SAVINGS, INVESTMENT, FOREIGN INFLOWS AND ECONOMIC GROWTH OF THE INDIAN ECONOMY
1950 - 2002

R. Verma and E. J. Wilson

Economics Discipline
University of Wollongong
Northfields Avenue
Wollongong NSW 2500
AUSTRALIA

E-mail: reetu@uow.edu.au
edgar_wilson@uow.edu.au
Phone: 61 2 42213666
Fax: 61 2 42213725

Paper presented to the
33rd Conference of Economists

University of Sydney
27-30 September, 2004
SAVINGS, INVESTMENT, FOREIGN INFLOWS AND ECONOMIC GROWTH OF THE INDIAN ECONOMY*
1950 - 2002

R. Verma and E.J. Wilson

ABSTRACT

There is a large research literature on the roles of domestic savings and investment in promoting long run economic growth. This paper attempts to identify the major interdependencies between savings, investment and foreign inflows for India since independence. An endogenous growth model of an open economy with government is adapted to specify the complicated interrelationships between the components of savings, investment and foreign inflows in a growing economy.

The time series of household, private (non-household) and public savings; private and public investment; and foreign inflows are tested for stationary under structural change. Empirical estimation of the possible relationships are conducted using ARDL cointegration techniques, which are appropriate for I(0) and I(1) processes. Granger causality techniques are then conducted to identify significant links. The preliminary results show that, whilst there are limited observed relationships between the aggregate measures of savings, investment and foreign inflows, there are significant and complicated relationships between the components. Household and public savings; public and private investment; and foreign inflows are found to be the long run forcing variables for private (non-household) savings. There is also evidence that all the savings components, as well as public investment and foreign inflows, drive private investment in the long run.

These findings have important implications for the formulation of appropriate policies relating to budget deficits and households, financial sector reforms and foreign inflows, in order to promote economic growth.

Keywords: Savings, investment, foreign inflows and economic growth
JEL Classifications: F43, E21, E22, C22.

* This research is part of a PhD thesis by R. Verma with co-supervisors E. J. Wilson D. P. Chaudhri and N. Perera. The authors would like to thank without implicating D. P. Chaudhri and N. Perera for helpful comments and suggestions. The data used in this work is available upon request from the authors.
1. Introduction

In recent years, there has been extensive empirical work on savings, investment and economic growth. The reasons for this are threefold. Firstly, the growing concern over the falling savings rates in the major OECD countries; secondly, the growing divergence in saving and investment rates between the developing countries; and thirdly, recent growth literature which emphasizes the role of investment in economic growth. Foreign capital inflows have also received considerable attention recently, which have beneficial effects in financing investment and economic growth. However they can be problematic in developing countries such as India because large inflows may create inflationary pressure, under fixed or pegged exchange rates.

The role of savings, investment and foreign inflows in promoting economic growth has received considerable attention in India especially after financial reforms were initiated in 1991. There have only been a few studies available on savings and investment behavior in India. These are Krishnamurty (1987) *et. al.*, Laumas (1990), Pandit (1991), Ketkar and Ketkar (1992), and Athukorala and Sen (2002). Only Athukorala and Sen (2002) consider the post financial deregulation time period.

Since independence, there has been a consistent increase in savings and investment in India but not without some fluctuations, as can been seen from Figure 1. Foreign capital inflows have been low during much of the period under consideration, only tipping 10% after financial deregulation in 1991. The growth rate in real GDP was consistently above 5% throughout the eighties and nineties except during the adjustment year of 1991-92.

The Gross Domestic Savings (GDS) rate increased from about 10% of GDP in the early 1950s to 16% in the early 1970s and then to over 20% in the 1980s and over 25% in the mid-1990s (*vide* Figure 1 and Table 1). Throughout the post-independence period, the household sector has accounted for the lion’s share of total domestic savings rate (*vide* Figure 2). Since the early eighties, there has been a decline in the public savings, reaching negative rates since 1998/99. The reason for the decline has been the deterioration in the fiscal position of the government administrative departments. There has been a rapid growth in private corporate savings over the past two decades.
Figure 1

Savings, Investment & Foreign Capital Inflow

<table>
<thead>
<tr>
<th>Years</th>
<th>GDS</th>
<th>GDCF</th>
<th>FI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950/51</td>
<td>9.7</td>
<td>10.0</td>
<td>0.9</td>
</tr>
<tr>
<td>1960/61</td>
<td>12.2</td>
<td>15.1</td>
<td>3.1</td>
</tr>
<tr>
<td>1970/71</td>
<td>15.7</td>
<td>17.1</td>
<td>2.8</td>
</tr>
<tr>
<td>1980/81</td>
<td>20.8</td>
<td>20.6</td>
<td>3.2</td>
</tr>
<tr>
<td>1990/91</td>
<td>25.7</td>
<td>26.8</td>
<td>8.7</td>
</tr>
<tr>
<td>2000/01</td>
<td>25.8</td>
<td>24.9</td>
<td>10.2</td>
</tr>
</tbody>
</table>

Source: Authors calculations

Table 1

Gross Domestic Savings (GDS), Gross Domestic Capital Formation (GDCF) and Foreign Capital Inflows (FI) (Percentage of GDP)

Source: Author’s calculations
Figure 2

Components of GDS

Source: Authors calculations

Gross Domestic Capital Formation (GDCF) rate increased from 10% of GDP in 1950/51 to around 18% in the early 1970s, and then to 26% by mid-1990 before dipping slightly to around 25% in the early years of 2000. As can be seen from Figure 3 and Table 2, the relative contribution of the private and public sectors to GDCF has changed considerably in the period under consideration. The increase in overall investment rate was driven by the public investment from mid-1960s to the early 1980s. The public investment rate improved from 28% in the early 1950s to 45% in the early eighties. However, private investment was the one which contributed to total GDCF since mid-1980 as public investment started to decline steadily. Private investment increased from 55% in the early 1980s to above 70% in the last couple of years.
Table 2
Components of Gross Domestic Capital Formation (percentage share)

<table>
<thead>
<tr>
<th>Years</th>
<th>Public Investment</th>
<th>Private Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950/51</td>
<td>27.9</td>
<td>72.1</td>
</tr>
<tr>
<td>1960/61</td>
<td>48.0</td>
<td>52.0</td>
</tr>
<tr>
<td>1970/71</td>
<td>40.4</td>
<td>59.6</td>
</tr>
<tr>
<td>1980/81</td>
<td>45.1</td>
<td>54.9</td>
</tr>
<tr>
<td>1990/91</td>
<td>38.8</td>
<td>61.2</td>
</tr>
<tr>
<td>2000/01</td>
<td>28.3</td>
<td>71.7</td>
</tr>
</tbody>
</table>

Source: Author’s calculations

Figure 3
Components of Gross GCDF

Source: Authors calculations
Figure 1 shows that foreign capital inflows were less than 1% in the 1950/51, increasing to 3% in 1980/81 after a fall in the seventies and then an increase in 1990/91 to 8.7%, increasing to 10% in 2001/02. The easing of restrictions on private capital inflows has led to a significant increase in both foreign direct and portfolio investment since 1991-92. It is the surge in the private capital inflow that has led to a sharp increase in India’s capital inflows. However, foreign investment has levelled off after 1997 due to various reasons, which include our weak infrastructure, rigid labour laws, cumbersome administrative procedures, to name a few. It could be said India gets very little foreign investment for its large economic and population size. India only receives one tenth of what China receives.

The paper is divided into four sections. Section 2 is devoted to formally modelling savings and investment in a small open economy with a government sector in a growth context. Section 3 deals with estimation procedures and discusses the estimated results. The final section brings out policy implications of these important empirical findings.

2. The Model

In order to explore the possible relationships between private, government and overseas savings and investment, it is necessary to develop a generic growth model which includes overseas and government sectors. The private sector is specified to comprise firms and households. A typical household supplies labour services \((l)\) to firms, in exchange for the real wage rate \((w)\), and owns real capital used in production \((k)\), which has real return \((rk)\). Positive household savings are lent to the government in the form of government bonds purchases \((b_g)\) with return on total borrowing \((rb_g)\). The household pays net taxes to the government \((\tau_h)\) and purchases consumption goods \((c)\) from firms.\(^1\) We assume the household has negligible investment expenditure and does not borrow or lend overseas. Total disposable income is therefore: \((wl + rk) - \tau_h\), which is consumed \((c)\) and retained as net saving: \(s = (b_g - rb_g)\). The budget constraint for the household becomes:

\[
c + (b_g - rb_g) = (wl + rk) - \tau_h
\]

\(^1\) Households may receive transfer payments from the government which are included in net taxes.
The representative non-household, private sector firm employs household labour and household owned capital to produce domestic real output \( y \). The sector is competitive with each firm’s output consisting of both consumption and capital goods. The production by a firm is also a function of total factor productivity \( A \):\(^2\)

\[
y = f(l, k; A)
\]  

The firm therefore pays the household wages for their labour services and profits in the form of the return to capital \( rk \). The firm is able to borrow from overseas \( \dot{b}_f \) and pays interest to overseas on the outstanding debt \( rb_f \). The typical firm pays tax \( \tau_p \) to the government, which purchases goods from it \( g \).\(^3\) Households purchase consumer goods from the firm, which also sells capital goods to other firms in the non-household private sector. Total cash inflows are therefore: \( c + \dot{k} + g + (\dot{b}_f - rb_f) \) and cash outflows are: \( wl + rk + \tau_p \). The cash flow constraint for the firms is:\(^4\)

\[
c + \dot{k} + g + (\dot{b}_f - rb_f) = wl + rk + \tau_p
\]  

The government budget constraint is:

\[
g = (\tau_h + \tau_p) + (\dot{b}_g - rb_g)
\]  

where receipts comprise taxation received from households and firms: \( \tau_h + \tau_p \) plus borrowings of net savings from households: \( \dot{b}_g - rb_g \). Outlays are in the form of government purchases of firm’s production.

Noting that household income comprises wage and profit receipts: \( y = wl + rk \) and rearranging (1) gives the well known representation:

\[
y = c + s + \tau_h
\]  

---

\(^2\) The firm’s production function is assumed to have the well behaved properties: \( \forall x \in \{l, k; A\} \)

\[
x(0) = x_0, f'_x > 0, f''_x < 0, \lim_{x \to 0} f'_x = \infty \quad \text{and} \quad \lim_{x \to \infty} f'_x = 0 \quad \text{where} \quad f'_x = \partial f / \partial x, \quad f''_x = \partial^2 f / \partial x^2.
\]

\(^3\) Government expenditure will include consumption spending on goods and services, broadly defined to include public service wages. For the purpose of this paper we will assume all spending is for investment purposes.

\(^4\) In order to ensure model stability it is necessary to constrain government and overseas borrowing. We restrict total borrowings \( \dot{b}_g + \dot{b}_f \) to be less than capital formation, \( \dot{k} \) in net present value terms. That
Similarly, substituting for the international borrowings to finance the trade balance \((x - m)\) in the current account of the balance of payments: \(\dot{b}_j = x - m\) and rearranging (3) gives:

\[
y = c + \dot{k} + g + \left(x - m - rb_j\right) - \tau_p\tag{6}
\]

Equating (5) and (6) derives the important identity:

\[
\left(\dot{k} - s\right) + \left(g - \tau\right) = \left(m + rb_j - x\right)\tag{7}
\]

where: \(\tau = \tau_h + \tau_p\). If \(\dot{k} = s\), then an increase in the budget deficit caused by a reduction in \(\tau\), is associated with a one-for-one increase in the current account deficit, \(m + rb_j - x\). This is called the “twin deficits hypothesis”. Alternatively, if: \(m + rb_j = x\), then the reduction in \(\tau\) is associated with a one-for-one reduction in \(s\). This represents the polar opposite case of the “Ricardian equivalence hypothesis”.

The representative competitive firm is assumed to maximise the intertemporal net present value of the return to capital, \(\nu(rk)\).

\[
\nu(rk) = \int_0^e \nu\left[\nu(k(t))\right] e^{-\rho t} dt\tag{8}
\]

with the discount rate \((\rho)\) assumed to be constant. The maximisation is subject to the constraint (3) which we manipulate to make the mathematics simpler. Set the tax rate to be a fixed proportion \((0 < \alpha_p < 1)\) of income for firms: \(\tau_p = \alpha_p y\) and substitute in (3):

\[
c + \dot{k} + g + \left(\dot{b}_j - rb_j\right) = y + \tau_p
\]

\[
= y + \alpha_p y
\]

\[
= \alpha y\tag{9}
\]

where: \(\alpha = 1 + \alpha_p\). The Hamiltonian: \(H = \nu(rk) e^{-\rho t} + \xi \dot{k}\) can be used to maximise intertemporal returns to capital, defined in (8), subject to (9). However we define the costate variable, \(\xi\), as the net present value of Tobin’s \(q\) at the current time period, \(t\); that is, \(\xi = qe^{-\rho t}\). The Hamiltonian for this frictional system becomes:

\[
is: \int_t^e \left[\dot{h}_g(t) + \dot{b}_j(t)\right] e^{-\rho(t-s)} ds < \int_t^e \dot{k}(t) e^{-\rho(t-s)} ds.
\]
\[ H = u(rk)e^{-\rho t} + q\dot{k}e^{-\rho t} \quad (10) \]

and the costate equation \( \dot{\xi} = -H_k \) gives the result: \( \dot{q} = rq - \alpha y'_k \), where \( y'_k = \frac{\partial y}{\partial k} \) denotes the marginal product of capital. This solves for \( q \):

\[ q(t) = \int_t^\infty (\alpha y'_k) e^{-\rho(t-s)} ds \quad (11) \]

Equation (11) clearly shows that Tobin's \( q \) is the sum of the weighted net present values of all future marginal products, \( \alpha y'_k \). Since \( q \) represents the marginal valuation of capital (relative to its replacement cost) when frictions are present, then values of \( q > 1 \) will encourage investment by firms according to the investment function:

\[ \dot{k} = \gamma(q-1) \quad \text{with} \quad \gamma' > 0 . \quad (12) \]

When \( q = 1 \), investment will be zero \( (\dot{k} = 0) \) and when \( q < 1 \), there will be disinvestment \( (\dot{k} < 0) \). Using (11) to substitute for \( q \) in (12) gives the required result for capital formation as a function of the net present value of the marginal products of capital in production:

\[ \dot{k} = \gamma \left( \int_t^\infty \alpha y'_k e^{-\rho(t-s)} ds - 1 \right) \quad (13) \]

Note from (2) that \( y = f(l, k; A) \), so the marginal product of capital (and therefore investment) is a function of total factor productivity \( (A) \).

Now let us consider the household behaviour. The representative household is assumed to select the time path of consumption which maximises intertemporal utility:

\[ u(c) = \int_t^\infty u[c(t)] e^{-\rho t} dt \quad (14) \]

where \( u(c) \) is a concave instantaneous utility function.\(^5\) The utility maximising growth in household consumption can be determined by substituting out the costate variable in the Hamiltonian maximisation to give:\(^6\)

\[^5\] The utility function has the standard properties: \( u(0) = 0 \), \( u(c) > 0 \) and \( u'(c) = \frac{\partial u}{\partial c} < 0 \).

\[^6\] The elasticity of marginal utility with respect to consumption term is given by \( -\frac{1}{\theta} \frac{u''(c)}{u'(c)} \).
\[ \dot{c} = \theta (\alpha f'_k - \rho) \]  

(15)

The growth in consumption is therefore an inverse function of the rate of the fixed time preference, \( \rho \), and a positive function of the marginal product of capital. Higher total factor productivity therefore allows households to obtain the benefits from increased the growth in their consumption. Integrating (15) forward with respect to time gives the accumulated value of consumption:7

\[ c(t) = e^{\int_0^t \theta (\alpha f'_k - \rho) ds} \]  

(16)

Now, setting \( \tau_h = \alpha_h y \), substituting in (5) and collecting like terms with \( \alpha' = 1 - \alpha_h \) gives:

\[ s = \alpha' y - c \]  

(17)

Substituting (16) into (17) gives the required result:

\[ s(t) = \alpha' y(t) - e^{\int_0^t \theta (\alpha f'_k(s) - \rho) ds} \]  

(18)

In summary, equation (13) specifies the rate of private investment (\( \dot{k} \)) which is the result of optimising competitive (non-household) private firms. Equation (18) shows the household savings (\( s \)) which maximise intertemporal utility of households. The government (dis)saving (\( \dot{b}_g - r b_g \)) is given by the budget constraint (4) for government investment, \( g \). The net foreign inflows (\( \dot{b}_f - r b_f \)) are determined by equation (3). Table 2 summarises the key relationships which will be estimated in the next section.

---

7 The initial value of consumption is standardised at unity, ie. \( c_s = 1 \)
Table 1
Summary of Important Relationships

<table>
<thead>
<tr>
<th>Variable</th>
<th>Specification</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Savings</td>
<td>( s(t) = \alpha' y(t) - e^{\int_t^\infty \theta (s) , ds} )</td>
<td>(18)</td>
</tr>
<tr>
<td>Private (non-household) Investment</td>
<td>( \dot{k} = \gamma \left( \int_t^\infty \alpha y' e^{-\rho (t-s)} ds - 1 \right) )</td>
<td>(13)</td>
</tr>
<tr>
<td>Production</td>
<td>( y = f(k, l; A) )</td>
<td>(2)</td>
</tr>
<tr>
<td>Government Investment</td>
<td>( g )</td>
<td>(22)</td>
</tr>
<tr>
<td>Government Dissaving</td>
<td>( g = (\tau_h + \tau_p) + (\hat{b}_g - r_b g) )</td>
<td>(4)</td>
</tr>
<tr>
<td>Net Foreign Inflows</td>
<td>( (\hat{b}_f - r_b f) = \alpha y - c - \dot{k} - g )</td>
<td>(3)</td>
</tr>
</tbody>
</table>

3. Empirical Evidence

Annual data for the period of 1950/51 to 2001/02 were used for the estimations. The data for savings and investment were taken from Central Statistics Organization (CSO) National Accounts (various issues). Data for Foreign Capital Inflows was taken from The Center of Monitoring Indian Economy. GDP figures were taken from the Reserve Bank of India. All the variables except for GDP (which was already in constant prices) were all converted from current prices into constant prices. All data is in Rupees for the new basis series 1993/94.

In order to carry out the estimation process, the economy is divided into three broad institutional sectors, namely the household sector, the private corporate sector and the public sector. The household sector (treated as a residual) comprises, apart from individuals, all non-government non-corporate enterprises such as sole proprietorships and partnerships owned and/or controlled by individuals, and non-profit institutions. The private corporate sector comprises all non-governmental financial/non-financial corporate
enterprises and co-operative institutions. The public sector covers government administration, departmental enterprises, and non-departmental enterprises.

Gross Domestic Savings (GDS) is the sum of household, private corporate and public savings. Gross Domestic Capital Formation is the sum of private investment (includes household investment) and public investment.

Tests for Unit Roots

We first took natural logs of the variables and tested them for unit roots in the presence of a structural break (a change in the mean) with an unknown time break. In this study, the Innovational Outliner (IO) unit root hypothesis test procedure proposed by Perron & Vogelsang (1992) is adopted. Under the IO model, the change is supposed to effect the level of series \( y_t \) gradually, during a transition period. We suppose that the economy responds to a shock to the trend function (the change in the mean) in the same way as it reacts to any other shocks. We assumed at most one change. The test procedure is formulated as:

\[
y_t = \mu + \delta DU_t + \theta D(TB)_t + \alpha y_{t-1} + \sum_{i=1}^{\kappa} c_i \Delta y_{t-i} + e_t
\]

where \( y_t \) stands for the variable being tested; \( DU_t \) is the dummy variable; \( TB_t \) is the time of the break; \( e_t \) is the error term and \( t \) is the time period. \( DU \) is equal to one if \( t > T_b \) and zero otherwise. \( D(TB) \) is equal to one if \( t = T_b + 1 \) and zero otherwise. Break time \( TB \) is unknown and therefore is determined through minimizing the \( t \) statistic for testing \( \delta = 0 \).

The number of lags \( \kappa \) is determined using the F-statistic to evaluate the significance of additional lags. The null hypothesis of a unit root is conducted by testing \( \alpha = 1 \), which also implies \( \delta = 0 \), when the above equation is estimated by the ordinary least squares (OLS) method.

The empirical results show that all the variables are non-stationary. The structural breaks seem consistent with the theory. Rajiv Gandhi (then prime minister) brought in financial reforms in 1986/87 budget; there was a major drought which affected agriculture in 1987; the years 87/88/89 saw a high level of policy intervention in the Indian banking sector; and finally, financial deregulation took place in 1991.
Table 1

Unit Root Test – Innovational Outlier (IO) model

<table>
<thead>
<tr>
<th>Variable</th>
<th>$T_b$</th>
<th>$\kappa$</th>
<th>$\alpha = 1$</th>
<th>$\delta = 0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>HHS</td>
<td>1989</td>
<td>2</td>
<td>1.0015</td>
<td>-0.0073</td>
</tr>
<tr>
<td>PRS</td>
<td>1993</td>
<td>3</td>
<td>1.0017</td>
<td>-0.0068</td>
</tr>
<tr>
<td>PUS</td>
<td>1988</td>
<td>4</td>
<td>0.9104</td>
<td>-1.3609</td>
</tr>
<tr>
<td>GDS</td>
<td>1989</td>
<td>2</td>
<td>0.9846</td>
<td>0.1388</td>
</tr>
<tr>
<td>PUI</td>
<td>1989</td>
<td>2</td>
<td>0.9250</td>
<td>0.0143</td>
</tr>
<tr>
<td>PRI</td>
<td>1990</td>
<td>2</td>
<td>1.0047</td>
<td>0.0060</td>
</tr>
<tr>
<td>GDCF</td>
<td>1989</td>
<td>2</td>
<td>0.9716</td>
<td>0.0148</td>
</tr>
<tr>
<td>FI</td>
<td>1993</td>
<td>3</td>
<td>0.9414</td>
<td>0.0999</td>
</tr>
<tr>
<td>GDP</td>
<td>1989</td>
<td>3</td>
<td>1.0221</td>
<td>0.0020</td>
</tr>
</tbody>
</table>

Note: Using the traditional Dickey-Fuller methods (DF and ADF) for testing unit root, we found that the results were non-conclusively I(1) for the variables.


Tests for Cointegration

These results are work in progress.

Bivariate cointegration using the residual-based method was carried out among the variables. Dummy variables which represented the year that the structural break took place were included in the regressions. In all cases the optimum lag was found to be equal to one, except for PRS and PRI; and PRS & GDCF, where the lag was equal to three. The optimum lag was 2 when testing PUI and GDP.

On the Investment side, all the variables (PUI, PRI & GCF) were cointegrated with each other (with a trend included). However the results were mixed for savings. All the variables were again cointegrated except when PUS was involved. We were not able to find any cointegration of PUS with either HHS, PRS & GDS (without a trend).

Looking at the savings and investment results, no cointegration was found between PUS & GCF without a trend; between PUS & PRI without a trend; and PUS & PUI with a trend. All the other variables were cointegrated with a trend. With regard to savings and foreign inflows, all the savings variables were cointegrated with foreign inflows except for
PUS. There was no cointegration between FI and PUS with or without a trend. With regard to investment and foreign inflows, all the investment variables were cointegrated with foreign inflows (with a trend included).

With regards to investment and GDP, no cointegration was found between GDP and the PUI with a trend. PRI and GDP were cointegrated with $r = 1$ with or without a trend. In terms of the cointegration between GDP and GDF, $r = 1$ with maximum eigenvalue and trace values while $r = 1$ with the SBC measure with a trend. No cointegration was found between GDP and foreign inflows.

**Need to look at savings and GDP.**

**The following results and others need to be synthesised with the above.**

The long run relationships between the variables were carried out using the ARDL model. Here, we test the existence of the long-run relationship between the variables. This is tested by computing the F-statistic for testing the significance of the lagged levels of the variables in the error correction form of the underlying ARDL model. Under the ARDL model, the asymptotic distribution of the F-statistic is non-standard, irrespective of whether the regressors are I(0) or I(1). Pesaran *et. al.* (1996) tabulates the appropriate critical values for different numbers of regressors and whether the model contains an intercept and/or trend. Two sets of critical values are given, one assumes that all the variables in the ARDL model are I(1) and the other assumes that all variables are I(0). The hypothesis we test is the null of ‘non-existence’ of the long-run relationship:

$$H_0: \delta_1 = \delta_2 = \ldots = \delta_r = 0$$

The results are summarised:

**Savings – HHS PRS PUS; Dummy variables D1 D2 D3**

F (PRS/HHS PUS) = 4.7025 (0.009) lag = 4, no intercept, no trend  
F (PRS/HHS PUS) = 5.0862 (0.005) lag = 3, no trend  
F (PRS/HHS PUS) = 7.7466 (0.000) lag = 2

**Investment & Foreign Inflows – PUI PRI FI; Dummy variables D1 D2 D3**

F (PUI/PRI FI) = 6.5889 (0.001) lag = 3  
F (PUI/PRI FI) = 6.2884 (0.002) lag = 2  
F (FI/PUI PRI) = 4.7154 (0.07) lag = 1, no intercept, no trend
Savings & Investment – HHS PRS PUS PUI PRI; Dummy variables D1 D2 D3 D4
F (PRS/HHS PUS PUI PRI) = 6.1869(0.002) lag = 4
F (PRS/HHS PUS PUI PRI) = 9.4319(0.000) lag = 3
F (PRS/HHS PUS PUI PRI) = 8.4556(0.000) lag = 2
F (PUI/HHS PRS PUS PRI) = 4.3380(0.06) lag = 3, no trend
F (PRI/HHS PRS PUS PRI) = 5.6037(0.001) lag = 1

These results show that GDS is the long run forcing variable for investment. In most cases the dummy variables were not found to be significant.

Savings, Investment & Foreign Inflows – HHS PRS PUS PUI PRI FI; D1 D2 D3 D4
F (PRS/HHS PUS PUI PRI FI) = 5.4643(0.002) lag = 3
F (PRS/HHS PUS PUI PRI FI) = 7.9949(0.000) lag = 2
F (PUS/HHS PRS PUI PRI FI) = 4.7808(0.004) lag = 3
F (PUI/HHS PRS PUS PRI FI) = 3.4401(0.012) lag = 2, no intercept, no trend
F (PRI/HHS PRS PUS PRI FI) = 4.6305(0.002) lag = 1,
F (FI/HHS PRS PUS PRI FI) = 3.7264(0.006) lag = 1, no intercept, no trend

Gross Domestic Savings, Gross Domestic Capital Formation & Foreign Inflows – GDS GDF FI; Dummy variables D1 D2
F (GDF/GDS FI) = 6.7847(0.001) lag = 4
F (GDF/GDS FI) = 6.4141(0.001) lag = 3
F (FI/GDS GDF) = 4.0750(0.013) lag = 2, no intercept, no trend
F (FI/GDS GDF) = 5.0979(0.004) lag = 1, no trend

Tests for Granger Causality
To be completed.
4. Conclusions and Policy Implications

This paper makes three contributions to the analysis of the interdependencies between savings, investment, foreign inflows and economic growth for India. The first is the holistic approach which involves the conceptualisation of the interrelated issues, formal modelling of the key factors and estimation in a long term setting. Each of these components in our research methodology are essential to the successful definition of the problem, the formulisation of the analytic structure to be used as the basis of the analysis and the selection of appropriate econometric techniques to derive relevant policy output.

The second contribution of this paper is the development of a basic endogenous growth model, with intertemporal household and private firm maximisation behaviour, with government and foreign sectors. The third contribution of our work is the econometric estimation of these relationships in a autoregressive distributed lag setting.

**Summarise the cointegration and Granger causality findings.**
REFERENCES


Reserve Bank of India (RBI), *Annual Report*, various issues.


