

*Full Length Research Paper*

# The Feldstein- Horioka paradox in the perspective of foreign direct investment (FDI): A pragmatic validation

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Accepted 28 February, 2011

**The purpose of this study is to test fundamental relationship between domestic saving and domestic investment for Pakistan from 1972 to 2008. Saving and investment are closely related to highlight the economic state of affairs of a country. Saving is a strapping source to enhance investment. Raising income enables people to increase consumption and saving level. The higher the level of income will improve the level of saving and ultimately investment will go up. Johanson co-integration shows that there is long run relationship between saving and investment. For short run dynamics and causality, the study utilizes vector error correction model (VECM). The results of VECM indicate that there is short and long run causal relation between saving and investment.**

**Key words:** Feldstine-Horioka, foreign direct investment (FDI), Johanson co-integration, Pakistan.

## INTRODUCTION

Most observers of the dilemma agreed that a major prerequisite for development is the accumulation of capital. It involved three mutually dependent activities. Firstly, an increase in the size of real savings. Secondly, a finance and credit mechanism, so that the resources might be maintained by capitalists. Thirdly, the act of investment itself. So that resources were used for the production of capital goods (Meir and Baldwin, 1957). Saving is an essential equipment to increase the volume of capital and investment. Saving remains an important determinant for capital accumulation. Saving and investment are robust variables to increase the Gross Domestic Product (GDP). Both the variables are fundamental for policy makers. For both developed and developing countries, saving and investment are key elements to achieve sustainable growth rates. As developing countries are aspired to gain higher growth targets in a short span but still are lacking behind due to low income. So their low saving and as a result low investment becomes main cause to remain poor. In such circumstances, Foreign Direct Investment (FDI) happens to be a major tool to grow at a higher pace.

Yasutomi (2000) elaborated that Adam Smith pointed out the existence of the Feldstein-Horioka Paradox or Puzzle and even gave an explanation for it more than 200 years before the publication of Feldstein and Horioka (FH) (1980). Smith argued that it was the search of their own safety that directed possessors of capital to invest their capital in their own country. Thirty years before Feldstein and Horioka (1980) established a practical association among domestic saving and investment in a cross section investigation based on saving and investment ratios on GDP. It was calculated for the period of 1960 to 1976. From the empirical test conducted on a sample of 16 OECD countries it was found that some 85 to 95% of national saving was invested domestically.

The developing countries face great hurdles in the way of their development and low saving is the most common among all of these. It was due to low income, agrarian background and unemployment. In a large number of studies, the variable investment includes both domestic and FDI. It does not reveal the exact picture of saving and investment relation. FDI has no link with domestic savings. So in this study, the saving and investment relation is evaluated in two parts, firstly, the link between saving and investment is examined, secondly, FDI is subtracted from investment and then examine the relation among saving and investment. Pakistan is a developing country and low saving is main issue in the path of

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**Table 1.** Investment, saving and fdi (million \$).

Years	Investment	Saving	FDI
1972-1980	2144.89	945.56	20.17
1981-1990	6245.93	2976.22	120.19
1991-2000	10736.8	9050.37	502.29
2001-2008	17254.3	13175	1428

(WDI, 2008).

development. The investment, saving and foreign direct investment in Pakistan is depicted through Table 1.

## LITERATUR REVIEW

There is huge literature on Feldstein and Horioka (1980) puzzle. The exclusive FH's findings were established by Feldstein (1983) and Feldstein and Bachetta (1991) by broadening the sample period to 1960 to 1979 and 1960 to 1986, respectively which include observations from the post Bretton Woods's agreement. Barro et al. (1995) found a theoretical model that authorized a correlation among saving and investment in a world of perfect capital mobility.

F H's outcomes were also acquired by other researchers using diverse samples and different empirical procedures .Murphy (1984) and Dooley et al. (1987) found a close relationship between saving and investment for lesser industrialized and developing economies. However the expected correlations are lower on standard. Obstfeld and Rogoff,(2000) found that the regularity of the results made the F H correlation one of the most important puzzles in international finance. Saving and investment is closely related issue and this thought is empirically investigated in different dimensions by a large number of economists. Saving and investment coefficient is interrelated to the country magnitude.

Georgopoulos and Hejazi (2005) found that the F H's outcome just replicated the fact that a large country is more reliant on domestic sources of investment. However, Baxter and Crucini (1993) and Mamingi (1994) explained that developing countries and small developed countries demonstrated superior resources mobility than bigger ones. FH puzzle has been primarily simulated using cross-section regressions, Frankel (1992) and Tesar (1991) apply a slighter degree and panel estimation techniques used by a number of economists as Coakley et al. (1996), Corbin (2001), Ho (2002) and Jansen (1999). The occurrence of provisional business cycle distresses like productivity is an additional reasonable clarification of a constant saving and investment association (Mendoza, 1991; Obstfeld, 1986). Another explanation put forward that the saving and investment correlation coefficient reflects the substitutability between domestic and external savings (Sachsida and Caetano,

2000).Kim (2001) applied co-integrated panel techniques to control the possible authority of various factors on the savings and investment relationship. Aggregate shocks as productivity, terms of trade, global shocks and country specificities were used and found the persistence of a high, positive correlation between savings and investment.

Sinn (1992) elaborated the current account solvency condition through FH puzzle. The solvency restriction requires that the current account as a share of GDP be immobile as the marginal debt cannot grow forever. Saving and investment are co-integrated with a unit coefficient. Mastroyiannis (2007) separated the literature on FH puzzle into two categories. On one hand, many researchers attributed the puzzle to aspects that were unrelated to capital mobility, and they argued that the FH tactic was improper for measuring capital mobility as non traded goods and stationary factors (Engel and Kletzer, 1987). On the other hand, the validity of the F H's methodology in measuring capital mobility, and they explained the puzzle on methodological and econometric grounds. Jansen and Schulze (1996) elaborated the role of changes in policy regime. It was found that policy regime changed structural breaks which extensively bias the practical results towards refusing the hypothesis of capital mobility.

Fouquau et al. (2009) estimated the FH puzzle by means of Panel Smooth Threshold Regression Model (PSTR). The study estimated  $\beta$  for 24 organization for economic co-operation and development (OECD) countries for the period 1960 to 2000. Whereas the country specific  $\beta$  disagrees mainly, the panel based estimation range amid 0.5 to 0.7. It was found that savings and investment relation is non-linear and the degree of openness, the volume of the nation state and the ratio of current account balance to GDP have noteworthy sound effects on the estimates of  $\beta$ .

However, there are studies which explicit that FH puzzle does not exist. Miller (1988) found that saving and investment in the US are co-integrated throughout the fixed, but not for the duration of the flexible exchange-rate time. Montiel (1994) elaborated about the vulnerability of FH test for indirect correlations between domestic saving and investment that did not reflect capital mobility. Pakistan, being a developing country the low income level keeps the investment at a low level, so foreign direct

investment is a good source to increase investment in the country. Ahmad and Ahmed (2002) elaborated that domestic recourse mobilization was one of the fundamental determinants of economic growth. Pakistan's saving presentation was deprived as relative to succeeding countries in the area that had experienced prolonged high growth. Consequently, Pakistan profoundly relies on foreign capital to bridge the gap among domestic saving and domestic investment.

The quantity of foreign direct investment enlarged considerably for developing economies during 1985 to 2000. The proportion of developing economies in world FDI inflows and outflows has increased from 17.4 to 26.1% for the duration of 1985 to 1990 to 1995 to 2000. Pakistan's sum of FDI inflows enhanced from \$ 0.24 billion in 1990 to \$ 55 billion in 2007(WDI indicators, 2008).

**DATA, MODEL AND ECONOMETRIC METHODOLOGY**

The study is aimed to find out short and long run impact of saving on investment. The impact of saving on investment without FDI is also evaluated. The data employed in this study are time series data covering the period 1972 to 2008. Data is taken from the World Development Indicator (WDI) 2008. The variables  $I_t$ ,  $S_t$  and  $IF_t$  represent gross fixed capital (proxy variable for capital), domestic saving and capital without FDI respectively.

For the specification of a model a Vector Autoregressive (VAR) approach is used to calculate the effects of saving on investment and saving on investment without FDI. For co-integration evaluation, the following multivariable VAR model is used:

$$LI_t = f(LS_t, \mu_{1t}) \tag{1}$$

$$LIF_t = f(LS_t, \mu_{2t}) \tag{2}$$

where:  $t$  is time period,  $L$  is natural log,  $I$  is investment,  $S$  is saving  $F$  is foreign direct investment,  $U_{1t}$  and  $U_{2t}$  are error terms.

For this purpose, co-integration and causality tests among these variables will be analyzed. It is important to check each time series for stationarity. If a time series is non-stationary, the regression analysis done in a conventional way will produce spurious results. Therefore, in order to examine this property of time series, the unit root test is conducted. The study uses Augmented Dicky Fuller (ADF, 1979) to check the stationarity. The ADF assumes the following equations for unit root test:

$$\Delta X_t = \Psi_0 + \Psi_1 X_{t-1} + \sum_{j=1}^k \alpha_j \Delta X_{t-j} + \epsilon_{1t} \tag{3}$$

$$\Delta X_t = \Psi_0 + \Psi_1 X_{t-1} + \Psi_2 t + \sum_{j=1}^k \alpha_j \Delta X_{t-j} + \epsilon_{2t} \tag{4}$$

Where:  $\Delta X_t$  is lag operator and  $\Delta X_t = X_t - X_{t-1}$ ,  $k$  is the total number of lags and  $\epsilon_{1t}$ ,  $\epsilon_{2t}$  are stochastic error terms. ADF assumes the following hypothesis:

$$H_0: \Psi_1 = 0; (X_t \text{ is non-stationary})$$

$$H_a: \Psi_1 < 0; (X_t \text{ is stationary})$$

After testing the stationarity of variables the next step to look for co-integration. Econometric literature recommends diverse procedural substitutes to empirically analyze the long-run relationships and dynamics connections among two or more variables. The majority extensively used methods comprise the two-step procedure of Engle and Granger (1987) and the full information maximum likelihood-based approach due to Johansen and Juselius (1990). A unified approach is developed to investigate co-integration within VAR models. For co-integration the unique variables in the structure must be integrated at similar level. There are two types of test are used to categorize the amount of co-integrating vectors, which are known as the trace test statistic and the maximum Eigen-value test statistic. The former tests the null hypothesis that there are  $r$  co-integration vectors in opposition to the alternative hypothesis of more than  $r$  co-integrating vectors. This is defined as:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^p \ln(1 - \lambda_i^{\wedge}) \tag{5}$$

Where,  $\lambda_j$  = The Eigen-values,  $T$  = total number of observations.

The later test statistic, is used to test the null hypothesis of at most  $r$  co-integrating vectors against the alternative hypothesis of more than  $r+1$  co-integrating vectors, is as under:

$$\lambda_{max}(r, r+1) = -T \ln(1 - \lambda_{r+1}^{\wedge}) \tag{6}$$

The customary Granger (1969) causality analysis for deducting direct unauthentic regression results, and the F-test is not suitable except the variables in levels are co-integrated. Granger (1988) elaborated that if two series are co-integrated, in that case there is Granger-causation in one direction at least. When a variable  $X_t$  causes  $Y_t$ , then  $Y_t$  can be forecasted with improved accuracy by means of past values of  $X_t$ .

$$Y_t = \alpha_t + \sum_{i=1}^p \beta_i Y_{t-i} + \sum_{j=1}^p \chi_j X_{t-i} + \epsilon_t \tag{7}$$

Where:  $\alpha_t$  is a deterministic element and  $\epsilon_t$  is an error term. Johansen S (1988); Johansen and Juselius (1990) have developed a maximum likelihood testing course of action on the number of co-integrating vectors inside the Vector Autoregressive (VAR) structure, which too includes testing methods for linear restrictions on the co-integrating parameters. The general VAR model can also be reformulated in the following manner:

$$\Delta X_t = \alpha + \sum_{i=0}^{p-1} \Gamma_i \Delta X_{t-i} + \Pi X_{t-1} + \epsilon_t \tag{8}$$

where:  $X_t$  is a  $(n \times 1)$  column vector of  $p$  variables,  $\alpha$  is a  $(n \times 1)$  vector of constant terms,  $\epsilon_t$  is  $(n \times 1)$  vector of usual error term,  $\Delta$  is difference operator and  $\Gamma$  and  $\Pi$  represent coefficient matrices. The coefficient matrix  $\Pi$  is also termed as impact matrix and it tells about the long run relationship. It captures the long run impact whereas coefficient matrix  $\Gamma$  captures the short run impact.

**EMPIRICAL RESULTS**

**Unit root test**

The data set consists of investment, saving and investment without FDI. Augmented Dicky Fuller (ADF) test with intercept and trend and intercept suggests that all

**Table 2.** Investment, saving and investment without FDI.

Variable	At Level		At 1 <sup>st</sup> Difference	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
LI <sub>t</sub>	0.2445	0.4967	0.0001*	0.0007*
LS <sub>t</sub>	0.0014*	0.0003*	0.0000*	0.0000*
LIF <sub>t</sub>	0.7902	0.6429	0.0000*	0.0000*

Note: \* and \*\* the variables are significance at 1 and 5% level.

**Table 3.** Unrestricted co-integration rank test (trace).

Hypotheses		Trace statistic	Critical value 0.05	Prob.
Ho	Ha			
$r = 0$	$r > 1$	22.93	15.49	0.0032
$r \leq 1$	$r > 2$	6.05	3.84	0.0139
Values of LIFT				
$r = 0$	$r > 1$	30.84	15.49	0.0001
$r \leq 1$	$r > 2$	4.69	3.84	0.0304

**Table 4.** Unrestricted co-integration rank test (Eigen-values).

Hypotheses		Max-Eigen statistic	Critical value 0.05	Prob.
Ho	Ha			
$r = 0$	$r > 1$	16.88	14.26	0.0189
$r \leq 1$	$r > 2$	6.050	3.84	0.0139
Values of LIFT				
$r = 0$	$r > 1$	26.15	14.26	0.0004
$r \leq 1$	$r > 2$	4.686	3.841	0.0304

all variables used in the study, are stationary at first difference. The results of ADF test are presented in Table 2.

### Autocorrelation and heteroskedasticity

The autocorrelation and heteroskedasticity tests are carried out which show that there is no problem of autocorrelation and heteroskedasticity. The p values are 0.5139 and 0.845519 of autocorrelation and heteroskedasticity respectively. The p values of autocorrelation and heteroskedasticity of investment without FDI are 0.7500 and 0.2823 respectively.

### Co-integration

Starting with null hypothesis of no co-integration ( $r = 0$  and  $r < 1$  and  $r < 2$ ) among the variables, the trace statistic are 22.93112, and 6.050877 which exceeds the 95% critical values, so we reject the null hypothesis. The trace statistic values of LIF<sub>t</sub> are 30.93112 and 4.636267 which

exceeds the 95% critical values and reject the null hypothesis (Table 3).

Consequently, we conclude that there are two co-integration relationships involving variables saving, investment and investment without FDI. Unrestricted co-integration rank test of  $\lambda_{\max}$  are reported in Table 4. The null hypothesis of no co-integration vector ( $r = 0$  and  $r = 1$ ) and null hypothesis cannot be accepted as the calculated value of  $\lambda_{\max}$  16.88024 and 6.050877. The  $\lambda_{\max}$  values of LIF<sub>t</sub> are 26.15444 and 4.686267 greater than the 95% critical value.

The presence of co-integration vectors shows that there exists a long run relationship among saving, investment and investment without FDI.

$$LI_t = 1.000 + 0.181906 \quad (9)$$

$$T\text{-value} \quad (2.83330)$$

$$LIF_t = 1.0000 + 2.354370 \quad (10)$$

$$T\text{-value} \quad (4.72371)$$

**Table 5.** Vector error correction model (VECM).

Dependent variable	$\Delta LI_t$	$\Delta LS_t$	$ECT_{t-1}$
$\Delta LI_t$	---	10.90734 (0.0010)	-0.294155(-3.62422)
$\Delta LS_t$	0.212569(0.6448)	---	1.476148(1.82632)

**Table 6.** Vector error correction model (VECM).

Dependent variable	$\Delta IF_t$	$\Delta LS_t$	$ECT_{t-1}$
$\Delta LIF_t$	---	10.04114(0.0015)	-0.010725(-0.34165)
$\Delta LS_t$	0.046917(0.8285)	---	0.441264(2.92777)

The normalized co-integrated vectors are reported in Equations 9 and 10. The estimates represent the long run elasticities of investment and investment without FDI with respect to saving. The significant positive coefficient of saving shows that these variables move in same direction with investment in long run.

### Vector error correction model (VECM)

The lagged error correction term ( $ECT_{t-1}$ ) capture long run dynamics and also indicates long run causality. The significant t-value of investment in  $ECT_{t-1}$  suggests the existence of short-run co-integration. While in first row investment is caused by saving. Table 5 and 6 shows the significant t-values of saving which show that there is short run co-integration prevail and investment without FDI is caused by saving.

### Conclusion

Investment and saving are important determinant for the development of a country. In this study, the FH puzzle is investigated. Investment is checked with and without FDI. The ADF test shows that the variables have unit root problem at level but these variables are significant at first difference. There are two co-integrating vectors. The maximum Eigen value statistics also show a long run relationship among saving and investment with and without FDI. This is the pioneer study to evaluate the FH puzzle, so it is suggested that the government should develop such policies which improve saving. Saving would become the future investment.

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