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An Empirical Research on the Saving–Investment Relationship for the Turkish Economy

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Abstract

For the research field of international macroeconomics, one of the stylized facts that researchers often observe empirically is the strong dependency of domestic investments to national savings. Feldstein and Horioka (1980) accept such a relationship as an indicator of capital mobility and try to examine how an increase in the national saving level finances domestic investments. The authors perceive this as a puzzle for the assumption that world capital markets are well-integrated. The paper aims to test the validity of such a relationship for the case of the Turkish economy. Not only does this study take account of the estimation result that there exists evidence of a cointegration as an estimation methodology between domestic investments and national savings for the time span 1975 - 2015, but it also enlarges the research area to the sensitivity of findings to the endogenous breaks, and then estimates some regime changes. This study finds a Feldstein – Horioka (FH) coefficient highly smaller than a unity value, and observes some structural breaks associated with policy transformation or macroeconomic crises periods of the economy.

Key Words: *Feldstein – Horioka (FH) Puzzle, Cointegration, Turkish Economy*

Jel Codes: *C32, C52, E21, E22, F41*

Türkiye Ekonomisi için Tasarruf–Yatırım İlişkisi üzerine Bir Araştırma

Öz

Uluslar arası makro ekonominin başlıca inceleme alanları açısından, araştırmacıların uygulamalı bir şekilde ve sıklıkla gözlemlediği kalıplaşmış gerçeklerden birisi yurt içi yatırım düzeyinin ulusal tasarruf düzeyine karşı güçlü bağımlılığıdır. Feldstein ve Horioka (1980) bu tür bir ilişkiyi sermaye hareketliliğinin bir göstergesi olarak kabul etmekte ve ulusal tasarruf düzeyindeki bir artış eğiliminin yurt içi yatırım düzeyini nasıl finanse ettiğini inceleme altına almaktadır. Yazarlar bu durumu dünya sermaye piyasalarının iyi bütünleştiği varsayımı karşısındaki sorunsal bir konu olarak algılamaktadır. Bu çalışma böyle bir ilişkinin geçerliliğini Türkiye ekonomisi örneği için sınama amacını taşımaktadır. Çalışma 1975 2015 döneminde yalnızca yurt içi yatırımlar ve ulusal tasarruflar arasındaki bir tahmin yöntemi olarak eşbütünleşimin varlığını tahmin etmemekte, aynı zamanda araştırma alanını bulguların içsel kırılmalara duyarlılığına genişletmekte ve daha sonra bazı rejim değişikliklerini tahmin etmektedir. Genel olarak değerlendirildiğinde çalışmadan elde edilen tahmin içerikli sonuçlar birim değerinden oldukça daha küçük bir FH katsayısı bulmakta ve ekonominin dönüşüm ya da makro iktisadi kriz dönemleri ile ilişkilendirilebilen bazı yapısal kırılmaları gözlemektedir.

Anahtar Kelimeler: *Feldstein – Horioka (FH) Sorunsalı, Eşbütünleşim, Türkiye Ekonomisi*

Jel Kodları: *C32, C52, E21, E22, F41*

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INTRODUCTION

In today's ever – increasing globalized world economies, the macroeconomic links between the basic identifying properties of the countries with respect to their long run growth process need to be investigated by researchers. Among the many other different perspectives, the saving (S) – investment (I) identity on which macroeconomics has been constructed is one of the most attributed theoretical approaches to economic growth possibilities. Feldstein and Horioka (1980), hereafter FH, examine this relationship and find highly interesting estimation results. Their contribution to the literature is that the saving – investment relationship emerges in a different way when closed and open economy conditions are compared with each other. Under perfect world capital mobility, what can normally be expected is that domestic investments would not be closely related to the amount of savings generated in the home country. Because, rational economic agents tend to search for the best worldwide investment possibilities. That is to say, capital would tend to move towards more efficient regions all around the world (Hogendorn, 1998).

However, in a closed economy, returns from savings depend mainly on the course of marginal products obtained from domestic capital and thus reflect the question of whether this product offers a high enough reward to justify postponing consumption. This property of the S – I relationship makes domestic investments sensitive to national savings reflective of the policies pursued by policy makers. For the 1960 – 1974 sample period inclusive of a group of OECD countries, FH using cross – sectional analyses estimate a long term relationship that yields a strong correlation between national savings and domestic investments. Feldstein and Bacchetta (1991) give further evidence to these findings and conclude that the larger the national savings the higher the domestic investments. These researches, then, have encouraged numerious other studies that question whether the leading estimation findings of FH are one of the robust stylized facts with some stable broad regularities observed in the data. Indeed, Taylor (2002) applying to calibration methods in a historical perspective concludes that over a century the relationship uncovered by FH is valid as an indicator of capital mobility for a group of 15 countries. This issue of interest in open economy conditions thus requires further investigations, and the results extracted from these studies will help policy makers interpret the effectiveness of discreationay policies given the increasing importance of capital flows affecting national economies.

A growing literature explores the relationship between savings and investments. Under the assumption that there exists no transaction costs and no restrictions for capital mobility between the countries, national savings and domestic investments should be uncorrelated with each other. In this case, capital flows tend to run from economies yielding low returns towards the economies serving investors high returns. But, empirical results revealing a high correlation between national savings and domestic investments for many country cases lead FH to call this empirical regularity a puzzle in international economics. For example, the studies of Hoffman (2004) and Sinha and Sinha (2004) use intertemporal budget constraints and solvency models for a current account to estimate a cointegrating relationship between savings and investments. On the other hand, papers yielded by Özmen and Parmaksız (2003), Telatar et al. (2007) and Katsimi and Zoega (2016) examine how the structural diversifications in this estimation process affect the puzzle identified by FH. Also, Corbin (2001) expresses that the issues for different country sizes and country specific characteristics can cause the FH puzzle to emerge. Some authors such as Kim et al. (2005), Adedeji and Thornton (2008) and Dzhumashev and Cooray

(2016) propose sample selection problems and use of cross section data as a possible reason for the incorrect estimation in this puzzle and suggest new methodological approaches to cope with these difficulties. Another problematic issue in this context is resulted from the time series problems of the variables as emphasized by De Vita and Abbott (2002), Narayan (2005) and Ma and Li (2016). Further, Ford and Horioka (2017) allege that tariffs impede equalization of interest rates among the economies and can cause an obstacle for international capital mobility. Yentürk et al. (2009) and Özdemir and Olgun (2009) give papers that somewhat touch upon the Turkish economy.

This study tries to examine the saving – investment relationship for the Turkish economy as an emerging market that seems to lack enough national savings to finance domestic investments. For this purpose, the paper applies to some modern time series estimation techniques that enable researchers to reveal the sensitivity of the results to the breaks endogenously occuring within the sample period. The author aims to test whether such a stylized fact summarized below can fit to the Turkish economy empirically and such a task is the main motivation for the contruction of this paper. In section I, a simple model for this relationship has been given and section II introduces data for savings and investments. Section III is interested in estimating a long term stationary relationship with the Turkish data. Section IV is attributed to stability issues and for this purpose employs Gregory and Hansen (1996) and Hatemi – J (2008) tests. Finally, the last section reports concluding remarks summarizing the main findings obtained in the paper.

1. BASE MODEL

For any observation period t, the saving – investment approach involves estimating the following equation where both investments and savings in level forms are expressed as a share of aggregate output:

$$(inv)_t = \alpha_0 + \alpha_1 (sav)_t + u_t \qquad (1)$$

where $(inv)_t$ is the domestic investments in proportion to gross domestic product (GDP), $(sav)_t$ is the national savings in proportion to GDP, and u_t is treated as a white noise disturbance term. The coefficient α_1, ceteris paribus, aims to measure the mobility of capital. Following Feldstein and Barcchetta (1991), the magnitude of α_1 is called as 'saving retention' coefficient. That the coefficient α_1 is equal to zero would indicate no correlation between these aggregates with an inference of exact mobility of capital in terms of what FH's findings would predict.

On the other hand, if α_1 is equal to one, domestic investments would be equal to national savings just as one can observe in closed economies with a low mobility of capital. Econometrically, any stationary (or cointegrating) relationship with a long term endogenous variable coefficient vector $\beta = [1, -1]'$ would give strong support to FH puzzle. In the estimation process below, the *ex – ante* assumed endogeneity / exogeneity relationships between the variables are tried to be verified in an econometric sense.

2. DATA INFORMATION

In empirical modeling, data will be utilised for aggregate investments $(inv)_t$ and savings $(sav)_t$ in proportion to GDP to

reveal a long term relationship. Time series realizations are presented in Figure 1. The data are extracted from the Department of Strategy and Budget for the Presidency of the Republic of Turkey (www.sbb.gov.tr/ekonomik-ve-sosyal-göstergeler/, date of access: 15.02.2021).

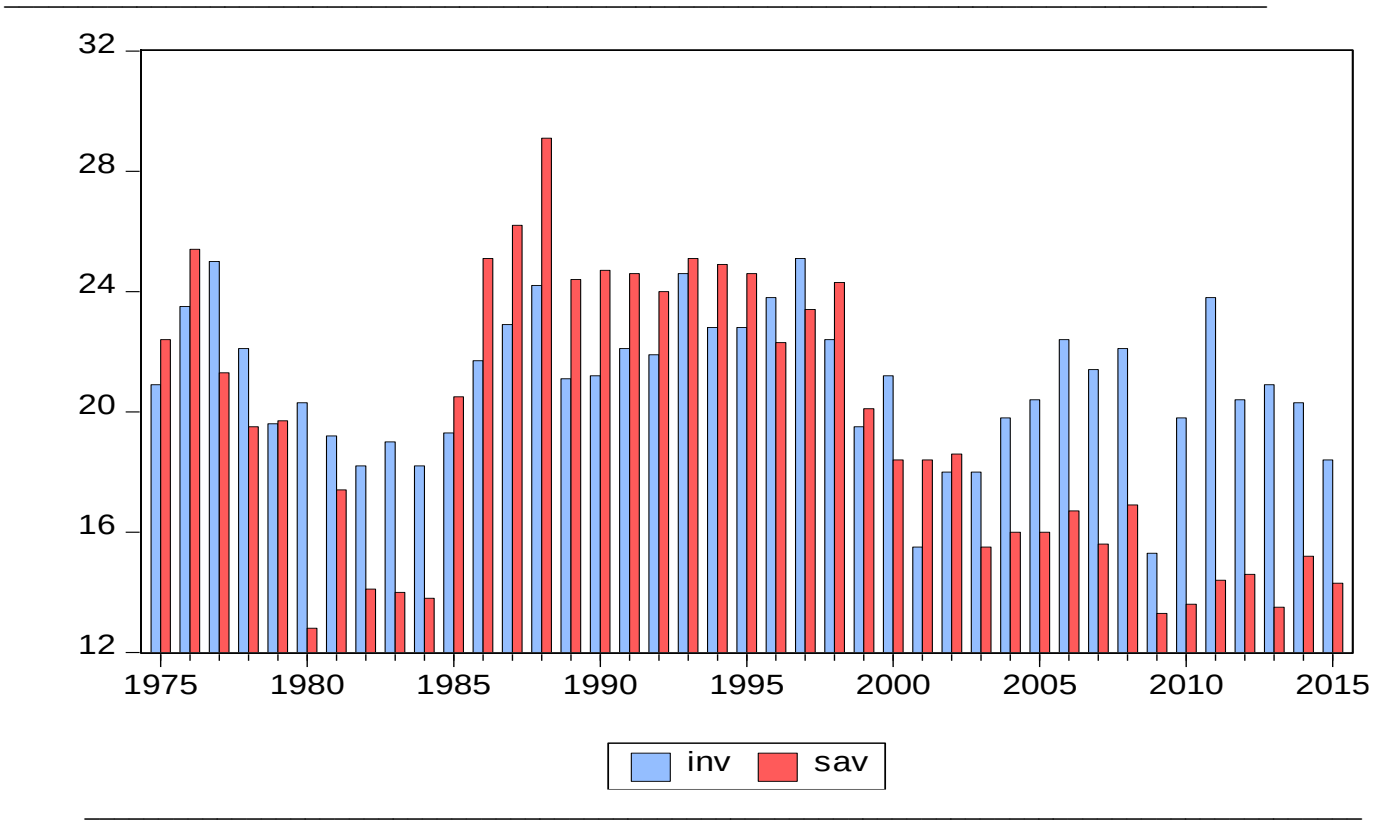

Figure 1: Graph of Data

Source: www.sbb.gov.tr/ekonomik-ve-sosyal-göstergeler/, date of access: 15.02.2021.

A cursory inspection using the recent published data for the sample period 1975 – 2015 points out that both ratios never exceeded the threshold value of 30% of GDP in the sample chosen for the economy. From the late –1970s till the mid – 1980s the economy witnessed a saving scarcity, which had a value much lesser than domestic investments, and then we see that savings started to rise again somewhat accompanied by a recovery in domestic investments. The 1990s seemed to be the most well – balanced periods between savings and investments, and both measures take a close value to each other. For the post-2000 period, it is noteworthy that the savings ratio behaves in a progressive way with a sharp decline similar to the late – 1970s, given an expenditure pressure coming from the domestic investment side of the economy. For the post – 2000 period, the Turkish economy has had a steadily unbalanced macroeconomic characterictic that leads to invest substantially over the volume of national savings.

Prior to proceeding to the time series estimation procedure, it is necessary to give some unit root knowledge of the variables. For this purpose, this paper follows Vogelsang and Perron (1998) assuming innovative and additive outlier models which allow the break to occur gradually and immediately, respectively. For Enders (2004), when the precise date of structural break is unknown, such a unit root estimation procedure will be more appropriate than the original unit root tests such as the augmented Dickey –Fuller test of Dickey and Fuller (1981). The results at the 5% significance level have

been summarized in Table 1:

Table 1: Vogelsang & Perron Tests Allowing for Breaks

Variables	Innovative Outlier Model	Additive Outlier Model	Inference
$(inv)_t$ -4.23	-4.35	$I(1)$	
$(sav)_t$ -2.72	-2.79	$I(1)$	
$d(inv)_t$	-8.80	-9.00	$I(0)$
$d(sav)_t$	-8.41	-8.56	$I(0)$
Crit. val. 5% -4.44	-4.44		

Source: Author's estimations using the programs EViews 12 and GAUSS 10.

In Table 1, the expression d in front of a variable name indicates the first difference of that variable. Estimations are the results of an unknown structural break in the sample period. It can be observed that the unit root null hypothesis in levels cannot be rejected for both variables. But, differencing makes them stationary, and enables us for employing cointegration between the level forms.

3. EVIDENCE FOR COINTEGRATION

For model estimation purposes, both the methodology of Engle and Granger (1987) and the multivariate cointegration approach suggested by Johansen (1995) using two likelihood test statistics will be applied to the data. The first one is a single equation residual based test using fully modified ordinary least squares estimation with $p-$values of selected correlogram of residuals squared for diagnostic control. At this point, Hansen's (1992) instability test results are also given by assuming the cointegration null against the no cointegration alternative using the statistic L_c.

Evidence for alternative hypothesis would mean parameter instability. For the second test, the Johansen methodology is applied to the data using the maximum eigenvalue ($\lambda-\max$) and trace ($\lambda-trace$) statistics. Critical values (cv) of Osterwald – Lenum (1992) are considered, and $t-$statistics of the normalized coefficients are given in parentheses:

Table 2: Engle-Granger Cointegrating Regression

FMOLS equation ($t-$statistics in parentheses)

$$(inv)_t = 15.41 + 0.29*(sav)_t \quad (2)$$
$$(3.66)\quad (9.91)$$

$R^2 = 0.37, Q(1) = 3.20(p-0.07), Q(4) = 4.68(p-0.32), Q(8) = 8.27(p-0.41), Q(20) = 22.59(p-0.31)$

H_0 : *Series are not cointegrated*

Dependent	*tau – stat.*	*p – value*	*z – stat*	*p – value*
$(inv)_t$	−4.75	0.00	−29.34	0.00
$(sav)_t$	−3.02	0.13	−15.00	0.10

Hansen parameter instability test (H_0 : *Series are cointegrated*) : *Lc – stat.* 0.15 p – *value* > 0.2

Source: Author's estimation using the programs EViews 12 and GAUSS 10.

Table 3: Johansen Multivarite Cointegration Test ($t-$statistics in parentheses)

Null Hypothesis	$r = 0$	$r \leq 1$
Eigenvalue	0.31	0.07
$\lambda - \max$ (0.05 cv)	14.54 (14.26)	2.72 (3.84)
$\lambda - trace$ (0.05 cv)	17.26 (15.49)	2.72 (3.84)

Unrestricted cointegrating coeff.

inv_t	sav_t
-0.67	0.19
0.05	-0.24

Unrestricted adjustment coeff.

$d(inv)_t$	1.27	0.07
$d(sav)_t$	0.33	0.63

One cointegrating equation

inv_t	sav_t
1.00	-0.28 (-3.27)

Adjustment coefficients

$d(inv)_t$	-0.85 (-3.94)
$d(sav)_t$	-0.22 (-0.80)

Residual serial correlation LM test LM(1) = 2.74 ($p-0.60$)

Source: Author's own estimations using the programs EViews 12 and GAUSS 10.

We must note here that the cointegration model of Johansen's methodology is estimated upon an unrestricted vector autoregressive (VAR) model using lag length 1 suggested by Akaike and Schwarz information criterions, and following Pantula principle, it includes only a deterministic constant. In Table 2 and Table 3, the model estimates significant saving retention coefficients. In Table 2, the Engle and Granger (1987) tests found the relevant coeffient as 0,29. In Table 3, after normalization to give the variables economic meaning, both the $\lambda - \max$ and $\lambda - trace$ statistics jointly indicate one cointegrating vector with a normalized coefficient 0,28. Further, the cointegrating relationship identified for Engle and Granger (1987) methodology can only be statistically significant in acceptable levels when the dependent variable is

assumed as inv_t. Supporting such a finding is that in Johansen's methodology the weak exogeneity can be rejected for the variable inv_t that enables the author to normalize upon this variable. However, the variable representing the savings to GDP ratio clearly has a weakly endogenous data characteristic. As for the diagnostic framework, there has been found no serious problem for residuals squared and no parameter instability problem leading us to question the no – cointegration relationship for Engle and Granger's (1987) equation. In a similar way, the data generating process in the estimation using Johansen's (1995) methodolgy yields no residual serial correlation problem at first order with annual frequency. These results increase the statistical consistency of our findings.

If we follow equation 3, it can be inferred that a 1% increase in national savings increases domestic investments only about 0,28%, which means that the national saving gap which is insufficient to finance domestic investments has been eliminated by use of external savings. Such a result in FH's findings clearly means a high capital mobility running from the world saving pool to the Turkish economy. Both testing procedures employed in this paper indicate that the cointegrating relationship between the variables must be normalized upon domestic investments. In other words, national savings seem to have an exogenous characteristic, which is a result supporting the explanations given in earlier sections.

4. SENSITIVITY TO ENDOGENOUS REGIME SHIFT

In the earlier section, the paper gives evidence for a cointegrating relation between national savings and domestic investments. However, there may be the problem of structural regime shifts for this model estimation. Let us apply the methodologies proposed by Gregory and Hansen (henceforth GH) (1996) and Hatemi – J (2008). The former is based on Engle and Granger 's (1987) cointegration and employs a residual based approach to test an unknown shift, while the latter test extends this approach by considering two possible endogenously determined unknown regime shifts. By assuming no cointegration null against the alternative of cointegration with a regime shift allowing the slope vector to shift, we can write down for $t = 1,...,n$:

$$\text{GH model: } y_t = \mu_0 + \mu_1 D_t + \alpha_0 X_t + \alpha_1 X_t D_t + \varepsilon_t \tag{3}$$

$$D_t = \begin{cases} 0 & \text{if } t \le [n\tau] \\ 1 & \text{if } t > [n\tau] \end{cases} \tag{4}$$

$$\text{Hatemi-J model: } y_t = \mu_0 + \mu_1 D_{1t} + \mu_2 D_{2t} + \alpha_0 X_t + \alpha_1 X_t D_{1t} + \alpha_2 X_t D_{2t} + u_t \tag{5}$$

$$D_{1t} = \begin{cases} 0 & \text{if } t \le [n\tau_1] \\ 1 & \text{if } t > [n\tau_1] \end{cases} \qquad D_{2t} = \begin{cases} 0 & \text{if } t \le [n\tau_2] \\ 1 & \text{if } t > [n\tau_2] \end{cases} \tag{6}$$

The unknown parameter $\tau \in (0,1)$ is used to specify regime change, and equals TB/n where TB is the break point. μ_0 is the constant before the shift, μ_1 and μ_2 are the changes in the constant at the time of the shift, α_0 is the slope coefficient before the regime shift, α_1 and α_2 are the change in the slope coefficient. For the GH model and Hatemi-J

model, the test statistics in equation (7) and equation (8) below are found for each $(\tau \in \mathrm{T})$ in the interval $([0.15n][0.85n])$ recursively by choosing and the minimum value. Below, Z_α^* and Z_t^* are the minimum Phillips test statistics, and ADF^* is the minimized ADF statistic:

$$\begin{aligned} Z_\alpha^* &= \inf_{\tau \in T} Z_\alpha(\tau) \\ Z_t^* &= \inf_{\tau \in T} Z_t(\tau) \\ ADF^* &= \inf_{\tau \in T} ADF(\tau) \end{aligned} \tag{7}$$

$$\begin{aligned} Z_\alpha^* &= \inf_{(\tau_1,\tau_2) \in T} Z_\alpha(\tau_1,\tau_2) \\ Z_t^* &= \inf_{(\tau_1,\tau_2) \in T} Z_t(\tau_1,\tau_2) \\ ADF^* &= \inf_{(\tau_1,\tau_2) \in T} ADF(\tau_1,\tau_2) \end{aligned} \tag{8}$$

The autoregressive order of the models are based on the Bayesian information criterion. 5% critical values (cv) consider one regressor case (*m* = 1) and have been taken from Gregory and Hansen (1996, Table 1) and Hatemi – J (2008, Table 1). The results with the maximum lag 4 are presented in Table 4:

Table 4: Cointegration with Regime Shift

	ADF^*	*cv*	Z_α^*	*cv*	Z_t^*	*cv*
GH model	-6.72	-4.95	-46.35	-47.04	-10.93	-4.95
Break dates	(1980)		(1984)		(1984)	
Hatemi-J model	-6.05	-6.02	-40.45	-76.00	-6.20	-6.02
Break dates	(1999, 2002)		(1994, 1998)		(1994, 1998)	

Source: Author's own estimations using the programs EViews 12 and GAUSS 10.

The results reveal that in both GH and Hatemi – J tests the null hypothesis is rejected for ADF^* and Z_t^* statistics that point out a regime change. In GH's test, the relevant points to shift the parameters derived from the findings of FH are estimated in 1980 as a single break point, 1999 and 2002 as double break points occuring in the data generation process. In Z_t^* test, these shifts are found in 1984 s a single break, 1994 and 1998 for double breaks. We can easily observe in Figure 1 above that the dates found by GH's test coincide with the dates of structural transformation of the economy at the first half of the 1980s leading the saving rates again to an upward trend. Also, the dates found by Hatemi – J test are either the pre – and post – macroeconomic crises dates of the early – 2000s or the 1994 economic crisis period and 1998 period of the economy. The former dates coincide with the beginning of ever – decreasing saving rate in the economy, while latter dates represent the macroeconomic crisis periods of the economy with a low growth rate of gross national product with 3,9 percent when compared with the average of 7,8 percent of the previous three years. Thus, these results

strongly mean regime shifts in the economy for aggregate savings and investments relationship, and require sub – period estimations to test sensitivity of the findings obtained from whole period to the regime shift dates. But, such analyses also necessitate using longer time spans for estimations of annual frequency data, and for this reason this task will be left to the future researches. But, at this point, it must be specified that the results obtained from saving and investment analyses from the Turkish economy can be appreciated cautiously due to the regime change sensitivity of the data.

CONCLUSION

In international macroeconomics, one of the stylized facts that the researchers often observe empirically is the high correlation between national savings and domestic investments. Feldstein and Horioka (FH) (1980) argue such a relationship by relating it to the mobility of capital and examine how increases in national savings tend to finance domestic investments. Under perfect world capital mobility, what can normally be expected is that domestic investments would not be closely related to the amount of savings generated in the home country due to the fact that rational economic agents tend to search for the best worldwide investment possibilities.

Given that inferences in an extensive related literature about international capital mobility derived from the S – I relationship alone remains appealing, the paper examines the validity of this relationship by employing data from the Turkish economy. Not only does it take account of the estimation result that there indeed exists evidence of a cointegration between national savings and domestic investments, but it also enlarges the research area to the sensitivity of findings to the endogenous breaks. The results obtained from alternative estimation techniques indicate that the saving retention coefficient in general tends to take a value around 0,28. In FH sense as a key policy inference from this paper, this clearly means the occurance of high capital mobility. Such a situation will render the economy in closing the saving gap, which is insufficient to realize the domestic investments required for financing the macroeconomic growth process. Thus, this result does not support the literature on a puzzling relationship between national savings and domestic investments, at least for the Turkish case, when the capital mobility assumption is fulfilled. Rather, by also considering the contemporaneous developments in estimation techniques with endogenous breaks, a high capital mobility assumption that helps financing the course of domestic investments has a critic inference that can be obtained from this small empirical paper.

Further, the findings are unable to reject the weak exogeneity of aggregate savings in the economy while accepting endogeneity of aggregate investments in the model constructed. What is more interesting in our results is that the sensitivity to endogenous regime shift analyses points out serious regime shifts in the economy for aggregate savings and investments relationship that requires sub – period estimations to test sensitivity of findings obtained from whole period. Thus, the results obtained must be appreciated cautiously due to the regime change sensitivity of the data. But, such a task has been left to the future researches. Further, that the paper is organized as an empirical application on the Turkish economy, which can be considered as a limitation for this study, requires more detailed theoretical background in more comprehensive research papers in the future studies.

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