

Do International Crude Oil Price and Public Investment Affect Private Investment? An Empirical Analysis for a Large Emerging Economy

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Introduction

- India is the fourth largest oil importer in the world after USA, China and Japan.

Table 1: Crude oil imports by countries (1000 bbl/day)

Country Rank (2014)	Countries/ Year	1980	1985	1990	1995	2000	2005	2010	2011	2012	2013	2014
1	USA	8459	6755	9633	1116	13879	15620	13705	13236	12003	11493	10342
2	China	-349	-620	-478	373	1564.	3161.	5109.	5769.3	6445.4	6919.8	7344.7
3	Japan	4950	4425	5282	5648	5473	5291.	4323	4340	4625	4499.3	4262.2
4	India	461	275	508	872	1481	1847	2554	2679	2839	2884	2968
5	Korea, South	537	552	1048	2008	2135	2191	2269	2259	2322	2328	2348
6	Germany	--	--	--	2823	2703	2557	2418	2341	2338	2383	2326
7	France	2230	1703	1766	1865	1972	1969	1804	1761	1723	1698	1677
8	Spain	957	814	994	1174	1428.	1603.	1438.	1382.8	1298	1200.7	1193.8
9	Italy	1896	1660	1781	1849	1764	1666	1448	1395	1269	1158	1160
10	Netherlands	767	534	664	701	826	977	1010	1003	977	969	962
11	UK	103	-913	-44	-673	-510	170	393	556	647	726	733

Source: U.S. Energy Information Administration.

Link: <http://www.eia.gov/petroleum/data.cfm>

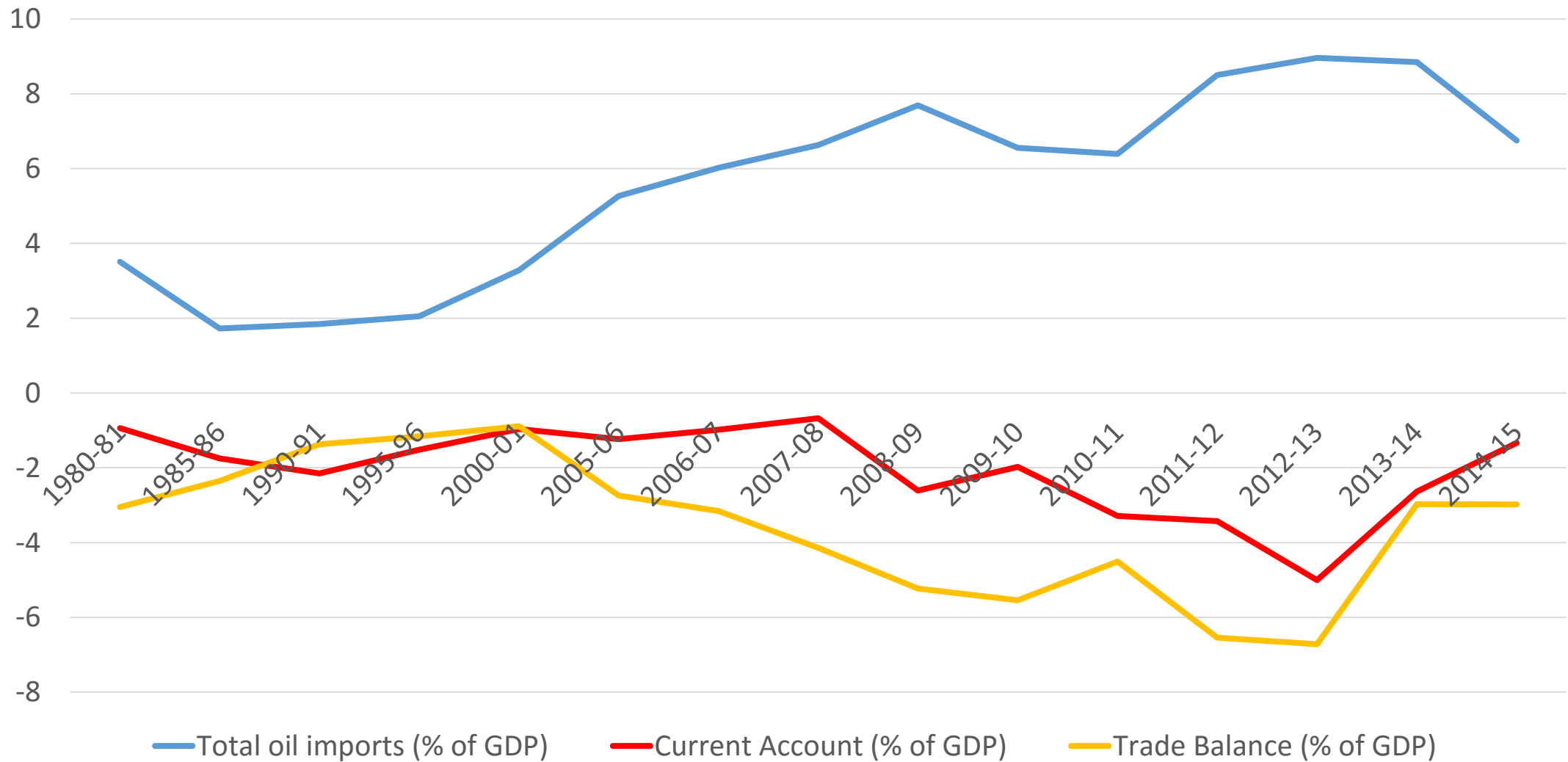
- Given India's high dependence on the oil as a source of energy, any larger fluctuation in the oil price can significantly affect the overall economic activities in India which includes consumption, business, investment and production activities.
- Along with the increase in population and urbanisation, which put increasing demand pressures on crude oil energy, rising macroeconomic activities is not the only cause of more demand for oil energy but also can be the cause of changes in the pattern in the usages of crude oil energy along with a change in the overall composition in the demand for various sources of energy.

Table 2: Trend in total oil imports, current account balance and trade balance of India.

Year	Total oil imports (% of GDP)	Total oil imports (% of total imports of goods and services)	Current Account (% of GDP)	Trade Balance (% of GDP)	Real oil price (Crude oil, Brent, \$/bbl, real 2010\$)
1980-81	3.510	39.313	-0.942	-3.052	58.09
1985-86	1.724	21.481	-1.750	-2.350	45.78
1990-91	1.846	20.416	-2.154	-1.375	28.65
1995-96	2.053	15.606	-1.518	-1.159	18.57
2000-01	3.284	21.416	-0.965	-0.891	35.54
2005-06	5.270	24.174	-1.233	-2.745	62.066
2006-07	6.021	25.387	-0.980	-3.159	72.717
2007-08	6.631	28.568	-0.672	-4.144	76.178
2008-09	7.693	24.062	-2.609	-5.229	94.946
2009-10	6.554	26.432	-1.978	-5.546	64.131
2010-11	6.390	24.108	-3.291	-4.508	79.636
2011-12	8.506	28.036	-3.429	-6.543	101.835
2012-13	8.962	28.266	-5.001	-6.720	104.062
2013-14	8.852	29.431	-2.636	-2.977	102.639
2014-15	6.749	24.903	-1.337	-2.979	93.445

Source: RBI & WDI

Figure 1: Trend in total oil imports, current account and trade balance of India.



Source: RBI & WDI

Table 3: Sectoral Shares in Consumption of Crude Oil in India (%).

Year	Consumption in Agriculture & Allied activities to total crude oil consumption	Industrial consumption to total crude oil consumption	Consumption in Transport and power generation to total crude oil consumption	Consumption for Miscellaneous services including private sales to total crude oil consumption
1985-86	1.44	26.61	66.94	5.01
1990-91	1.72	24.74	69.91	3.63
1995-96	2.41	22.73	69.81	5.06
1999-00	14.93	23.65	51.59	9.82
2005-06	13.07	11.29	47.71	27.94
2006-07	14.10	11.28	49.60	25.02
2007-08	14.76	8.37	46.05	30.82
2008-09	0.85	8.64	12.93	77.59
2009-10	2.34	8.79	10.36	78.50
2010-11	0.96	7.52	10.92	80.60
2011-12	1.01	7.02	9.73	82.24
2012-13	0.90	5.83	8.84	84.42
2013-14	0.67	3.55	6.30	89.48
2014-15	0.83	3.56	7.88	87.73

Source: Ministry of Petroleum & Natural Gas, Govt. of India.

Greater reliance on traditional source of energy

- It is seen that countries with their economic progress, although they have gone in for production and consumption of more cleaner forms of energy (such as electricity, natural gas and solar power and wind energy etc.) and in some cases they have gone in for substituting the import of most cleaner forms of energy in place of crude energy.
- However, there are also **natural and financial resource constraints** which limit the production and uses of these cleaner energy sources for individual countries.
- Even in the most advanced countries, one would observe that along with the rise in the consumption of cleaner forms of energies, there is still an increasing use of these crude forms of oil energy in absolute terms.
- Therefore, the advanced countries such as USA and Europe are still heavily using crude oil energy along with the alternative cleaner forms of energies.

International price of oil and Economic activities

- Given the fact that the emerging economies have limited capacity and resources to invent and produce more subtle forms of cleaner energy and intensively use those energy sources, in relation to their demand for total energy, still their demand for these traditional energies are increasing along with slow and gradual discovery of other modern renewable sources of energies.
- Since many of the large emerging economies like India and China have very limited oil mineral deposits, they continue to import significant portion of crude oil energy from gulf and other countries.
- As a result, when the international crude oil prices shoots up due to any exogenous factors (like excess demand for crude oil or speculative forces in the international market), the oil importing countries are likely to experience retrenchment of economic activities as well as often severe imbalances in their BOP, which gets reflected in the deterioration of trade balance and current account deficits in the BOP.

- Given that India imports huge amounts of oil from gulf and other oil exporting countries, it is important to understand the dynamics of international crude oil prices and real private investment activity along with capturing the other key determinants of private investment, as private investment is a key determinant of economic growth of every economy.

Objective

- Among the activities, the study focuses on understanding the linkage between the movement of international crude oil prices and the real private investment.
- It also incorporates the major factors influencing private investment – public investment, real interest rate, financial development, economic growth and economic globalisation.

Theoretical Framework

- The theoretical model is based on the ***Flexible Accelerator Model (FAM)*** originated by Chenery (1952). It shows that the **desired stock of capital** can be assumed to be proportional to the **expected output**:

$$KP_t^* = \alpha YR_t^e \quad (1)$$

The desired stock of capital is assumed to be influenced due to changing economic conditions.

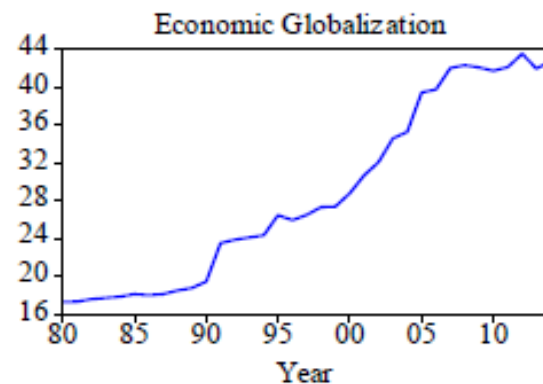
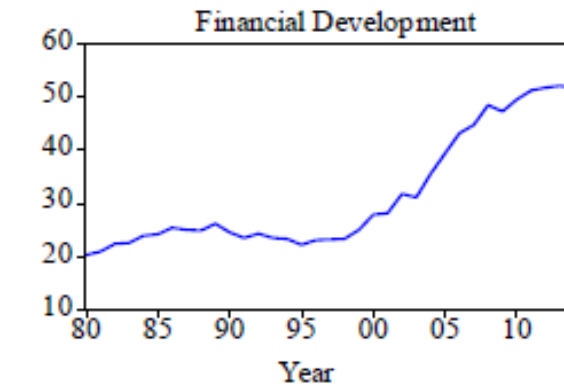
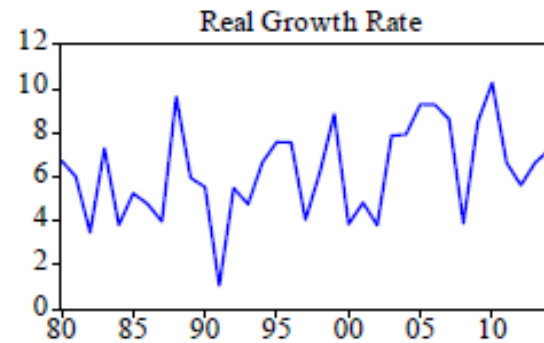
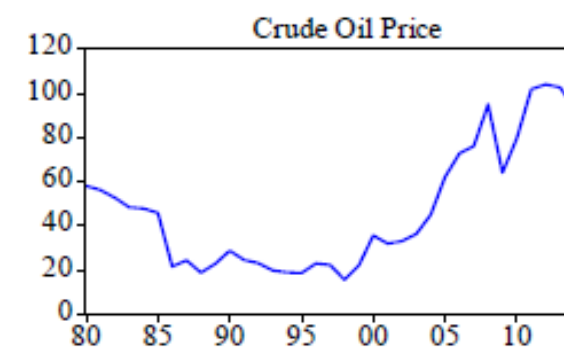
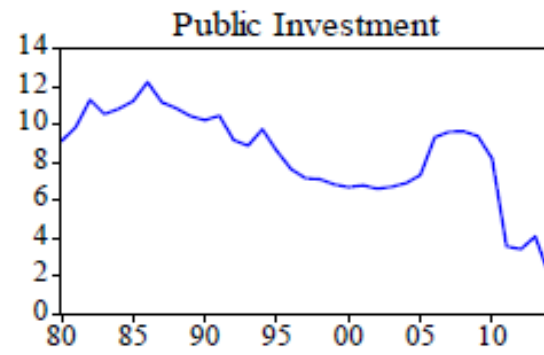
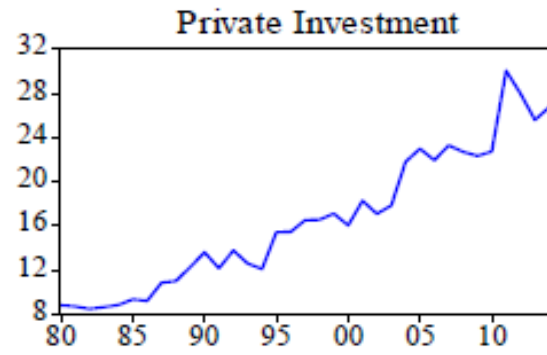
Private Investment Model

$$PRI_t = f(OP_t, IR_t, PUI_t, FD_t, GR_t, GLOBAL_t)$$

- Whereas, PRI- private investment, OP- crude oil price, IR-interest rate, PUI- public investment, FD – Financial development, GR- growth rate, Global- Economic globalisation.

$$PRI_t = \beta_1 + \beta_2 OP_t + \beta_3 IR_t + \beta_4 PUI_t + \beta_5 FD_t + \beta_6 GR_t + \beta_7 GLOBAL_t + \varepsilon_t$$

Trends of Macro variables used in the analysis



where:

PRI- Private investment (% of GDP)

PUI- Public investment (% of GDP).

OP- Real oil price (Crude oil, Brent, \$/bbl, real 2010\$)- The data is in original form as given in WDI.

IR-Real interest rate (Real interest rate data is directly available in WDI. So no need to change nominal to real.

FD- Financial development [measured as Domestic credit to private sector (% of GDP)]

GR- Real GDP growth (Source-WDI)

GBLECO- Economic Globalisation (Dreher Index)

Unit root test results

Variables	ADF		PP	
	Level	1st Diff.	Level	1st Diff.
PRI _t	1.735723	-6.391045*	0.159824	-12.96541*
OP _t	-0.464919	-5.925972*	-0.403006	-5.926502*
IR _t	-3.807285*	-	-3.889474*	-
PUI _t	0.014429	-4.640262*	-0.257682	-4.568376*
FD _t	-0.363071	-13.01134*	0.468790	-5.161775*
GR _t	-4.876728*	-	-4.881878*	-
GLOBAL _t	0.138300	-5.792221*	0.054724	-5.822460*

Note: *, ** represent significance at 1% and 5% levels respectively.

Conducted other unit root tests

- Ng and Perron (2001) test
- Zivot-Andrew's (1992) unit root test

Cointegration test results

ARDL Bounds test for Cointegration				
Dependent Variable	Optimal Lag	Time Break	F-Statistic	Cointegration
Model 1: $PRIt=f(OPt, PUIt, FDt, GRt, IRt, GLOBALt)$	(1,2,1,0,2,1,0)	2004	16.789*	Yes
Model 2: $PRIt=f(OPt, PUIt, FDt, GLOBALt)$	(1,2,1,0,0)	2004	15.384*	Yes
Narayan's (2005) Critical bounds values at significant levels	Model 1 (t=35, k=6)		Mode 2 (t=35, k=4)	
	I(0) Lower Bound	I(1) Upper Bound	I(0) Lower Bound	I(1) Upper Bound
1%	4.704	6.537	5.604	7.172
5%	3.426	4.790	4.512	5.304
10%	2.879	4.114	3.374	4.512
Bayer-Hanck (2013) Combined Cointegration				
Dependent Variable	Optimal Lag	EG-JOH	EG-JOH- BD-BDM	Cointegration
$PRIt=f(OPt, PUIt, FDt, GLOBALt)$	2	13.803**	40.350**	Yes
Fisher's (1932) critical values at 5% level of significance		10.576	20.143	

Long-run Estimates

Dependent variable: PRI_t				
Variable	Model 1		Model 2	
	Coefficient	Prob. Value	Coefficient	Prob. Value
OP_t	-0.072* (-5.050)	0.000	-0.056* (-2.873)	0.009
PUI_t	-0.710* (-8.936)	0.000	-0.614* (-5.198)	0.000
FD_t	0.241* (3.938)	0.001	0.1695*** (1.819)	0.082
GR_t	0.408* (2.906)	0.009	-	-
IR_t	-0.155 (-1.662)	0.114	-	-
$GLOBAL_t$	0.192* (4.189)	0.001	0.216* (3.112)	0.005
$D_t=2004$	2.808** (2.769)	0.013	3.942** (2.754)	0.011
Constant	10.232* (5.702)	0.000	11.360* (4.654)	0.000

Short-run Estimates

Variable	Model 1		Model 2	
	Coefficient	Prob. Value	Coefficient	Prob. Value
ΔOP_t	-0.035*** (-1.893)	0.075	0.003 (0.185)	0.855
ΔPUI_t	-0.971* (-7.185)	0.000	-1.112* (-7.866)	0.000
ΔFD_t	0.247* (3.286)	0.004	0.141 (1.623)	0.118
ΔGR_t	-0.008 (-0.113)	0.911	-	-
ΔIR_t	0.001 (0.015)	0.988	-	-
$\Delta GLOBAL_t$	0.197* (3.694)	0.002	0.179** (2.753)	0.011
Dt=2004	2.884* (3.100)	0.006	3.278* (3.254)	0.004
ECT _{t-1}	-0.780* (-5.010)	0.000	-0.832* (-6.423)	0.000
R ²	0.994		0.988	
F-statistic	216.141*	0.000	211.802*	0.000
D.W	2.828		2.368	

Examining the Robustness of the Estimates from ARDL model

Long run Estimates from FMOLS

Dependent variable- PRI_t				
Fully Modified Ordinary Least Squares (FMOLS)				
Variable	Model 1		Model 2	
	Coefficient	Prob. Value	Coefficient	Prob. Value
OP_t	-0.052* (-3.792)	0.001	-0.051* (-3.820)	0.001
PUI_t	-0.735* (-8.140)	0.000	-0.712* (-7.726)	0.000
FD_t	0.154** (2.571)	0.016	0.167** (2.730)	0.011
GR_t	-0.059 (-0.734)	0.470	-	-
IR_t	0.002 (-0.004)	0.997	-	-
$GLOBAL_t$	0.270* (5.190)	0.000	0.264* (4.951)	0.000
$D_t=2004$	3.944* (3.550)	0.002	3.766* (3.623)	0.001
Constant	11.686* (5.584)	0.000	10.918* (5.665)	0.000
R^2	0.970446		0.970	
Adj- R^2	0.962489		0.965	

Long run Estimates from DOLS

Dynamic Ordinary Least Squares (DOLS)				
Variable	Coefficient	T-statistic	Coefficient	T-statistic
OP _t	-0.046* (-2.773)	0.009	-0.044* (-2.843)	0.008
PUI _t	-0.789* (-6.611)	0.000	-0.785* (-6.791)	0.000
FD _t	0.149*** (1.982)	0.058	0.152** (2.099)	0.045
GR _t	-0.046 (-0.434)	0.668	-	-
IR _t	-0.006 (-0.059)	0.953	-	-
GLOBAL _t	0.264* (3.826)	0.001	0.265* (3.947)	0.001
D _{t=2004}	3.744** (2.539)	0.017	3.520** (2.703)	0.011
Constant	12.165* (4.474)	0.000	11.689* (4.951)	0.000
R ²	0.972		0.972	
Adj-R ²	0.965		0.967	

Conclusion and Policy Suggestions

- The long run results estimated from the ARDL model shows that oil price and public investment negatively affect the private investment, whereas the financial development, growth rate and economic globalisation positively influence the private investment in the long run.
- In the short run, the oil price and public investment have also negative and significant impact similar to the long run.

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- The results of both the FMOLS and DOLS estimators give similar results like the ARDL model.
- However, as the coefficient of public investment was found to be consistently negative and significant both in the short run as well as in the long run, so this leads us to infer that public investment crowds out private investment in India.
- Further, the crowding out impact of public investment on the private investment is higher in the short run than in the long run.

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- This means that India invests so much on creation of physical infrastructures, but why it does not encourage the private investment is a big question mark for the government policy making and implementation and strategies of those policies.
- It calls for a thorough and greater examination, which are the areas where government is investing and how that retards the private investment in the economy and what needs to be done in order to encourage more investment in the economy.
- It also suggests that the public sector should make investment in areas where private sector is abysmally small and rather it should encourage private investment in areas where private investment is absent and already private investment is present but requires a big push from its present level.

Limitations of the Study

- We have not considered alternative energy prices in the model which can affect the consumption of crude oil and therefore consumption of other energies for industrial use such as Electricity.
- We have not considered the domestic price of oil and price of other substitutes to oil in the model. However, it may not have much bearing on our results, as the oil price is only recently got liberalised and being determined by market forces.

Thank you...