CHAPTER - VIII

Comparative Perspective of Macroeconomic Instability in the 1960s & 1990s: An Empirical Approach

INTRODUCTION

This chapter examines the role of sectoral savings and investment in economic growth in the light of the Indian instability experiences over the studied sample period up to 2002-03. These are important intermediate variables which link the real economy with the financial sector. This chapter is based on recent advances in time-series econometrics. The findings are carefully interpreted in relation to key policy shifts in India to inform the comparative recessionary perspective in the 1960s and 1990s. To examine the link between sectoral savings, investment and growth, it needs to have an analytical framework which appropriately captures causality running from the former to the latter in an empirically testable manner because they are appropriate indicators in explaining the long-term growth. They also provide an explicatory role for policy to influence interactively with the relationship between investment and growth.

A useful perspective in this research is on the relationship between macroeconomic policies, public deficit and current account deficit. These indicators consider separately the balance of savings and investment of the public, private corporate and private household sectors, concentrating on savings, investment and their determinants. It also shows implicitly how total investment is financed by the savings of the three sectors and by foreign savings. However, deficits by themselves do not imply macroeconomic problems particularly when the resources are used productively as they can generate a future stream of income to cover the servicing costs of macroeconomic dis-equilibria incurred.

Useful information on the relationship between macroeconomic policies and the twin-deficit adjustment has already been highlighted in table 7.1 in the earlier chapter 7, which shows government and private savings-investment balances and the corresponding current account deficits. As the current account deficit (I – S) is identically equal to the difference between gross fiscal deficit of the government sector ($=I_g - S_g$) and private sector surplus ($=S_p$

– I_p), causal relationships inevitably involve the underlying judgements rather than exact proofs. This identity indicates that improvements in the current account deficits can only take place if sectoral savings rise relatively to sectoral investment. The policies which do not have any impact on savings cannot be expected to improve the current account balance of the external sector [Dornbusch and Helmers, 1988]. It is generally believed that an increase in current account deficits (external savings) offset government sector dis-savings thereby preempting the crowding out of private sector investment. This research has also concentrated on government and private investment, and on its efficiency and contribution to growth. However, it is beyond the purview of this research to attempt a complete explanation of the determinants of savings and investment. It has rather concentrated on suggesting ways in which macroeconomic policy may have been influential.

This chapter is structured as follows. Section 8.1 estimates the Indian private savings function and private corporate investment function in multivariable framework to provide an account of overall policy assessment to throw light on the possible key structural shifts particularly to investigate the comparative perspective of macroeconomic dips in the 1960s and 1990s. Section 8.2 investigates the causal relationships and the direction of contemporaneous movements of these three gaps and their proximate determinants. Section 8.3 explains the trends of sectoral savings and investments in the three gap problems. The rest would conclude the chapter.

8.1 ECONOMETRIC EVIDENCE: INSTABILITY FUNDAMENTALS IN THE ESTIMATED INDIAN PRIVATE SAVINGS AND PRIVATE CORPORATE INVESTMENT BEHAVIOUR

This section has econometrically made an attempt to explore as to whether the disjunction between private corporate investment and public investment to be one of the many reasons behind twin macroeconomic crises in the 1960s and 1990s. The findings would also facilitate the subsequent section of causality analysis particularly to focus on the role of sectoral savings and investment and their disjunction for Indian macroeconomic growth process and instability. This section should have been preceded by the next one as the nature of the Indian macroeconomic time-series examined and contained in the second one. However, this does not necessarily signify that this research has been relegated with minor importance to this econometric issue. What in sequence of this chapter is done is only to focus the research issue.

There are two opposing hypotheses as a policy issue of very great practical relevance in macroeconomics: Feldstein and Horioka hypothesized that changes in the savings rate are primarily reflected in investment levels while Dornbusch and Helmers hypothesized that in the external balance.

Table 8.1: *Regression Results: Feldstein Horioka hypothesis (I/Y on S/Y) versus Dornbusch and Helmers hypothesis (CAD/Y on S/Y) in the Indian context*

Regression Model	***Equation Number***						
Model: OLS: 1950-51 – 2002-03	8.1a	I/Y =	.017	+ 0.97 S/Y	R^2	*R-Bar Sq.*	*DW-Statistic*
		T-Ratio (Prob.)	3.15 (.003)	31.50 (.000)	0.96	0.95	0.67
Model: OLS: 1950-51 – 2002-03	8.1b	CAD/Y =	.064 S/Y		R^2	*R-Bar Sq.*	*DW-Statistic*
		T-Ratio (Prob.)	6.68 (.000)		-.17	-.17	.55

***Source*:** Author's calculation from CSO, National Accounts Statistics

To ascertain the validity of these two opposing propositions in the Indian context, the following regression equations disregarding the time-series properties are estimated by classical OLS method in the below Table 8.5. Equation (8.1a) indicates a very high correlation between savings and investment rates while equation (8.1b) indicates nearly absence of any correlation between current account deficit rates (CAD/Y) and savings rates (S/Y) [see Table 8.1, as estimated co-efficient in the former case has been 0.97 as compared to .064 in the latter and in both the cases, estimated co-efficient have well been statistically significant. Equation (8.1a) reveals high goodness of fit as having more R^2 and R Bar^2 and in terms of DW statistic too compared to (8.1b) estimation]. This hypothesis is also supported well even if regression done using co-integrating regression method. Thus, it is clear that in the Indian context, the proposition that domestic savings is the main source of domestic investment holds good and changes in the savings rate are reflected primarily in the external balance stands rejected. It is important to note that CAD or foreign capital inflows (or foreign savings, which represents the difference between domestic investment and savings) have been less than 2 per cent of GDP during much of the period under consideration. Thus, it can be argued that the two specific recessionary episodes of the 1960s and 1990s in the Indian economy may be the consequence of investment instability or rather volatility in the public and private sectors in addition to the

impact of exogenous shocks, which needs rigorous econometric investigation and the relevant exercise on that count to be followed next.

It is well known that the Indian private sector consists of two sub-sectors namely private corporate and private household. The specification of the following two regressions of private savings (of both household and corporate) rate function and private corporate investment function and their determinants are given in equation (8.2a) and (8.2b). These specifications would facilitate to understand how the relative contribution of the public and private sectors to gross domestic capital formation in Indian macroeconomic growth process changed in the period under consideration in this study providing useful policy implications from theoretical point of view particularly to understand India's twin instability episodes in the 1960s and 1990s. It is best to say at its outset that all the variables used in the regressions found t0 be non-stationary, as is examined rigorously contained in the next sub-section.

Private savings function can be specified as follows:

$$SSP = f(\Delta Y, RINT, RINF, SSG, SYA, TOT, NFIFA, D) \qquad (8.2a)$$

For private corporate investment function, this research uses the following specification:

$$SIC = f(\Delta Y, SIG, P_{90}D) \qquad (8.2b)$$

NOTATIONS:

Dependent variables	*Description*
SSP	Private savings as per cent of GDP
SIC	Private corporate investment as per cent of GDP.
Independent variables	*Description*
ΔY	Inter-year change in real GDP
RINT	Real interest rate
RINF	Inflation rate
SSG	Government savings as per cent of GDP
SYA	Share of agriculture to GDP
TOT	Terms of trade
NFIFA	Remittances
D	Crisis dummy variable; 1 for years 1971 through 1977 and zero otherwise, to capture combined effects of exogenous shocks, if any, of war in 1971, oil price crises in 72-74 and political emergency 1975-77
SIG	Government investment as percent of GDP
$P_{90}D$	Post reform dummy; 1991 onwards = 1; and 0, otherwise

It is important to note that drought may have instability impact for the short-run and the variable SYA stands to be proxy in this regard. However, oil crises might have long-run impact through adversely affecting balance of payments (BoP) . Thus this variable is added to account for the dips in the sectoral savings-investment function, if any, in the twin instability sub-periods in the 1960s and 1990s.

Equations (8.2a) and (8.2b) are estimated over the studied sample period from 1950-51 to 2002-03 using the Indian annual macroeconomic time-series dataset. All the variables are measured relative to GDP at current prices except obviously for TOT, D and $P_{90}D$. Data sources are listed in the previous chapters and methods of data transformation adopted are also discussed elsewhere in this research. Though the exercise to examine the time-series properties of the adopted variables is shown in the following section using the standard Dicky-Fuller procedure, this section, however, does have information on a priori basis about the nature of the variables used as to whether either I(1) or I(0) category.

The unit test results have been reported in the following sub-section in the Table 8.4, suggesting that all the variables do not have the same order of integration. The variables – SSP, SSG, SYA, ΔY, TOT, NFIFA, SIC and SIG are found to be integrated of order one (I(1)) while RY, RINF belong to the I(o) category [see Table 8.4 in subsection 8.2]. This section has therefore used the general to specific modeling procedure of ARDL (auto regressive distributive lag) approach of co-integration with ECM model, which minimizes the possibility of estimating spurious relations to keep retaining long-run information.

Regression estimates for private savings rate and private corporate investment rate are reported in the following Table 8.2 and Table 8.3.

TABLE 8.2: *Determinants of the Private Savings Rate in India: Regression Results*

$\Delta SSP =$	0.16	0.03 RY_t	+ 0.17 $RINT_{t-1}$	+ .003 $RINF_t$	-.29SSG_t	-.003ΔTOT_t
	(0.78)	(1.45)[a]	(1.58)[a]	(1.57)[a]	(3.61)[c]	(1.37)[a]
	-.04 TOT_{t-1}	+ .001 $NFIFAZ_{t-1}$	-.002SYA	-.004D	- .36SSP_{t-1}	
	(1.89)[b]	(1.37)[a]	(0.96)	(1.35)[a]	(5.45)[c]	
R^2=0.78			$F(10,42)$ = 9.27[C]			*S.E. of regression* = .009
DW = 2.25			$LM1$ - $\chi^2(1)$ =2.09			$LM2$ - $\chi^2(2)$ =2.17
$RESET - \chi^2$ = 0.20			JBN - $\chi^2(2)$ = 0.08			

Long-run (steady – state) effect on savings rate	
Real GDP growth(RY)	0.11[a]
Real interest rate(RINT)	0.25[a]
Inflation rate(RINF)	0.20[a]
Government savings rate(SSG)	-0.54[c]
Terms of trade(TOT)	-.007[a]
Remittances(NFIFAZ)	0.02[a]
Crises Dummy (D)	-.005[a]

***Notes*:** t-ratios of regression coefficients are given in brackets. Approximate critical values for the t-ratios are as follows: 10 per cent = 1.31 ([a]); 5 per cent = 1.69 ([b]) and 1 per cent = 2.44 ([c]). The test statistics are : *LM* = Lagrange multiplier test of residual serial correlation; *RESET* = Ramsey test for functional form misspecification; *JBN* = Jarque – Bera test for the normality of residuals
Source: Author's calculation from CSO, National Accounts Statistics, various issues and other official sources as is mentioned in the section: data sources in chapter 1

The final prudent estimated equation combined with a set of commonly used diagnostics statistics and long-run elasticities relating to the candidate explanatory variables, which are computed from the long-run (steady-state) solutions to the estimated equation, which are given in each lower panel of the tables Table 8.2 and Table 8.3. Both the estimated equations have statistically been significant at the one per cent level of significance with respect to standard F test and perform well by all diagnostic tests. From the point of view of Chow test for parameter stability conducted by splicing the total sample period into 1950-90 and 1991-2003, there has been no evidence of parameter instability. On re-estimating for the various sub-periods, all equations went through Chow test of out of sample forecasting ability (Chow's prediction failure test for the post-reform period 1991-03).

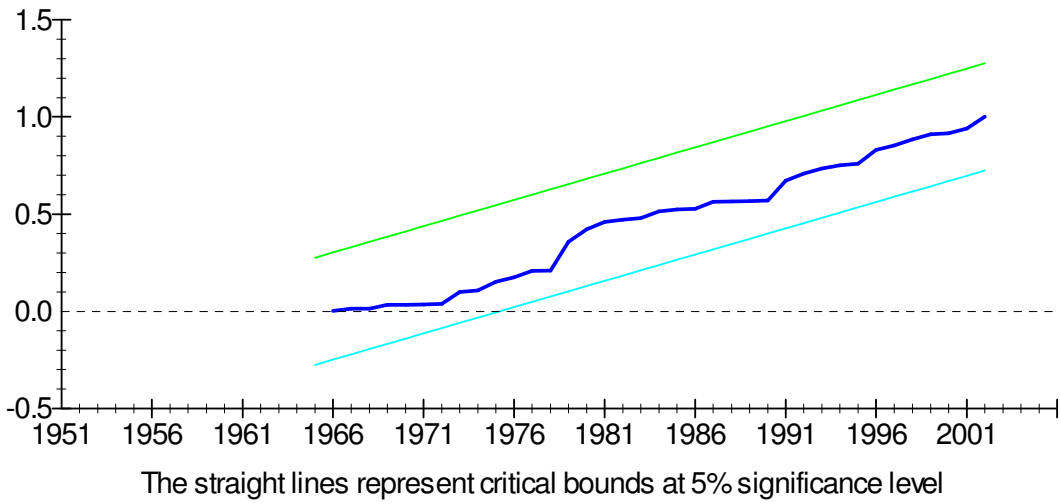


Figure: 8.1 : *Plot of Cumulative Sum of Squares of Recursive Residuals of Private Savings Rates using Equation (8.2a)*

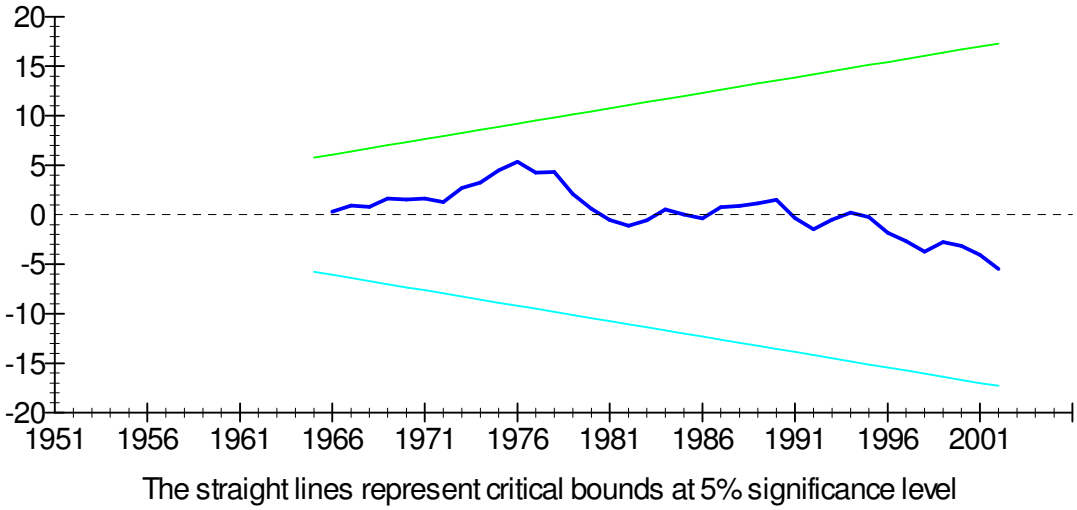


Figure: 8.2 *Plot of Cumulative Sum of Recursive Residuals of Private Savings Rates using Equation (8.2a)*

Besides these tests, a residual correlogram up to five years are estimated for each equation, with no indication of significant serial correlation.

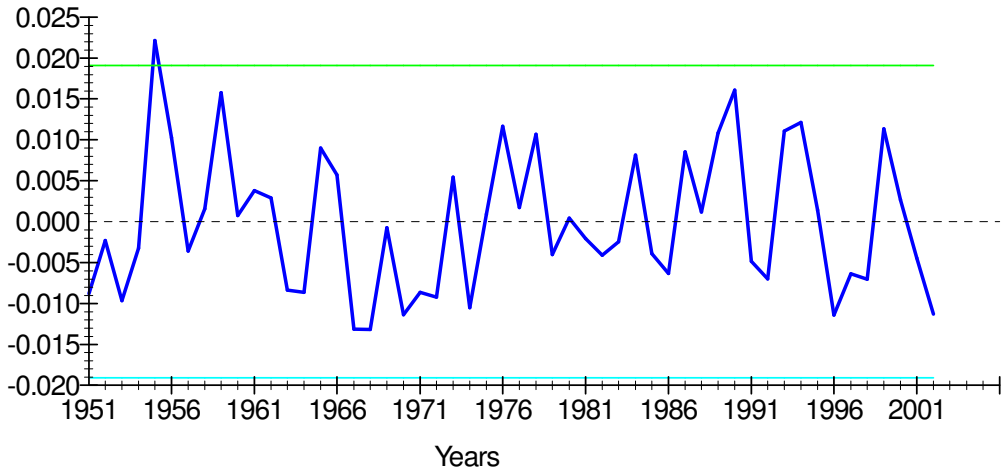


Figure: 8.3 *Plot of Residuals and two Standard Error Bands of Private Savings Rates using Equation (8.2a)*

Turning to the Table 8.2, the finding for the real interest rate variable (RINT, which is the difference between deposit rate and inflation rate) reveals that one percentage point increase in RINT is associated with a 0.25 percentage point increase in the private saving rate. This result seems to have been interesting considering the fact of macroeconomic instability sub periods in the 1960s and the 1990s (as in both decades annual plan holidays were the common feature) during the studied period. Overall the Indian experiences provide support that high real interest rates promote private savings in the economy. It is important to note that the real interest rates remained positive for much of the period under study. This has clearly been an important factor behind the high savings rate evidenced in India in the post independence period.

However, the theoretical argument is that there is an inverse relationship between the real rate of interest and the incremental capital-output ratio (ICOR) [the theoretical justification is: $p.MP_k = r$; where, p is the price of the product; MP_k ($=\Delta Y/\Delta YK$) = marginal product of capital; ICOR = $\Delta K/\Delta Y$ and productivity of capital is the reciprocal of ICOR; and 'r' is the real interest rate]. It is true that a rise in the real interest rate would by wiping out unproductive investment increase the productivity of capital and thereby a fall in ICOR. It is also true that a rise in the real interest rate could reduce domestic capital formation (investment) rate per se and thereby growth rate of output. Since the growth rate is the product of the marginal productivity of capital and the investment rate, the overall effect of the real interest rate on the growth rate

would depend on the relative magnitude of these two opposing effects. Thus it seems plausible that a very high real rate, the negative impact would offset the positive impact, thereby causing a contraction in growth.

This inverse pattern between real interest rate and ICOR and thereby investment rate is by and large true right across the sample, especially over the cyclical variations in real interest rate during the mid-60s and 90s though the inverse relationship seems to have broken down after the mid 90s as there witnessed positive relationship may be owing to change in interest rate regime from its earlier 'administered' to 'deregulated'. This could be one of the many reasons as to why the Indian growth rates dipped into recession in the 1960s and the 1990s. However, to ascertain the validity of this claim that high real interest rate affected adversely the investment and thereby output in the 1960s and the 1990 and to empirically establish this proposition, it needs more exhaustive investigation by estimating the regression equation of real growth rate on real interest rate.

Now turning to the Table 8.2, the variable - real GDP growth rate (RY) is an important determinant of the private savings rate – the coefficient of RY is positive and is statistically significant. A rise in the growth rate by one percent leads to a long-run increase in the private savings rate by 0.11 per cent. The coefficient of TOT is negative and statistically significant, implying that real income gains (losses) consistent with terms of trade improvement lead to lower (higher) savings, as the terms of trade movements is generally considers as permanent shocks. The coefficient on NFIFAZ is narrowly positive as significance only at the 10 per cent level, implying some, though weak, statistical support for the view that migrant remittances promote domestic savings performance. The positive coefficient of the inflation rate as captured by the RINF suggests that a positive effect on the private savings rate supporting increased uncertainty in the Indian macroeconomic environment.

There is support that government savings is a substitute for private savings in the context of Indian economy though not to the fuller extent as suggested by the Ricardian equivalence hypothesis. The findings indicate that a one percentage point increase in the government saving ratio is siphoned off with 0.54 percentage point reduction in the private savings rate. Thus, an improvement in government savings consequent to a shift in income from the private end to the public end, say, by higher income tax would contribute to an

increase in gross domestic savings. The coefficient on SYA i.e. the share of agriculture in GDP failed to attain statistical significance to the growth in private savings rate and so is dropped from the final equation from being considered its impact on long-run growth. However, the variable D is found having statistically significant coefficient in all experimental runs and hence cannot be dropped from the final equation.

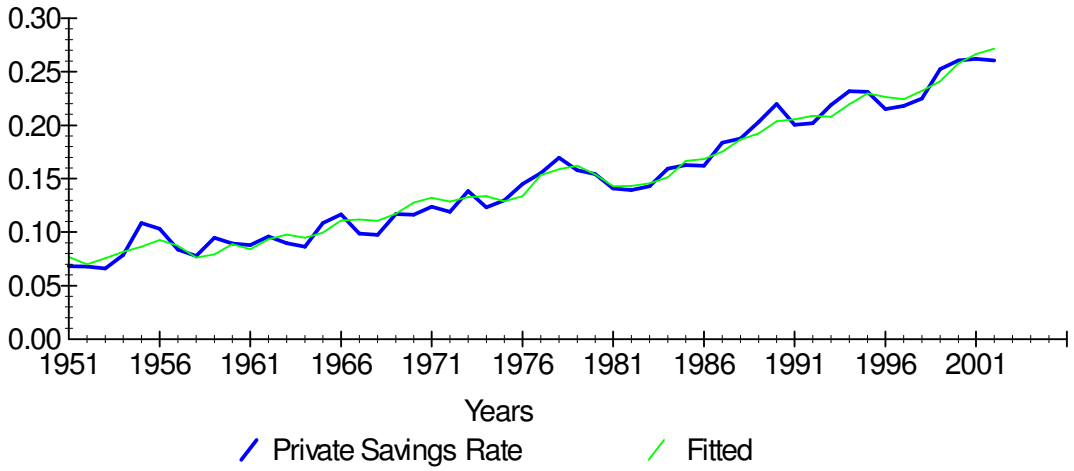


Figure: 8.4: *Plot of Actual and Fitted values of Private Savings Rates in the long-run using Equation (8.2a)*

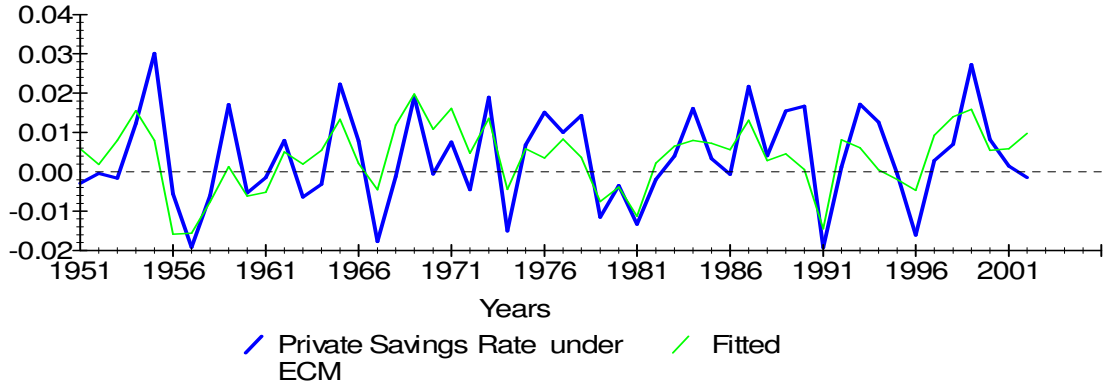


Figure: 8.5: *Plot of Actual and Fitted values of Private Savings Rates in the long-run with short-run impact using Equation (8.2a)*

TABLE 8.3 : *Determinants of Investment of the Private Corporate Sector in India: Regression Results*

ΔSIC_t =	-2.17 +	1.11 ΔY_t	+ 0.17 ΔSIG_t	+0.12 IG_{t-1}	-.59SIC_{t-1}	+ 0.53 $P_{90}D$
	$(1.79)^b$	$(1.57)^a$	$(3.61)^c$	$(2.69)^c$	$(2.47)^c$	$(3.47)^c$
R^2=0.58			$F(3,49) = 7.22^C$		*S.E. of regression* = .15	
DW = 2.45			*LM*1 - $\chi^2(1)$ =1.57		*LM*2 - $\chi^2(2)$ =0.45	
RESET – χ^2 = 0.20			*JBN* - $\chi^2(2)$ = 0.06		*SPEC* - $\chi^2(2)$ = 3.19	
		Long-run (steady – state) effect on savings rate				
		Change in real GDP (ΔY)				1.97^a
		Government Investment Rate (ΔSIG_t)				42^c

***Source*:** Author's calculation from CSO, National Accounts Statistics, various issues and other official sources as is mentioned in the section: data sources in chapter 1

Notes: t-ratios of regression coefficients are given in brackets. Approximate critical values for the t-ratios are as follows: 10 per cent = 1.31 (^{a}); 5 per cent = 1.69 (^{b}) and 1 per cent = 2.44 (^{c}). The test statistics are : *LM* = Lagrange multiplier test of residual serial correlation; *RESET* = Ramsey test for functional form misspecification; *JBN* = Jarque – Bera test for the normality of residuals, *SPEC* = Sargan's test for the correct specification of instruments

Turning to the Table 8.3, the results support the hypothesis that the acceleration principle has not been very significantly important in explaining the Indian corporate investment behavior as the coefficient on the GDP variable (ΔY) though positive but significant at 10 per cent level. A one percentage point increase in the rate of growth in real GDP is associated with a 1.97 percent increase in corporate investment in the long-run.

In so far as the issue of crowding –in or crowding –out effect of private corporate investment is concerned, the results for the government investment (SIG) variable does not robustly support the view that in the Indian economy public investment has a strong complementary relationship with corporate investment. The impact (short-run) and long-run (steady-state) elasticities of private corporate investment with respect to public investment are 0.17 and 1.97 respectively. However, it is important to note that in the long-run the degree of complementary is more pronounced as compared to the short-run. The positive and significant coefficient entangled to the post-90s- dummy ($P_{90}D$) can be interpreted as the private household investment being substituted, albeit, marginally by the private corporate investment following 1991-92.

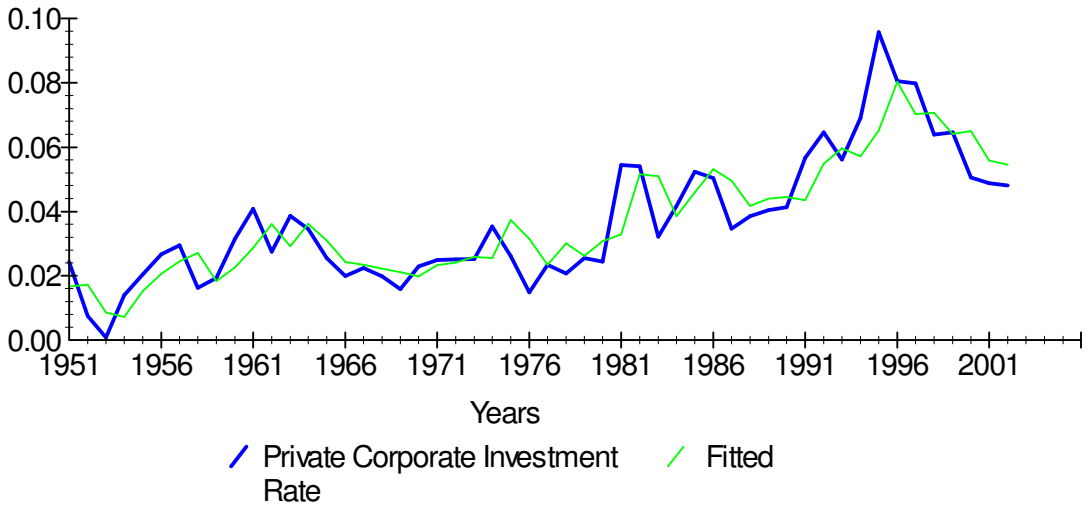


Figure: 8.6: *Plot of Actual and Fitted values of Private corporate investment rates in the long-run using Equation (8.2b)*

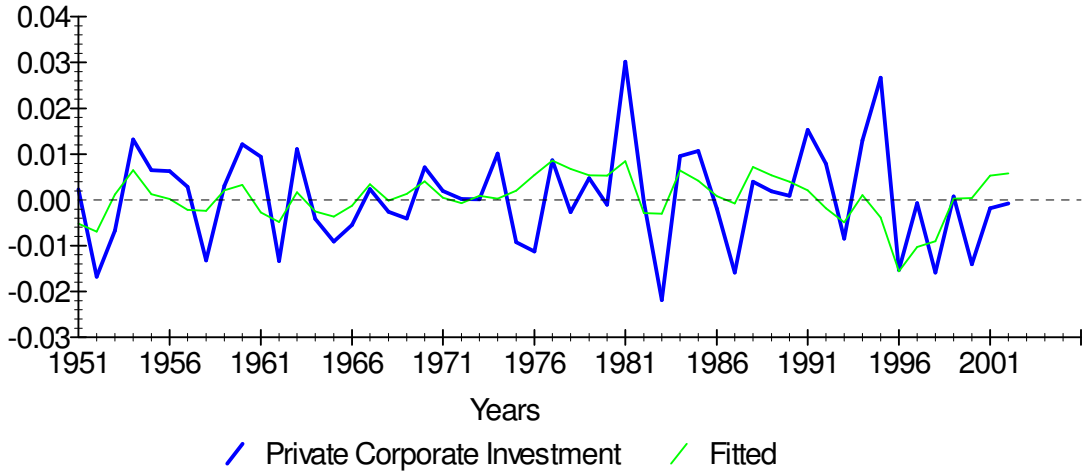


Figure: 8.7: *Plot of Actual and Fitted values of Private corporate investment rates in the long-run with short-run impact using Equation (8.2b)*

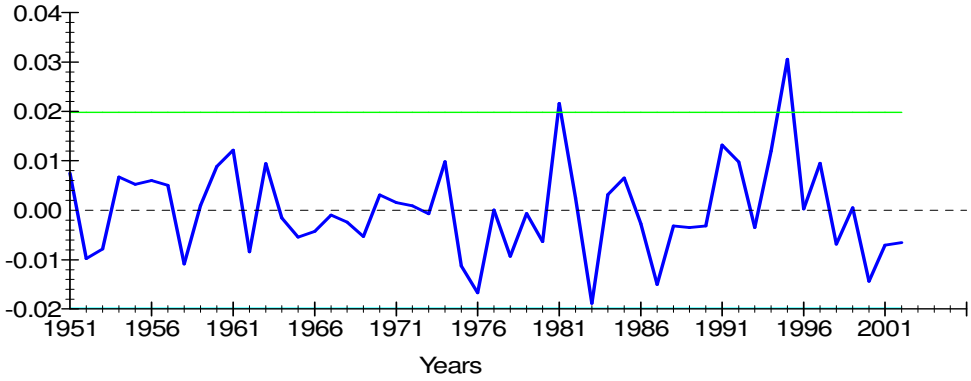


Figure: 8.8: *Plot of Residuals and two Standard Error Bands of Private corporate investment using Equation (8.2b)*

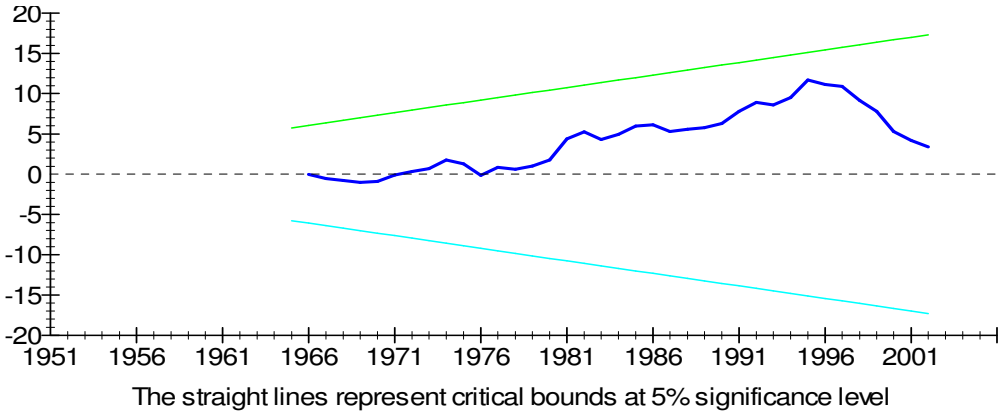


Figure: 8.9: *Plot of Cumulative Sum of Recursive Residuals of Private corporate investment rates using Equation (8.2b)*

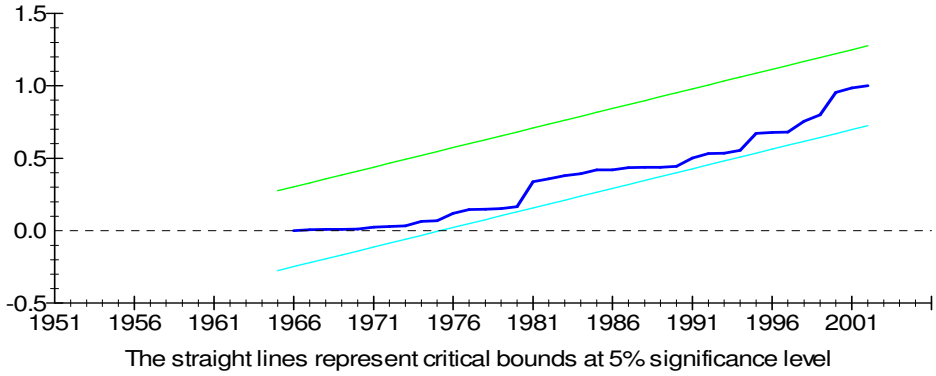


Figure: 8.10: *Plot of Cumulative Sum of Squares of Recursive Residuals of Private corporate investment rates using Equation (8.2b)*

The above figures 8.1, 8.2, 8.9 and 8.10 show that the parameters of both the private savings rate function and private corporate investment function have almost been stable. However, in Figure 8.10, it can be seen that there is a tendency to shift the recursive residuals of private corporate investment function tending to touching the band line during the mid-60s and 1990s may be attributable its role to the macroeconomic instability episodes as it had critical value of standard error during the mid 1960s and the 1990s [see Figure 8.8]. However, the seemingly parameter instability of private corporate investment in Figure 8.10 might suggest that recursive residual test holds good to test structural break-point and remains far from being significant for lag adjusted model, for which parameter stability mis-specification be solved by the predictive failure test [Chow, 1960].However, this evidence may be a claim of structural shifts. Both in the Figure 8.3 and 8.8, plot of residuals have almost been within two standard error bounds implying that residuals are serially uncorrelated or white noise. This is another way of saying that the assumed determinant of both the private saving function and private corporate investment function are found to be co-integrated. In this sense, the dynamic model specification for both the Indian functions seems to have been reasonably just. However, in the figure 8.8, there is a tendency of the residuals of private corporate investment function in very rare cases have been out of bound lines may suggest that the behavior of private corporate investment may be partly held responsible for that twin instability episodes of the 1960s and 1990s and the dynamism for private corporate investment seemed to have been halted for some sub-periods as findings suggest under this study.

Thus it is important to note that gross domestic savings has still been the predominant source for gross domestic capital formation. Till 1980s, government investment behavior was less volatile than its private outfit. Public savings started showing dismal performance since 1980s. There has been a series of variations in real interest rate and growth differentials and thereby sectoral savings-investment disjunction, mainly of private corporate sector as household sector till date is the major player as stationary its behavior either in terms of savings or investment. Thus, the disjunction of savings behavior between government sector and private corporate sector in terms of domestic capital formation might have led the seeds for underlying macroeconomic crises as economic fundamentals besides exogenous shocks in which government's policy co-ordination between fiscal, monetary and exchange rate might not have worked properly with a vision of long-run stable growth rate, inflation target, interest

target and exchange rate target. Thus may be, it was difficult to play for all the four variables rightly in tandem with like growth rate, inflation rate, interest rate and exchange rate as composite combo variable for stabilization to have had stable macroeconomic environment.

Combining the regression estimated results reported in the Table 8.2 and the Table 8.3 for the private savings function and the private corporate investment with an analysis of the behavior of the key explanatory variables such as sectoral savings and investment and their determinants like real interest rate, inflation rate, terms of trade, remittances to figure out the underlying macroeconomic fundamentals and stylized facts of recessions in the 1960s and the 1990s in explaining comparative perspective of instability episodes and how Indian macroeconomic growth process differed across periods in the face of exogenous shocks informing Indian macroeconomic policies to stabilize the economy which summarily would be presented in the next chapter.

8.2. THE INDIAN DEFICIT INDICATORS & MACROECONOMIC VARIABLES: A CO-INTEGRATION AND CAUSALITY ANALYSIS

The above description about how the variations in the three gaps to maintain savings-investment balance over the entire sample period in the Indian context occurred motivates this section to investigate econometrically the short-run and long-run causal relationship and the direction of contemporaneous movements in these three gaps, and the results are presented below in the table. Deficits impact major macroeconomic variables. With the state growingly being viewed as a welfare state, this relationship between deficit indicators and macroeconomic variables is becoming very evident particularly in developing countries. Any effort to study the relationship between the three gaps more systematically must analyse the related variables in aggregate sense as well as sector-wise on all fronts, including domestic, external, real, financial such as sectoral consumption, investment, savings, exports, imports, internal debt and external debt, foreign direct investment, foreign capital inflow, factor income from abroad, money supply, the real exchange rate, interest rate, inflation rate, and above all economic growth and thereby macro policy mix. Thus, one of the main objectives of this chapter is to identify the probable transmission channels of instability in the Indian context to compare the instability sub-periods in the 1960s and 1990s.

This section investigates the role of sectoral savings and investment in influencing macroeconomic growth process in India using a multivariate co-integration and causality analysis framework. It attempts to examine whether deficit indicators and the macroeconomic variables share a co-integration and causal relationships using the Indian annual macroeconomic time-series dataset for the 54-year period from 1950-51 to 2003-04 particularly to understand how India's macroeconomic policies are prudent to maintain these deficits at a level consistent with other macroeconomic objectives such as controlling inflation, prompting private investment and maintaining external credit worthiness. Prior to causality testing, co-integration is first employed to test as to whether long-run equilibrium relationships exist between deficit indicators and the variables. The co-integration framework enables to investigate the existence of one or more long-run relationships between them.

This section examines time-series properties of the data used by employing unit-roots tests and reports their nature and estimates economic relationships in the co-integration – error correction framework to shed light on the short-run dynamics out of equilibrium and to provide information for one or more co-integrating long-run stable relationships between macroeconomic variables in a multivariate framework with full sample and non-overlapping sub-samples when some or all of the variables are non-stationary in the Indian context with lead-lag relationships.

NATURE OF INDIAN MACRO TIME-SERIES DATABASES

This section has first examined the underlying time-series properties of the variables used and thereby the nature of the data. It begins the estimation process by using the standard Dicky-Fuller procedure. Testing for stationarity and finding the order of integration of an observed time-series has been the principal concern in doing so. Prior to testing for a causal relationship between the time-series, the first step is to check the stationarity of the variables employed as regressors in the equations to be estimated. The following Table 8.4 contains the test reports along with description of variables used for empirical investigation.

TABLE 8.4: *Tests for Unit Roots of Variables Used In the Econometric Analysis*

Notations / Data Series	***ADF test of H_0: I (1) versus H_1: I(0)***	***Whether I(1) or I(0)***
Y (gross domestic product at 1993-94 prices)	4.92(0)[3]	I(0)
YZ (gross domestic product at current market prices)	12.8(0)[3]	I(0)
RY (growth rate of gross domestic product at 1993-94 prices)	-2.92(0)[3]	I(0)
ΔY (Inter-year change in gross domestic product at 1993-94 prices)	-0.43	I(1)
GDPDEF (price deflators at gross domestic product at market prices; where, 1993-94=100; = YZ/Y*100	1.65(0)	I(1)
RINF (inflation rate)	-2.49 (0)[3]	I(0)
CAD (adjusted current account deficit)	-0.51(0)	I(I)
GFD (gross fiscal deficit)	1.24(0)	I(I)
TD (trade deficit)	-2.98(0)	I(1)
C (total final consumption expenditure at 1993-94 prices)	3.02 (0)	I(I)
CG (government final consumption expenditure at 1993-94 prices)	0.96 (0)	I(I)
CP (private final consumption expenditure at 1993-94 prices)	2.86 (0)	I(I)
SG (gross savings of the government sector)	-0.61(0)	I(I)
SP (gross savings of the private sector)	7.08 (0)	I(1)
SH (gross savings of the household sector)	8.01(0)[3]	I(0)
SC (gross savings of the private corporate sector)	0.20 (0)	I(I)
SZ (Gross domestic savings)	5.17(0)[3]	I(0)
IG (gross capital formation of the government sector)	0.79 (0)	I(I)
IP (gross capital formation of the private sector)	2.82 (0)	I(I)
IH (gross capital formation of the household sector)	5.09 (0)[3]	I(0)
IC (gross capital formation of the private corporate sector)	-0.77(0)	I(I)
GDCF [adjusted gross domestic capital formation (or gross capita formation) at 1993-94 prices]	0.03(0)	I(I)
XZ (exports of goods and services at current prices)	9.02(0)[3]	I(0)
MZ (imports of goods and services at current prices)	8.46(0)[3]	I(0)
IPDZ (interest on public debt at current prices)	13.23(0)[3]	I(0)
YA (Gross domestic product from agricultural sector)	-1.75(0)	I(I)
YM (Gross domestic product from manufacturing sector)	2.27(0)	I(I)
YC (Gross domestic product from construction)	2.72(0)	I(I)
YINFS (Gross domestic product from infrastructure)	-1.50(0)	I(I)
PDA (Price-deflator in agriculture)	0.51(0)	I(I)
PDM (Price-deflator in manufacturing)	-0.40	I(1)
E [Nominal exchange rate (Rs. Per US$)]	0.02 ())	I(1)
RER (Real exchange rate)	-1.69 (0)	I(1)
ID (Total internal debt)	7.9 (0)	I(0)
ED (External debt of the central government)	-0.08 (0)	I(1)
INT (Nominal interest rate (one-year deposit rate)	-0.85	I(1)
M3 (Broad Money)	1.31 (0)	I(1)
RINT [Real interest rate (INT – RINF)]	-1.86 (0)	I(1)
ICOR (Incremental capital-output ratio)	-7.40 (0)	I(0)
NFIFAZ (Net factor income from abroad or remittances)	.52 (0)	I(1)
SSYA(Share of agriculture to real GDP)	-.42 (0)	I(1)
TOT (Terms of trade)	-2.40 (0)	I(1)
SSP (Private savings as percentage of GDP)	-.13(0)	I(1)
SIC (Private corporate investment as percentage of GDP)	-1.89(0)	I(1)
SIG (Government investment as percentage of GDP)	-2.14(0)	I(1)

Notes:

1. Except in the cases of RY, ΔY, RINF, TD, all the tests are performed with 'trend and intercept' to allow for the possibility that for most economic time-series, the usual competing alternative to the presence of a unit root is a deterministic linear trend. The critical value at the 5 per cent level is -3.49 and for RY, ΔY, RINF, TD allowing no intercept and no trend, the critical value at the 5 per cent level is -1.94.
2. Figures in parentheses imply the order of augmentation required to obtain residual whiteness.
3. Rejection of null hypothesis

***Source*:** Author's calculation from CSO, National Accounts Statistics, various issues and other official sources as is mentioned in the section: data sources in chapter 1

The results for the ADF test (presented in the above Table 8.4) suggest that the variables do not have the same order of integration. The Table 8.4 suggests that the variables- annual change in real GDP, GDP deflator, current account deficit, trade deficit, aggregate final consumption expenditure, government final consumption expenditure, private final consumption expenditure, government savings, private savings, private corporate savings, government investment, private investment, private corporate investment, gross domestic capital formation, GDP from agriculture, GDP from manufacturing, GDP from construction, GDP from infrastructure (i.e. from electricity, gas and water-supply; and, transport, roads, communications), price deflator in agriculture, price deflator in manufacturing, exchange rate, real exchange rate, external debt, nominal interest rate, money supply, real interest rate, remittances, share of agriculture to GDP, terms of trade, ratio of private savings as percentage of GDP, ratio of corporate investment as percentage of GDP, and ratio of government investment as percentage of GDP are found to be integrated of order one (I(1) [i.e. non-stationary or presence of unit roots] while retaining long-run information against the variables – real GDP, monetary GDP, growth rate of real GDP, growth rate of inflation, gross domestic savings, household savings and household investment, exports of goods and services, imports of goods and services, interest rate on public debt, internal debt, and incremental capital output ratio belong to the I(0) category [i.e., stationary or absence of unit roots].

Prior to apply ADF test for the presence of unit root, this section has also performed the exercise having gone through their visual inspection of time-series plots of correlogram or autocorrelation function (ACF) of the candidate variables under scrutiny as a first priory to understand the nature of the data. If the visual inspection of a time-series variable at levels shows linear trend and if its first difference shows no evidence of trend, then the variable is found to be non-stationary or having presence of unit roots [I(1)] i.e. the distribution function of the variable is believed to be time-variant or would have non-constant mean and variance and then the graphical plot of that variable is believed to be consistent being integrated at an order 1 and denoted as I(1).

However, the ADF tests are sensitive to the choice of lag length and over-parameterization for the selected model can happen when the lag length chosen exceeds the 'true' lag length. In view of the size-power trade-off, to choose appropriate model selection criteria indicating correct lag length with optimal order of augmentation, Akaike Information

Criterion (AIC) and Schwarz Bayesian Criterion (SBC) leads to a parsimonious model as reported in the following Table 8.4 while finding the studied variables whether I(1) or I(0). The theoretical justification of applying unit root tests are avoiding the risk of spurious regression as conventional OLS method may prevent to get the true short-run and long-run macroeconomic relationships providing short-run instability information within long-run stable dynamic analysis.

THE INDIAN REAL GDP ANALYSIS

One important question seems to have cropped for this research is that why the Indian real GDP at level value and at rate value found stationary though there has been a considerable rise in the trend rate of growth of real GDP since the mid-1970s. From 1950-51 to 1975-76, it was below 3.4 per cent a year growth compared to slight more than five per cent since then till 2002-03. If dated the change since early 1980s, the difference would be still greater. The question arises behind these two trend growth rates as to whether be there anything to explain? The question seems to involve the analysis of Indian macroeconomic management i.e. how important were the Indian macroeconomic policies in explaining economic growth. On this count, demand management and supply management short-run and long-run policies are important in the context of greater pressure of demand, more efficient use of existing resources, higher investment and more efficient investment.

This section reports the estimated autocorrelation and partial autocorrelation functions of Indian real GDP, 1950-2003, shown in the following Table 8.5. The estimated function in Table 8.5 combined with the similar analysis of the estimation of the first-order AR model of the first-differenced, logarithmic - transformed Indian real GDP series, shown in Table 8.6 along with the other corresponding graphical plot of correlogram of Indian real GDP in Figure 8.11 show virtually identically result that Indian real GDP at level value has by and large been stationary. The uni-variate time-series model, Table 8.6 has been statistically an adequately fitted model [as the computed T-ratio has been greater than the critical value at 5 percent level to being stationary to be statistically significant, see Table 8.6], albeit, it is argued that the AR(1) and random walk with drift processes are adequate representations of the time-series process of Indian real GDP to be comparable to understand the dips in the 1960s and 1990s as there would be some significant macroeconomic association as is why changes in real GDP,

given the lags of the autocorrelation and partial autocorrelation functions as there is a variation of the random walk with drift as the residuals of this model show few deviations from normality.

TABLE 8.5: *Estimated correlogram Function of India's Real GDP 1950-51 to 2003-04*

Lags	Autocorrelation coefficient	Standard error	Partial autocorrelation coefficient	Box – Pierce Q-Stat	Probabilities
1	0.919	0.13	0.919	48.144	0
2	0.846	0.22	0.011	89.72	0
3	0.774	0.27	-0.029	125.22	0
4	0.704	0.31	-0.023	155.24	0
5	0.635	0.34	-0.037	180.16	0
6	0.571	0.36	-0.01	200.73	0
7	0.511	0.37	-0.016	217.51	0
8	0.45	0.39	-0.036	230.84	0
9	0.395	0.401	-0.008	241.32	0
10	0.344	0.408	-0.006	249.47	0
11	0.299	0.413	-0.004	255.75	0
12	0.254	0.417	-0.022	260.41	0
13	0.212	0.42	-0.021	263.73	0
14	0.168	0.422	-0.048	265.86	0
15	0.126	0.423	-0.02	267.09	0
16	0.086	0.4244	-0.022	267.68	0
17	0.052	0.4248	-0.001	267.9	0
18	0.019	0.4249	-0.019	267.94	0

***Source*:** Author's calculation from CSO, National Accounts Statistics, various issues

TABLE 8.6: *Autoregressive Time-Series Model of Real India GDP*

Variable	Coefficient	Std. Error	T-Ratio	Prob.	5% Critical Value
Real GDP (-1)	0.069021	0.014465	4.771706	0	-3.4969
C	-6383.06	3887.05	-1.64214	0.107	
Trend@ 1950=1	-114.9436	345.0802	-0.33309	0.7405	
R-squared	0.740522				
Adjusted R-squared	0.729931				
S.E. of regression	14101.43	Akaike info criterion		22.0019	
Sum squared resid	9.74E+09	Schwarz criterion		22.11447	
Log likelihood	-569.0494	F-statistic		69.92029	
Durbin-Watson stat	2.137456	Prob (F-statistic)		0	

Note: Dependent Variable: DGDP
Adjusted Sample: 1952 2003
Source: Author's calculation from CSO, National Accounts Statistics, various issues

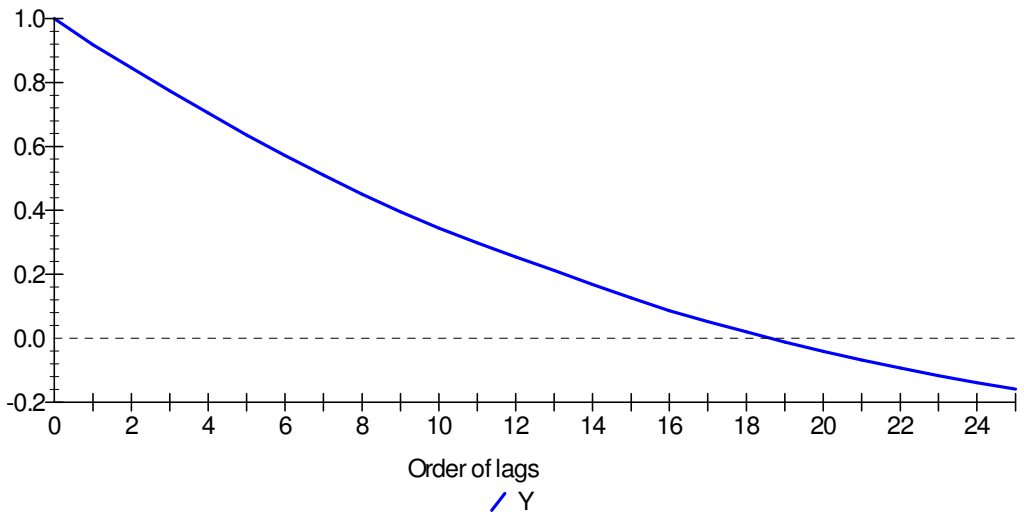


Figure 8.11: *Correlogram of the Indian Real GDP (Y) at level value over the sample period from 1950 to 2003*

Source: Author's calculation from CSO, National Accounts Statistics, various issues

The Indian rate of inflation has also been stationary as the statistical findings in the above Table 8.4 and the corresponding plot below 8.12 suggest. Now the question is has India been a low inflation country? But, the PBC literatures argue that India might be politically induced low inflation country. Now the question is has the Indian fiscal and monetary stances been conservative or rather countercyclical throughout the studied sample period? It has already been pointed out that India's pre-80s conservative fiscal and monetary stances diluted or rather eroded to chase debt burden, deficit monetization and to combat foreign exchange constraint, especially after 1991 as India's late 60s administered interest rate cum financial repression approach in bank nationalization spirit to induce import substituting development strategy has changed radically to deregulated interest rate cum market determined exchange rate regime. On the other hand, India had to face various exogenous shocks particularly due to droughts, oil price rises and political aberration such as war. That might have led to inflationary bubble for the time being and seems could not sustain its shocks for longer period. In other words, shocks might have made inflation more volatile without affecting the low long-run trend. Inflation is affected by exogenous shocks such as changes in food production, non-farm production (domestically produced raw materials) and import prices via adverse terms of trade shocks and exchange rate shocks. However, oil price shocks might have had sustainable impacts as it makes foreign reserve depleted and current account deficit worsen.

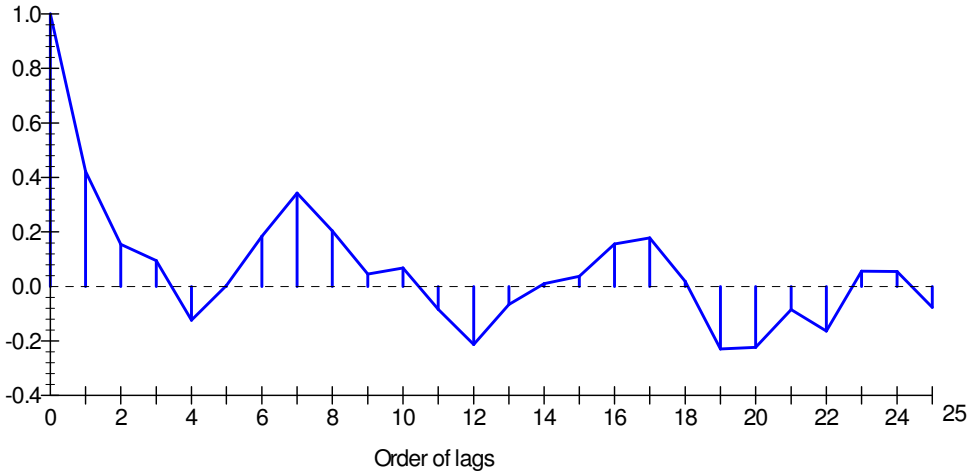


Figure 8.12: *Correlogram of the Indian Annual Inflation Rate, 1951 to 2003*
***Source*:** Author's calculation from CSO, National Accounts Statistics, various issues

However, this uni-variate the no-change naïve model of unit root tests may cast doubt on the effectiveness in modeling statistically significant the respective real GDP changes and inflation creeping episodes in the 1960s and the 1990s , examining the predictive information, and recent development of regime-switching model might well be conjecture one. However, this section came to help for the subsequent causality and co-integration analysis to slate the Indian comparative instability perspective in the 1960s and 1990s.

HOW INDIAN INSTABILITY MEASURES CAUSE MACROVARIABLES

This sub-section has utilized the Indian annual macroeconomic time-series datasets for the years 1950-51 to 2002-03 to see the Granger causality between the macroeconomic deficit measures viz. GFD, CAD and TD and macroeconomic variables (all in Indian rupees). Though it has not tested for the Akaike criterion for the purpose of determining optimum lag length, given the annual data series for the variables. It has opted for three period lag lengths for the test. Then it has tested the standard zero restriction of H_0. Following the F –statistic and corresponding probabilities nearing zero, it cannot reject the null hypothesis, although the second one is rejected at 5 per cent level of significance. Thus one-way Granger cause implies not the reverse is true while bidirectional causality refers the reverse is also true. Given the granger causality, it helps to concentrate on the regressions in determining dependent and explanatory variables.

TABLE 8.7: *Results of Causality for GFD and the Macroeconomic Variables (Granger Test) & Summary of the Causal Relationship between them(Full Sample 1950-51 to 2002-03)*

Variables	Null Hypothesis		
	Variables do not Cause GFD F- statistic(Prob.)	**GFD does not Cause Variables F – statistic(Prob)**	**Direction of Causality**
	GR	GR	Granger
CAD	14.81	15.70	X
	(1E-05)	(6E-06)	
TD	14.42	1.90	TD→GFD
	(1E-05))	(0.16)	
GDCF	6.96	5.94	GDCF↔GFD
	(0.0023)	(0.0051)	
Ig	11.80	16.53	X
	(7E-05)	(4E-06)	
Ip	17.30	3.67	Ip →GFD
	(2E-06))	(0.033)	
Ic	15.75	1.13	Ic →GFD
	(6E-06))	(0.33)	
Sg	11.80	2.60	Sg →GFD
	(7E-05)	(0.084)	
Sc	13.10	5.009	Sc→GFD
	(3E-05))	(0.0108)	
Cg	10.51	3.35	Cg ↔GFD
	(0.0002)	(0.04)	
E	4.40	15.52	GFD→E
	(0.01)	1E-05	
RER	4.11	7.99	RER↔GFD
	(0.02)	(0.001)	
ED	3.87	2.27	GFD→ED
	(0.02)	(0.11)	
INT	2.51	2.18	GFD →INT
	(0.09)	(0.12)	
M3	11.74	9.9	M3↔GFD
	(.0001)	0.0003	

Note: 'x' denotes no causality; ' →' denotes unidirectional causality; and, '↔' denotes bidirectional (feedback) causality
Source: Author's calculation from CSO, National Accounts Statistics, various issues and other official sources as is mentioned in the section: data sources in chapter 1

The results of the causality tests among deficit measures and macroeconomic variables reported in the above Table 8.7 seem to have been very interesting. It is found that deficit measures like fiscal deficit causes mostly the non-stationary variables and in most of the cases deficit measures has not caused the stationary variables (see, household savings and investment found stationary not having been caused by fiscal deficit while corporate investment, corporate savings, government investment, government savings being non-stationary are caused by fiscal deficit. Thus Indian deficit measures and non-stationary variables are believed to be in long-run relationship as co-integrated at order one not only using ADF tests but also based on CRDW test (results not reported). On the other hand, though there is weak evidence relating with twin-deficit causation, however, all the intermediate candidate variables like sectoral

investment and savings and policy variables like interest rate, exchange rate, inflation rate and growth rate have reasonably been found having causation from deficit indicators.

It may be noteworthy finding that as household investment and savings are found to be stationary, then for stability, government and corporate saving- investment nexus may be the prerequisite essential for the long-run stability and their disjunction may lead periodic instability. Thus the problem is at the core of macroeconomic management. Thus stability depends on how government uses corporate surplus.

The following Table 8.8 has reported the estimated dynamic cross-correlation functions between private investment and government investment in India and in this one year lead/lag rolling approach it is found that the relationship between them is not quite clear as there is no clear indication of being complementary or not. Thus the issue of crowding out / in of private investment has been subject to policies relating with demand and supply side both.

TABLE 8.8*: Dynamic cross-correlation (lag/lead) between private investment (IPZ) and government investment (IGZ) over the sample period 1950-2003: Correlations are asymptotically consistent approximation*

IPZ,IGZ(-i)	IPZ,IGZ(+i)	i	lag	Lead
. |**********	. |**********	0	0.9739	0.9739
. |*********|	. |*********|	1	0.9122	0.8518
. |*********|	. |******* |	2	0.8474	0.7433
. |******** |	. |****** |	3	0.7762	0.6419
. |******* |	. |***** |	4	0.6862	0.5416
. |****** |	. |***** |	5	0.6156	0.4588
. |****** |	. |**** |	6	0.5544	0.3769
. |***** |	. |*** |	7	0.4904	0.3107
. |**** |	. |**. |	8	0.4250	0.2275
. |**** |	. |**. |	9	0.3554	0.1752
. |*** |	. |* . |	10	0.3028	0.1362
. |**. |	. |* . |	11	0.2537	0.0930
. |**. |	. |* . |	12	0.2074	0.0601
. |**. |	. | . |	13	0.1637	0.0264
. |* . |	. | . |	14	0.1235	-0.0020
. |* . |	. | . |	15	0.0879	-0.0282
. |* . |	. *| . |	16	0.0591	-0.0487
. | . |	. *| . |	17	0.0245	-0.0665
. | . |	. *| . |	18	-0.0065	-0.0846
. | . |	. *| . |	19	-0.0337	-0.0998
. *| . |	. *| . |	20	-0.0568	-0.1129
. *| . |	. *| . |	21	-0.0809	-0.1258
. *| . |	. *| . |	22	-0.1022	-0.1393
. *| . |	.**| . |	23	-0.1174	-0.1503
. *| . |	.**| . |	24	-0.1339	-0.1608

8.3. THE SUSTAINABILITY OF SAVINGS AND INVESTMENT BALANCES IN THREE GAPS: INDIAN MACROECONOMIC CRISES

Based upon the basic twin-deficit identity, the following Table 8.8 describes variations in three gaps over the entire studied sample period and the results are contained in the table itself. It portrays savings and investment of the three sectors, as well as for India as a whole before, during, and after the macroeconomic instability sub-periods. It also shows how total gross domestic capital formation is financed by the savings of the three sectors and by external savings.

Table 8.9 : *Behaviour of Three Gaps Before, During, and After Instability Episodes across Decades*

(Percentage of GDP at market prices)

Periods	*Government Investment*	*Government Savings*	*Public Gap*	*Private Savings*	*Private Investment*	*Private Surplus*	*Gross Domestic Capital Formation (Adjusted)*	*Gross Domestic Savings*	*External Savings*
1950-59	4	1	2.6	8.18	7.04	1	11	10	1.1
1960-69	6	2.7	4.1	9.8	8.4	.1	14	12	2.0
1970-79	8	3.7	4.4	13	10	3	17	17	.0.1
1980-89	9	3	6	16	12	4	21	19	1.8
1990-03	7.4	0.2	7.1	23	15	8	24	23	1

Note: Gross Domestic Savings not estimated at 1993-94 prices as given by the CSO
***Source*:** compiled from NAS, CSO, EPWRF, 2004

The above Table 8.8 shows that both the gross domestic savings and gross domestic capital formation rates have grown in India over the studied sample period. Domestic capital formation in India has predominantly been financed through domestic savings. Both the savings and investment rates revealed significant cyclical behaviour, with the savings rate more volatile than the investment rate. The coefficient of variation over the period 1950-2003 was .30 for the savings rate as compared to .28 for the investment rate. Until the 1980s, private investment was less volatile than government investment. This was because of changes in government investment were made with the intention of controlling inflation and stabilizing the economy. On the other hand, private savings has accounted for the bulk share of gross domestic savings, with government savings revealing a decline from the early 1980s onwards [see Table 8.8]. However, private savings increased at different pace across decades. Within the private savings, household savings has continued to remain the lion sharer. However, the share of

corporate savings in total savings increased in the 1990s. There has been dismal showing in public savings since 1970s persistently.

Turning to investment, the relative contribution of the government and private sectors to gross domestic capital formation has changed considerably across sub-periods under consideration. Till the early 1980s, the increase in the overall gross capital formation was driven mainly by increase in government investment. Albeit, the rise in investment rate from the mid-1980s onwards can be attributed mostly to the increase in private investment, in respect to a steady decline in government investment. The rise in private investment in the 1980s and 1990s has mostly obtained from a rapid rise in private corporate investment, particularly in the 1990s resulting a fall in household investment between these two periods.

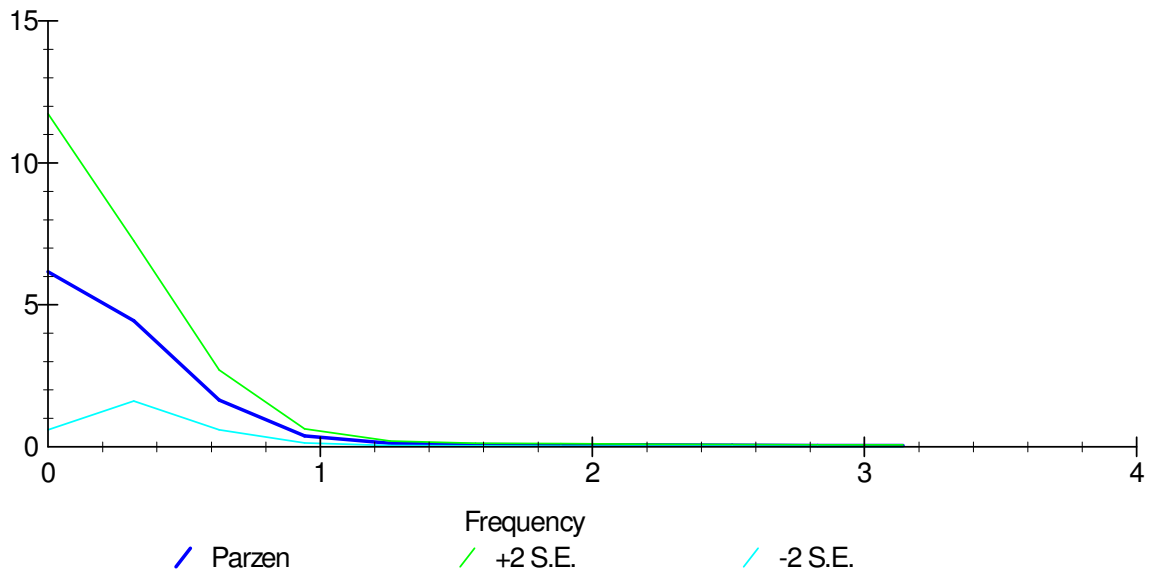
It can be observed that the private sector surplus remained somewhat roughly constant during the 1980s. The current account balance would have been improved without cutting government investment had there been risen in public savings. This tendency continued to exist till the early 1990s. The relentless increase in the gross fiscal deficit and the current account deficit culminated in 1991-92 crises. However, gross fiscal deficit and current account deficit were reduced instantaneously and significantly in 1992-93 due to stabilization cum structural reforms measures.

There were few occasions in the 90s when private surpluses exceeded public gap because of current account surpluses. However, there witnessed scarcely an indication of current account adjustment despite some rise in private surplus. The underlying basic indicators reveal that these gaps have increased again after mid-90s and private surplus continued to be the major source of financing the gross fiscal deficit, implying that fiscal and external stances are economically vulnerable for macroeconomic stability and fiscal consolidation as policy commitments declared to combine successfully sustained rapid growth with low inflation.

In this way, the above Table 8.8 having examined effectively the Indian sectoral savings and investment behavior analyses contemporaneous movements in the two gaps, namely gross fiscal deficit and current account deficit by invoking the third one – private surplus (deficit) to describe variations in these three gaps over the entire sample period in order to get the results for pursuing comparative macroeconomic instability perspective in the Indian economy in the

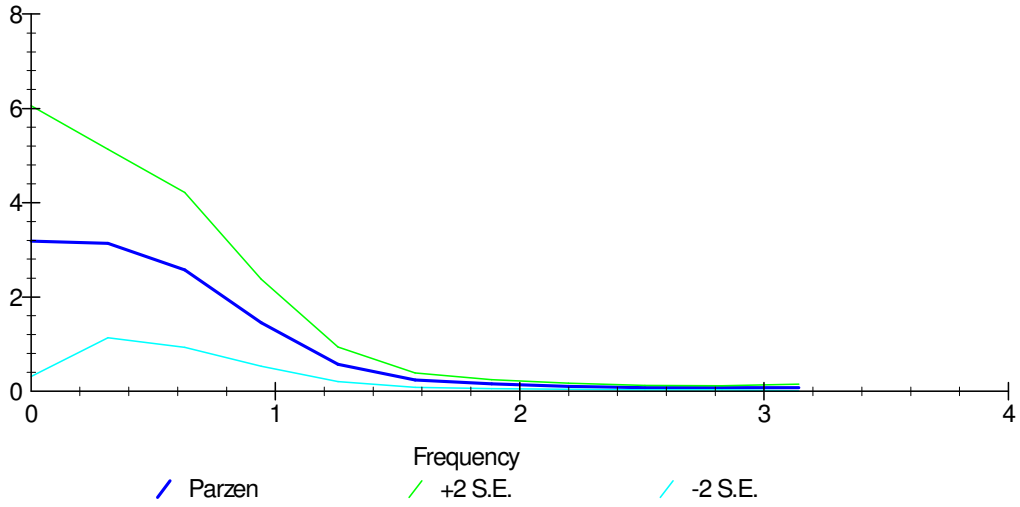
1960s and 1990s as the three gaps identity suggests that the gross fiscal deficit of the government must be financed either by an excess of private sector savings over investment (private surplus), or by a current account deficit.

Combining the following figures from 8.13 (A) to 8.13(D), the diametrical asymptotic behavior of standardized spectral density function in Parzen window also displays the public savings rate lagging behind (sluggish) public investment rates widened the gross fiscal deficits and current account deficits.



***Source*:** Compiled data from NAS, CSO [EPWRF, 2004]

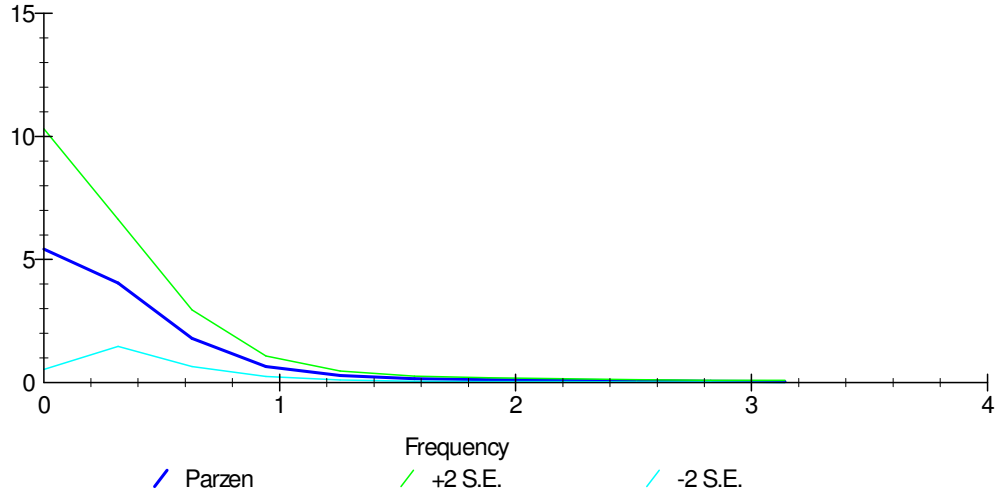
***Figure 8.13(A)*:** *Standardized Spectral Density Function of Public Gross Domestic Capital Formation*



***Source*:** Compiled data from NAS, CSO [EPWRF, 2004]

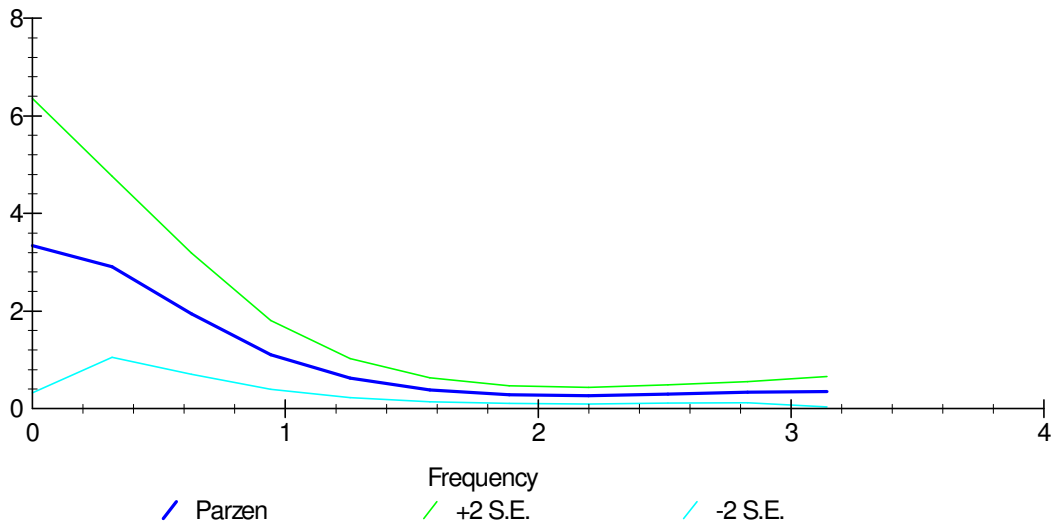
***Figure 8.13(B)*:** *Standardized Spectral Density Function of Public Savings*

Source: Compiled data from NAS, CSO [EPWRF, 2004]



***Source*:** Compiled data from NAS, CSO [EPWRF, 2004]

***Figure 8.13(C)*:** *Standardized Spectral Density Function of Gross Fiscal Deficit*



***Source*:** Compiled data from NAS, CSO [EPWRF, 2004]

***Figure 8.13(D)*:** *Standardized Spectral Density Function of Current Account Deficit*

This diametric dynamic view, their upper and lower openness, the changes in curvature with robustness of ordering and their deviations from standard errors bands and their variation get support from the above empirical analysis as provide similar qualitative results consistent with a priori expectations. This allows further investigation among their basic proximate determinants, as is carried out in the next chapter.

CONCLUSION

This empirical investigation provides a descriptive assessment of the following distinct but interrelated instability issues, viz., (i) fiscal transmission mechanism after and before the implementation of economic reforms; (ii) change in the fiscal operating procedure and the debt management; (iii) the possible changes in the monetary transmission mechanism in the face of financial reforms; (iv) trade related transmission mechanism; (v) BoP related transmission mechanism; (vi) economic activity wise transmission mechanism; (vii) the initiation of financial reforms and capital management mechanism.

The next chapter would end the thesis by presenting a comparative perspective of recessionary study in the 1960s and 1990s and summarise the findings in a nutshell.