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Revisiting the Feldstein-Horioka puzzle for Turkey

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ABSTRACT
The domestic saving and investment correlation as posited by Feldstein and Horioka is revisited for Turkey and tested over the whole period (1950–2017) and the two subperiods (1950–1989 and 1990–2017). The time-series properties of the data and the presence of structural breaks are properly addressed by the bounds testing procedure. Although, the investment and savings are positively correlated during the period of restricted capital mobility (1950–1989) and negatively correlated during the period of perfect capital mobility (1990–2017) according to the joint F-test on the significance of the coefficients, the long-run elasticity of investment with respect to savings ratio is significant for the whole period and for the first sub-period. The results confirm the Feldstein and Horioka hypothesis in a closed economy. However, the high, negative and insignificant long-run elasticity and non-constant coefficients in the second sub-period necessitate a full-investment model.

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1. Introduction

Feldstein and Horioka (1980) questioned whether a higher domestic saving rate in a country is correlated with a higher rate of domestic investment, not only to investigate international capital mobility but also to draw attention to an optimal savings policy and to the incidence of tax changes. For example, national savings policy depends on the pre-tax marginal product of capital in a closed economy, but depends on the after-tax return to investors in the case of perfect capital mobility. Therefore, international capital mobility is an important determinant of the optimal national savings policy. Likewise, international capital mobility has implications for the analysis of tax incidence. A tax on the income of all capital used in production is carried only by the capital owners under a closed economy, but by the domestic labour and foreign capital owners under a perfect capital mobility. Feldstein and Horioka (1980) measured the extent to which a higher domestic saving rate in a country correlated with a higher rate of domestic investment for the 21 OECD countries over the 1960–1974 period. They estimated the following equation in order to assess the relationship between investment and saving ratios:

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Supplemental data for this article can be accessed here.

$$\left(\frac{I}{Y}\right)_i = \alpha + \beta\left(\frac{S}{Y}\right)_i \tag{1}$$

where $\left(\frac{I}{Y}\right)_i$ denotes the ratio of gross domestic investment to gross domestic product and $\left(\frac{S}{Y}\right)_i$ is the ratio of gross domestic saving to gross domestic product in country *i*. The coefficient β is interpreted as the saving-retention coefficient and measures the degree of capital mobility. Under perfect capital mobility, the value of coefficient β would be close to zero, in contrast to a closed economy where the value of coefficient β would be close to one. Since the distribution of the incremental capital among countries varies inversely with the elasticity of the country's marginal product of capital, an increase in the saving rate in country *i* would spread investment uniformly over the world under perfect capital mobility. Therefore, under capital mobility, there would not be a relationship between domestic saving and investments. Feldstein and Horioka (1980) find the estimate of β to be 0.89. The coefficients for each of the five-year sub-periods (0.85–0.95) are also found to be similar to the overall coefficient. The results also do not change even when they considered the potential endogeneity of the domestic saving, and sample selection bias. However, their results contradict the perfect international capital mobility hypothesis and suggest that most of the incremental saving remains in the country in which saving is done, and international capital flows do not respond to international differences in returns.

Feldstein and Horioka (1980) explain these contradictory results by saying that although liquid financial capital moves very rapidly to arbitrage short-term international differentials, long-term portfolio capital or direct investment is less mobile. This is because of uncertainties and risks associated with foreign investment, official restrictions, and high taxation on foreign investment, as well as institutional rigidities such as the saving institutions, insurance companies, and pension funds that deter foreign investment. In addition, foreign direct investments are linked to executing marketing strategies, employing production knowledge, or overcoming trade restrictions rather than to international yield differentials. However, it was still surprising to find a high correlation between domestic savings and investment among the OECD countries during the analysed period, during which financial market deregulations and easing of capital controls were in place. This contradiction produced the Feldstein-Horioka (FH) puzzle or paradox and has resulted in widespread debates and research in the economic literature (Apergis & Tsoumas, 2009; Obstfeld & Rogoff, 2000).

The FH puzzle has led to two parallel streams of literature. The first has tried to explain the high correlation between domestic saving and investments under perfect capital mobility with theoretical grounds and frictions.[1]

A second stream of literature relates to an improper modelling of the saving and investment relationship for the explanation of the FH puzzle, as Feldstein and Horioka (1980) use cross-sectional and time-averaged data in order to eliminate the pro-cyclical nature of savings and investment. However, the Feldstein and Horioka (1980) methodology is criticized on a number of grounds: the FH sample period was very short to capture increases in capital mobility in the second half of the 1970s; time-averaged data in cross-sectional regressions overestimate or underestimate the true relationship; the nature of shocks and the structure of the economy for each country should have been taken into

[1]Appendix A provides the detailed information and references for the theoretical arguments.

account; outliers, the choice of the time period, endogeneity, the regime changes, the omitted variables' bias, a constant in the regression, non-stationarity of variables in levels, and cointegration techniques; and short-run dynamics of the relationship between savings and investment should have been considered (Choudhry, Kling, & Jayasekera, 2014; De Vita & Abbott, 2002; Dooley, Frankel, & Mathieson, 1987; Ho, 2002; Jansen & Schulze, 1996; Katsimi & Zoega, 2016; Krol, 1996; Miller, 1988; Obstfeld, 1986, 1995; Sachs, 1981; Serletis & Gogas, 2007; Sinn, 1992). Therefore, the saving-investment relationship for individual countries with time-series analysis has been investigated to overcome the drawbacks of cross-sectional analysis such as sample selection bias, and the neglect of the country-specific saving-investment structure, structural changes, government policies, and country-specific shocks (e.g., De Vita & Abbott, 2002; Miller, 1988 for the US[2]). Panel techniques have been used in another group of studies, but they reached similar conclusions to the time-series approaches (Adedeji & Thornton, 2006; Coakley, Fuertes, & Spagnolo, 2004; Ho, 2002; Krol, 1996; Younas, 2007). The results from the panel studies point out that the cointegration tests are valid only when structural breaks or regime changes are considered. For example, Westerlund (2006) finds that savings and investment are cointegrated under the presence of breaks in their levels.

Similarly, many studies have investigated the FH puzzle for Turkey, and these studies find a saving-retention coefficient to vary between 0.16 to almost one, depending on the econometric method used, time period and data frequency, and whether structural breaks are considered (see Appendix C). The general conclusion from the studies in Appendix C is that there is a cointegration or a long-run relationship between domestic saving and investments in Turkey, and this relationship weakens in the recent period with more integration to global financial markets. However, time-series analysis and cointegration approaches to the FH puzzle have created more confusion than clarification, since the results are very sensitive as to whether the saving and investment series are treated as stationary, I(0), or non-stationary, I(1), and whether the structural breaks in the series and in the cointegration relationships are taken into account.[3]

In this article, the bounds-testing approach to cointegration (Pesaran, Shin, & Smith, 2001) is adopted, and several features of our approach are worth emphasizing. First, consistent with the critics of Feldstein and Horioka (1980) that capital mobility is not a short-run phenomenon, we use the longest time-series data on saving and investment rates at the annual frequency for Turkey for the period covering 1950 until 2017. The period in question spans about seven decades, allowing us to focus on a truly long-run relationship between saving and investment rates in Turkey.

Second, the structural breaks are most likely to occur in our data series, as it covers almost seven decades that witnessed the economic and financial crisis, economic and financial integration, and policy changes; the military coups in the early 1960s, 1970s, and 1980s; and global financial crises in the late 1990s and 2000s. We accommodate these structural breaks by means of impulse dummies.

Third, we test the existence of a long-run relationship between saving and investment rates in Turkey by applying the bounds-testing procedure of Pesaran et al. (2001). The advantage of using this approach is that it can be performed in cases when regressors are I

[2]Please see Appendix B for the references for other countries.
[3]Appendix C provides the detailed information, conclusions, and references on studies for Turkey.

(1), I(0), or mutually cointegrated. In addition, this procedure captures the data-generating process with a sufficient number of lags in a general-to-specific modelling approach, and a dynamic error correction model (ECM) can be derived from a simple-linear transformation. Furthermore, the procedure is based on an unrestricted error-correction model, which allows for the joint estimation of long – as well as short-run effects. As argued by Banerjee, Dolado, and Mestre (1998), joint estimation has better statistical properties than the two-step Engle–Granger procedure that pushes the short-run dynamics into the error term. In addition, the use of the procedure of Pesaran et al. (2001) is suitable in the current context because there is no uniform agreement in the literature so far on whether Turkish saving and investment rates are an I(1) or I(0) process.

Fourth, the original model is augmented with the foreign-direct investment inflows to GDP ratio for all three cases for a robustness check.

Fifth, the diagnostic and stability tests are performed on all final models that are ignored in previous studies in the application of the Pesaran et al. (2001) procedure to the saving and investment relationship in Turkey.

Finally, the results have important implications for the Turkish national savings policy.

Our main finding is that there is the existence of a long-run relationship between saving and investment rates in Turkey over the whole period. This relationship is positive over the first sub-period (1950–1989) and negative over the second sub-period (1990–2017). Our finding is in contrast to that reported in other studies (Appendix C) that also employ the bounds-testing procedure. The differences between our findings and the results in other studies can be explained by several factors. We address the relationship between saving and investment rates using a much longer sample of data; we properly account for the presence of structural breaks; and the bounds-testing procedure is applied to two sub-periods (1950–1989 and 1990–2017) and to the overall sample period (1950–2017). The 1950–1989 period is characterized by a relatively low degree of international capital mobility and high financial restrictions, whereas the 1990–2017 period is typified by a high degree of capital mobility. However, although we confirm a long-run relationship between saving and investment ratios for the whole period and sub-periods, the long-run elasticity of investment with respect to saving ratios are significant only for the whole period and the first sub-period. This result is robust to the inclusion of foreign direct investments into the model. The results are in conformity with the Feldstein and Horioka hypothesis that in a closed economy domestic, investments are financed with domestic savings. However, investments have a different structure and dynamics in the second sub-period under perfect international capital mobility. Thus, the high, negative and insignificant long-run elasticity and non-constant coefficients in the second sub-period under perfect international capital mobility necessitate a full-investment model, since national savings policy is an important part of the Turkish government's policies.

The remainder of the paper is organized as follows. Section 2 discusses the description of data and their sources, Section 3 describes the bounds-testing procedure, Section 4 reports estimation results, and Section 5 concludes.

2. Data

Gross-fixed investments as a share of GDP and total domestic savings as a share of GDP are used as indicators of domestic investments and savings in Turkey, respectively. The data are annual and cover the period 1950–2017. The data come from various sources and are compiled by the author from the following sources: The Turkish Statistical Institute, the State Planning Organisation, the Five-Year Development Plans, the World Development Indicators of the World Bank, and from Gürtan (1959) and Korum (1969) for the early period. There have been several revisions to the series, with major revisions in 1998 and 2011.

In sequel, we will denote the investment and saving ratios as $\left(\frac{I}{Y}\right)_t$ and $\left(\frac{S}{Y}\right)_t$, and the changes in these ratios are denoted as $\Delta\left(\frac{I}{Y}\right)_t$ and $\Delta\left(\frac{S}{Y}\right)_t$, respectively. Both investment and saving ratios and the corresponding first differences are displayed in Figure 1.

The overall impression from Figure 1 is that there are certain common features shared by the two ratios in the early period: they both have an increasing trend until the late 1970s, then a decreasing trend in the early 1980s, and then a stepwise increase in the mid-1980s. However, the decrease and the increase in the saving ratio in the 1980s are more pronounced than the investment ratio. In addition, different dynamics in investment and saving ratios are observed in the 1990s: a stable investment ratio, but a declining saving ratio. Both series decrease in the early 2000s and increase until the late 2000s; however, this time the decrease and increase in investment ratio are sharper than the saving ratio. They both again decrease in the late 2000s and then show an increasing trend afterwards; again, the decrease in the late 2000s and the increase afterwards are more pronounced in the investment ratio than in the saving ratio. The similar differences before and after the 1990 period are also observed in the changes of the series. The two lower panels in Figure 1 present the changes of investment and saving ratios, which look quite similar aside from the observation that the changes in the investment ratio are more volatile in the 2000s than the changes in the saving ratio, and the changes in the saving ratio are more

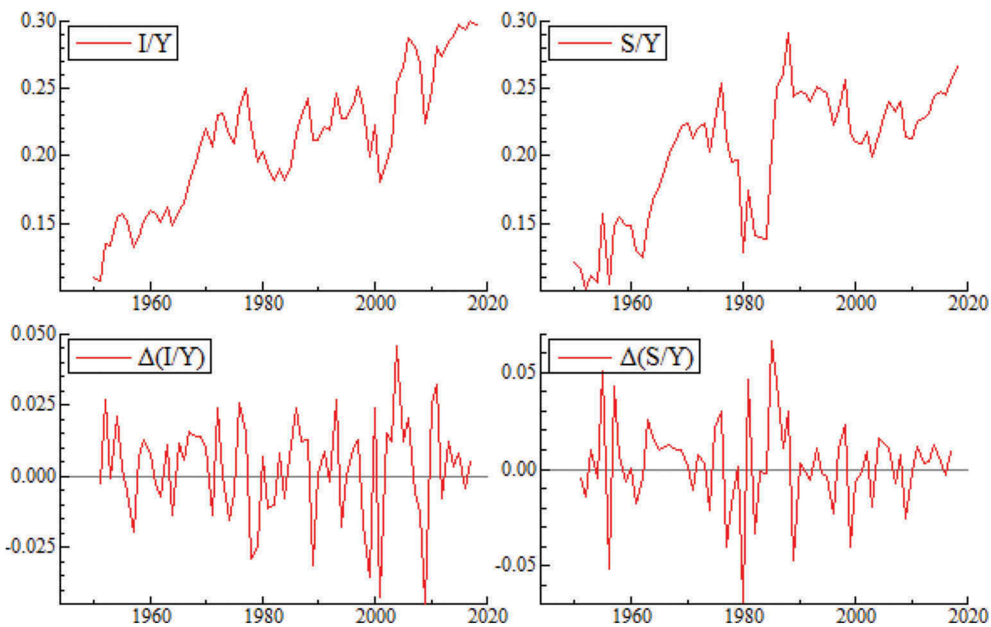

Figure 1. Actual data: investment and saving ratios and the changes in these ratios.

volatile in the late 1950s and in the 1980s than the changes in the investment ratio. A spike in the changes of the investment and saving ratios during these periods corresponds to a stepwise shift in the levels of investment and saving ratios.

In light of the visual inspection, we can say that investment and saving ratios tend to move together with a sharp decrease and increase in the investment ratio in the 1980s and a sharp decrease and increase in the saving ratio in the 2000s. In addition, investment ratios have been higher than saving ratios since the mid-2000s. However, the similarities and differences in the series observed by visual inspection need to be confirmed by the application of formal statistical methods.

3. Methodology

Since there is uncertainty about the order of integration for the Turkish investment and saving ratios, the cointegration between investment and savings is analysed by means of a bounds-testing procedure developed by Pesaran et al. (2001), which is applicable whether regressors are purely I(0), purely I(1), or mutually cointegrated.

We model Equation (1) as a VAR model of order p, which is further reduced to the following conditional ECM in order to implement the bounds procedure:

$$\Delta\left(\frac{I}{Y}\right)_t = \alpha + \theta_1\left(\frac{I}{Y}\right)_{t-1} + \theta_2\left(\frac{S}{Y}\right)_{t-1} + \sum_{i=1}^{p}\gamma_i\Delta\left(\frac{I}{Y}\right)_{t-i} + \sum_{j=0}^{p}\delta_j\Delta\left(\frac{S}{Y}\right)_{t-j} + \omega' D_t + \varepsilon_t \quad (2)$$

The lagged values of $\left(\frac{I}{Y}\right)_t$ and $\left(\frac{S}{Y}\right)_t$ constitute a long-run relationship. The deterministic terms such as a constant and dummy variables are given by α and D_t, respectively. The short-run dynamics are captured by means of lagged values of $\Delta\left(\frac{I}{Y}\right)_t$ and current and lagged values of $\Delta\left(\frac{S}{Y}\right)_t$. The conditional long-run elasticities of investment ratio with respect to saving ratio is given by $-\theta_2/\theta_1$ (Banerjee et al., 1998). The examination of evidence for a long-run relationship between investment and savings is conducted by using an F-test. The F-test statistic tests the joint significance of the coefficients on the one period lagged levels of investment and saving ratios in Equation (2). That is, $H_0 = \theta_1 = \theta_2 = 0$. However, this statistic has a nonstandard distribution that depends upon: (i) the order of integration of the regressors, (ii) the number of regressors, (iii) an intercept and/or trend included in the model, and (iv) sample size. Pesaran et al. (2001) provide two sets of asymptotic critical values that are critical value bounds for all classifications of the regressors as purely I(1), I(0), or mutually cointegrated. However, given the relatively small sample size in the present study (68 for the whole sample, and 40 and 28 for the subsamples), critical values are based on Narayan (2005), which are specific to the sample size.

There are two sets of critical values for a given significance level, with and without a time trend. The lower bound assumes that all regressors are I(0), and the upper bound assumes that all regressors are I(1). If the calculated F-statistic falls below the lower bound, we cannot reject the null hypothesis of no cointegration between investment and savings. Conversely, if the F-statistic exceeds the upper bound, we can conclude that a long-run relationship between investment and savings in Turkey exists. Finally, if the

F-statistic falls within the critical bounds, the order of integration of the variables must be investigated in order to obtain conclusive inference.

The estimates of $\theta_1 - \theta_2$ are used to form an error-correction term (ECT) in order to determine whether the adjustment of investment and savings is toward their long-run equilibrium values. Therefore, lagged-level investment and saving ratios in Equation (2) are replaced by ECT_{t-1} in order to form the conditional ECM:

$$\Delta\left(\frac{I}{Y}\right)_t = \alpha + \mu ECT_{t-1} + \sum\nolimits_{i=1}^{p} \gamma_i \Delta\left(\frac{I}{Y}\right)_{t-i} + \sum\nolimits_{j=1}^{p} \delta_j \Delta\left(\frac{S}{Y}\right)_{t-j} + \omega' D_t + \varepsilon_t \qquad (3)$$

A negative and significant estimation of μ represents the speed of adjustment as well as an alternative way of supporting cointegration between investment and saving ratios. In addition, long-run causality is ascertained by the ECT, and its significance indicates evidence of long-run causality from the independent variable to the dependent variable.

4. Estimations

The first step in the bounds-testing procedure is to determine the appropriate lag structure through the information criteria and Lagrange Multiplier (LM) statistics. The results of the lag order p selection procedure for Equation (2) are shown in Table D1. The information criteria (Akaike, AIC, and Schwarz, SIC) and the LM statistical testing for the remaining autocorrelation up to the first and second orders in regression residuals are provided. Akaike information criteria (AIC) selects the lag length $p = 2$, whereas the Schwarz information criteria (SIC) selects the lag length $p = 1$ for the whole period (1950–2017). Since none of the lags suffer from serial correlation as indicated by LM statistics, the model with $p = 1$ is preferred for the whole period. Both information criteria – AIC and SIC – select $p = 2$ for the first sub-period (1950–1989). For all three values of p, there is no evidence of remaining autocorrelation in the regression residuals. Given the evidence from the information criteria and the evidence of no residual autocorrelation regardless of the value of p, the model with $p = 2$ is chosen for the first sub-period. AIC selects the lag length $p = 2$, whereas SIC selects the lag length $p = 1$ for the second sub-period (1990–2017). However, the lags suffer from serial correlation as indicated by LM statistics for the models with $p = 1$ and $p = 2$; therefore, the model with $p = 3$ is preferred for the second sub-period.

Several dummies have been included in the test regressions to account for the presence of outliers corresponding to the periods of unusually large discrepancies between investment and savings ratios and are reported in Table D1.

The second step of the bounds procedure is to compare the computed F-statistics for the conditional ECM to the lower and upper bounds corresponding to case III in Pesaran et al. (2001), i.e., with unrestricted constant and no linear-deterministic trend for cointegration. The F-test statistics for the joint null hypothesis $H_0 = \theta_1 = \theta_2 = 0$ using the finite-sample critical values from Narayan (2005) for T = 30, T = 35, T = 40, T = 65, and T = 70 corresponding to case III in Pesaran et al. (2001), i.e., with unrestricted constant and no linear deterministic trend and with 1%, 5%, and 10% critical values, are given in

Table D2. F-statistics for estimated conditional ECM are given for the three periods for $p = 1$, $p = 2$, and $p = 3$ in Table D3.

As seen, the null hypothesis of no long-run relationship between investment and saving ratios can be rejected for $p = 1$ for the whole period at the 5% significance level; for all p values for the first sub-period at the 1% significance level; and for all p values for the second sub-period at the 5% significance level. Given the results and evidence from information criteria and lag order selection in Table D1, the model with $p = 1$ is preferred for the whole period, indicating that there is a long-run relationship between investment and saving ratios at the 5% significance level; the model with $p = 2$ is chosen for the first sub-period, accepting the cointegration between investment and saving ratios at the 1% significance level; and the model with $p = 3$ is chosen for the second sub-period, confirming a long-run relationship between investment and saving ratios at the 5% significance level.

The third step of the bounds-testing procedure after establishing a long-run relationship between variables of interest is to estimate the coefficients of interest. We start with the error correction model of $p = 1$ for the whole period (1950–2017), and after deleting the insignificant augmentation lags, we obtain the following parsimonious model (SEs are in parentheses and error probabilities are in brackets):

$$
\begin{aligned}
\Delta\left(\frac{I}{Y}\right)_t = {} & \underset{(0.007)}{0.007} + \underset{(0.072)}{0.123}\Delta\left(\frac{S}{Y}\right)_t - \underset{(0.057)}{0.206}\left(\frac{I}{Y}\right)_{t-1} + \underset{(0.059)}{0.204}\left(\frac{S}{Y}\right)_{t-1} - \underset{(0.012)}{0.026D1979_t} \\
& - \underset{(0.013)}{0.041D1989_t} - \underset{(0.013)}{0.041D1999_t} - \underset{(0.012)}{0.046D2001_t} + \underset{(0.012)}{0.040D2004_t} - \underset{(0.013)}{0.042D2009_t} \\
& + \underset{(0.012)}{0.032D2011_t} + \varepsilon_t
\end{aligned} \tag{4}
$$

The parsimonious model passes the standard specification tests (e.g., tests of no residual autocorrelation, of no residual ARCH effects, of residual normality, and of no residual heteroscedasticity and the RESET test for functional form misspecification). The outliers have been identified as those residuals exceeding regression SE by a factor of 2 in the estimated regression (4) with $p = 1$ without intervention dummies. Therefore, several dummies are added to consider these breaks and are explained in Appendix E.

According to Equation (4), the long-run elasticities of investment ratio with respect to saving ratio is $(- \theta_2/\theta_1 = -(0.204/ - 0.206) =)0.99$. An increase of 1% in the saving ratio increases the investment ratio almost by 1%. This is a very large effect and is consistent with the FH hypothesis that domestic investments are spurred by domestic savings.

However, we need to test if the long-run elasticity of investment with respect to saving ratio $(- \theta_2/\theta_1)$ is equal to 0 or not. The test result rejects the long-run elasticity $(- \theta_2/\theta_1)$ being 0 at 1% significance level:

$$\chi^2_{(1)} = 34.755[0.0000] *\!*\!*$$

The estimated model (Equation 4) allows us to compare the coefficients belonging to the lagged investment and saving ratios. These coefficients are of a similar absolute magnitude with the implied long-run vector of (1, –0.99)′ such that one can safely impose a homogeneity restriction $\theta_1 = -\theta_2$, i.e., the long-run relationship vector between investment and saving ratios is $(1, -1)^{'}$. The restricted ECM is given below:

$$\begin{aligned}\Delta\left(\frac{I}{Y}\right)_t &= \underset{(0.002)}{0.006} + \underset{(0.071)}{0.124}\Delta\left(\frac{S}{Y}\right)_t - \underset{(0.054)}{0.205}\left(\frac{I}{Y}-\frac{S}{Y}\right)_{t-1} - \underset{(0.012)}{0.026}D1979_t - \underset{(0.013)}{0.041}D1989_t \\ &- \underset{(0.013)}{0.042}D1999_t - \underset{(0.012)}{0.046}D2001_t + \underset{(0.012)}{0.040}D2004_t - \underset{(0.013)}{0.042}D2009_t + \underset{(0.012)}{0.032}D2011_t + \varepsilon_t \end{aligned} \tag{5}$$

The homogeneity restriction in Equation (5) does not make any difference in the estimated coefficients apart from the constant, which becomes significant. All retained coefficients, especially the impulse dummies, are estimated with a high degree of precision. In addition, the long-run relationship is highly significant in the restricted ECM. All the graphical representations of the final model in Equation (5) are satisfactory. The fitted values, residuals, residual density, density correlogram, the recursive estimates for the coefficients and their respective t-ratios, and the recursive residual sum of squares, one-step residuals, and one-step, break–point and forecast Chow test statistics are shown and discussed in Figures in Appendix F for all three models.

As shown in Equation (4), the long-run coefficient of the saving ratio with respect to the investment ratio or the saving-retention coefficient of the FH hypothesis (Feldstein & Horioka, 1980) for the whole period is 0.99. However, the graphs for the investment and saving ratios in Figure 1 show differences in the investment-saving relationship before and after the capital market liberalization that started in 1989. Therefore, we employ the bounds procedure for the first sub-period (1950–1989) and also for the second sub-period (1990–2017) to see whether the saving-retention coefficients are similar in both periods, and whether the models in different periods can be used for the Turkish national savings policy.

Given the evidence from the information criteria and the evidence of no residual autocorrelation regardless of the value of p in Table D1, the model with $p = 2$ is chosen for the first sub-period (1950–1989). In addition, the null hypothesis of no long-run relationship between investment and saving ratios is decisively rejected for all values of p at the 1% significance level. We start with the error-correction model of $p = 2$ for the first sub-period (1950–1989), again delete the insignificant augmentation lags, and obtain the following parsimonious model:

$$\Delta\left(\frac{I}{Y}\right)_t = \underset{(0.008)}{0.012} - \underset{(0.095)}{0.331}\Delta\left(\frac{I}{Y}\right)_{t-2} + \underset{(0.050)}{0.190}\Delta\left(\frac{S}{Y}\right)_t + \underset{(0.066)}{0.134}\Delta\left(\frac{S}{Y}\right)_{t-1} - \underset{(0.083)}{0.344}\left(\frac{I}{Y}\right)_{t-1} + \underset{(0.068)}{0.297}\left(\frac{S}{Y}\right)_{t-1} + \underset{(0.008)}{0.031}D1954_t - \underset{(0.008)}{0.024}D1964_t + \underset{(0.008)}{0.023}D1972_t + \underset{(0.007)}{0.018}D1983_t - \underset{(0.008)}{0.037}D1989_t + \varepsilon_t \tag{6}$$

$R^2 = 0.82$, $F_{(10,26)} = 12.110[0.000]$, T = 37

$F^{AR(1-2)}_{(2,24)} = 1.405[0.265]$, $F^{ARCH(1-1)}_{(1,35)} = 0.267[0.609]$, $\chi^{2\,Norm}_{(2)} = 1.540[0.463]$,

$F^{Hetero}_{(10,21)} = 0.652[0.755]$, $F^{RESET23}_{(2,24)} = 2.946[0.072]$

The second parsimonious model also passes the standard specification tests.[4]

The long-run elasticities of investment ratio with respect to saving ratio in the first sub-period is $(-\theta_2/\theta_1 = -(0.297/-0.344)) = 0.86$. An increase of 1% in the saving ratio increases the investment ratio by 0.86% – a large impact. However, this result is consistent with the Feldstein and Horioka (1980) hypothesis that domestic investment and savings follow each other closely under imperfect international capital mobility, which characterizes the first sub-period.

The test for the long-run elasticity of investment with respect to saving ratio $(-\theta_2/\theta_1)$ being 0 is rejected at 1% significance level:

$$\chi^2_{(1)} = 69.140[0.0000] *{*}*$$

The implied long-run vector of (1, –0.86)′ allows us to impose a homogeneity restriction $\theta_1 = -\theta_2$, i.e., the long-run relationship vector between investment and saving ratios is $(1, -1)'$. The restricted ECM for the first sub-period is given below:

$$\Delta\left(\frac{I}{Y}\right)_t = \underset{(0.002)}{0.004} - \underset{(0.094)}{0.352}\Delta\left(\frac{I}{Y}\right)_{t-2} + \underset{(0.047)}{0.197}\Delta\left(\frac{S}{Y}\right)_t + \underset{(0.066)}{0.145}\Delta\left(\frac{S}{Y}\right)_{t-1} - \underset{(0.069)}{0.289}\left(\frac{I}{Y} - \frac{S}{Y}\right)_{t-1} + \underset{(0.008)}{0.034}D1954_t - \underset{(0.008)}{0.023}D1964_t + \underset{(0.008)}{0.023}D1972_t + \underset{(0.008)}{0.018}D1983_t - \underset{(0.008)}{0.040}D1989_t + \varepsilon_t \tag{7}$$

$R^2 = 0.81$, $F_{(9,27)} = 13.150[0.000]$, T = 37

[4]The dummy variables in Equation (6) are discussed in Appendix E2.

$$F^{AR(1-2)}_{(2,25)} = 0.629[0.542], F^{ARCH(1-1)}_{(1,35)} = 1.703[0.200], \chi^{Norm}_{(2)} = 2.249[0.325],$$

$$F^{Hetero}_{(8,23)} = 0.804[0.606], F^{RESET23}_{(2,25)} = 1.767[0.192]$$

Again, all retained coefficients are estimated with a high degree of precision with the homogeneity restriction. All the graphical representations are satisfactory in Appendix F2. The coefficient of the long-run relationship in Equation (7) indicates that 29% of disequilibria of the previous year is corrected in the next year.

For the second sub-period (1990–2017), as explained previously, $p = 3$ is selected and the null hypothesis of no long-run relationship between investment and saving ratios is rejected at the 5% significance level. We start with the ECM of $p = 3$ for the second sub-period, again delete the insignificant augmentation lags, and reach the following parsimonious model:

$$\begin{aligned}\Delta\left(\frac{I}{Y}\right)_t &= \underset{(0.039)}{0.125} - \underset{(0.131)}{0.231}\Delta\left(\frac{I}{Y}\right)_{t-2} + \underset{(0.214)}{1.036}\Delta\left(\frac{S}{Y}\right)_t + \underset{(0.170)}{0.246}\Delta\left(\frac{S}{Y}\right)_{t-2} - \underset{(0.072)}{0.174}\left(\frac{I}{Y}\right)_{t-1} \\ &\quad - \underset{(0.181)}{0.330}\left(\frac{S}{Y}\right)_{t-1} + \underset{(0.012)}{0.026}D1996_t - \underset{(0.012)}{0.036}D1998_t - \underset{(0.013)}{0.057}D2001_t + \varepsilon_t\end{aligned} \tag{8}$$

$$R^2 = 0.82, F_{(8,19)} = 10.590[0.000], \mathrm{T} = 28$$

$$F^{AR(1-2)}_{(2,17)} = 1.291[0.301], F^{ARCH(1)}_{(1,26)} = 0.674[0.419], \chi^{Norm}_{(2)} = 5.376[0.068],$$

$$F^{Hetero}_{(10,14)} = 0.271[0.978], F^{RESET23}_{(2,17)} = 0.041[0.960]$$

The second parsimonious model also passes the standard specification tests.[5]

The long-run elasticity of investment ratio with respect to saving ratio in the second sub-period is $(-\theta_2/\theta_1 = -(-0.330/-0.174)) = -1.89$. An increase of 1% in the saving ratio decreases the investment ratio by almost 2%.

The existence of the negative relationship between investment and saving ratios is discussed with the theoretical arguments of Westphal (1983) that a higher world interest rate leads to an increase in the domestic interest rate, thus encouraging domestic savings but discouraging domestic investment. Similarly, Tobin (1983) argues that higher domestic savings do not necessarily lead to higher domestic investment if foreign returns are greater than the marginal return of domestic investments, because of the differences in taxation between countries. In addition, the large current-period short-run impact of the saving ratio may reflect short- and medium-term frictions in international capital markets (Hoffmann, 2004). However, the negative long-run elasticity of 1.89 is rather too large and requires further investigation. Therefore, we test for the significance of the long-run elasticity of investment with respect to saving ratio and include foreign direct investment ratio as a robustness check.

[5]The dummy variables in Equation (8) are explained in Appendix E3.

We cannot reject the test for the long-run elasticity $(-\theta_2/\theta_1)$ being 0:

$$\chi^2_{(1)} = 1.542[0.2143]$$

This is an interesting result, since a long-run relationship between investment and savings exists according to an F-test which is the joint significance of the coefficients on the one period lagged levels of investment and saving ratios, but we cannot reject the test for the long-run elasticity being 0. Thus, the high-negative elasticity is not reliable.

The long-run relationship between investment and saving ratios in Equation (8) can be written as the following ECT:

$$ECT_{t-1} = \left(\frac{I}{Y} + 1.89 * \frac{S}{Y}\right)_{t-1}$$

The error-correction model that replaces the long-run relationship for the ECT for the second sub-period is presented below:

$$\begin{aligned} \Delta\left(\frac{I}{Y}\right)_t &= \underset{(0.030)}{0.125} - \underset{(1.81)}{0.231}\Delta\left(\frac{I}{Y}\right)_{t-2} + \underset{(0.182)}{1.036}\Delta\left(\frac{S}{Y}\right)_t + \underset{(0.165)}{0.246}\Delta\left(\frac{S}{Y}\right)_{t-2} - \underset{(0.044)}{0.174}ECT_{t-1} \\ &\quad + \underset{(0.012)}{0.026}D1996_t - \underset{(0.012)}{0.036}D1998_t - \underset{(0.013)}{0.057}D2001_t + \varepsilon_t \end{aligned} \tag{9}$$

$R^2 = 0.82$, $F_{(7,20)} = 12.740[0.000]$, T = 28

$F^{AR(1-2)}_{(2,18)} = 1.367[0.280]$, $F^{ARCH(1-1)}_{(1,26)} = 0.675[0.419]$, $\chi^{2\,Norm}_{(2)} = 5.376[0.068]$,

$F^{Hetero}_{(8,16)} = 0.250[0.974]$, $F^{RESET23}_{(2,18)} = 0.040[0.961]$

All retained coefficients are estimated with a high degree of precision with the inclusion of the ECT. However, the histogram and estimated density of the residuals raise some concerns in Figure F3.1. Coefficients do not seem to be constant in the early 2000s in Figure F3.2. Thus, we cannot use the model for the second sub-period as a national savings policy. In addition, some t-ratios decrease rather increase in absolute values in the early 2000s in Figure F3.3 that are also worrying. Yet, the model does not show any signs of instability in Figure F3.4. The value of the ECT indicates that 17% of the disequilibria of the previous year comes back to the long-run equilibrium in the next year. The speed of adjustment is different in sub-periods and is faster in the first sub-period.

5. Robustness

We include the foreign-direct investment inflows to GDP ratio (FDI/Y) in all three models for the robustness check. Openness and financial integration can impact the saving retention coefficient as suggested by Guiso, Paola, and Zingales (2004), Younas and Chakraborty (2011), Payne and Kumazawa (2006), Ben Slimane, Ben Tahar, and Essid (2013), Choudhry et al. (2014), and Bibi and Jalil (2016). Indeed, Bibi and Jalil

(2016) find that the interaction of the globalisation measure with saving rate enters significantly negative implying weakening home bias effect with the increase of economic globalization over time.

The current account sustainability with financial liberalisation becomes an intertemporal issue and the current account balance may substantially loose its significance as the primary policy objective (Artis & Bayoumi, 1990). In addition, Lewis (1999) argues that financially more developed countries are expected to have higher "equity home bias", because of the easy flow of capital from a domestic intermediator to a domestic borrower, whereas financial underdevelopment can lead to a bias for overseas equities and thus can purpose incremental domestic saving to finance primarily overseas investment. Ben Slimane et al. (2013) find trade openness and foreign direct investments as a share of GDP have a positive impact on the investment rate and the saving retention coefficient decreases with their inclusion.

The following conditional ECM is utilised to implement the bounds procedure for the robustness check:

$$\begin{aligned}\Delta\left(\frac{I}{Y}\right)_t &= \alpha + \theta_1\left(\frac{I}{Y}\right)_{t-1} + \theta_2\left(\frac{S}{Y}\right)_{t-1} + \theta_3\left(\frac{FDI}{Y}\right)_{t-1} \\ &\quad + \sum_{i=1}^{p}\gamma_i\Delta\left(\frac{I}{Y}\right)_{t-i} + \sum_{j=0}^{p}\delta_j\Delta\left(\frac{S}{Y}\right)_{t-j} + \sum_{j=0}^{p}\lambda_j\Delta\left(\frac{FDI}{Y}\right)_{t-j} + \omega' D_t + \varepsilon_t\end{aligned} \tag{10}$$

The lagged values of $\left(\frac{I}{Y}\right)_t$, $\left(\frac{S}{Y}\right)_t$ and $\left(\frac{FDI}{Y}\right)_t$ constitute a long-run relationship. The short-run dynamics are captured by means of lagged values of $\Delta\left(\frac{I}{Y}\right)_t$ and current and lagged values of $\Delta\left(\frac{S}{Y}\right)_t$ and $\Delta\left(\frac{FDI}{Y}\right)_t$. The conditional long-run elasticities of investment ratio with respect to saving ratio and with respect to foreign direct investment ratio are given by $-\theta_2/\theta_1$ and $-\theta_3/\theta_1$. The examination of evidence for a long-run relationship between investment, savings, and foreign direct investments is conducted by an F-test. The F-test statistic tests the joint significance of the coefficients on the one period lagged levels of investment, saving, and foreign direct investment ratios in order to determine a long-run relationship between investment, savings, and foreign direct investments in Equation (10). That is, $H_0 = \theta_1 = \theta_2 = \theta_3 = 0$.

5.1. The whole period (1950–2017)

Given the evidence from information criteria and of no residual autocorrelation, the model with $p = 3$ is chosen for the whole period. The presence of foreign direct investments requires a richer lag structure. The null hypothesis of no long-run relationship between investment, saving, and foreign direct investment ratios can be rejected for $p = 3$ for the whole period at the 5% significance level according to the F-test (F(3,45) = 4.275**).

The final parsimonious model with foreign direct investments for the whole period is given by:

$$\Delta\left(\frac{I}{Y}\right)_t = \underset{(0.009)}{0.005} - \underset{(0.098)}{0.260}\Delta\left(\frac{I}{Y}\right)_{t-1} - \underset{(0.082)}{0.348}\Delta\left(\frac{I}{Y}\right)_{t-2} + \underset{(0.061)}{0.164}\Delta\left(\frac{S}{Y}\right)_t + \underset{(0.075)}{0.202}\Delta\left(\frac{S}{Y}\right)_{t-1}$$
$$+ \underset{(0.065)}{0.151}\Delta\left(\frac{S}{Y}\right)_{t-2} + \underset{(0.389)}{1.249}\Delta\left(\frac{FDI}{Y}\right)_t - \underset{(0.408)}{0.884}\Delta\left(\frac{FDI}{Y}\right)_{t-3} - \underset{(0.078)}{0.191}\left(\frac{I}{Y}\right)_{t-1} + \underset{(0.062)}{0.172}\left(\frac{S}{Y}\right)_{t-1}$$
$$+ \underset{(0.262)}{0.712}\left(\frac{FDI}{Y}\right)_{t-1} + \underset{(0.011)}{0.033}D1954_t + \underset{(0.010)}{0.022}D1972_t - \underset{(0.011)}{0.038}D1989_t + \underset{(0.010)}{0.022}D1993_t$$
$$- \underset{(0.011)}{0.042}D1999_t - \underset{(0.012)}{0.059}D2001_t + \underset{(0.012)}{0.061}D2004_t - \underset{(0.013)}{0.029}D2009_t + \varepsilon_t \qquad (11)$$

$$R^2 = 0.79,\ F_{(18,45)} = 9.309[0.000],\ \mathrm{T} = 64$$

$$F_{(2,43)}^{AR(1-2)} = 0.784[0.463],\ F_{(1,62)}^{ARCH(1-1)} = 0.236[0.629],\ \chi_{(2)}^{2(Norm)} = 0.733[0.693],$$

$$F_{(20,35)}^{Hetero} = 0.369[0.990],\ F_{(2,43)}^{RESET23} = 0.266[0.768]$$

The long-run elasticities of investment ratio with respect to saving ratio and foreign direct investments ratio for the whole period are $(-\theta_2/\theta_1 = -(0.172/-0.191) =)0.90$ and $(-\theta_3/\theta_1 = -(0.712/-0.191) =)3.73$, respectively. The long-run elasticities are both positive, and the long-run elasticity of investment ratio with respect to saving ratio (0.90) is slightly lower than the value without foreign direct investments (0.99). Thus, the inclusion of the foreign direct investments impacts the long-run elasticity of investment ratio with respect to saving ratio only slightly.

The long-run elasticity of investment ratio with respect to foreign direct investment ratio (3.73) seems rather large, however, given the small mean value of the foreign-direct investment to GDP ratio over the whole period (0.0058), this is not a concern. The model passes all the diagnostic tests which are also supported by the close match between the actual and the fitted values, the estimated regression residuals, and recursive stability, etc.[6]

In addition, we test and reject the long-run elasticities $(-\theta_2/\theta_1)$ and $(-\theta_3/\theta_1)$ being 0 at 1% significance level for both elasticities.

The test result for the long-run elasticity of investment ratio with respect to saving ratio being 0:

$$\chi_{(1)}^2 = 16.972[0.000] ***$$

The test result for the long-run elasticity of investment ratio with respect to foreign investment ratio being 0:

$$\chi_{(1)}^2 = 10.407[0.000] ***$$

[6]The detailed estimation results and graphs are available upon request from the author.

The coefficients of the model as well as the long-run elasticity of investment with respect to savings are robust to the inclusion of foreign direct investments for the whole period.

5.2. The first sub-sample (1950–1989)

Based on information criteria and of no residual autocorrelation, the model with $p = 5$ is chosen for the first sub-sample. The null hypothesis of no long-run relationship between investment, saving, and foreign direct investment ratios can be rejected for $p = 5$ for the first sub-period at the 1% significance level according to the F-test (F(3,21) = 27.003***).

The final parsimonious model for the first sub-period:

$$\begin{aligned}
\Delta\left(\frac{I}{Y}\right)_t &= \underset{(0.008)}{0.018} - \underset{(0.088)}{0.201}\Delta\left(\frac{I}{Y}\right)_{t-5} + \underset{(0.051)}{0.257}\Delta\left(\frac{S}{Y}\right)_t - \underset{(0.050)}{0.116}\Delta\left(\frac{S}{Y}\right)_{t-2} - \underset{(0.054)}{0.209}\Delta\left(\frac{S}{Y}\right)_{t-3} \\
&+ \underset{(1.790)}{4.101}\Delta\left(\frac{FDI}{Y}\right)_{t-2} + \underset{(1.709)}{6.003}\Delta\left(\frac{FDI}{Y}\right)_{t-3} - \underset{(0.062)}{0.505}\left(\frac{I}{Y}\right)_{t-1} + \underset{(0.053)}{0.468}\left(\frac{S}{Y}\right)_{t-1} - \underset{(1.783)}{4.369}\left(\frac{FDI}{Y}\right)_{t-1} \\
&- \underset{(0.008)}{0.031}D1964_t + \underset{(0.008)}{0.015}D1972_t - \underset{(0.009)}{0.025}D1989_t + \varepsilon_t
\end{aligned} \tag{12}$$

$$R^2 = 0.88,\ F_{(12,21)} = 12.55[0.000],\ \mathrm{T} = 34$$

$$F_{(2,19)}^{AR(1-1)} = 0.917[0.417],\ F_{(1,32)}^{ARCH(1-1)} = 0.014[0.907],\ \chi_{(2)}^{2(Norm)} = 0.312[0.936],$$

$$F_{(18,12)}^{Hetero} = 1.447[0.260],\ F_{(2,19)}^{RESET23} = 3.263[0.061]$$

The long-run elasticities of investment ratio with respect to saving ratio and foreign direct investment ratio for the whole period are $(-\theta_2/\theta_1 = -(0.468/-0.505) =)0.93$ and $(-\theta_3/\theta_1 = -(-4.369/-0.505) =) - 4.37$, respectively. The long-run elasticity of investment ratio with respect to saving ratio (0.93) for the first sub-period is found to be similar to the elasticity for the overall period (0.86). The long-run elasticity of investment ratio with respect to foreign direct investment ratio is negative and seems rather large (−4.37), however, the sample mean of the foreign-direct investment ratio over the first sub-period is only 0.0014. The negative long-run elasticity of investment ratio with respect to the foreign-direct investment ratio is consistent with the Karadeniz (1995)'s findings that before 1990 foreign firms could not purchase their inputs locally because foreign firms were using relatively more advanced technologies and required more sophisticated inputs. As a result, foreign direct investments did not promote linkages effects to encourage domestic investments.

The model passes all the diagnostic tests which are also supported by the close match between the actual and the fitted values, the estimated regression residuals, and recursive stability, etc.[7]

[7]The detailed estimation results and graphs are available upon request from the author.

We test and reject the long-run elasticities $(-\theta_2/\theta_1)$ and $(-\theta_3/\theta_1)$ being 0.

The long-run elasticity of investment ratio with respect to saving ratio being 0 $(-\theta_2/\theta_1 = 0)$ is rejected at 1% significance level:

$$\chi^2_{(1)} = 156.17[0.000] *** $$

The long-run elasticity of investment ratio with respect to foreign direct investments ratio being 0 $(-\theta_3/\theta_1 = 0)$ is rejected at 5% significance level:

$$\chi^2_{(1)} = 6.008[0.014] ** $$

Thus, the coefficients of the model as well as the long-run elasticity of investment with respect to saving ratio is robust to the inclusion of foreign direct investment into the model for the first sub-period, suggesting that the model for the first sub-period can be used for the Turkish national savings policy.

5.3. The second sub-sample (1990–2017)

Based on information criteria and of no residual autocorrelation, the model with $p = 5$ is chosen for the second sub-sample. The null hypothesis of no long-run relationship between investment, saving, and foreign direct investment ratios can be rejected for $p = 5$ for the first sub-period at the 1% significance level according to the F-test (F(3,16) = 8.301***).

The final parsimonious model for the second sub-period:

$$\begin{aligned}\Delta\left(\frac{I}{Y}\right)_t &= \underset{(0.028)}{0.122} - \underset{(0.089)}{0.222}\Delta\left(\frac{I}{Y}\right)_{t-1} + \underset{(0.149)}{0.910}\Delta\left(\frac{S}{Y}\right)_t - \underset{(0.082)}{0.302}\Delta\left(\frac{S}{Y}\right)_{t-4} + \underset{(0.326)}{0.177}\Delta\left(\frac{FDI}{Y}\right)_t \\ &\quad - \underset{(0.088)}{0.177}\left(\frac{I}{Y}\right)_{t-1} - \underset{(0.142)}{0.320}\left(\frac{S}{Y}\right)_{t-1} + \underset{(0.286)}{0.031}\left(\frac{FDI}{Y}\right)_{t-1} + \underset{(0.008)}{0.027}D1996_t - \underset{(0.009)}{0.037}D1998_t \\ &\quad + \underset{(0.008)}{0.018}D2016_t + \varepsilon_t\end{aligned} \tag{13}$$

$R^2 = 0.92$, $F_{(11,16)} = 18.08[0.000]$, T = 28

$F^{AR(1-2)}_{(2,14)} = 1.985[0.174]$, ${}^{ARCH(1-1)}_{(1,26)} = 0.306[0.585]$, $\chi^{2(Norm)}_{(2)} = 0.149[0.929]$,

$F^{Hetero}_{(14,9)} = 1.3867[0.3164]$, $F^{RESET23}_{(2,14)} = 1.881[0.189]$

The long-run elasticities of investment ratio with respect to saving ratio and foreign direct investment ratio for the whole period are $(-\theta_2/\theta_1 = -(-0.320/-0.177) =) -1.81$ and $(-\theta_3/\theta_1 = -(0.031/-0.177) =) 0.18$, respectively. The long-run elasticity of investment ratio with respect to saving ratio is negative for the second sub-period as before, however, the magnitude is slightly lower than the one without foreign direct investments. The long-run elasticity of investment ratio with respect to foreign direct investment ratio is positive, but small for the second sub-period. The mean value of the foreign-direct investment ratio is 0.012 for the second sub-period. The dummy for 2016 represents the sharp decline in the interest rates.

The model passes all the diagnostic tests. The histogram and estimated density of the residuals raise some concerns, coefficients are not constant during the 2000s, some t-ratios decrease rather increase in absolute values in the early 2000s, but the model does not show any signs of instability as before without the foreign-direct investments in the model.[8]

We test and cannot reject the long-run elasticities $(-\theta_2/\theta_1)$ and $(-\theta_3/\theta_1)$ being 0.

The test result for the long-run elasticity of investment ratio with respect to saving ratio being 0:

$$\chi^2_{(1)} = 1.457[0.227]$$

The test result for the long-run elasticity of investment ratio with respect to foreign investment ratio being 0:

$$\chi^2_{(1)} = 0.013[0.910]$$

Although there is a long-run relationship between investment, saving and foreign-direct investment ratio at 1% significance level for the second sub-period with the inclusion of foreign direct investments, the long-run elasticities are not significant. In addition, non-constant coefficients in the model suggests that we cannot use this model for the national savings policy for the second sub-period, because non-constant coefficients might be due to an omitted regressor which is correlated with the included one such as saving ratio or foreign direct investments or any other omitted variables, and this correlation changes over time because of the regime or policy changes over time.

6. Conclusions

Feldstein and Horioka (1980) predicted that in a closed economy the domestic investments would follow domestic savings very closely. However, these scholars' empirical results presented a puzzle, because of a high-saving investment correlation during the period of more open and integrated markets in the OECD countries. In this paper, the FH hypothesis is revisited and tested for Turkey over the whole period (1950–2017) and for two sub-periods (1950–1989 and 1990–2017). The first sub-period is characterized by restricted capital mobility and the second sub-period represents a period of perfect capital mobility that offer a natural experiment to test the FH hypothesis.

Several novel contributions are made to the literature. First, the longest time period with two sub-periods for Turkey are studied. Secondly, we properly consider the time-series properties of the data by using the bounds-testing procedure that can be used in situations when there is no consensus in the literature on the order of integration of the variables of interest. Third, the presence of structural breaks is addressed when testing for the presence of a long-run relationship between investment and saving ratios. Fourth, foreign direct investments are included in all three models for a robustness check.

[8]The detailed estimation results and graphs are available upon request from the author.

Amongst the key findings, it is found that saving and investment are cointegrated for Turkey over the whole period and the sub-periods. However, the investment and savings are positively correlated during the period of restricted capital mobility (1950–1989) and negatively correlated during the period of perfect capital mobility (1990–2017). These results are in conformity with the FH hypothesis that in a closed economy, domestic investments are financed with domestic savings. However, the long-run elasticity of investment with respect to savings ratio is significant for the whole period and for the first sub-period, but not for the second sub-period. The results are robust to the inclusion of foreign direct investments into all three models. The negative correlation in the second sub-period under perfect international capital mobility can be explained by higher world interest rates, which lead to an increase in the domestic interest rates and therefore domestic savings, but not necessarily to an increase in domestic investments, especially if foreign returns are greater than the returns on domestic investments due to differences in taxation between countries. However, a high, negative and insignificant long-run elasticity of investment with respect to savings ratio in the second sub-period under perfect international capital mobility appraises that the two sub-periods have a completely different structure and dynamics; and the FH hypothesis should also be tested for the subperiods rather than only for the whole period, especially with sufficient observations in the subperiods as in this paper. In addition, non-constant coefficients in the second sub-period model suggests that we cannot use this model for the Turkish national savings policy for the second sub-period, given that the national savings policy is an important part of the Turkish government's policy. This result further suggests that a full-investment model is needed to explain the investment behaviour for the second sub-period under perfect international capital mobility for Turkey and for the national savings policy.

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No potential conflict of interest was reported by the author.

Notes on contributor

Şule Akkoyunlu is a Lecture in Economics and Finance and her research interests include macroeconomics, econometrics, international economics, development economics, economic history, public economics, political economy, labour economics, demography, and international migration.

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