FELDSTEIN-HORIOKA PUZZLE: BRIC COUNTRIES EXAMPLES

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Abstract
In this study four countries which are named BRIC (Brazil, Russia, India, China) relation was examined between savings to GDP and investments to GDP. Previous studies have discussed investment and saving relationships. The Feldstein-Horioka study concludes that the correlation between savings and investment is large and that there is low capital mobility. In globalizing economies capital mobility is increasing. Therefore, according to the obtained data, it will be tried to determine saving and investment amounts in GDP ratio of these countries. The study results support the Feldstein-Horioka Puzzle. A long run positive and significant relationship between savings and investment has been identified.

Keywords: *Investment, Savings, Feldstein-Horioka Puzzle, BRIC*
Jel Classification Codes : E22, E21, C23

INTRODUCTION

The existence of the correlation between the investments and savings of the countries and the high level of this present relationship are known until this time. Feldstein and Horioka (1980) reported that the existence of high correlations between savings and investments in their study is due to low capital mobility. According to this study, it may be seen as the opposite in globalizing economies. Accordingly, the liberalization of emerging trade and economies among national economies may lead to a reduction in savings and investment relations. Because capital mobility is increasing in globalized economies. In this study, the savings-investment relationship of countries called BRIC (Brazil, Russia, India and China), which recognize themselves in terms of

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growth and economic growth has been investigated. Also theFeldstein-Horioka Puzzle has been examined. As noted by Frankel and MacArthur (1988) capital mobility among global industrialized countries has been at a high level. This proves that the capital movement of the industrialized countries is high in the global sense (Sachs, 1981).After the concept of Feldstein-Horioka Puzzle, many studies have been carried out in support of this study (Vos, 1988;Jansen, 1997). Moreover, the opinion of the industrialized countries put forward in the Feldstein-Horioka Puzzle that the relation between saving and investment (GDP ratios) is high has been maintained for many years. This means that scientists believed in the acceptability of this thought. Subsequent studies claim that savings and investment variables are cointegrated variables. In Miller (1988) 's study, the long run relationship of savings and investment is addressed by peer integration techniques. In the study, Kónya (2015) examined the saving investment relationship for BRICS (Brazil, Russia, India, China and South Africa) countries. Ketenci (2012) study tested the validity of Feldstein-Horioka Puzzle for 23 European countries. As a result, the validity of Feldstein-Horioka Puzzle was accepted in this study for the period 1995-2009. In Ketenci's study, analyzes such as structural fracture test and cointegration approach were applied.

Ho (2002) described in his study the Feldstein-Horioka Puzzle and his analysis of the studydone earlier in Kroll's study of why the result of the 1996 study is low-coefficient. He stressed that it is very important to decide which analysis should be applied in a study. Some researchers have found that savings and investment variables in their studies tend to be long run cointegrated variables (Jansen and Schultz, 1996, Coakley and Kulasi, 1997, Gundlach and Sinn, 1992, Mamingi, 1997). Chang & Smith (2014) has developed a DSGE model for Feldstein-Horioka Puzzle. Accordingly, this model explains the high saving-investment relationship in the developed countries and the low relation in the undeveloped countries. The validity of Feldstein Horioka Puzzle evaluated the results of using some regression estimators to test in his study (Chu, 2012). It can not be said that Feldstein-Horioka Puzzle is invalid according to this study. Because in the study some analysis of the researcher's anxieties about the reality of some data and the analysis of the construction has been revealed.

In their study, Ma & Li (2016) set up a time-dependent cointegration model by referring to Feldstein-Horioka Puzzle and evaluated the results of the analysis. Accordingly, saving-investment relationships are examined within this model. According to the results of the analysis, the saving coefficients were found to be higher in the developed countries compared to the undeveloped and developing countries. Some researchers use cointegration variables to test the hypothesis of the saving-retention coefficient and have found supportive findings in Feldstein-Horioka Puzzle (Caporale, Panopoulou and Pittis, 2005). Drakos, Kouretas, Stavroyiannis, & Zarangas (2017) studied the saving-investment relationship in relation to the data of 14 developed EU countries. According to the results of the analysis, it has been stated that the long run saving changes according to the investment-related capital mobility. He also mentioned that the error correction parameters are a great asset for this issue. Including the 1960s and the following 36 years, there are also studies using cointegrated variables of savings and investment variables for Greece data (Pelagidis and Mastroyiannis, 2003). They have also observed that the savings reserve coefficient decreases at certain rates.

A study is noteworthy here. Contrary to the studies that point out that the saving retention coefficient mentioned above is significantly reduced, Krol (1996) developed a panel technique. On the contrary, Gomes, Ferreira and Filho (2008) examined whether the relation between savings and investment variables could change for any period of time or for a particular period. Investigations that show a similar savings-investment relationship due to certain economic relationships between countries are usually cross-sectional surveys. This is a strong assumption. Because every country has enough capital to control and transfer capital at a certain level. In most of the increasingly industrialized national economic markets, integration has emerged because of the liberalization of markets (Ozmen and Parmaksiz, 2003). Therefore, the saving retention criterion can change over time without stagnation. In the study of Ozmen and Parmaksız (2003), it was found out that in 1979, with the abolishment of foreign currency trading control, the saving investment relationship was also left behind. In the study of Behera (2015), he interpreted BRICS countries' savings investment relationship between 1970-

2013. In some studies, it is claimed that the savings-investment relationship varies due to the fluctuation of the floating exchange rate on weekends (De Vita & Abbott, 2002). In some studies the validity of the Feldstein-Horioka Puzzle has been tested (But & Morley, 2017). As a result of the analysis, according to OECD data, there was a record low in saving-investment relation in 2008 crisis, but since 2008 crisis, saving investment relationship has been found to be getting stronger.

According to Goldman Sachs, a US based multinational investment bank established in 1869 and headquartered in New York, the BRIC economies are expected to have a G6 in 2025 (US, Japan, France, Germany, Italy and United) (Pao & Tsai, 2010).Because of the high population density in India and China, and because of the low labor costs, China and India are positioned to confront many countries around the world with their economic growth and development rates.Russia, on the other hand, has the advantage that its current position in these fields is due to its natural resources and social, political, economic, technological and military developments. Brazil, one of the BRIC countries, has gained mastery over the US's global idea of property law. With the patent law created in 1997, drug costs have been reduced, and the new law and the ability to develop local manufacturing capacity and expertise for specific drug products ending their patents have been introduced. Such developments highlight Brazil's economic position in the world (Bird & Cahoy, 2007).

Contrary to the Feldstein-Horioka study, there are studies that claim that the relation between saving / GDP and investment / GDP is not a sign of capital mobility. In Behera (2015) study, Obstfeld (1986) stated that savings / high relationship between GDP and investment / GDP may be a sign of economic growth. In the same study, it is mentioned that McClure (1994) 's financial and monetary policies are well coordinated by monetary authorities and that the relationship between savings / GDP and investment / GDP ratios is a sign of high capital mobility.

In this study, it was aimed to determine the course of this relationship with the saving investment relation of BRIC countries by referring to the Feldstein-Horioka Puzzle which is mentioned in many parts about this topic. According to this, the saving-GDP ratio and investment-GDP ratio data of BRIC countries (Brazil, Russia, India and

China) are used between 1994-2015. With this study the first contribution is aimed at providing the literature on Feldstein-Horioka Puzzle together with this study is to test the validity of Feldstein-Horioka Puzzle in the rapidly developing countries. The second contribution is to determine the long run short run relationship with the cointegration test in BRIC countries. In this study, we first mentioned the previous studies in the literature. In the second part, the sample group included in the study is given information about the data and the analysis applied. In the third part of the study, the results obtained are tabled and examined. In the last part, the results related to the study were interpreted and suggestions for researchers and firms were presented.

1.   METHODOLOGY

In the study, savings-GDP ratios and investment-GDP ratios of BRIC countries between 1994 and 2015 were used for analysis. In the study of Feldstein & Horioka (1980), these two ratios were formulated as follows:

$$\frac{I_i}{Y_i} = \propto \ + \beta \frac{S_i}{Y_i} + \varepsilon_i$$

Eviews 9.5 and Stata 14.2 package program was used in analyzing the data in the study. According to this, between 1994 and 2015, it was determined whether there is a relation between the investment / GDP ratios of the saving / GDP ratios of the mentioned countries. The data is derived from the World Bank official website (The World Bank) and from Quandl (Quandl: Financial, Economic and Alternative Data) websites, where financial, economic and alternative data are available. In the study, the data was analyzed with the panel data system. In order to avoid the problem of seasonality in the study, the data are annually analyzed.

2.   RESULTS

Before the BRIC countries are analyzed to determine the relationship between savings/GDP and investment/GDP ratios, in order to have an idea about the data it will be useful to understand the structure of these rates that countries have. Table 1 below

shows the largest, smallest, average and standard deviation of savings/GDP and investment/GDP rates on a country basis from 1994 to 2015.

Table 1: Savings / GDP and Investment / GDP Statistics of BRIC Countries

Country		Max	Min	Mean	Std. Dev.
Brazil	I/GDP	24,173	16,857	19,405	1,986
	S/GDP	19,664	10,595	15,404	2,586
Russia	I/GDP	25,245	14,038	20,487	2,849
	S/GDP	36,154	17,159	27,814	4,057
India	I/GDP	39,577	23,683	30,804	5,547
	S/GDP	41,001	26,918	32,909	4,327
China	I/GDP	48,006	34,328	41,362	4,465
	S/GDP	51,966	36,459	45,259	5.355

Between 1994-2015

The correlation graph for the determination of the relationship between savings / GDP and investment / GDP ratios of BRIC countries is given in Figure 1 as a result of the correlation analysis.

Figure 1: Savings / GDP and Investment / GDP Trends of BRIC Countries
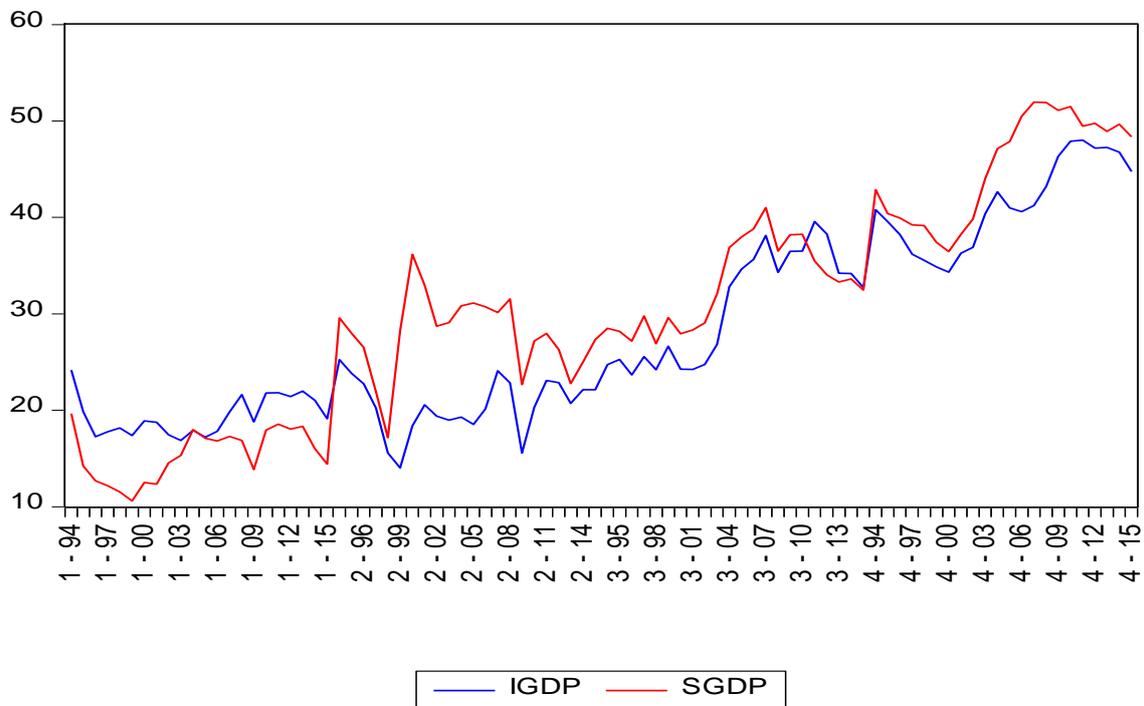
Between 1994-2015

The horizontal axis according to Fig. 1 is Brazil, Russia, India and China which are denoted by 1, 2, 3, 4 and abbreviated as BRIC respectively. The red line represents the savings / GDP ratio, while the blue line represents the investment / GDP ratio. The correlation coefficient takes a value between -1 and +1. Correlation coefficient of -1 is a perfect relation, 0 means it is irrelevant. If the coefficient is less than 0,30 it is weak, between 0,30 and 0,70 is medium, and if it is 0,70, it is highly correlated (İslamoğlu & Alnıaçık, 2016). As a result of the correlation analysis of these two variables, the correlation coefficient is 0.898. Accordingly, a high level of association has been identified.

After this point, the unit root test was applied to determine the stability of the variables. According to the results obtained with this test, if the probability values related to the data are below the significance levels, it is determined that the data are not stable if it is greater than 0,1. According to this, in the study, LLC test that Levin, Lin, & Chu (2002) developed. The results of the analysis are shown in Table 2.

Table 2. Levin Lin Chu Unit Root Test Results at a Level

VARIABLES	Constant			Constant and Trend		
	Statistic (Unadjusted t^*)	Statistic (Adjusted t^*)	P-Value	Statistic (Unadjusted t^*)	Statistic (Adjusted t^*)	P-Value
SGDP	-3,0038	-0,7951	0,2133	-3,3019	-1,4463	0,9260
IGDP	-3,2528	-0,9466	0,1719	-5,7557	-0,7012	0,2416

Abbreviations: SGDP (Savings/GDP) IGDP (Investment/GDP) ***0,01 significant at the level of %1 **0,05 significant at the level of %5 *0,1 significant at the level of %10.

Table 2 shows the significance values for the SGDP and IGDP variables. On the left side of the table is constant, while on the right side is the constant and trend unit root test results. According to this, when the probability values of both variables are

considered, it is seen that they are both stable and not stationary and trendy. That is, both variables contain unit roots. In order to ensure the stability of the variables, the first difference was taken and the LLC test was applied again. The results of the LLC test for the first difference variables are shown in Table 3.

Table 3. Levin Lin Chu Unit Root Test Results at First Level

VARIABLES	Constant			Constant and Trend		
	Statistic (Unadjusted t^*)	Statistic (Adjusted t^*)	P-Value	Statistic (Unadjusted t^*)	Statistic (Adjusted t^*)	P-Value
SGDP	-5,8269	-2,0463	0,0204 **	-5,8564	-1,9644	0,0247**
IGDP	-7,3760	-3,8389	0,0001 ***	-7,2416	-3,2087	0,0007***

Abbreviations: SGDP (Savings/GDP) IGDP (Investment/GDP) *******0,01 significant at the level of %1 ******0,05 significant at the level of %5 ***0,1 significant at the level of %10.

As a result of the LLC unit root test for the variables according to Table 3, the probability values were found to be crude stable and stationary in the constant and constant and trend . According to this, IGDP and SGDP variables are stationary in the first difference, ie they do not contain unit roots.

In the study, ARDL analysis was conducted to determine long and short run relationships of relations. In the Nkoro and Uko (2016) study, it refers to the ARDL approach as an assumption that there is only one relationship between the dependent variable and the exogenous variables in a reduced form. According to this, it is obtained by calculating the long-run relationship between the variables first determined in the ARDL analysis (Nkoro & Uko, 2016). Below are the results of ARDL analysis of investment/GDP and savings/GDP panel data.

Table: 4 ARDL Analysis Results of Investment / GDP and Savings / GDP Data of BRIC Countries Between 1994-2015

Variable	Coefficient	Standart Error	T- Statistic	Prob.
Long Run				
IGDP	0,645	0,093	6,902	0,001***
Short Run				
COINTEQ01	-0,394	0,089	-4,439	0,001***
D(SGDP(-1))	0,309	0,078	3,942	0,001***
D(SGDP(-2))	0,202	0,218	0,927	0,358
D(SGDP(-3))	0,138	0,188	0,737	0,465
D(IGDP)	0,538	0,076	7,052	0,001***
D(IGDP(-1))	-0,470	0,097	-4,869	0,001***
D(IGDP(-2))	-0,066	0,073	-0,905	0,370
D(IGDP(-3))	0,047	0,260	0,180	0,858
C	4,78	1,549	3,086	0,003***

*** significant at 0,01 level ** significant at 0,05 level ** significant at 0,1 level

Standard error, coefficient, t values and significance level values of the savings/GDP and investment/GDP variables in the table are shown. According to the table, long run relationship between saving / GDP and investment / GDP ratios of BRIC countries was found at a significance level of 0,01. Again, the relationship between the same variables at the level of significance of 0,01 was determined in the short run. Looking at the coefficient values in the table, it can be said that in the long run, one unit increase in saving will cause an increase of 0,645 units in investments. In the short run, it is seen that there is a significant cointegration relationship between the variables in the study (p=0,001). There is also a significant short run relationship between IGDP and SGDP variables according to the first difference (p=0,001). According to the first difference, a unit increase in the SGDP would result in an increase of approximately 0,3% in the IGDP.

3.   CONCLUSION

In this study, the relationship between savings / GDP and investment / GDP ratios of the BRIC countries in 1994-2015 as a sample of the study by referring to Feldstein-Horioka Puzzle was analyzed and the results are shown. In order to avoid the problem of seasonality, the data are annually analyzed and analyzed by panel data technique. The high correlation between investment/GDP and savings/GDP in Feldstein-Horioka Puzzle is claimed to be a sign of low capital mobility. However, the relationship between investment / GDP and savings / GDP ratios in an environment of increasing capital mobility between globalizing economies and countries has been shown to be influenced by the coordination of monetary and fiscal policies of the monetary authorities or the study of Obstfeld (1986) can be said to be a demonstration of economic growth.

In the study, data from four countries called BRIC (Brazil, Russia, India and China) were analyzed and the analysis results were evaluated for these four countries. The results of the study do not support the judgement of Feldstein and Horioka (1980) that the high correlation between investment / GDP and savings / GDP, expressed as Feldstein-Horioka Puzzle, is indicative of low capital mobility. In this study, the results obtained may be different because the number of countries included in the analysis is less qualitative.

Accordingly, in the future study to be undertaken in this regard, researchers' studies involving BRIC countries with larger numbers of samples may lead to different results. In the study, the results of the data for the countries of 1994-2015 were analyzed and interpreted. In subsequent studies, providing data containing larger time periods that may be available may allow more general results to be achieved. As the BRIC countries are seen as an economic threat by these countries to register faster growth and growth than those in the US and EU countries, the movements in various economic competitiveness may differ from the economic data of the countries in the other group.

Assuming that long run savings can turn into investment, long run savings in developing countries can be considered suitable for investment but not enough when compared with developed countries. Because coefficient number is 0,645 is lower than 0,7. İslamoğlu & Alnıaçık (2016) accept 0,7 value as a high correlation coefficient.

Accordingly It can not be said there is a high correlation between investment and savings in the long run. In the short run, it is seen that the relation coefficient is lower than long run. From this point of view, it can be said that in the short run, which has a higher relation because of the higher savings and investment relation coefficient in the long run, it has a lower relation because the coefficient is lower than the long run.

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