



## International Journal of Economic Research

ISSN : 0972-9380

available at <http://www.serialsjournals.com>

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Volume 14 • Number 15 (Part 4) • 2017

### Does Interest Rate Really Triggers Capital Formation in India?

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#### ABSTRACT

The study investigates the Co-integration between Capital formation and Interest rate in the period of High and low growth scenarios of the economy for the period 1992-2015. We built a multivariate framework by constructing a model of Capital Formation, Interest rate and GDP Growth rate employing ARDL Bounds Test in addition to Johansen Maximum likelihood procedure. Though ARDL bound and Johansen Integration test establish a long run equilibrium relationship between Capital Formation and Interest rate in conjunction with GDP growth rate. The results of the study are not within the expectation of the popular understanding on possible casualty of the Interest rate on the Capital formation. However, the model demonstrates a surprise unidirectional reverse casualty on interest by Capital formation and GDP and justified the reason for co-integration.

**JEL classification:** E22, E43, C22.

**Keywords:** Capital formation, Time series, ARDL Bounds Test, Interest rate.

#### 1. INTRODUCTION

Capital Expenditure has been considered as one of the key macro-economic variables. The increase in capital investment would trigger employment and demand for capital goods and eventually the positive growth of an economy. A strand of literature argues past and present profit of a corporation (Lamont et. al., 2006; Chen et. al., 2011, Tinbergen et. al., 1938; Barro 1990; Morck, et. al., 1990; Cochrane 1991; Blanchard et. al., 1993; Lamont 2000; Arif and Lee, 2014; S.P. Kothari et. al., 2016) and other argues that demand and capacity could trigger potential capital investment decision (Clark, et. al., 1917), reduction in Corporate Tax (Eisner, 1964), Net worth (Jorgenson, 1963) and stock Return (Fairfield, et. 2003; Titman,

et. al., 2004; Fama & French 2006; Cooper et. al., 2010; Lam and Wei, 2011). In a recent study (S.P. Kothari et, 2016) were found weak evidence for short-term interest rate and corporate Investment and a negative relationship with GDP and profit.

In the present scenario, In India, there is an increased pressure on RBI governor over reducing the repo interest rate. This reduction in repo rate is expected to reduce lending rates of banks that can possibly revive Capital Expenditure. This demand from government to reduce interest rate is triggering a revival in this area of research. We argue from the past literature that reduction in the interest rate may not increase capital expenditure as it is also linked with other factors such as low corporate tax, in juncture with a period of high growth, corporate profit and slack accumulated over a period of time. At the time of demand for reduced interest rate, Indian corporate profit is under pressure and Industry with over capacity scenario witnessed may not trigger further investment.

In this research, we consider Capital Formation as the measure of Investment in Capital stocks such as Plant and Machinery which is the core of the economy development. The increase in Rate of Interest is speculated to increase capital expenditure and eventually expected to trigger higher growth and employment. We tested the ongoing discussion by linking Interest Rate with Capital formation and in combination with GDP growth rate. A low-interest rate in combination with higher growth period can trigger a positive relationship with Capital formation. We included Capital formation due to its constituents such as Private, Public and Housing which are likely to benefit.

## 2. DATA AND ECONOMETRIC METHODOLOGY

Annual data of GDP Growth Rate in percentage, Capital Formation and Interest rate from 1992-2015 time periods is taken from World Bank databank. Table 1 depicts the summary statistics of the analysis.

## 3. ARDL BOUND TEST

A dynamic specification model ARDL bound test is used to establish a long run equilibrium relationship among variables. Lagged contemporaneous independent variable and lags of the dependent variable to estimate a short-run effect and long-run equilibrium relationship can be estimated  $\Delta$  is the first difference.

$$\Delta Lca_t = a_{0cf} + \sum_{k=1}^n b_{ica} \Delta Lcf_{t-1} + \sum_{k=1}^n c_{ica} \Delta Lgdp_{t-1} + \sigma_{1cf} Lcf_{t-1} + \sigma_{2cf} Lgdp_{t-1} + \epsilon 1t$$

This procedure is used for any level of stationary I(0) or I(1). The calculated F statistic is used to interpret any co-integrating relationship exists or not, Pesaran et. al., (1999, 2001) have provided F value for large sample size and Narayan (2005) for sample size between 30–80, where one set variables in the model is of I(1) and another set of I(0) in nature (S.Ghosh,2010). The arrived values of F Statistics of the results are greater than I1 then we conclude that there is Long term co-integration exists between the variables irrespective of the order of Integration.

## 4. JOHANSEN PROCEDURE

This method involves a testing of an order of co-integration of the variable and subsequently investigating the co-integration using the VAR approach. The procedure by specifying the optimum lag ( $p$ ) of the underlying VAR to be 1 based on Akaike Information Criteria is set before conducting the co-integration test.

**Table 1**  
**Statistical Property of Data**

<i>Variable</i>	<i>Mean</i>	<i>Median</i>	<i>Maximum</i>	<i>Minimum</i>	<i>Std. Dev.</i>	<i>Skewness</i>	<i>Kurtosis</i>
GDP	6.885396	7.243472	10.25996306	3.803975321	2.0683988	-0.2160221	1.823497
Interest Rate	11.51031	11.45833	13.83333333	8.33335	1.4291615	-0.2103836	2.52801
Capital Formation	32.58969	34.09285	42.46239161	23.51398918	6.5069621	-0.0756525	1.549542

## 5. EMPIRICAL ANALYSIS

In the first step, we have tested the order of Integration for the variables of interest. Empirical studies have established from the past literature that Macro economic variables are generally either I(0) or I(1) in nature. We conducted the unit root test for all the variables of interest in this study. Table 2 represents the results of the unit root test conducted for the variables of the interest. We calculated ADF, PP and KPSS statistics on the actual data at level and first difference. The result of unit root test demonstrates that Gross Capital Formation and Interest Rate are I(1) and GDP at I(0).

**Table 2**  
**Unit Root Test Result**

Variable	ADF	PP	KPSS
<i>Level</i>			
Gross capital Formation	-1.37165	-1.38451	0.40518
Lending Rate	-2.17951	-2.04901	0.50433
GDP	-3.56342	-3.55208	0.22734
<i>First Difference</i>			
Gross Capital Formation	-4.38407	4.38560	0.27370
Lending Rate	-4.00373	-5.28170	0.25876
GDP	-5.15104	-5.15104	0.49990
1% level	-3.88675		
5% level	-3.05217		
10% level	-2.66659		

## 6. ARDL BOUND TEST

Changes in Interest rate may have an immediate effect on the investment decision, but the effect may be reflected on the longer term basis as the capital formation likely to happen from 6 months to 2 years lag. However, we tested the long-term relationship between Interest rate and Capital formation and GDP growth using ARDL bound test. The bound test results depicted in Table 3 indicates that there is longer term co-integration between interest rate and Capital formation. This is because F value is greater at 6.310442 (k2) than upper bound Critical Values of I 1 at 5% level. This signifies there is longer term relationship and Co-Integration between the Capital formation, Interest rate and GDP Growth rate where Capital formation is treated as a dependent variable.

In order to establish robustness of the ARDL bound test, we conducted the Johansen Maximum Likelihood procedure by specifying the optimum lag ( $p$ ) of VAR set as 1 based on AIC results. The Trace

and Rank test further asserted our ARDL bound test results of co-integration at 10% level of significance. Both the test confirms there is a significant co-integration relationship between Capital formation and Interest rate.

**Table 3**  
**ARDL Bound Test**

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
D(GROSS_CAPITAL_FORMATION_)	0.351668	0.121132	2.90319	0.012332
D(LENDING_INTEREST_RATE__)	-0.77362	0.309753	-2.49752	0.026713
GROSS_CAPITAL_FORMATION_	0.146539	0.058884	2.488603	0.027166
LENDING_INTEREST_RATE__	0.086591	0.123344	0.702023	0.495043
GDP(-1)	-0.87432	0.20507	-4.26355	0.000924

<i>Significance</i>	<i>I0 Bound</i>	<i>I1 Bound</i>
10%	2.17	3.19
5%	2.72	3.83
2.50%	3.22	4.5
1%	3.88	5.3

**Table 4(a)**  
**Johansen – Juselius likelihood co-integration Tests: Trace test**

<i>Hypothesized No. of CE(s)</i>	<i>Eigen value</i>	<i>Statistic</i>	<i>0.05 Critical Value</i>	<i>Prob.**</i>
None	0.672732846	29.52517	29.79707334	0.053725
At most 1	0.405069274	10.53654	15.49471288	0.241685
At most 2	0.095602412	1.708265	3.841465501	0.19121

**Table 4(b)**  
**Johansen – Juselius likelihood co-integration Tests: Rank test**

<i>Hypothesized No. of CE(s)</i>	<i>Eigenvalue</i>	<i>Statistic</i>	<i>0.05 Critical Value</i>	<i>Prob.**</i>
None	0.672732846	18.98863	21.1316163	0.097154
At most 1	0.405069274	8.828275	14.26460015	0.300728
At most 2	0.095602412	1.708265	3.841465501	0.19121

Since the data is non-stationary and there is no serial correlation we proceeded to conduct VAR Granger causality test by employing Toda Yamamoto (1995) procedure. The results show there is no causality between the between Interest Rate and GDP on Gross Capital formation. However, there is a reverse causality of GDP and Gross Capital formation on Lending Interest rate that was the possible cause of co-integration in the previous tests. The results demonstrate that the co-integration might have happened due to reverse causality, not because of Lending interest rate.

	<i>Gross Capital Formation</i>	<i>Lending Interest</i>	<i>GDP</i>
Gross Capital Formation		0.566675(0.7533)	1.611931(0.447)
Lending Interest Rate	6.274265(0.0434)		10.361(0.0056)
GDP	1.059752(0.588)	0.061792(0.9696)	

## 7. CONCLUSION

Among the economist, there is a recent debate on a possible reduction in interest rate on Central Banks could affect the Banks MCLR rate. The general perception that the reduction in lending rate could trigger Gross Capital formation as Indian corporate expected to make use of the lower lending rate to ramp up the Capacity with a lower cost of capital. The results of the study contradict the common understanding on this subject. However, the results are in line with past study conducted in the US data by S.P. Kothari, et. al., (2016). The results justified the policy adopted by past Central Bank Governor's decision of keeping it tight on interest rate regime under pressure from the government.

The unidirectional relationship of Gross Capital Formation and GDP on Lending Rate can be justified from the Demand-Supply side of the argument. In a higher growth scenario, the demand generated when consumers chase for goods. In an environment of higher growth consumers and corporate tend to borrow more to augment the capacity to meet the demand arising out of higher growth and consumer demand that can keep the interest northward.

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