SAVINGS AND INVESTMENT IN INDIA: THE FELDSTEIN HORIOKA PUZZLE

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Abstract
The main objective of this paper is to investigate the degree of integration of the Indian economy into international capital markets using the analytical framework proposed by Feldstein Horioka. For this purpose we have used the annual data on savings and investment rates over the period 1970-2012. To examine the time series properties of the data we have employed various unit root and cointegration tests. The results reveal that in short run there is moderate capital mobility and long run the savings and investment rates are not moving together indicating the absence of Feldstein Horioka puzzle for the Indian Economy.

JEL Codes: E2, O53
Keywords: India, Feldstein-Horioka Puzzle, Savings, Investment

1. Backdrop of the Paper:
In 1970-71, the real GDP of the Indian economy with the base year 2004-2005 was 589786 crores and it has reached 5222027. For the past four decades Indian economy has grown on an average 5.5%. Overall the Indian economy GDP growth rate moved out from the infamous Hindu growth rate. However the growth has not been uniform in all the years not only in aggregate level but also across the sectors. It may be observed from figure 1 that the agriculture contribution towards GDP in 1970-71 was 41.66% and in 2011-12 is 13.92% indicating a continuous decrease in Agriculture sector contribution, where as the contribution of manufacturing sector towards GDP is marginal (in 1970-71 was 13.94% and 2011 -2012 is 19.34% overall the contribution is flat) and the contribution of service sector increased unambiguously. It seems the policy makers have given more importance to service sectors neglecting the agriculture sector as well as industry sector. It may be observed from figure 2 that both current account deficit to GDP (CAD/GDP) and Gross fiscal deficit to GDP (FD/GDP) continuously increasing indicating the problem of twin deficit or double deficit, it may also observe from the figure the continuous depreciation of currency.

It may be observed from figure 3 that though the national savings rate and investment rate is increasing, the national savings rate fell below the domestic investment rate indicating insufficient savings to finance the domestic investment and therefore borrowings from abroad. The investment rate increased from 17.8 % in 1970-71 to 38% in 2011-12 where as the savings rate increased 15.5% in 1970-71 to 32% in 2011-12. Hence the current account is in deficit continuously. It is also observed from the figure that both the periods 1970-1990 and 1991-2012 savings are not supporting investment except in few years.

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In this section we present the review of literature, Section III deals with Data and Methodology; Section IV deals with the Empirical Investigation and discussion Section V Conclusion and Discussion.

2. Review of Literature:
The genesis of literature on the relationship between savings and investment is due to the seminal paper by Feldstein and Horioka (1980). In their study covering 16 OECD countries using data for the time period 1960-74, they found high correlation between domestic savings and investment that suggested the existence of limited capital mobility. This study gave rise to a new way of measuring international capital mobility derived from the extent of correlation between savings and investment.

From correlation, the focus of the study extended to the cointegration between these variables. Miller (1988) found that in U.S. (using data for 1946-87) both savings and investment were integrated of order 1 and shared a cointegrating relationship prior to the Second World War period and that the long-run relationship did not exist after. He concluded that this phenomenon could be explained by the increased international mobility after the War. Levy (1998) examined the relationship in the short run as well in the long run and finds evidence in favor of long run and cyclical relationship between savings and investment. The study also found stronger relationship between savings and investment relationship in the postwar period than during prewar period.

Frankel et al. (1986) used a sample of 64 countries (14 developed and 50 developing countries) in his study on savings-investment relationship and found that in case of all the countries except a few less developed countries\(^1\), savings and investment are highly correlated and shared a long-run equilibrium relationship.

Arginon and Roldan (1994) investigate the observed correlation between domestic saving and investment in E.U. countries using annual data for the period 1960–1988. They distinguish between the pair of saving/investment of the private and public sector. Bayoumi (1990) argues that current account targeting by the Government could cause high correlation between the variables. However, both the studies suggest causality flowing from savings to investment without any feedback effect. Another study in the US, which uses quarterly data, by Pollin and Justice (1994) suggests that saving and lending are not cointegrated, indicating that the period under study witnessed high capital mobility. De Vita and Abbott (2002) found similar results using an ARDL bounds testing procedure and so did Yamori (1995) for Japan.

Apergis and Tsoulfidis (1997) use similar econometric technique in their study for 14 EU countries and find that savings and investment are cointegrated which suggests that capital mobility is not as high even after the move towards economic integration in Europe has gained momentum. The study also finds that savings Granger-causes investment using Vector Error-Correction Model.

Krol (1996), examined the relationship between savings and investment using annual data, pooled for 21 OECD countries over the period 1962-90 and found that the estimated impact of saving on investment is considerably smaller than the estimates of the

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\(^1\) Countries heavily dependent on foreign aid and assistance programs
earlier researcher that were used averaged data (also see Pelagidis and Mastroyiannis, 2003 for Greece).  

Jansen (1998) suggests that correlation between savings and investment in the long run is determined by one or more of these factors - limited capital mobility, current account targeting by the Government and inter-temporal budget constraint and the short-run co-movements are due to capital mobility. In addition, the paper also finds that the short-run correlation seems to vary across countries and is determined by country-specific business cycles (in line with Leachman, 1991; Jansen, 1996 and Taylor, 1996). Moreno (1997) extends the study to Japan along with the U.S.

Most of the studies have focused on developed countries; similar studies for developing countries have been few and far between.

Mamingi (1997) estimated the relationship between saving and investment correlations for 58 developing countries by assessing the degree of capital mobility in the Feldstein–Horioka sense for these developing countries. They found that the relationship between savings and investment in case of middle–income countries tend to be lower than those that of low-income countries. Sinha (2002) finds that Savings and Investment rates are cointegrated for Myanmar and Thailand indicating the growth of savings rate causes the growth of investment rate. Interestingly, reverse causality between savings rate and investment rate has been observed for Hong Kong, Malaysia, Myanmar and Singapore.

Ghosh and Ostry (1995) use a current-account solvency model for some developing countries to explain the correlation of savings and investment co-movement in advanced and developing economies. Their approach takes into account demand-side factors. Coakley, Hasan and Smith (1999) extend the study and find that the correlation is low in LDCs, which could be attributed to country-specific macroeconomic policies and not high mobility.

Theodore Pelagidis and Tasos (2003), Using Greek data on savings and investment for the period 1960-1997 to assess the long run relationship using Cointegration analysis with an emphasis on the error correction process. They found that savings and investment are cointegrated though the partial correlations for short run decreased.

Andrew J. Abbott and Gauco De vita (2003), re-examined the nature and degree of relationship between savings and investment for U.K quarterly data using Cointegration within an autoregressive distributed lag (ARDL) frame work. They found that the long relationship between savings and investment is not exclusively dependent on upon the level of financial integration and suggested that F-H frame work provides at least a partial measure of the degree of capital mobility.

Sinha and Sinha (2004) use a huge sample of 123 countries to estimate the short run and long-run relationship between savings and investment rates using an error correction framework. Results suggest capital should be more mobile for the countries with high per capita income. They also found that the capital is mobile for 16 countries most with a low per-capita income.

N.R.Vasudeva Murthy (2007), using data from a panel consisting of fourteen Latin American and four Caribbean countries over the period 1960-2002 estimated the
relationship between savings and investment. He concluded that F-H puzzle is not valid for Latin American and Caribbean courtiers and there is a moderate degree of capital mobility.

Guisan and Exposito(2012) have analyzed the relationship between investment per capita and savings per capita in 30 countries and territories of Asia and Pacific, for the period 2000-2010, and found a high positive correlation between both variables. In the case of India savings and investment were very much alike. Investment per capita in India, in US Dollars at constant prices and purchasing power parities of year 2005, evolve positively during that period from 412, to 760 and to 1068, in years 2000, 2005 and 2010 respectively. Savings per capita evolve in the same period from 430 to 760 and 1036. These authors recommend to foster investment per capita in India beyond savings per capita. This goal might be reached with international investment provided that it is addressed to Indian development and does not cause financial instability. Their econometric model shows that both domestic investment and foreign investment have a positive role on the increase of real Gross Domestic Product per capita.

3. Data and Methodology

Data

For the study, we use annual data on Gross Domestic product (Y), savings (S) and investment (I) from the Reserve Bank of India database (http://www.rbi.org.in). We use annual data for the period 1970-71 to 2011-2012 (base period 2004).

Methodology

Using the cited data we have calculated Savings ratios (S/Y) and Investment ratios (I/Y) for the purpose of using the following Feldstein Horioka Methodology.

\[(I/Y)_t = \alpha + \beta (S/T)_t + \mu \]

Where I = Investment, Y = Real GDP, S = Savings, I/Y = Investment Ratio and S/Y = Savings ratio, $\beta =$ Savings retention coefficient.

If $\beta = 1$ Domestic savings are supporting the domestic investment
If $\beta = 0$ No relationship between savings and investment and perfect capital mobility

The empirical exercise comprises two parts:

**Part 1:** To examine the short period savings retention coefficient we have decomposed the data into two periods such as 1970-71 to 1990-1991 and 1991-1992 to 2011-2012.

**Part 2:** In an attempt to examine the long run relationship between investment ratios the following methodology is used (1) testing for a unit root, I (1), in each series and (2) testing for the number of cointegrating vectors in the system, provided that we cannot reject the null hypothesis of unit root in each of the time series being studied; and causality tests.

4. Empirical Investigation and Discussion:

**Empirical Investigation:**

Though Feldstein Horiok (1979) felt that gross savings is the most suitable variable since it involves no estimate of depreciation but is likely to be highly correlated with true net savings. However we felt that the countries like India with high population and predominant unorganized sector, the coefficients may not be upward bias and hence we
have used net savings, household savings, public sector savings and corporate savings apart from gross savings, to assess the relationship between savings and investment. It may be observed from table 1 that gross domestic savings retention coefficient for the period 1970-1990 is higher than that of the gross domestic coefficient for the period 1991-2012, the same may be observed in case of net domestic savings, household savings, and corporate savings retention coefficients. However in case of public sector savings, savings coefficient for the period 1970-1990 is higher than that of the savings coefficients for the period 1991-2012 Based on the savings retention coefficients of gross domestic savings, and household savings for the period 1970-1990, we cannot conclude that some amount of capital mobility was there because this might be because of heavy dependency on foreign aid. The net domestic savings retention coefficient for the same period is equal to one indication that net domestic savings are supporting the investment, which is fact in case of closed economy. The decrease in savings retention coefficients for the period 1991-2012 compared to the period 1970-1990 savings retention coefficients indicates moderate capital mobility and both corporate sector and public sector must be borrowing fund from other countries to support their investment.

We have used both ADF, Phillips – Perron and ERS DF –GL tests to find the existence of a unit root in each of the time series. The results are reported in Table 1 suggests that the variables found to be non-stationary in levels but stationary in first difference from at 1% level of significance, that is, the variables are integrated of order 1 [I (1)].

Table 3 presents the trace test results obtained from the Johanson – Juselius maximum likelihood cointegration procedure (1990), with various deterministic components in the specified cointegration VAR model. Model 1 does not incorporate any deterministic components in the data, Model 2 allows constants in the Cointegration space and no linear trend in the data, Model 3 accommodates the linear trend in the data as constant in Cointegration space, model 4 includes linear trend in the differenced variables and model five Engel-Granger cointegration method (1987). The results clearly indicate that there is no Cointegration.

**Discussion:**

Though FH argued that, under perfect capital mobility, there is no necessary association between national savings and investment, we argue that the countries like India this may not be true in both short run as well as in long run, because of the following reasons.

1. India is predominantly dominated by unorganized or informal sector, till today 66% of the population living in rural area are away from banking facilities and no room for savings and hence difficult to get data on savings from these population.
2. Since 64% of the people depend on agriculture sector and this sector always suffers from crop failure, because of drought or floods, there is always a need for money. Though investment in Indian capital market gives reasonably good returns people prefers to invest in informal capital markets because of higher returns compared to the capital market returns.
3. Because of the boom in the real estate sector most of the money is moving to that sector where market value is greater than that of the government value. The difference money is not accounted anywhere.
4. India's deficit on the current account increased throughout the period and hence it is pushed into greater dependence on high interest commercial loans from international banks to finance their deficits. The growth in private savings could not finance most of India’s investment throughout the period except in some years, the point 2 above may be the reason.

5. The rise in savings could not finance investment even after 1990’s, this might be because of the new financial innovations in the Indian economy such as GDRs, ADRs and FCCBs, infrastructure bonds etc., coupled with lower interest rates in other countries attracted Indian private as well as public sector and hence a part of domestic savings must have moved to unorganized sector.

Though the β coefficients greater than zero in both periods (1970-1990 and 1991-2012) and there is no long run relationship between savings and investment we cannot conclude that there is a capital mobility in Indian economy in the long run because of the cited reasons. Hence it is felt that Feldstein Horioka procedure will not applicable to examine the capital mobility, in the countries like India where savings may move to informal sector rather than moving to other countries.

5- Conclusion:
The purpose of this paper is to investigate the relationship between savings and investment using Feldstein Horioka procedure. The results are quite interesting showing that domestic savings not fully supporting the domestic investment in both the periods 1970-1990 and 1991-2012. It is also observed no association between savings and investment in the long run for Indian economy. Though we may conclude based on the savings retention coefficient results that capital mobility is taking place, we felt that since in India the economic activity predominantly run by the unorganized capital market or informal capital market and moreover the new financial innovations in the Indian economy such as GDRs, ADRs and FCCBs, infrastructure bonds etc., coupled with lower interest rates in other countries attracted Indian private as well as public sector and hence a part of domestic savings must have moved to unorganized sector. Hence no association between official savings and investment.

It is suggested the policy makers of India should come up with the savings policy that attracts the savers to save in formal capital markets of India by adopting proper mix of monetary and fiscal policies.

Finally it is concluded that based on the results we may compromise and conclude that Feldstein Horioka puzzle does not apply to India during the period 1970-2012 and hence capital mobility. However we strongly feel that because of the dominance of informal sector the savings are moving to informal sector and hence capital mobility from India to other countries is a question mark? It is felt that resulting are misleading and the applicability of Feldstein Horioka procedure itself is a puzzle to the Indian context.

References
Seshaiah, S.V.  

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Bayoumi, T. (1990) Saving-investment correlations: immobile capital, government policy, or endogenous behavior? International Monetary Fund Staff Papers, 37, pp. 360–387


**Annex**
Table- 1 (Dependent Variable is gross Investment)

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Constant</td>
<td>coefficient</td>
<td>R²</td>
<td>Constant</td>
<td>coefficient</td>
<td>R²</td>
</tr>
<tr>
<td>Gross Domestic savings</td>
<td>0.199349</td>
<td>0.520477 (0.005097)</td>
<td>0.520477 (0.095852)</td>
<td>0.205055</td>
<td>0.369716 (0.005966)</td>
<td>0.369716 (0.095532)</td>
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<tr>
<td></td>
<td>0.7872</td>
<td></td>
<td></td>
<td>0.7494</td>
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<tr>
<td>Net domestic savings</td>
<td>0.200813</td>
<td>0.882917 (0.005473)</td>
<td>0.882917 (0.180641)</td>
<td>0.205007</td>
<td>0.676680 (0.006130)</td>
<td>0.676680 (0.175469)</td>
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<td></td>
<td>0.7805</td>
<td></td>
<td></td>
<td>0.7644</td>
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<tr>
<td>Household savings</td>
<td>0.203201</td>
<td>0.618243 (0.005183)</td>
<td>0.618243 (0.128588)</td>
<td>0.206948</td>
<td>0.468741 (0.005724)</td>
<td>0.468741 (0.087534)</td>
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<tr>
<td></td>
<td>0.7794</td>
<td></td>
<td></td>
<td>0.7620</td>
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<td>Public sector savings</td>
<td>0.249507</td>
<td>-0.906095 (0.029172)</td>
<td>-0.906095 (1.814929)</td>
<td>0.255678</td>
<td>-1.813902 (0.022932)</td>
<td>-1.813902 (1.213003)</td>
</tr>
<tr>
<td></td>
<td>0.6739</td>
<td></td>
<td></td>
<td>0.7052</td>
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<tr>
<td>Corporate Savings</td>
<td>0.207286</td>
<td>3.807892 (0.006340)</td>
<td>3.807892 (1.085243)</td>
<td>0.227311</td>
<td>1.566154 (0.009568)</td>
<td>1.566154 (1.187169)</td>
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<tr>
<td></td>
<td>0.7455</td>
<td></td>
<td></td>
<td>0.6860</td>
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Note: Standard errors in parentheses
### Table 2: Battery of Unit Root Test results

<table>
<thead>
<tr>
<th>Series</th>
<th>ADF</th>
<th>PP</th>
<th>ERS DF -GL</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/Y Levels</td>
<td>0.052272</td>
<td>-1.64225</td>
<td>-0.783445</td>
</tr>
<tr>
<td>S/Y Levels</td>
<td>2.992218</td>
<td>0.935119</td>
<td>1.704807</td>
</tr>
<tr>
<td>Δ(I/Y) Differences</td>
<td>-4.544778*</td>
<td>-4.671364*</td>
<td>-4.613551*</td>
</tr>
<tr>
<td>Δ(S/Y) Differences</td>
<td>-5.269509*</td>
<td>-5.477483*</td>
<td>-4.897075*</td>
</tr>
</tbody>
</table>

#### Unit Root test on Residuals

<table>
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<th>ERS DF -GL</th>
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</thead>
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<tr>
<td>RINVEST Levels</td>
<td>-2.933281</td>
<td>-1.732531</td>
<td>-2.292565</td>
</tr>
<tr>
<td>RSavings Levels</td>
<td>-1.583803</td>
<td>-1.088408</td>
<td>-1.784832</td>
</tr>
<tr>
<td>ΔRinvest Differences</td>
<td>-4.54478*</td>
<td>-4.671364*</td>
<td>-4.613551*</td>
</tr>
<tr>
<td>ΔRSavings Differences</td>
<td>-5.269509*</td>
<td>-4.897075*</td>
<td>-5.477483*</td>
</tr>
</tbody>
</table>

Note: * Rejection of null of Non stationary at the 1% significance level

### Table 3: INVESTMENT SAVINGS

<table>
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<tr>
<th>Model</th>
<th>Eigenvalue</th>
<th>Likelihood</th>
<th>5 Percent</th>
<th>Critical Value</th>
<th>Hypothesized</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ratio</td>
<td></td>
<td></td>
<td></td>
<td>No. of CE(s)</td>
</tr>
<tr>
<td>Model 1</td>
<td>0.203787</td>
<td>9.115541</td>
<td>11.22480</td>
<td>None **</td>
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<tr>
<td></td>
<td>0.000792</td>
<td>0.031709</td>
<td>4.129906</td>
<td>At most 1</td>
<td></td>
</tr>
<tr>
<td>Model 2</td>
<td>0.273250</td>
<td>12.76693</td>
<td>14.26460</td>
<td>None **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.026951</td>
<td>1.092826</td>
<td>3.841466</td>
<td>At most 1</td>
<td></td>
</tr>
<tr>
<td>Model 3</td>
<td>0.273290</td>
<td>12.76910</td>
<td>19.38704</td>
<td>None **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.168116</td>
<td>7.362494</td>
<td>12.51798</td>
<td>At most 1</td>
<td></td>
</tr>
<tr>
<td>Model 4</td>
<td>0.255836</td>
<td>11.81975</td>
<td>17.14769</td>
<td>None **</td>
<td></td>
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<tr>
<td></td>
<td>0.086449</td>
<td>3.616651</td>
<td>3.841466</td>
<td>At most 1</td>
<td></td>
</tr>
<tr>
<td>Model 5 Engel-Granger cointegration method (1987)</td>
<td>0.235349</td>
<td>10.73344</td>
<td>15.89210</td>
<td>None **</td>
<td></td>
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<td></td>
<td>0.093368</td>
<td>3.920750</td>
<td>9.164546</td>
<td>At most 1</td>
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