Capital Mobility and Feldstein Horioka Puzzle in India

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Abstract

This Study attempts to investigate the degree of capital mobility for Indian economy using the Investment – saving Quantitative approach proposed by Feldstein and Horioka in 1980. They hypothesized that low degree of correlation between domestic savings and investment is a measure of higher capital mobility as latter makes international capital pool available for domestic investment. However, the empirical results of their study produced results contrary to their own hypothesis and came to be known as Feldstein- Horioka puzzle. This was followed by number of studies some of which tried to explain the puzzle where others doubted the saving investment criteria as a measure of capital mobility. This study, using data of Indian economy tries to investigate whether Feldstein-Horioka Puzzle is supported by saving investment behaviour in India or their proposed criteria for capital mobility suits well to the Indian economy, as far as measurement of capital mobility is considered. Using Engel-Granger Cointegration analysis long term equilibrium relationship was found and validity of saving investment criterion was established.

Key Words: Investment, Savings, F-H Hypothesis, cointegration.
JEL Classification: C22, E21, F32.

1) Introduction: The evolution of international capital markets has imbibed inquisitiveness, among the economists, towards empirical verification of international capital mobility, for a variety of reasons. For example the extent to which fiscal deficits will result in crowding out of private investment will readily depend upon the ease with which domestic firms can access the international capital markets. Secondly the reduction in welfare due to temporary negative shocks can be minimized if country can easily borrow from the international market. The growth rate of an economy, at least in short run, will be influenced by availability of funds from international capital market .Although degree of exchange restrictions (or Capital controls in

general) imposed by an economy can be used to judge the extent of international capital mobility; its efficacy can not be relied upon in view of the growing evidence that capital flows take place despite exchange restrictions imposed by many economies. As a solution to this problem two broad approaches have evolved in economic literature which are, price approach and quantitative approach. Price approach is based upon equalisation of rates of return in different countries through capital flows. In the context of developing countries this approach as a measure of capital mobility is not considered more relevant for lack of requisite information on price and assets. Further because of exchange restrictions, forward rates are not always available as such equailsation of rates of return on capital through capital flows may not take place. Quantitative approach has two variants. First, consumption smoothing approach, which examines whether consumption is adequately smoothed through capital flows despite shocks in income. Second variant of Quantitative approach is saving-investment approach which has its genesis in the seminal paper by Feldstein and Horioka (1980) wherein they proposed saving investment correlation as a measure of international capital mobility. They argued that, in a world of perfectly mobile capital, domestic savings would seek out the highest returns in the world capital market independent of local investment demand, and by the same token the world capital market would cater to domestic investment needs independent of domestic savings supply. They stated that, "With perfect capital mobility, there should be no relation between domestic saving and investment rates: saving in each country responds to the worldwide opportunities for investment while investment in that country is financed by the worldwide pool of capital".

Their study is based upon use of cross-sectional regression of the type

$$\frac{I}{Y} = \alpha + \beta \left[\frac{S}{Y}\right] \quad \ldots\ldots\ldots\ldots(01)$$

with ratio of gross domestic investment (I) to gross domestic product (GDP) in country i on the left hand side and the corresponding ratio of gross domestic saving (S) to gross domestic product on the right hand side. Feldstein and Horioka coined the term "savings-retention coefficient" to describe the regression coefficient β in equation (01), the value of which, as they suggested, will be a measure of international capital mobility. With perfect international capital mobility saving and investment shares should be uncorrelated (i.e $\beta = 0$) while a β coefficient close to or equal to one would imply a low degree of capital mobility. This inference is based upon analysis of capital flows by means of savings and investment identity. To arrive at this

identity in a simple way we may define gross national product (O) as the sum of goods and services produced, which with imports (M) , may be allocated to private consumption (C), public consumption G, investment (I), or export (X), so that

$$O + M = C + 1 + G + X. \quad \text{……. ………..} \quad (02)$$

Or $\quad\quad\quad GNP = O = C + I + G + NX \quad \text{………………..} \quad (03)$

where NX = X – M is net exports.

If the country's net credit (or net debt) position vis-a-vis the rest of the world is T (or (-T) in case of debit position), and these claims by country on rest of the world(or claims of rest of world on this country) earn (or country has to pay) interest at a world interest rate r, then gross domestic product is GNP plus(minus) this net factor income from (to) the rest of the world will be as,

$$GDP = Y = O + rT = C + l + G + NX + rT \quad \text{…………..} \quad (4)$$

It is then straightforward to show that the net balance on the current account

CA satisfies

$$CA = NX + rT = (Y - C - G) - I = S - 1, \quad \text{…………..} (5)$$

$$CA = S - I \quad \text{……..} (06)$$

where S = Y – C – G is gross national saving.

Within this frame work, in a closed economy, total national saving is equal to total national investment, as such current account would be equal to zero. Hence correlation between savings and investment will be equal to one. However, in an open economy correlation between savings and investment may not be equal to one, as the gap between national savings and investment could be filled by capital flows from (to) rest of the world, depending upon whether the current account is in deficit or surplus. If domestic savings exceed domestic investment, economy would be running a current account surplus and in turn exporting capital to the rest of world. Similarly, if domestic savings fall short of domestic investment, economy would be running a current account deficit and will be importing capital from the rest of the world to finance the current account deficit. Thus under perfect capital mobility, the correlation between savings and investment would be zero.

In their study, covering 16 OECD countries, Feldstein and Horioka expected to find low correlations of domestic saving and investment rates among developed countries given the conventional wisdom that international capital markets were well integrated by the 1960s and

1970s. However to their surprise, from their empirical results they discovered a high and significant investment-saving coefficient in regression of the form of equation (01) with β typically close to unity. It appeared that changes in domestic saving passed through almost fully into domestic investment, suggesting imperfect international capital mobility. The results of Feldstein-Horioka's study showed that the saving retention coefficient, which measures the level of capital mobility in member states of the Organization for Economic Cooperation and Development (OECD) was between 0.87 and 0.91, which proves relatively low capital mobility in these countries (Misztal, 2011). As the capital in these countries was considered to be mobile, this gave rise to 'Feldstein- Horioka Puzzle' and had spawned a number of studies thereafter. The Feldstein-Horioka (1980) research findings, which are contrary to economic theory, have to be referred to as "the mother of all puzzles" (Obsfeld and Rogoff, 2000). With this introduction to Feldstein Horioka puzzle we try to test it in Indian context because as noted by Levy (2004) capital mobility has following important implications on an economy.

1. The effect of fiscal policy crucially depends on the extent of capital mobility.

2. The cost of adjustment to external shocks gets reduced via the access of an economy to capital markets.

3. Capital mobility determines the rate at which incomes converge to long-run equilibrium path.

4. Perfect capital mobility is often assumed to hold in macroeconomic models and exchange rate models.

However, the results of Feldstein and Horioka's original study as well as subsequent works (Feldstein, 1983; Feldstein and Bacchetta, 1991) have been closely scrutinised. Most authors have accepted the close correlation between savings and investment shares as a robust empirical regularity but deny that it is evidence for less than perfect capital mobility. A broader review of such reasoning is presented in the next section of this paper. Rest of the paper is organised as: section 2 gives a review of literature, in section 3 empirical analysis using Indian data is presented and conclusion is presented at end under section 4.

2) Literature Review: Franklen et al. (1986) in his study, using data from 14 developed and 50 developing countries, found that savings and investment were highly correlated and shared a long run equilibrium relationship, except in a few less developed countries.

Similarly, Murphy (1984), obstfeld (1986), Dooley et al. (1987) and Wong (1990) found evidence for fair degree of association between investment and savings for various less

industrialized and developing countries. However, the results of their studies deviated from Feldstein Horioka puzzle as the estimated correlations were lower in periods before the mid 1970s (period of relatively low capital mobility) than afterwards, when capital mobility was supposed to have increased.

Miller (1988) using US data for the period 1946-87 found that savings and investment were cointegrated before 1971 (period of fixed exchange rate) but not during subsequent periods due to increased international capital mobility thus conforming the F-H hypothesis.

Apergis and Tsoulfidis (1997) using data of 14 EU countries found that saving and investment rates were cointegrated , with savings causing investment and suggested that capital movements were not high even after the move towards economic integration gained momentum in these countries.

Using data for Japan economy, Yamori (1995) and De Vita and Abbott (2002), applied ARDL bounds testing approach to examine cointgration between savings and investment rates. Results showed a high degree of association thereby implying low capital mobility as postulated by F-H hypothesis.

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.

There are also a number of studies that do not agree with F-H hypothesis that a high degree of correlation between savings and investment is a measure of low degree of capital mobility or low capital mobility results in higher correlation between domestic savings and investment in an economy. Instead they   support the notion that savings investment relationship is largely uninformative about capital mobility, as a number of other factors could influence   the relationship.In this context different researchers have given different reasons and suggested

different possible factors that might distort the relationship between savings and investment as opined by F-H hypothesis. Baxter and Crucini (1993) argued the role of third variable viz, global shock that impinges simultaneously on savings and investment thereby resulting in high correlation between savings and investment irrespective of the degree of capital mobility. Bayoumi (1990) argues that using fiscal policy to target current account can endogenously change public savings and cause high correlation between savings and investment rates. Jansen (1996) using inter temporal approach to current account for sample data from 23 OECD countries found that savings and investments can be highly correlated even in the presence of capital mobility if the inter temporal budget constrain is satisfied. Further , Jansen (1998) suggests that relationship between savings and investment in the long run could be determined by any of these factors- limited capital mobility, current account targeting by the government and inter temporal budget constrain. In the short run, co- movements could be due to capital mobility with variations in short run correlation across countries determined by country specific business cycles.

 Hansen and Smith (1999) employing inter temporal model found low correlation between savings and investment in LDCs but attributed it to country specific macroeconomic policies and not to high capital mobility.

Rocha (2006) in a study involving data for 22 developing countries for the period ranging from 1960 to 1996 fund that for India, long run relationship between saving and investment is sensitive to type of estimation procedure followed and capital mobility obtained from alternative estimation procedures ranged from intermediate to highly mobile. Besides these some other arguments include current account solvency constraints (Coakley et al.1998), the growth rate of income (Obstfeld , 1985), targeting of sustainable current account through government policies (summers ,1985), non traded goods and immobile factors (Engel and Kletzer 1987) country size affects (Tsung –Wu Ho, 2003) could produce co movements in capital and current account even if capital is mobile.

3) Empirical Analysis: The variables considered in this study are Gross Domestic savings and Investment (proxied by Gross Fixed Capital formation) both of which are expressed as ratios to GDP. In order to test Feldstein Horioka puzzle we take two time periods one ranging from 1950-51 to 1990-91 (period with relatively more restrictions as far as capital movements are considered) and 1950-51 to 2011-12 which involves the post liberalization era also. The data for

variables was taken from Handbook of Statistics on Indian Economy published by Reserve Bank of India. Four variables for analysis include investment (I1) and savings (S1) during 1950-51 to 1990-91 and investment (I2) and Savings (S2) during period 1950-51 to 2011-12. Before applying regression analysis all the four variables were tested for stationarity properties using Augmented Dickey Fuller Test (ADF). The graphs of all four variables are showing an upward trend which is an indication of non stationarity and this was confirmed using ADF test in three different forms-with drift and constant, constant only, no drift no constant. The behaviour of all the four variables in level form is shown by graphs presented in table (01). The results of ADF test are presented in table (02) both for variables in level form and also for their first difference.

Table (01)
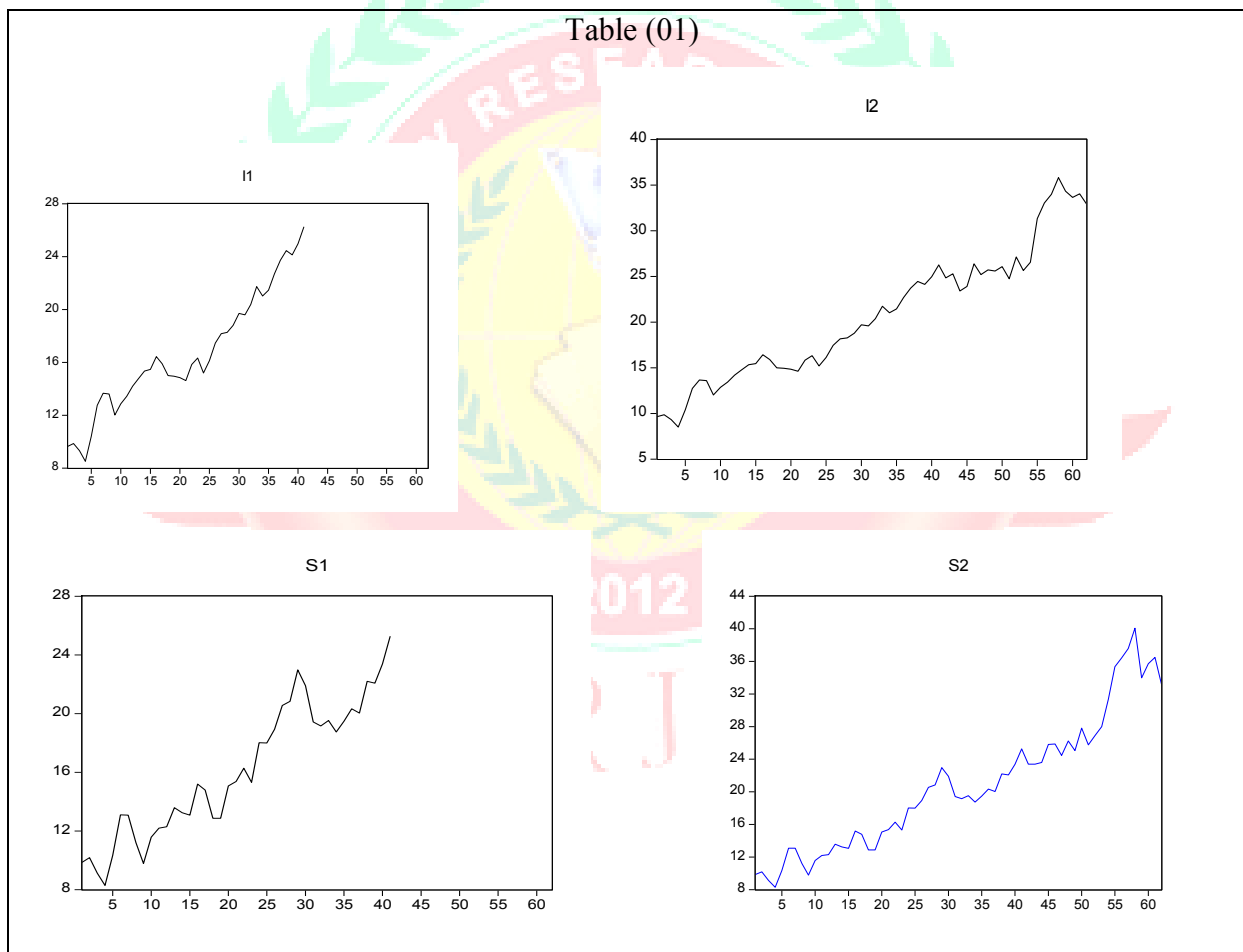
From table 2 it is clear that ADF test upholds the view that four variables are non-stationary in their level forms and this is confirmed by the three different forms of models considered in the test To check the stationarity properties if these variables in their first differences we apply the same test results of which are presented in table (03). From table it is clear that all the variables are stationary in their first difference form even at 1% level of significance and again it is

Model	Variable	Test statistic	Critical value (5%)	P- value
Intercept only	I1	0.35775	-2.936942	0.9785
	I2	-0.4327	-2.1900	0.8963
	S1	-0.2988	-2.9369	0.9161
	S2	-0.6763	-2.9100	0.8446
Trend and intercept	I1	-1.7709	-3.5266	-0.697
	I2	-2.8007	-3.4852	0.2027
	S1	-2.8893	-3.5266	0.1766
	S2	-3.0847	-3.4852	0.1192
None	I1	3.1449	-1.9493	0.9991
	I2	2.2224	-1.9462	0.9932
	S1	1.6827	-1.9493	0.9757
	S2	1.32900	-1.9462	0.9523

Table (02)

Confirmed by all the three cases. To ensure further robustness of results we apply Phillip Perron test also both in level and stationary forms using trend and constant option. The results for this test are presented in table (04). From table it is clear that variables turn out to be stationary at their first differences. From both these tests we infer that all the four variables under consideration are integrated of order one or (I). Since regression of non stationarity variables could be of spurious nature we consider following two regressions for Engel Granger test of cointegration.

$invst1 = \alpha + \beta saving1 + U1$ …………..(07)

$invst2 = \alpha + \beta saving2 + U2$ ……………..(08)

where invst1 =I1 and Saing1=S1, Invst2=I2 and Saving2=S2 and expressed as ratios to GDP. As required by Engel Granger test residuals (U1 and U2) are tested for stationarity so as to

Model	Variable	Test statistic	Critical value (5%)	P- value
Intercept only	ΔI1	-5.9223	-2.9411	0.0000
	ΔI2	-7.6082	-2.9108	0.0000
	ΔS1	-5.8344	-2.9388	0.0000
	ΔS2	-8.3503	-2.9108	0.0000
Trend and intercept	ΔI1	-5.9068	-3.5331	0.0001
	ΔI2	-7.5407	-3.4865	0.0000
	ΔS1	-5.8089	-3.5297	0.0001
	ΔS2	-8.2737	-3.4865	0.0000
None	ΔI1	-4.3202	-1.9496	0.0001
	ΔI2	-6.9620	-1.9463	0.0000
	ΔS1	-5.4623	-1.9496	0.0000
	ΔS2	-7.9738	-1.9463	0.0000

Table (03)

Variable form	Variable Name	Test statistic	Critical value (5%)	P- value
Level	I1	-1.7350	-3.5266	0.716
	I2	-2.9982	-3.4852	0.1412
	S1	-2.9865	-3.5266	0.1485
	S2	-8.2737	-3.4865	0.000
First difference	ΔI1	-6.6096	-3.5297	0.000
	ΔI2	-7.5407	-3.4865	0.000
	ΔS1	-6.3304	-3.5297	0.000
	ΔS2	-8.2737	-3.4865	0.000

Table (04)

establish stationarity/non stationarity and hence the presence of cointegration between savings and investment. The results of unit root test on residuals –U1 and U2 are presented in table (05) below.

Table (05)

Residual	Test statistic	P value	Conclusion
U1	-2.0823	0.0372	Stationary
U2	-3.1682	0.002	Stationary

Since residuals appear to be stationary in their level form there exists a long run equilibrium relationship between two variables as such the regressions involving these variables will have meaningful coefficient estimates. The regression results are presented in table (06).

Table (06)

Time perid	Dependent Variable	constant	Saving retention coefficient	R Square
1950-51 to 1990-91	I1	1.7271	0.9296	0.8565
1950-51 to 2011-12	I2	2.9021	0.8582	0.9461

From table it is clear that saving retention coefficient in pre reform period when capital restrictions were relatively more is 0.9296. Once the data for post reform period is included the saving retention coefficient decreases to 0.8582. From this one could infer that with introduction of liberalization measure association between domestic savings and investment had decreased as foreign pool of resources became available for investment in India. Thus empirical evidence stands for this thing that with increase in capital mobility is associated with low degree of correlation between savings and investment. Hence Feldstein- Horioka puzzle is not a phenomenon supported by saving investment behaviour in India. Instead, our analysis supports the Feldstein-Horioka notion that saving investment correlation could be taken as a measure of degree of capital mobility with correlation between the two decreasing with increase in capital mobility.

4) Conclusion: Saving investment correlation as a measure of capital mobility is one of the quantitative approaches and is doubted because of empirically furnished Feldstein-Horioka Puzzle. Although, the empirical research does not categorically reject it as a measure of capital mobility, the view that is also supported by theoretical literature and some national income

identities, this criterion is doubted as far as its efficiency as capital measurement tool is considered. This study applied the generic regression used by Feldstein and Horioka in 1980 on data pertaining to two time periods (1950-51 t0 1990-91   and 1991-92 to 2011-12) with relatively different degrees of capital mobility. Having established the unit root properties of both the time series variables for all the time periods considered long term equilibrium relationship was found between domestic savings and investment in India, thus avoiding the possibility of spurious regression. Since liberalization measures had increased capital mobility in post reform period, the inclusion of data pertaining to this period in analysis was supposes to weaken the saving retention coefficient as postulated by Feldstein-Horioka puzzle. This coefficient was 0.9296 in period 1950-51 to 1990-91 and decreased to 0.8582 when data of post reform period was also considered in the analysis, implying thereby decreases in association between savings and investment. Thus, high capital mobility period was associated with low degree of association between savings and investment, thereby confirming the validity of saving –investment criteria as a measure of capital mobility and avoiding the Feldstein-Horioka Puzzle in case of India.

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