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Are Saving and Investment Cointegrated? A Cross Country Analysis

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Saving is an important part of the economic process that gives rise to investment and economic growth. In this paper an attempt is made to explore the relationship between saving and investment in three diverse economies, *viz.*, US, UK and China and compare it with India. We used Autoregressive Distributed Lag (ARDL) bounds testing approach for testing cointegration relationship between saving and investment in all the four countries. The temporal movements of the long term coefficients are also examined using recursive estimates. We found that saving and investment are cointegrated in all the countries examined but the magnitude of the long-run coefficient is different for different economies.

JEL classification : E21, E22

Key Words : Saving, Investment, Cointegration

Introduction

The relationship between saving and investment plays a vital role in national income accounting. The System of National Accounts, 1993 (SNA93) (paragraph 9.19) defines saving as,

'Saving represents that part of disposable income that is not spent on final consumption of goods and services. It may be positive or negative depending on whether disposable income exceeds final consumption expenditure, or vice versa.'

In other words, saving is defined as that part of current disposable income that is not spent to consume current final goods and services. The non-current income, which pertains to previous years, and profit/ loss not related to the current business of economic units, such as sale of assets during the previous years, are not covered in the saving. Investment measures the amount of money spent to buy capital goods for future expansion of production capacity. Thus, saving withdraws some amount of money from the financial system, while investment injects some amount of money into the financial system.

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The precise relationship between saving and investment is somewhat complex. There is considerable theoretical debate on whether saving causes investment or investment causes saving. Classical theory depicts that an increase in savings will lead to a reduction of the interest rate causing investors to demand more for the available savings and thus causing increase in investments. Keynes argued that an increase in the investment will result in increase in the output which, in turn, will affect savings. Therefore, resolving the causality issue is more of an empirical matter than of a theoretical one.

Since the ground-breaking seminal work of Feldstein and Horioka (1980) on the relationship between saving and investment in 16 OECD countries where they found high correlation between saving and investment and explained it as an evidence of low capital mobility, several researchers investigated this relationship. Some of the researchers supported this puzzle[2] while others disagreed on the ground that it is not the high saving-investment correlation that determines capital mobility between nations rather capital mobility is explained by some other factors such as the economic size, international financial linkages, fiscal policy coordination, *etc*.

In this paper, an attempt is made to explore the relationship between saving and investment in different countries. We attempted the cases of three diverse economies, *viz*., United States of America (US), United Kingdom (UK) and China and compared them with India. US is characterised by low domestic saving rate that fall short of investment. This shortfall is made up through net foreign borrowings by making use of foreigners' saving to finance part of domestic investment (Bernanke, 2005). Further, the flow of foreign capital to US may be attributed to high productivity growth and deep capital markets (Bernanke, 2007). On the other hand, China has been experiencing rise in both saving and investment rates, with higher rise in saving rate. This has led to an increase in China's current account surplus. China's saving rate increased at a greater pace than the investment rate, which may be attributed to the rapid growth in its income. As stated by Bernanke (2007), '*Chinese saving rates rose rapidly (by more even than investment rates); that rise in saving was, perhaps, a result of the strong growth in incomes in the midst of an underdeveloped financial sector and a weak social safety net that increases the*

[2] Feldstein and Horioka (1980) argued that if there is perfect capital mobility, investors in one country do not need the funds from domestic savers and can borrow from international markets and savers can lend to foreign investor the entire domestic savings. Under this assumption domestic saving would have no relation with domestic investment. However, the data provides contrasting evidence which was widely known as Feldstein-Horioka puzzle.

motivation for precautionary saving'. The bulk of China's investment is financed through domestic saving, with foreign direct investment playing a relatively modest role. Much of China's high saving and investment is due to unusually high savings of enterprises and of the Government.

In India, household sector saving accounts for almost 70[3] percent of the total savings and the rest is contributed by the private corporate sector and government. The Indian economy has huge potential to grow that is somewhat constrained by capital scarcity. The domestic saving has not been able to finance the required investment. To mitigate the saving investment gap, India had to borrow funds from the overseas market. Accordingly the Government of India initiated steps to gradually remove various restrictions since the first half of 1990s and allowed Indian entities to access to the overseas funds through Foreign Direct Investment (FDI) and External Commercial Borrowings (ECB). The improved investment climate and sound macroeconomic fundamentals also led to upsurge in the inflows of FDI. The high investment rate has not only been able to absorb the domestic savings but also generated the capability to absorb capital inflows.

The rest of the paper is structured as follows; Section I discusses literature review; followed by Autoregressive Distributed Lag (ARDL) bound testing approach method in Section II. Section III reports the empirical results and the interpretation of the same. Section IV presents summary and conclusions emanating from the empirical study.

Section I
Review of Literature

The question of whether saving and investment are cointegrated has been inexplicable for decades, and is at the core of what has come to be known as the Feldstein-Horioka (FH) puzzle. Feldstein and Horioka (1980), in their pioneering study covering 16 OECD countries using data for the time period 1960-74, found high correlation between domestic saving and investment. They argued that due to limited capital mobility, most of the incremental saving tends to remain in the country where the saving is done.

Applying the Engle-Granger cointegration technique for the period 1946 to 1987 for US economy, Miller (1988) found that saving and investment rates were both integrated of order one and are cointegrated from 1946 to1971, the

[3] Average rate calculated over the period from 1950-51 to 2009-10.

period pertains to the fixed exchange rate period. However, no cointegrating relationship could be established between the two variables during the flexible exchange rate period. Later Gulley (1992) raised the validity of Miller's initial tests of the order of integration of the saving and investment rates as well as on exclusion of the constant term from the estimation, as both the variables had non-zero means. He found that both saving and investment were stationary in levels and they were not cointegrated during both fixed and flexible exchange rate regime. De Vita and Abbott (2002) applied the ARDL cointegration technique to reassess the existence of cointegration between saving and investment for US for the period from 1946:Q1 to 2001:Q2. The empirical findings suggest weaker saving-investment correlation during the flexible exchange rate period (post 1971:Q3) with a significant reduction in the saving rate coefficient compared to the fixed exchange rate regime (till 1971:Q2). These empirical findings provide some idea about capital mobility.

The relationship between savings and investment was examined for 21 OECD countries by Krol (1996) using pooled annual data for the period from 1962 to 1990 and found the impact of saving on investment to be considerably small. Apergis and Tsoulfidis (1997) found existence of long run relationship between saving and the provision of credit in 13 EU countries out of the 14 countries studied, which they argued as flow of money saved to the money that is finally invested. Their empirical findings indicated minor role of degree of capital mobility in the EU countries investment. Further the analysis found causal linkages in most countries from saving to investment.

Mamingi (1997) examined F-H hypothesis for 58 developing countries, including India, through the cointegration technique estimated using fully modified ordinary least square and found lack of capital mobility for 12 countries, while 17 countries were found to have perfect capital mobility and 24 in the intermediate position. The sample covers the period from 1970 to 1990. The study found intermediate position of capital mobility for India. Sinha (2002) studied the relationship between saving and investment rates for Japan and 11 other Asian countries and found existence of long-run relationship between the two variables in Japan, Indonesia and Thailand. Further, considering exogenously determined structural break, the study found existence of long run relationship between saving and investment in Japan, India, Malaysia and Thailand. Sinha and Sinha (2004) using annual data for 123 countries studied both short run and long run relationship between saving and investment rates under an error correction framework. Empirically, existence of long run relationship was found for 46 countries including India and US. Evidence of

capital mobility was found for 16 countries, of which only three were developed economies (Hong Kong, Norway and US), while existence of short run relationship between the two variables was found for 84 countries[4].

Levy (2000) examined the relationship between saving and investment in US over the period 1897 to 1989 and found existence of long-run and business cyclical relationship, through frequency domain analysis, regardless of the time period covered. The study also found existence of short run relationship between investment and saving for the postwar period only. Levy argued that the variation in the extent of the saving- investment co-movement over the long run, business cycle and short run frequencies, emphasises the importance of separating the long run correlation between the two indicators from the short run and business cycle correlation.

Onafowara *et al.* (2011) studied the relationship between saving and investment in eight advanced economies of the European Union using the ARDL cointegration framework and found statistically significant evidence of cointegration for six countries. Existence of long-run unidirectional causality from saving to investment was established for UK and the Netherland. These two countries were characterized by highest share of financial activity in GDP[5]. Long-run bidirectional causality was found between the two variables for Belgium, while causality from investment to saving was found for Denmark, Germany and Luxembourg.

Narayan (2005) examined the relationship between saving and investment for China. The saving-investment relationship was examined over the two periods from 1952-1998 and 1952-1994. The second period represents the fixed exchange rate regime and restricted capital movement. Till 1994, China followed a fixed exchange rate regime and thereafter it has been following a managed floating exchange rate regime (Jin, 2003). Empirically, saving and investment were found to be cointegrated for China for both the periods and the results support the F-H hypothesis for the Chinese economy. The correlation between saving and investment was found to be stronger under the fixed exchange rate regime.

In the Indian context also, several studies have been made to examine the relationship between saving and investment. Sinha and Sinha (1998) found evidence of existence of a long-run equilibrium relationship between saving

[4] Includes China, UK, US and India.

[5] The financial activity were measured by the ratios such as Private Credit/ GDP, Financial System Deposits/ GDP or Stock Market Capitalisation/ GDP.

and investment in India applying Johansen-Juselius framework and concluded that India is unlikely to suffer from macroeconomic instability in the long-run, based on the behavior of the past data. The empirical analysis was done using data over the period from 1950 to 1992 and was confined to the pre liberalisation period of India. Seshaiah and Sriyval (2005) studied the nexus between saving and investment in the Indian context, using annual data from 1970-71 to 2001-02, under a cointegration framework and found that savings and investment are cointegrated. Further, the study found unidirectional causality from saving to investment, after considering interest rate into the cointegration framework also. Verma (2007) using an ARDL bound testing procedure for the period 1950-51 to 2003-04 found that domestic saving drives investment in both short-run and long-run for India. Rocha (2006) studied the F-H hypothesis for 22 developing countries through alternative specifications, including India, for the period from 1960 to 1996 and found capital to be immobile.

Bordoloi (2008) employing the Engle-Granger two-step method over the sample period from 1950-51 to 2005-06 found existence of cointegration relationship between saving and investment in India with a high coefficient. In a recent paper, Khundrakpam and Ranjan (2010) examined the F-H hypothesis for India for two separate periods using ARDL cointegration approach. The first period covers the period from 1950-51 to 1990-91 while the second period cover from 1950-51 to 2006-07, to examine the behavior of saving and investment post liberalisation of the Indian economy. The study found existence of a unidirectional cointegrating relationship from saving to investment and not vice-versa and the relationship was found to have weakened while incorporating post-liberalisation data. The various economic policies initiated by the Government of India post the Balance of Payments crisis in the early 1990s have gradually increased the flow of overseas saving into India leading to the weakening of the saving-investment relationship post 1990-91. Mishra *et al.* (2010) found existence of cointegration relationship between saving and investment for India over the period from 1950-51 to 2008-09 using annual data for the period 1950-51 to 2008-09 using the Johansen's cointegration technique. The study found bidirectional causality between the two variables.

Section II
Research Methodology

The coverage of the study and the econometric method used for the empirical analysis has been described in this section. The conventional wisdom

about three decades ago was that non-stationary variables should be transformed to make them stationary before incorporating under a multivariate framework. Engle and Granger introduced the concept of cointegration wherein it was proved that even if the variables are non-stationary, a linear combination of the variables may be stationary. In such a situation, the variables are said to be cointegrated. Subsequently, several methods have been developed for testing cointegration. These include Johansen (1988), Johansen-Juselius (1990) and Gregory-Hansen (1996). Pesaran and Shin (1995, 1998) and Pesaran *et al.* (1996, 2001) proposed ARDL approach for testing cointegration between the variables.

II.1 Coverage of the Study: Spatial and Temporal

For empirical analysis, all the data have been collected from International Financial Statistics (IFS), IMF database for the period 1950 to 2010 for four countries, *viz.*, US, UK, China and India. For India, the calendar year relates to the corresponding financial year (April- March), hence data corresponds from 1950 to 2009. Macroeconomic aggregates for China are available in public domain from 1978 onwards and hence period of study for China is from 1978 to 2009.

II.2 Econometric Method Used: ARDL Bounds Testing Procedure

The main advantage of the ARDL framework, given the power and testing of the long-run relationship, is that it can be applied irrespective of the order of integration,[6] while other cointegration techniques[7] require same order of integration for all variables. Further, the ARDL technique approach can be applied with small sample as well, whereas the robustness of the estimates of alternative methods depends on larger sample size. Thus, the ARDL approach avoids use of unit root tests and autocorrelation function tests for testing the order of integration.

Hendry *et al.* (1984) argued that the ARDL process of econometric modeling is an attempt to match the unknown data generating process with a validly specified econometric model, and thus economic theory restrictions on the analysis are essential. As per the Hendry-type approach, test for the adequacy of the ARDL model is defined in terms of its statistical properties, *i.e.*, the diagnostic tests for the error term, *viz.*, absence of serial correlation, homoscedasticity and the normality test.

[6] The ARDL-Cointegration method has the advantage over other cointegration methods as it can be applied regardless of whether the variables are I(0), I(1) or fractionally integrated.
[7] Engle-Granger, Johansen techniques.

The F-H hypothesis requires the estimation of the equation:

$$\left(\frac{I}{Y}\right)_t = \alpha + \beta\left(\frac{S}{Y}\right)_t + u_t \qquad \ldots(1)$$

Where, I is investment measured in terms of gross fixed capital formation (GFCF), S is gross saving, and Y is gross domestic product (GDP). GFCF has been used as a measure of investment in the literature (Sinha (2002), Sinha and Sinha (2004)). The major advantage of using GFCF as a measure of investment can be attributed to the fact that it has a lesser tendency to behave procyclically due to the exclusion of the highly procyclical inventory component (Bayoumi, 1990).

Testing the cointegration of investment and saving using ARDL bounds starts with modeling Equation (1) as a conditional ARDL-ECM[8] defined as,

$$\Delta\left(\frac{I}{Y}\right)_t = c_0 + \pi_1\left(\frac{I}{Y}\right)_{t-1} + \pi_2\left(\frac{S}{Y}\right)_{t-1} + \sum_{i=1}^{p}\gamma_i\Delta\left(\frac{I}{Y}\right)_{t-1} + \sum_{i=0}^{q}\delta_i\Delta\left(\frac{S}{Y}\right)_{t-1} + \varepsilon_t \ldots(2)$$

Where C_0 is the drift component and ε_t is the white noise error term.

Following Pesaran *et al.* (2001), two separate statistics are employed to 'bounds test' for testing the existence of a long-run cointegration relationship:

(i) An F-test for the joint significance of the coefficients of the lagged levels in (2) (so that $H_0: \pi_1 = \pi_2 = 0$)

(ii) A t-test for the null hypothesis $H_0: \pi_1 = 0$ (Banerjee *et al.* 1998).

Two asymptotic critical value bounds provide a test for cointegration when the independent variables are *I(d)* (where $0 \leq d \leq 1$) with a lower value assuming the regressors are *I(0)* and an upper value assuming purely *I(1)* regressors. A long run cointegrating relationship between the variables exists in case the test statistics exceed the respective upper critical values. The null hypothesis of no cointegration cannot be rejected if the test statistic falls below the lower critical values. If the test statistic falls within their respective bounds no inference can be drawn.

The conditional long-run equation for *(I /Y)* can be derived from the reduced form solution of Equation (2) when $\Delta\left(\frac{I}{Y}\right) = \Delta\left(\frac{S}{Y}\right) = 0$ and is defined as:

$$\left(\frac{I}{Y}\right)_t = \Theta_0 + \Theta_1\left(\frac{S}{Y}\right)_t + v_t \qquad \ldots.(3)$$

[8] Error Correction Model.

where $\Theta_0 = -c_0/\pi_1$, $\Theta_1 = -\pi_2/\pi_1$ and v_t are random errors. These long-run coefficients are estimated by the ARDL approach to cointegration of Pesaran and Shin (1998).

When Θ_1 is equal to zero, there will not be any relationship between domestic saving and investment. Value nearer Θ_1 to zero indicates that the economy experiences high capital mobility while a value nearer to one indicates that capital is highly immobile. In case Θ_1 is equal to one, the domestic saving fully finances the domestic investment.

Section III
Empirical Results and Interpretation

The ARDL bounds testing approach described above has been used to test for the existence of cointegration relationship between investment and saving in the four countries separately. Further, to track the behavior of the saving-investment relationship over time, recursive estimates with a window size of 30 has been used[9].

The ARDL bounds testing cointegration approach does not require the variables to be of the same order. However, we have used the ADF unit root tests to identify the order of integration (Table 1)[10]. From the table, it is clear that investment and saving are integrated of order one for China and India, while in case of US and UK, the test does not provide a clear picture of the order of integration. As the test gives an indication that the order of integration for both the variables for the four countries lie between zero and one, we preferred using ARDL bound testing approach.

Table 1: Augmented Dickey-Fuller Unit Root Test

Variable	India	US	UK	China
(I/Y)	0.793	-2.451*	-2.498*	-0.644
(S/Y)	1.079	-0.2189	-1.452	0.451
$\Delta(I/Y)$	-4.538*	-5.323*	-4.306*	-4.264*
$\Delta(S/Y)$	-4.424*	-5.100*	-4.745*	-3.032*

Note: The Dickey-Fuller test statistic is reported. The critical values are the finite sample values suggested by Mackinnon (1991). (*) indicates that the test statistic is significant at the 10% level.

[9] Starting from a 30 year window and augmenting one observation in each step.
[10] The results are also confirmed using Phillips - Perron test.

Table 2: Bounds Tests for Cointegration

India		US		UK		China	
F statistic	t statistic	F statistic	t statistic	F statistic	t statistic	F statistic	t statistic
6.91	-3.69	5.08	-3.51	4.56	-3.44	6.26	-3.51

Notes: The *F*-statistic is used to test for the joint significance of the coefficients of the lagged levels in the ARDL-ECM.
The *t*-statistic is used to test for significance of the coefficient of the lagged dependent variable.
All test statistics are significant at the 10% level.

The lag lengths of the variables in the ARDL model are chosen using the general-to-specific method starting from 3 lags and progressively dropping the insignificant lags. The bounds test for each of the countries using the full data set is presented in Table 2.

The asymptotic critical value bounds computed by Pesaran *et al.* (2001) were generated for large sample sizes and may not be appropriate for small sample sizes. Accordingly, the critical values for F-statistics are taken from Narayan (2005). All the test statistics are found to be significant at the 10 percent level, leading us to reject the null-hypothesis of no cointegration in all cases.

In contrast, when saving was considered as the dependent variable, the calculated F-statistics are found to be lower than the lower bound of the critical value at the 10 percent level, suggesting that the null of no cointegration between saving and investment could not be rejected for all the countries. Thus, existence of long-run relationship between saving and investment could be established, only in case when investment is considered as the dependent variable. This validates the use of investment as the dependent variable. Thus domestic saving is the long-run forcing variable for explanation of investment for the selected countries during the sample period.

The estimates of the long-run coefficients from the ARDL specification of the short-run dynamics are presented in Table 3.

In case of India, the long run coefficient is found to be the highest (0.89). According to Feldstein and Horioka (1980), high correlation is an evidence of low capital mobility. Therefore, high correlation for India appears to confirm low capital mobility and heavy dependence on domestic savings for much of its investment as compared to other countries studied. For US, even though the saving and investment are found to be cointegrated, the long run saving coefficient is found to be lower compared to the other countries (0.32).

Table 3: Estimated Long and Short-run Coefficients as per Equation 2

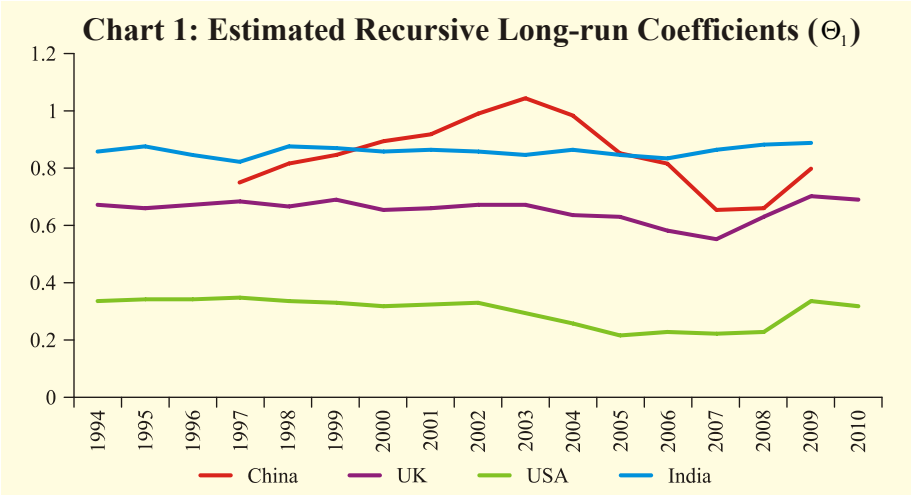
	India	US	UK	China
c_0	0.01* (0.004)	0.04* (0.01)	0.02* (0.01)	0.02 (0.03)
π_1	-0.38* (0.10)	-0.29* (0.08)	-0.22* (0.07)	-0.57* (0.16)
π_2	0.34* (0.09)	0.09* (0.03)	0.15* (0.06)	0.45* (0.13)
δ_0	0.43* (0.07)	0.33* (0.05)	0.30* (0.11)	0.36* (0.21)
δ_1	-0.02 (0.11)	-0.09 (0.07)	-0.10 (0.12)	-0.09 (0.24)
γ_1	0.01 (0.13)	0.49* (0.13)	0.30* (0.13)	0.59* (0.20)
Θ_0	0.02	0.14	0.09	0.03
Θ_1	0.89	0.32	0.69	0.80

(Standard errors in parenthesis) (*) indicates that the test statistic is significant at the 10% level.

The adequacy of the ARDL bound testing approach can be tested using the diagnostic tests of the model (Hendry *et al*. 1984). We tested for the residuals for autocorrelation (using Durbin-Watson statistic), homoscedasticity (using Breusch-Pagan/Cook-Weisberg) and normality (using normal probability plots). The diagnostics tests are found to be satisfactory. Further, the residuals are also tested for their white noise property and found to be satisfactory.

The temporal movements of the long term coefficients **(Θ_1)** are obtained using recursive estimates starting from 30 year window and augmenting one observation in each step. In the case of China, due to lack of observations, a 20 year window has been used. The F and t statistics are also obtained recursively. It was observed that the hypothesis of no cointegration between investment and saving is rejected for all the four countries during the span of the study. Chart 1 provides the movement of the long term coefficient in the past 15 years (1995-2010).

It can be noted that the long term saving coefficients are fairly stable for India which hovered around 0.85. In China, the long term coefficient of saving on investment gradually increased till 2003. This may be attributed to the high domestic saving driven investment. During 2004 to 2008, the coefficient



declined. This is in line with the fact that the China's domestic savings grew at a faster rate (compounded annual growth rate of 21.2 per cent) than its investment growth (compounded annual growth rate of 19.2 per cent) during this period. Prior to the financial crisis of 2008, US and UK had witnessed decline in the long-run saving coefficients, which subsequently picked up during the crisis period (2008-09).

Section IV
Summary and Conclusions

The question of whether saving and investment are cointegrated has been baffling economists for decades, and is at the core of what has come to be known as the Feldstein-Horioka (FH) puzzle. In this paper, an attempt is made to explore the relationship between saving and investment and test for the FH puzzle for India with other three diverse economies, *viz.*, US, UK and China. For this, ARDL bounds testing approach has been used to test for the existence of cointegrating relationship between saving and investment for all the four countries. The temporal movements of the long term coefficients are also examined using recursive estimates.

Empirically, it has been found that saving and investment are cointegrated for all the four selected countries. The results suggest that India depends on its own saving for most of its investment. For US, even though the saving and investment are found to be cointegrated, the long run saving coefficient is found to be lower compared to the other countries. In China, the long term coefficient

of saving on investment gradually increased till 2003. This may be attributed to the high domestic saving driven investment. From 2004 to 2008, the coefficient declined. This is in line with the fact that the China's domestic savings grew at a faster rate than its investment growth during this period. US and UK had witnessed decline in long-run saving coefficients during the pre-crisis period of 2008, which subsequently picked up during the crisis period.

References:

Apergis, N. and L. Tsoulfidis (1997). ''The relationship between saving and finance: theory and evidence from E.U. countries'', *Research in Economics*, Vol. 51, No. 4, 333–358

Banerjee, A.J., Dolado, J., Mestre, R. (1998). ''Error-correction mechanism tests for cointegration in single-equation framework;'', *Journal of Time Series Analysis*, Vol. 19, 267–283.

Bayoumi, T. (1990). ''Saving- Investment Correlation: immobile Capital, Government Policy or Endogenous behaviour'', *IMF Staff Papers,* Vol. 37, No. 2, 360-387.

Bernanke, B.S. (2005). ''The Global Saving Glut and the U.S. Current Account Deficit'', Remarks at the Homer Jones Lecture, St. Louis, Missouri on April 14, 2005.

Bernanke, B.S. (2007). ''Global Imbalances: Recent Developments and Prospects'', Speech at the Bundesbank Lecture, Berlin, Germany on September 11, 2007.

Bordoloi, S. (2008). ''Saving and Capital Formation in India: Some exploration'', *The Journal of Income and Wealth,* Vol.30, No. 1, 11- 26.

De Vita, G. and A. Abbott (2002). ''Are saving and investment cointegrated? An ARDL bounds testing approach'', *Economic Letters,* Vol. 77, 293-299.

Engle, R.F. and C. W. J. Granger (1987). 'Cointegration and Error-Correction: Representation, Estimation, and Testing', *Econometrica*, Vol. 55, 251-276.

Feldstein, M. and C. Horioka (1980). ''Domestic Saving and International Capital Flows'', *The Economic Journal*, Vol. 90, 314-329.

Gregory, A. W. and B. E. Hansen (1996). ''Tests for cointegration in models with regime and trend shifts'', *Oxford Bulletin of Economics and Statistics*, Vol. 58, 555-560.

Gulley, O.D. (1992). ''Are saving and investment cointegrated? Another look at the data'', *Economics Letters*, Vol. 39, 55–58.

Hendry, D. F., A. R Pagan and J. D Sargan (1984). ''Dynamic specification'', in Griliches, Z. and Intriligator, M. D. (eds.), Handbook of Econometrics, Elsevier, Amsterdam, Vol. II: 1023-1100.

Johansen, S. (1988). ''Statistical Analysis of Cointegrating Vectors'', *Journal of Economic Dynamics and Control*, Vol. 12, 231-254.

Johansen, S. and K. Juselius (1990). ''Maximum likelihood estimation and inference on cointegration-with application to the demand for money'', *Oxford Bulletin of Economics and Statistics*, Vol. 52, 169-210.

Jin, Z. (2003). ''The dynamics of real interest rates, real exchange rates and the balance of payments in China: 1980- 2002'', *IMF Working Paper*, 67.

Krol, R. (1996). ''International capital mobility'', *Journal of International Money and Finance*, Vol. 15 No. 3, 467-474.

Khundrakpam, J.K. and R. Ranjan (2010). ''Saving-Investment Nexus and International Capital Mobility in India: Revisiting Feldstein-Horioka Hypothesis'', *Indian Economic Review,* Vol. XXXXV, No. 1, 49-66.

Levy, D. (2000). ''Investment-Saving Co-movement and Capital Mobility: Evidence from Century Long U.S. Time Series'', *Review of Economic Dynamics*, Vol. 3, 100-136.

MacKinnon (1991). "Critical Values for Cointegration tests", in Engle, R.F. and Granger, C.W.J. (eds.), Long-Run Economic Relationship: Readings in Cointegration, Oxford University Press, Oxford.

Mamingi, N. (1997). ''Saving-Investment Correlations and Capital Mobility: The Experience of Developing Countries'', *Journal of Policy Modeling*, Vol. 19, No. 6, 605-626.

Miller, S. (1988). "Are saving and investment cointegrated?", *Economic Letters*, Vol. 27, 31–34.

Mishra, P.K., J.R. Das and S.K. Mishra (2010). ''The Dynamics of Saving and Investment Relationship in India'', *European Journal of Economics, Finance and Administrative Sciences,* Issue 18, 163-172.

Narayan, P.K. (2005). ''The saving and investment nexus for China: evidence from cointegration tests'', *Applied Economics,* Vol. 37, 1979- 1990.

Onafowara, O.A., O. Owoye and F. Huart (2011). ''The Temporal Relationship between Saving and Investment: Evidence from Advanced EU Countries'', *International Journal of Business and Social Science*, Vol. 2, No. 2, 1-12.

Pesaran, M. H. and Y. Shin (1995). ''Autoregressive distributed lag modeling approach to cointegration analysis'', *DAE Working Paper Series*, No. 9514, Department of Economics, University of Cambridge.

Pesaran, M. H. and Y. Shin (1998). ''An Autoregressive distributed lag modeling approach to cointegration analysis'', in S. Storm. (ed.), Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium, Cambridge: Cambridge University Press.

Pesaran, M. H., Y. Shin and R. Smith (1996). ''Testing for the existence of a long-run relationship'', *DAE Working Paper 9622*, Department of Applied Economics, University of Cambridge.

Pesaran, M. H., Y. Shin and R. Smith (2001). ''Bounds testing approaches to the analysis of level relationships'', *Journal of Applied Econometrics*, Vol. 16, 289-326.

Rocha, F. (2006). ''Are error correction models the best alternative to assess capital mobility in developing countries?'', *Economic Applications*, Vol. 10, No. 2, 267-285.

Seshaiah, V. and V. Sriyval (2005). ''Saving and Investment in India: A Cointegration Approach'', *Applied Economics and International Development*, Vol. 5, 25-44.

Sinha, D. and T. Sinha (1998). ''The long run relationship between saving and investment in India'', *Indian Economic Journal*, Vol. 45, 118-123.

Sinha, D. (2002). ''Saving-investment relationships for Japan and other Asian countries'', *Japan and the World Economy,* Vol. 14, 1-23.

Sinha, T. and D. Sinha (2004). ''The mother of all puzzles would not go away'', *Economic Letters*, Vol. 82, 259-267.

United Nations (1993). "System of National Accounts", 1993, Washington, D.C.

Verma, R. (2007). ''Saving, Investment and Growth in India: An Application of the ARDL Bounds Testing Approach'', *South Asia Economic Journal*, Vol. 8, No. 1, 87-98.