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THE FELDSTEIN-HORIOKA PUZZLE AND TWIN DEFICITS IN PAKISTAN

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ABSTRACTS

The previous literature points to a high correlation between domestic rates of investment and saving among OECD countries. Some take this as evidence of limited financial integration in the industrialized world. This paper tries to find any evidence of Feldstein-Horioka (F-H) puzzle in the presence of Twin deficits for Pakistan using annual time series data for the period 1972 to 2008. The cointegration results found evidence in favor of a high degree of capital mobility by rejecting the F-H puzzle in case of Pakistan. So, F-H puzzle not exists although Pakistan is not perfectly integrated in to the world economy.

Keywords: Domestic rates of investment, OECD countries, Twin deficits

INTRODUCTION

The Feldstein and Horioka (1980) finding that changes in domestic investment are very sensitive to changes in domestic savings for OECD countries launched a debate regarding the degree of financial integration and financial openness within the industrialized world. The issue of the sensitivity of domestic investment to changes in domestic savings has been tackled mainly in the case of the industrialized nations. However it is also relevant for developing countries. Twin deficits are defined as positive long run relationship between the current account and budget deficits. The twin deficit issue can also be linked to the degree of capital mobility across borders and to the Feldstein and Horioka (FH) (1980) puzzle. In fact, if domestic savings and investments are not highly related (due to free mobility) the BDEF and the CAD can be expected to move together. If the Ricardian equivalence does not hold, then an increase in public borrowing (due to budget deficit) is likely to decrease national saving (both domestic and foreign). For a given amount of investment, this decrease in national saving leads to an increase in the current account deficit. Hence, the perfect capital mobility results into twin deficits in a non-Ricardian world. In other words, if the FH puzzle holds there is no possibility of twin deficits to coexist. In this study an attempt has been made to empirically test the validity of Feldstein Horioka puzzle for Pakistan and find any evidence in favor of a high degree of capital mobilityusing annual time series data for the period 1972 to 2008.

The rest part of the paper is organized as follows. Section 2 reviews the existing literature on Feldstein-Horioka puzzle. Theoretical and analytical framework is presented in section 3. Section 4 gives data description and econometric methodology. Section 5 discusses the estimation results while section 6 is devoted to conclusion.

LITERATURE REVIEW

In this section, we have reviewed the some existing theoretical as well as empirical literature related to Feldstein-Horioka puzzle. There would be little correlation between the saving and the domestic investment in that country with perfect capital mobility across border. In contrast, if portfolio preferences and institutional rigidities hinder the flow of long-term capital across countries, then an increase in domestic saving would be reflected primarily in additional domestic investment. Feldstein and Horioka (1979) statistically investigated the two views of international capital mobility. The evidence on the relation between domestic investment and saving implied that the truth lies closer to the second view than to the first. Feldstein (1982) retested and confirmed the earlier findings of

Feldstein and Horioka (1980) that sustained increase in domestic saving rate induce approximately an equal increase in domestic rate of investment. New estimates for the post-OPEC period (1974-79) implied that each extra dollar of domestic saving increases domestic investment by approximately 85 cents in a sample of 17 OECD countries. Jerry et al. (1998) investigated as to how economists responded to the Feldstein–Horioka (FH) view that a high saving-investment association across OECD countries concealed low capital mobility. However, the debate whether saving-investment co movements are indication of capital mobility is still inconclusive. The FH result of a high cross-section association between saving and investment rates in OECD countries has remained remarkably strong. Sachsida and Caetano (1999) corroborated the evidence that in the real side of the economy, Feldstein-Horioka test does not reflect capital mobility. The F-H coefficient does not mean capital mobility, but just a substitutability relation between external and domestic savings. Fountas and Tsoukis (2000) examined empirically the interactions among the current account, budget balances and the real interest rate as it can provide more information about the effective degree of financial openness than simple saving-investment correlations. They found that in short run there is some evidence in favor of the twin deficits and current account targeting hypotheses. Fidrmuc (2003) examined the evidence of twin deficits and the F–H puzzle for such economies and found a positive long-run relationship between the twin deficits in several countries. Investment in some EU countries is financed to a relatively high degree via the international financial markets involving that the F–H puzzle is less significant in the EU countries. The FH puzzle is revisited by Caporalea et al. (2003) employing a variety of efficient cointegration estimators They concluded that despite evidence supporting the FH result, there appears to be considerable heterogeneity in terms of the savings-investment association. Levy (2004) found that long-run investment-saving correlation follows directly and this does not depend on the degree of international capital mobility. Khedhiri andHebiri (2005) found evidence of a significant correlation between savings and investment, and thus no solution to the F-H puzzle, despite the implications of international capital mobility in six countries such as Algeria, Egypt, Morocco, Saudi Arabia, Syria and Tunisia. Rao et al. (2008) found the F-H puzzle exists in a weaker form with a reduced saving retention coefficient the F-H equation for 12 OECD countries.

The FH result of a high cross-section association between saving and investment rates in OECD countries has remained remarkably strong. The response of economists to the FH view regarding a high association between saving-investment and implicitly meaning low capital mobility across OECD countries is much discussed. The long-run investment-saving correlation follows directly and this does not depend on the degree of international capital mobility. Unless the budget constraint is removed, the time series of investment and saving show high cointegration. However, the debate over the point whether saving-investment co movements are indication of the degree of capital mobility is still unresolved.

TWIN DEFICITS AND THE FELDSTEIN-HORIOKA PUZZLE

With perfect capital mobility worldwide, domestic saving is not necessarily related to domestic investment. However, there is strong empirical evidence that domestic investment and national saving are correlated. Much of the evidence is based on cross-section regressions of 16 OECD countries for the 1960–74 periods. This empirical finding is known as the Feldstein-Horioka (1980) puzzle. According to this puzzle, the relationship between national savings and domestic investment can be used as a measure of international capital mobility. Under perfect mobility, the investment is not controlled by domestic saving but only by the accessibility of funds in the international fully integrated capital market. Saving in each country should react to the worldwide opportunities for investment while investment in that country should be financed by the international pool of funds. The important factor of concern for investors should be the rate of return. In a closed economy, domestic saving must finance investment but in case of open economy some of the investment may be financed by foreign

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saving. Therefore, saving and investment could move independently of each other. Alternatively, the high *I-S* correlation suggests that capital might not be fully mobile across borders. (Levy 2004)[10]

Analytical Framework for Twin Deficits and F-H Puzzle

Feldstein and Horioka (1980) proposed an assessment of the degree of capital mobility by measuring the correlation between investments and saving. They estimated cross section regressions of the form:

$$(I/Y)_i = a + b\,(S/Y)_i + u_i \qquad (3.1)$$

In the above relation, I/Y is the ratio of gross domestic investment to gross national product (GNP) and S/Y is the ratio of national saving to GNP. For small countries, the value of slope parameter 'b' should be close to zero if the international capital mobility is perfect. In contrast, the parameter should be large if capital is immobile. Such relationships between national investment and saving shares of GDP, or their variants such as first differences have been essential for many countries. These are called *FH regressions* where 'b' is the *FH coefficient representing* the *saving-investment association.* The results for 16 OECD countries for the 1960–74 periods indicated a very high saving-investment association although the capital mobility is near to perfect. This cointegration exists under fixed exchange rate and this relation is an indictor of economic solvency (Rocha and Zerbini, 1998).

Importance of F-H Puzzle

It is very critical to know the degree of capital mobility for financial decisions. Its importance can be seen in following perspectives:

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

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

Capital mobility determines the rate at which incomes converge to equilibria.

Perfect mobility is often assumed to hold in macroeconomic models (Levy, 2004).

The twin deficit hypothesis has a clear link with the so-called F-H puzzle since the later is concerned with the source of financing the external deficit. The causality between external and fiscal balance also stresses the role of private investment. Fidrmuc (2003) presented a regression model that encompasses both the twin deficit hypothesis and the Feldstein-Horioka puzzle. The model makes no difference between net exports and current account balance. Rearranging the macro identity, one obtains the relation:

$$X_t - M_t = Y_t - (C_t + G_t) - I_t = S_t - I_t \qquad (3.2)$$

This identity implies that the trade balance must equal the difference between national savings (defined as output less total consumption) and investment (gross capital formation). It provides a link between the external balance and saving-investment decisions. Hence, an increase in investment has a negative impact on the external trade balance. On the other hand, policies that reduce (public or private) consumption are expected to have a positive impact on the external balance via increased national savings. National savings can be subdivided into private (Sp) and public savings (Sg). The latter corresponds to the budget balance and given by the difference between tax revenues and government expenditures. Private savings are defined as the disposable income less private consumption. Thus the macro identity may be rewritten as under:

[10] See levy (2004) for further details.

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$$X_t - M_t = (Y_t - T_t - C_t) + (T_t - G_t) - I_t = S_{p,t} + S_{g,t} - I_t \quad (3.3)$$

This identity motivates the testing of a long run relationship among the current account, the budget deficit and total investment. Therefore, gross capital formation denoted by Investment as share of GDP, is included into the relationship between the current account (*X-M*) and the fiscal balance (*T-G*)

$$X_t - M_t = \beta_1 + \beta_2 (T_t - G_t) - \beta_3 (I/Y)_t + u_t \quad (3.4)$$

Here, the expected sign of the coefficient for fiscal balance is positive and that of investment is negative. It implies thatthe current account balance is worsened by budget deficit and high investment. If an economy is perfectly integrated into the world market, then the coefficients of both the variables should equal to unity. In this case, the budgetary as well as investment expenditures are financed by the world financial market. However, it is shown in the study by Feldstein and Horioka (1980) that a large portion of domestic investment is still financed from domestic sources (savings).

The above result, generally referred to as the Feldstein–Horioka puzzle, has been widely confirmed by subsequent intensive research. Following Fidrmuc (2003), we may specify the following regression model; with variables (in small caps) expressed as a share of GDP:

$$x_t - m_t = \beta_1 + \beta_2 (t_t - g_t) - \beta_3 \, inv_t + \varepsilon_t \quad (3.5)$$

Keeping in view the identity, a positive coefficient is expected for private savings and the budget surplus (β_2, β_3>0), and a negative coefficient investment (β_4<0). Hence, both the budget deficit and high investment are expected to be translated into current account deficit. Moreover, the coefficients of both the variables should approach unity if a country is perfectly integrated into the world economy, implying that both the budget deficit and investment are financed through the world capital market. However, if the Feldstein-Horioka puzzle is there, the β_4 coefficient is significantly lower than unity. Likewise, a negative β_3 coefficient leads to the rejection of the twin deficit hypothesis.[11]

ECONOMETRIC METHODOLOGY AND DATA DESCRIPTION

In this section, we discuss the methodology of research and the data used in the analysis with reference to Pakistan. In this study, we employed the unit root tests, Johansen co- integration technique and the Error Correction Model to attain our objectives. The main purpose of co-integration analysis is to verify the nature of long run relationship between a set of time series variables. However, it is essential to check each time-series for stationarity before starting the co-integration tests. In case the time-series at hand is non stationary, then the regression analysis carried out in the usual manner may produce spurious results. So the unit root tests are conducted first to examine this property of the time-series.

Co Integration Analysis

If the variables of interest share a common stochastic trend, they are said to co-integrated in the long run (Christensen, Nielsen 200). The concept of co-integration was firstly introduced by Granger (1981) and further formalized by Engel and Granger (1987) by introducing a very simple method to check the existence of long run relationship between the variables. Although the EG test is very simple and convenient to implement, but it does not intimate as to which of the variable should be used as regressor and why. It may lead to contradictory results, especially when there are more than two I(1) variables under consideration (Pesaran and Pesaran, 1997). Therefore Johansen (1988; 1991) and Johansen and Juselius (1992) tests are employed in multivariate analysis. We discuss the Johansen co-integration procedure briefly:

[11] These specifications are used for Pakistani data and resemble those adopted by Marinheiro (2008) for analysis of Egypt data. Only the proxy variable of wealth is excluded from model.

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Lets assume that we have three variables Y_t , X_t and W_t which can all be endogenous. Each time series variable has links with its past values. The variables can written in the matrix notation as Z_t =[Y_t , X_t, W_t], where the vector may be expressed as:

$$Z_t = \alpha_0 + \alpha_1 Z_{t-1} + \alpha_2 Z_{t-2} + \ldots\ldots\ldots + \alpha_k Z_{t-k} + \mu_t \qquad (4.1)$$

Defining Δ=1-L, where L is the lag operator, the above can be formulated in a vector error correction model (VECM) as follows:

$$\begin{aligned} \Delta Z_t &= \Pi_1 \Delta Z_{t-1} + \Pi_2 \Delta Z_{t-2} + \ldots\ldots\ldots + \Pi_k \Delta Z_{t-k-1} + \alpha_k \; Z_{t-k} + \mu_t \\ &= \alpha_0 + \sum_{i=1}^{k-1} \Pi_i \Delta Z_{t-1} + \alpha_k \; Z_{t-k} + \mu_t \end{aligned} \qquad (4.2)$$

where $\Pi_i = -(1 - \alpha_1 - \alpha_2 - \ldots\ldots\ldots - \alpha_k), \quad i = 1,2,\ldots\ldots, \; k-1$

The Π matrix is 3×3 due to the fact that we assume three variables in Z_t. The matrix contains the information regarding the long run relationships among the variables concerned. If the matrix has a full rank, all the elements in the vector Z are stationary. On the other hand, a zero rank indicates the absence of any co-integration and the model reduces to VAR in the first difference. In case the rank is positive but less than full, there exists co-integration. To test whether there exists co-integration among the variables or otherwise, two methods (test statistics) are used that determine the rank of co-integration space, due to Johansen (1988) and Johansen and Juselius (1990). The procedures are based on the propositions about eigenvalues.

This method tests the null hypothesis that rank of the matrix Π is 'r' against the alternative hypothesis that the rank is r+1. Thus, according to the null hypothesis, there are 'r' co-integrating vectors. The test statistics is based on the characteristic root (Eigenvalues).

To test how many of the numbers of the characteristics roots are significantly zero this test uses the following statistics:

$$\lambda_{\max} \; (r, r+1) = -T \ln (1 - \lambda_{r+1}) \qquad (4.3)$$

The test statistic is based on the maximum eigenvalue (maximum eigenvalue statistic)

The second method is based on a likelihood ratio test about the trace of the matrix (trace statistic). This statistic is considers whether the trace is increased by adding more eigenvalues beyond the rth eigenvalue. The null hypothesis in this case is that the number of cointgrating vectors is less than or equal to r. This statistic is calculated by:

$$\lambda_{trace} \; (r) = -T \sum_{i=r+1}^{n} \ln \; (1 - \lambda_{r+1}) \qquad (4.4)$$

The usual procedure is to work downwards and stop at the value of r which is associated with a test statistic that exceeds the displayed critical value.[12]Another important aspect is to select the appropriate model regarding the deterministic components in the multivariate system. It means that whether an intercept and/or a trend should enter either the short run and long run model, or both models.

Granger Causality Test

If a pair of series is cointegrated then there must be Granger-causality in at least one direction, which reflects the direction of influence between series. Theoretically, if the current or lagged terms of a

[12] See Asterious Revised Edition 2006, chap 17, p 319-326.

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time-series variable, say X_t, determine another time-series variable, say Y_t, then there exists a Granger-causality relationship between X_t and Y_t, in which Y_t, is Granger caused by X_t.

The Short Run Analysis

The short run dynamics are examined using the Error Correction Model (ECM). It explains changes in the dependent variable in term of changes in the explanatory variables as well as deviations from the long run relationship between the variables and its determinants. The model follows from general to specific approach in econometric modeling which best fits the given data set. The co-integration of any two variables implies that there is some adjustment process which prevents the error term to enter in the long run relationship. However, if the variables are co-integrated over time, then an Error Correction Model (ECM) is appropriate. According to Engle and Granger (1987), the co-integrated variables have an ECM representation, which has the advantage of incorporating both the short-run and long run relationship between the variables in the same regression.

Data and Variables

Availability of adequate and reliable data is very important for consequential analysis. The validity of results depends on sufficient and consistent data. We have done our utmost effort for the collection of reliable and consistent data set for our research. We have used annual data set of Pakistan for the period 1972-2008. This data set is retrieved from different data sources. Most of the data is collected from Federal Bureau of Statistic, Annual Reports of the State Bank, Pakistan Economic Survey and Yearbook of International Financial Statistic (IFS) published by the IMF. The main variables used were Current Account Balance, Budget Balance, and Investment etc.

RESULTS AND INTERPRETATION

As discussed in the previous section, we have adopted a three-step procedure in testing the three hypotheses under consideration. First we apply the Augmented Dickey Fuller (ADF) unit root test to check the stationarity and order of integration of different economic variables used in this study. Next we resort to the Johansen's Maximum Likehood procedure to test for the long run co-integration among the variables. Finally, the Error Correction Model is employed to see the causality between the crucial variables. In the following lines, we discuss the findings and analyze the relevant results.

Unit Root Tests

At the outset, we test for the staionarity of all the time series variables involved with all the three hypotheses of this study. we have used the variables in level and also in term of their ratios to GDP for testing of the Twin Deficit Hypothesis and the F-H puzzle. We use the ADF model to check for the stationarity and the order of integration. The results are projected in Table 5.1 below.

Table 5.1: The ADF Test $\Delta y_t = \mu + \delta y_{t=1} + \sum_{i=1}^{k} \beta_i \Delta y_{t-i} + \varepsilon_t$

Variable	Levels	**First Difference**	**Conclusion**
	ADF T-test	**ADF T-test**	**I(1)**
	GDP ratios		
Current Account deficit	-1.43423	-5.259725*	I(1)
Budget balance	-3.09269	-9.20222*	I(1)
Budget Deficit	-3.60052	-7.607254*	I(1)
Current Account balance	-2.97252	-4.71215*	I(1)
Investment	-0.66064	-3.59167**	I(1)

Note: the Mackinnon critical values of significance at the 1%, 5% and 10% are -3.69987, - 2.97626 and -2.62742 respectively. The superscripts *, **, *** shows significance at 1%, 5% and 10% respectively.

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It is evident from the test that the series have become stationary by taking the first difference, which implies the presence of unit roots in the original data. In other words, all the variables are non-stationary at level and stationary at first difference or they are integrated of same order I (1). This validates our propositions that the variables concerned are indeed co-integrated and a long run relationship holds among them. With this information at hand, we proceed further to examine the nature of long run and short run relationships among the variable.

The Feldstein and Horioka Puzzle

Finally, we concentrate on exploration of the F-H puzzle with reference to Pakistan economy by following the model proposed by Fidrmuc (2003). The model tackles the twin deficit issue and Feldstien–Horioka puzzle simultaneously. To be specific, we are going to estimate the model as discussed earlier and given in equation 3.14, reproduced below:

$$x_t - m_t = \beta_1 + \beta_2 (t_t - g_t) - \beta_3 inv_t + \varepsilon_t \qquad (3.14)$$

Estimated results of Fidrmuc's (2003) model specification are given below:

$$x_t - m_t = -17496.1 + 0.921(t_t - g_t) + 223.02 invt_t$$

The TD hypothesis implies a positive coefficient for the budget balance. The empirical results also reveal a positive coefficient which leads to acceptance of the TD hypothesis. These results indicate no rejection of the TD hypothesis and rejection of F H puzzle for Pakistan. The coefficient of (invt) is not equal to one (unity) so this implies that there is perfect capital mobility which means that there is no F-H puzzle present in Pakistan.

The co-integration results are reported in Table 5.2.

Table 5.2 Johansen's Maximum Likelihood Test for Twin Deficits & F-H Puzzle

(The budget deficit, current account deficit and investment are expressed as %GDP)

			Λ-Trace				***Λ- Max***	
Eigen-value	H_0	H_1	**Trace**	**5%** Critical Value	H_0	H_1	**Max**	**5%** Critical Value
0.4814	R≤0	r>0	35.36	35.19	R≤0	r>0	22.33	22.3
0.3015	R≤1	r>1	13.03	20.26	R≤1	r>1	12.2	15.89
0.024	R≤2	r>2	0.83	9.1614	R≤2	r>2	0.8271	9.16

Note: The lag length of one is used in the VAR. Critical values for trace and maximum likelihood tests are due to Osterwald-Lenum (1992). The estimation is carried by assuming only an intercept and no trend in the co-integration equation.

The above results reveal that the null hypothesis of no co-integration among the time series variables is rejected at 5% level of significance by the eigen-value max and trace statistics. The results speak of the existence of one co-integrating vector and confirm the long run relationship among trade balance, budget deficit and capital formation in the economy. There is a large degree of capital mobility as FH puzzle does not hold in Pakistan. But Pakistan is not perfectly integrated into the world economy. Since increase in the government's net borrowing requirements could be financed by the external financing.

CONCLUSIONS

The objective of this paper was to find any evidence any evidence of Feldstein-Horioka (F-H) puzzle in the presence of Twin deficits for Pakistan. The estimated empirical results showed no evidence in favor of the Feldstein-Horioka puzzle for Pakistan. This is because our economy is not perfectly integrated into the world economy. Moreover the degree of international capital mobility has never been perfect. Despite these factors, the domestic investment in Pakistan (particularly in the public sector) has never depended on domestic saving or internal borrowing only. Foreign assistance has always played an important role in financing the national development programs. Thus the historical relationship between domestic investment and saving is very poor in Pakistan. As such, the empirical results do support the validity of twin deficit hypothesis but reject the F-H puzzle in case of Pakistan.

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