demonstrated that rapid capital formation played a major role in the output growth of these economies.

The study on Technical Progress, Capital Formation and Economic Growth, by Robert M Solow of Massachusetts Institute of Technology observed that capital formation is not the only the source for growth of productivity. In a study on formation of capital and economic development in western China by Zhao and Du (2009) investigated empirically that the regional disparities were considered to be very much connected to formation of capital like Foreign Direct Investment (FDI), private investment, equity financing, central-government investment, loans. The researcher concludes that central-government investment and local-fiscal capital expenditure have a predominant proactive impact on the economic development of various regions of China.

Adam (1776), Ricardo (1817), Harrod (1939), Kaldor (1963), Srinivasan (1964), Jorgenson and Griliches (1967), Marx and Engels (1975), Kendrik (1976) and Greenwood and Hercowitz (1991) and many other socio-economic reformists have reiterated the importance of formation of capital on economic prosperity and development through their historic contributions.

Jorgenson and Griliches (1967) and Lucas (1988), have made it clear that formulation of capital has interdependent relationship to the issues relating to the progress of technological up gradation, innovations and increase in productivity over time and hence, very significant for the economic growth and development of a country.

Maddison (1982), Klein (1983) and Uzawa (1996) explained the significance of capital formation in the global comparisons of environmental issues involved in economic growth.

Levine and Zervos (1998) empirically analyzed the nexus between formation of fixed capital and economic development in international growth regression factors and concluded that the growth of physical capital formation has influenced the pace of a country's economic development. However, the causality analysis

of investment on fixed assets and its impact on the selected countries economic development by Blomstrom *et al.* (1992) objected this conclusion. Their observation indicated the existence of single-sided cause and effect association between developments and investment of fixed nature, which does not impact the percentage of changes in formulation of capital on future growth rates.

Pahlavani *et al.* (2006) estimate the correlation between real capital formation, saving and output for Iran in the revolutionary years 1960 to 2003. Chang (2010) in a study on estimating nexus among the factors like external source of funding, Capital with in the country and Economic development using the entry error correction approach found three short-term relationships:

- Promoting growth may stimulate domestic capital accumulation
- Increasing FDI inflow may stimulate investment from domestic sources rather than crowd out the formation of capital
- FDI inflows directly influence growth through stimulating domestic investment

Michel T Maloney, Joseph Prizinger, Holley Ulbrich in an empirical assessment on capital formation in an inflationary environment concluded that reduction in inflation would provide a stimulus to the capital formation to maintain the needed rate of economic growth.

The review of above theoretical literature reveals the fact that generation of capital is an important element of the economic development of a country. But the existing empirical literature provides paradoxical evidence about the role of capital formation in influencing the economic growth of a nation. The findings of these researchers provide only a broad guidance to the researchers and decision makers for attending to the unresolved issues. The task of the policy maker has been made even more difficult while studying developing countries with individual and specific characteristics like that of India. Furthermore, the empirical literature is very thin in investigating the linkage between formation of capital and economic development of a developing nation like India.

Therefore, this research work aims at examining the long-run link between formation of capital and economic development in India for the period 1950- 51 to 2011-12.

Objectives of the study: Economic growth generally depends on the ability of a nation to accumulate capital and effect of inflation. The capital formation, comprising of Household savings, Enterprises savings i.e., Public sector and Private sector savings is an important indigenous source of capital in addition to external source of finance like, Foreign Direct finance, Foreign Institutional finance and External commercial Borrowing. The main objective of the current study is to analyze the influence and relationship of internal source of finance i.e., Gross Domestic Capital Formation (GDCF) and Inflation in terms of Whole sale Price Index (WPI) on economic growth in terms Gross Domestic Product (GDP) at factor cost in current market prices.

Hypotheses of the study: The following Hypotheses have been formulated.

Hypothesis-1: Moderate to High degree of association exists between the capital formation, inflation and economic growth.

Hypothesis-2: No co-movement exists between the selected variables.

Hypothesis-3: No causal relationship exists among the select variables.

METHODOLOGY OF THE STUDY

Since the research objective is to investigate the long-run affiliation between capital formation, Inflation and economic growth in India, the annual data expressed in natural logarithm for the period from 1950-51 to 2011-12 has been considered for the study. The data extracted from the hand book of Reserve Bank of India on Indian economy has been considered for this study. To meet the objectives of the study, the primary model showing the estimation of the long run connection between formation of capital, Inflation and economic development in India is thus specified in its log-linear form. Johansen's system cointegration and Granger causality tests were applied to study the relationship between the select variables. The procedure for examining the link between the variables consist of three steps. Unit root test was applied at first; secondly, Johansen's cointegration test; and third, the Granger causality test. The stationary properties of each data under consideration were examined at first by applying the ADF unit root test. The co-integrated vector element present in non-stationary data were determined

by applying co-integration test which is based on the maximum likelihood procedure. The cointegrating equations were identified by comparing trace and the maximum eigenvalue with the critical values.

EMPIRICAL ANALYSIS

At first the descriptive statistics have been calculated and the results are presented in Table 1 for discussion.

It is clear that the standard deviation is of Gross Domestic Capital Formation is highest and the WPI is the lowest. Thus Capital formation in India is highly fluctuating as compared to inflation. The Skewness and Kurtosis analysis indicate that the distributions of values are not normal. The outcome of the above analysis provoked the researcher to proceed with further analysis of the select variables using econometric tools. Before studying the stationarity of the data, it is essential to examine the association between the capital formation, inflation and GDP data under consideration. The relationship of these data has been studied using Pearson's correlation coefficient as reported in Table 2.

The degree of correlations between Domestic Gross Capital formation, Inflation in terms of WPI and Gross Domestic Product are positive and strong. So, it can be said that the correlation between capital formation, inflation and economic growth is statistically important. However, correlation analysis does not substantiate anything about the long-term association between these variables and thus gives scope for the study of long-term association between these variables. The array of combination for each of the select factors is required to be determined before proceeding with the causality test. The stationarity of the data was determined by applying ADF unit root test and the outcome of the test is presented in Table 3.

Table 1: Descriptive statistics

Statistics	GDCF	GDP	WPI
Mean	10.55	12.13	4.75
Median	10.33	11.90	469
Std. dev.	2.46	2.10	0.15
Skewness	0.17	0.20	1.41
Kurtosis	1.78	1.73	4.27
Obs.	62	62	59

Table 2: Pearson's correlation

Factors	DGCF	GDP	WPI
GDCF	1		
GDP	0.99	1	
WPI	0.67	0.68	1

Table 3: ADF unit roots test

Factors	ADF statistic at level	p-value	ADF statistic at 1st difference	p-value
GDCF	1.26	0.99	-8.48	0.0000*
GDP	4.11	1.00	-6.86	0.0000*
WPI	-2.25	0.19	-8.44	0.0000*

*: Significant at 5% level

Table 4: Cointegration test

Hypothesized No. of CE (s)	Eigen value	Trace statistic	Critical value (5%)	p-value	Max-eigen statistic	Critical value (5%)	p-value
None*	0.82	178.86	76.97	0.00	99.67	34.81	0.00
At most 1*	0.41	78.99	54.08	0.00	30.24	28.58	0.03
At most 2*	0.36	48.75	36.19	0.01	26.55	22.31	0.01

*: Rejection of hypotheses at 0.05 level; Trace and max eigian value indicates 3 integrating eqations at 0.05 level

Table 5: Results of pair-wise causality test

Null hypothesis	Obs.	F statistic	Prob.
Capital formation does not granger cause wholesale price index	59	6.3685	0.0009
Wholesale price index does not granger cause capital formation	59	2.0141	0.1233
Gross domestic product does not granger cause wholesale price index	59	11.0070	0.0001
Wholesale price index does not granger cause gross domestic product	59	2.9821	0.0396
Gross domestic product does not granger cause capital formation	59	4.5099	0.0069
Capital formation does not granger cause gross domestic product	59	13.0713	0.0002

Table 6: Inference of pair-wise causality test

Factors	GDCF	GDP	WPI
GDCF			⊗
GDP	↔		
WPI	↵	↔	

From the above table it is clear that the time series data is non-stationary based on the p-value and the ADF statistic at level form whereas the data is stationary in their first differences.

To identify the long term stability association between the variables the co integration check was applied. The outcome of the cointegration check is presented in Table 4. The results of cointegration test indicate that there exist three cointegrating equation. It is clear from the test that there is long run co-movement among the variables under study. Once the long-term co-movement between the variables is identified there is a need to know the direction of their short-term movement. In order to study the short-term dynamics of these variables, the pair-wise Granger-causality test was performed and the outcome and the inference of the investigation are presented in Table 5 and 6.

It is inferred that there is no causal relationship between Inflation in terms of WPI and Gross Domestic Capital formation; the short run dynamics of Gross Domestic Capital Formation (GDCF) and Gross Domestic Product (GDP) and between GDP and WPI are bi-directional. GDCF and WPI has unidirectional relationship. Thus we find that the short-run dynamics are significant as like the long-run relationship.

CONCLUSION

In this study the researcher investigated the linkage between the capital formation, inflation and economic development. The results of the various analysis revealed that there exists long run stable association among these variables. Thus the economic growth opportunities are significantly influenced by capital formation and inflation.

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