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# EXPLORING INDIA'S ECONOMIC SCENARIO THROUGH THE LENS OF FELDSTEIN HORIOKA PUZZLE

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**ABSTRACT** DOI No: 10.36713/epra15916 Article DOI: https://doi.org/10.36713/epra15916

***The Feldstein Horioka Puzzle has been a subject of extensive research, with various studies offering conflicting perspectives on its validity. The puzzle focuses on the relationship between saving and investment and whether the relationship holds true at the national level. The puzzle pertains to the persistent correlation between savings and investment, implying that countries with higher savings rates should also exhibit higher investment rates, in opposition to what conventional economic models predict. In the case of India, the Feldstein Horioka Puzzle has yielded diverse conclusions. Annual data from 1970 to 2021 has been used in the study to examine the validity of the Feldstein Horioka Puzzle in India. To confirm the long-term association between saving and investment, it is crucial to consider the cointegration test results. The results of the study***

**KEYWORDS:** ***Feldstein-Horioka Puzzle, saving, investment, fixed exchange rate, cointegration***

## INTRODUCTION

In recent years, there has been a growing interest in understanding the relationship between savings and investment, particularly in the context of the Indian Economy. This has led to a multitude of studies that aim to examine the validity of the Feldstein Horioka Puzzle in the Indian context. The Feldstein Horioka Puzzle pertains to the relationship between savings and investment, specifically addressing the question of whether domestic savings and investment are closely linked or there is greater capital mobility. This has significant implications for economic policy and growth.

The Feldstein-Horioka Puzzle is a perplexing issue in the field of international finance. Economists have debated it for decades. The puzzle focuses on the observed correlation between savings and investment across different countries. According to traditional economic theory, capital should flow seamlessly across borders in an open and integrated global economy to seek the highest returns. This should lead to a weak connection between domestic savings and domestic investment. However, empirical evidence often shows a contrary picture, revealing a surprisingly strong association between these two variables. The puzzle is named after economists Martin Feldstein and Charles Horioka.

Historically, the degree of exchange limitations was used to assess international capital movement. However, its effectiveness has been called into question in light of emerging evidence that capital transfers occur despite exchange limitations. As a result, two major approaches to evaluating the degree of capital mobility have emerged: the price approach and the quantity approach. The pricing method investigates the equalisation of rates of return between

countries via capital flows. In developing nations, measuring capital mobility using forward rates may not be reliable due to the absence of asset and price information. Additionally, the equalisation of rates of return on capital through capital flows may not happen because of exchange restrictions that prevent the availability of forward rates. (Ahmad, 2014) The quantity approach, on the other hand, comes in two forms. The first is the saving and investment rate correlation, which hypothesises that if investments are not controlled by local saving but are fulfilled by global capital, the correlation will be low. The consumption smoothing approach, the second variation of the quantity approach, investigates whether consumption is properly smoothed by capital flows notwithstanding income shocks. (Khundrakpam & Ranjan, 2010) The Quantity approach to evaluate the degree of capital mobility using the saving-investment relationship was popularised by Feldstein and Horioka (1980).

Their study provides solid evidence of the link between domestic savings and international capital flows. They found that almost all additional savings remain within the country of origin, which contradicts the assumption of complete arbitrage in a perfect global capital market. This suggests that the increase in the domestic supply of capital does not necessarily lead to higher returns overseas. The perfect capital mobility results in a weak connection between investment and saving. In a scenario of perfect capital mobility, the relationship between domestic saving and local investment should be non-existent. Each country's savings should respond to global investment opportunities, while the global pool of capital should fund investment in that country. Conversely, if additional savings tend to be invested in the country of origin, differences in investment rates between countries should closely correlate to differences in saving rates. (Feldstein & Horioka, 1980) The Feldstein-Horioka puzzle was called "the mother of all puzzles" in international monetary economics by Obstfeld & Rogoff (2000)

Many studies following Feldstein-Horioka discovered that savings and investment are highly correlated, indicating limited capital mobility. (for example, Patra & Mohanty (2019); Kaur & Sarin (2018); )

Savings play a crucial role in the investment process. If a country's domestic savings are not enough to meet the funding needs for domestic investments, it leads to a savings deficit and, subsequently, a current account deficit. In such cases, to fuel economic growth, the country has to rely on external sources of funding. Savings and investment are considered vital elements in achieving key macroeconomic objectives, particularly economic expansion. (Fry, 1980)

Numerous macroeconomic theories suggest that saving and investment are critical in generating and sustaining high economic growth in any given economy. Developing countries, in particular, heavily rely on domestic savings to finance investment projects due to the inadequacy of capital markets. Consequently, the economic progress of most developing countries is hindered by the insufficiency of national savings. (Krieckhaus, 2002) Saving and investment relationships in India are not only complex but also it is everchanging, which makes it more relevant for the study.

Venkata & Sriyval (2005) state that the saving and investment relationship is accounting in nature. The reasons were: (i) continuous rise in interest rates before liberalisation in India, therefore individuals saved more. However, the corporate sector faced the problem of undesirable investment due to higher inventory costs. Hence, classical economists' view that planned saving is equal to planned investment is not applicable before liberalisation. (ii) Statistics have revealed that domestic savings are not sufficient to meet domestic investment. India heavily depends on foreign aid to meet their investment requirements.

**Figure 1: Trend of Savings and Investment in India**

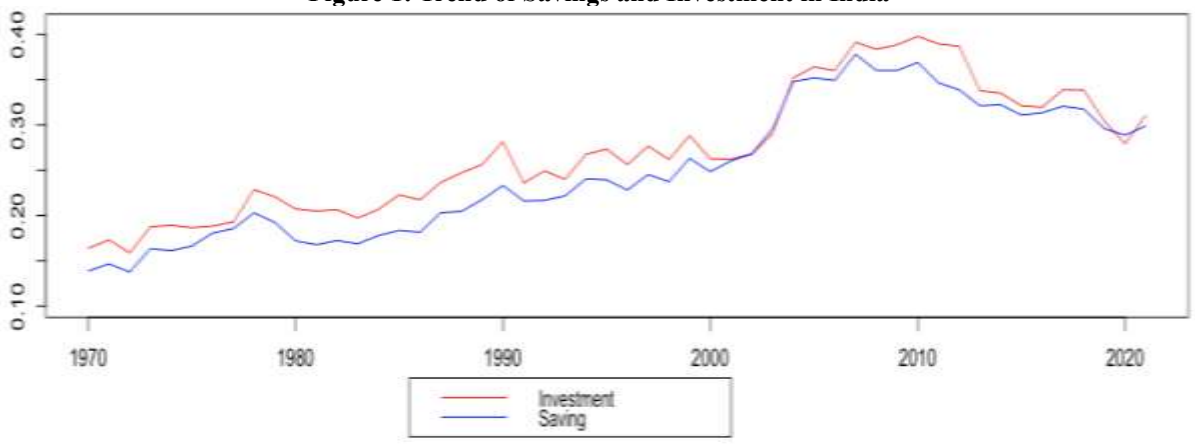


Figure 1 illustrates the trend of savings and investment in India from 1970 to 2021. Gross domestic savings, expressed as percentage of GDP, showed a steady increase from 13.4% in 1970-71 to 23.3% in 1990-91 and reached 28.2% in 2020-21. Similarly, Gross Capital Formation, as a percentage of GDP, which is a proxy for investment, showed a similar trend. It revealed a gradual increase in investment over the years, i.e., 15.5% in 1970-71, 26.1% in 1990-91, and finally 26.6% in 2020-21.

## METHODOLOGY

This study used the classical Feldstein-Horioko model, which is specified as:

$I_t = \alpha + \beta * S_t + \varepsilon_t$ (1)

Where $I_t$ and $S_t$ are the gross domestic investment proxied by gross capital formation and gross domestic saving, respectively. $\alpha$ indicates the intercept or constant of the model, while $\varepsilon_t$ is the disturbance term. $\beta$ shows the degree of relationship between investment and saving.

The period for the study is from 1970 to 2021. The period helps to understand the FHP during the period of fixed exchange rate regime and managed exchange rate regime. Different methodologies were involved during the analysis to understand the relationship between investment and saving. The data for the study was compilled from the Handbook of Statistics on Indian Economy – Reserve Bank of India.

## RESULT

Before analysing the relationship between the variables, we first test the stationarity of the variables to understand whether the variables have the presence of unit roots. The test is important because, in the presence of a unit root, the results of the estimations could be spurious and unreliable. To test the unit root, we have involved the Augmented Dickey-Fuller test [ (1979) (1984)] and the Phillips-Perron test (1988).

**Table 1: Unit Root Result based on ADF and PP test**

| Variable | ADF Test | | PP Test | |
|---|---|---|---|---|
| | I(0) | I(1) | I(0) | I(1) |
| S | -1.14 | -4.45* | -1.41 | -7.02* |
| I | -1.54 | -4.91* | -1.89 | -7.55* |

Source: Authors' Calculation[1].

To find the structural break in the variable, we have employed the Zivot-Andrews (1992) unit root test in table 2. While verifying our results of unit root tests employed in Table 1, the ZA test also provided us with the structural breaks for both variables.

**Table 2: Zivot-Andrews Unit Root Test**

| Variables | Intercept | Year | Trend | Year | Both | Year |
|---|---|---|---|---|---|---|
| S | -2.29 | 2012 | -2.54 | 2009 | -5.38* | 2003 |
| I | -3.45 | 2012 | -3.33 | 2010 | -5.83* | 2003 |

Source: Authors' Calculation[2].

The ZA test has provided the structural breaks for the variables. It also showed that when the variables are analysed for the "Both" model, it rejects the null hypothesis of unit root at level only. Since, at this point, the result of unit root tests contradicted, it is best to move towards the cointegration tests like the Johansen and Bound test instead of the standard cointegration test. But before moving to the cointegration test, we employed the ZA test on the residual of the classic FHP model to know the breaks in the residuals.

**Table 3: Zivot-Andrews Test on Residual**

| Variables | Intercept | Year | Trend | Year | Both | Year |
|---|---|---|---|---|---|---|
| Res | -3.81 | 1977 | -3.52 | 1985 | -3.86 | 1977 |

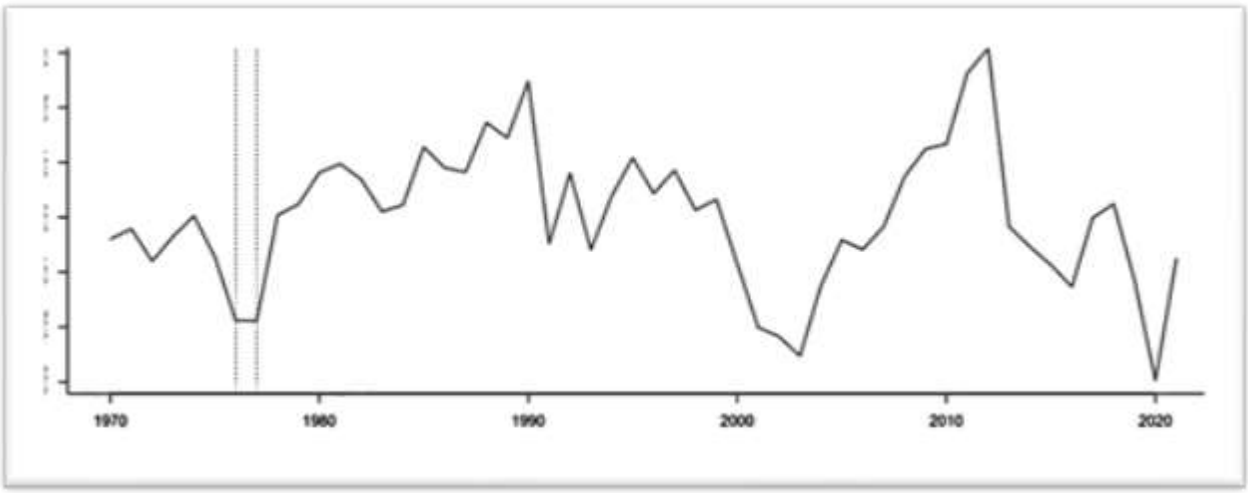
Source: Authors' Calculation

From the result of Table 3, it can be analysed that a major structural break in the model occurred during the period of 1977, and to understand it, we have plotted a residual chart in which it was shown that from the period 1976-77 to 1977-78 there is low constant prevailed in the model. Figure 1 shows the residual plot discussed above.

[1] *Notes: * denotes statistical significance at 1% confidence interval*

[2] *Notes: * denotes statistical significance at 1% confidence interval*

**Figure 2 Residual Plot of Model 1**




Source: Authors' Compilation

Since at this 2-year period, residuals are showing a break and a constant line; we have decided to treat these periods as the dummy variable in the upcoming analysis.

The Johansen cointegration test values are with intercept and no trend in VAR.

**Table 4: Johansen Cointegration Test**

| Null Hypothesis | Maximum Eigen Value | Critical Values | | |
|---|---|---|---|---|
| | Test Statistic | 10pct | 5pct | 1pct |
| r <= 1 | 12.00 | 13.75 | 15.67 | 20.20 |
| r = 0 | 24.29 | 19.77 | 22.00 | 26.81 |

Source: Authors' Calculation[3].

Table 3 indicates that there is only one cointegrating variable; it does not explain which variable is explained and which is explanatory. Further, we involved Bound cointegration test to estimate the cointegration in the model 1. The maximum lag was selected as 2 because the number of observations involved in the study is only 52.

**Table 5: Bound Cointegration Test**

| Models | | F-statistics | t-statistics |
|---|---|---|---|
| $F_S(S/I)$ | | 0.87 | -0.39 |
| $F_I(I/S)$ | | 2.46 | -2.42 |
| 95% Critical Bound | I(0) | 3.79 | -2.86 |
| | I(1) | 4.81 | -3.51 |

Source: Authors' Calculation[4].

Table 5 shows that both investment as well as saving models don't show cointegration. The F statistics is calculated from Narayan (2005), and t-statistics is extracted from Pesaran, Shin and Smith (2001). Since both cointegration tests have shown different aspects, we now turn towards the estimation of the causal relationship between the variables. The causality test will help us to know whether the variables have a causal relationship or not.

The Granger Causality test was performed on both variables, which helps to understand the direction of causation and verifies whether the variables have cointegration.

[3] *Lag length was selected based on BIC. We put a dummy for 1976-77 and 1977-78 to dampen an outlier in the cointegrating relationship.*

[4] *Lag length was selected based on BIC. We put a dummy for 1976-77 and 1977-78 to dampen an outlier in the cointegrating relationship.*

**Table 6: Pairwise Granger Causality Test Result**

| Null Hypothesis | Obs. | F-statistics | Probability |
|---|---|---|---|
| Saving does not Granger Cause Investment | 52 | 17.71 | 0.000 |
| Investment does not Granger Cause Saving | | 14.09 | 0.000 |

Source: Authors' Calculation

Table 6 shows that there is a bi-directional relationship between the variables.

Since there is a causal relationship between the variables, we will now estimate the long-run model from different estimators. The bound test has shown no long-run cointegration, so we will not involve the long-run ARDL model in this study. Further, we will use FMOLS and DOLS estimators to show the correlation[5].

**Table 7: Long-Run Models**

| Dependent Variable: $\Delta I_t$ | | | |
|---|---|---|---|
| | FMOLS | DOLS | Johansen |
| Constant | -0.001 (0.000)*** | -0.001 (0.000)** | 0.041 (0.015)** |
| $S_t$ | 1.229 (0.023)*** | 1.210 (0.056)*** | 0.899 (0.388)** |
| $D_t$ | -0.024 (0.009)*** | -0.022 (0.021) | -0.004 (0.016) |

Source: Authors' Calculation[6].

Results presented in Table 7 show a strong relationship between saving and investment rates in India, but they also show coefficients of similar magnitudes by all the estimation methods, indicating the robustness of our results. The correlation between the variables is higher for the FMOLS and DOLS, while its magnitude is low for Johansen. However, the significance of the coefficient shows that from any estimation method, the relationship stands significant.

The bound test has shown no long-run relationship, so we have estimated the short-run dynamics from the error correction model within the ARDL framework in Table (8).

**Table 8: Short-Run Dynamics**

| Period | Dependent Variable: $\Delta I_t$ | | | | |
|---|---|---|---|---|---|
| | Constant | $\Delta S_t$ | $\Delta S_{t-1}$ | $D_t$ | $ECM_{t-1}$ |
| 1970-2021 | 0.010<br>(0.008) | 1.093<br>(0.106)*** | -0.804<br>(0.189)*** | -0.011<br>(0.007) | 0.696<br>(0.125)*** |

Source: Authors' Calculation[7].

It is seen from Table 8 that the error correction term is positive, indicating that there is a divergence to long-run equilibrium after a shock to the saving rate. The results of short-run dynamics show that savings have a positive impact on investment, whereas the previous lag of savings has a negative impact on investment. The short-run correlation is also strong, the same as the long-run results have shown.

## CONCLUSION

The Feldstein Horioka Puzzle has been a topic of extensive research in recent years. It pertains to the relationship between savings and investment, explicitly addressing whether domestic savings and investment are closely linked or there is greater capital mobility. This puzzle has significant implications for economic policy and growth. Thus, understanding this relationship in the Indian context is critical. The study examines the validity of the Feldstein Horioka Puzzle in India by using annual data from 1970 to 2021. A Johansen Cointegration test was performed in the study to establish the link between the variables. The variables were discovered to be integrated in the same order. The test revealed that there is one cointegrating variable present in the model. Before conducting the test, the data series was thoroughly examined to determine the existence of unit roots. As an additional measure to ensure the robustness of the analysis, the ARDL cointegration approach was also incorporated along with the Johansen cointegration test. The cointegration test results confirm the long-term association between saving and investment in India. It has been confirmed that savings and investment have a bidirectional causality relationship based on the

[5] *FMOLS and DOLS procedures are valid only when there is one cointegrating relationship, which is already satisfied in our case.*

[6] *** and **** denote statistical significance at 5% and 1% levels, respectively. $D_t$ stands for the dummy which stands 1 for 1976-77 and 1977-78, and 0 otherwise.*

[7] **** denote statistical significance at 1% level, respectively. $D_t$ stands for the dummy which stands 1 for 1976-77 and 1977-78, and 0 otherwise.*

results of the Pairwise Granger Causality tests. The findings of the study suggest that the Feldstein Horioka Puzzle holds true for India, and there is a strong correlation between domestic savings and investment. This implies that policies aimed at increasing savings could also lead to higher levels of investment, which could contribute to the country's economic growth. However, further research is needed to explore the factors that determine the strength of the correlation between savings and investment in India.

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