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REVISITING OF FELDSTEIN- HORIOKA PUZZLE: AN EMPIRICAL ANALYSIS

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Abstract

The relationship between saving and investment attracts a great majority of macroeconomists. Briefly, Feldstein- Horioka puzzle has been observed as a puzzle, which is related with saving and investment in open macroeconomics. Feldstein-Horioka puzzle argues saving and investment relation under international capital mobility. If internationally capital is highly mobile, this means that relationship between saving and investment is weak. If not so, capital mobility is limited and then saving- investment relation is so powerful. Under perfect capital mobility, it is expected that domestic investment should not finance fully domestic saving. However, Feldstein- Horioka's (1980) findings show to rebut of this presume. This paper shows extensive literature review for Feldstein- Horioka puzzle especially last two decades. Because literature separates two streams. One group of them try to explain correlation between saving and investment under capital mobility to support Feldstein- Horioka's finding. Other group of them prove Feldstein- Horioka's finding inappropriate. This study aims to investigate validity of Feldstein- Horioka hypothesis for 5 big European developed countries: Germany, England, France, Italy and Spain. Findings show that saving retention coefficient is low then it implies capital mobility between countries are high. Finally, Feldstein- Horioka hypothesis is valid but weak form.

Key Words: Feldstein- Horioka Puzzle, Capital Mobility, Panel Data.

Jel Codes: F21, F32

Introduction

One of the important topic in macroeconomics is economic growth and development. In this sense, saving and investment is like a driving force of economic growth and development. In a closed economy, investments have to be equal to the savings. However, in an open economy, this situation changes. In an open economy, liberalization of the capital or mobility of the capital across countries have to be taken into consideration. As the mobility of capital increases, we think that the relation between domestic savings and investment deteriorates. In general, this assumption is expected to happen, especially after 1980 in the effect of the liberalization of capital. However, Feldstein-Horioka puzzle, which is, defined as one of the six major puzzle in international macroeconomics by Obstfeld and Rogoff (2001) states that in contrast

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to economic theory empirical findings indicate a strong relation between domestic saving and investment rates. It is a big challenge for the general expectations to this situation. Briefly, Feldstein- Horioka (1980) finds saving and investment highly correlated and this finding shows low level of capital mobility.

The remaining part of the paper is designate as follows. First, we explain Feldstein-Horioka puzzle and then present empirical literature especially for last two decades. Second part of the study presents model and data. After this title, we offer estimation result and findings. Finally, we concludes study.

Feldstein- Horioka Puzzle

In economic sense, under perfect capital mobility, people should invest their savings in countries, which offer higher return to them. Moreover, domestic investments should be financed by global rather than domestic capital markets. As a result the relationship between domestic savings and domestic investment should cease to exist. However, this idea is first challenged by Feldstein and Horioka's (1980) original study. They test the relation between domestic saving and investment rates for 21 OECD countries for the period 1960-1974 where they find a strong relationship between the variables. They use pooled cross section regression in order to estimate the following equation (Feldstein and Horioka, 1980:318):

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

In this equality *I* represents domestic investment, *S* represents domestic savings. Both *I* and *S* are then divided by *Y*, which is GDP. In this equation Feldstein and Horioka (1980) are especially interest in estimate of the β coefficient. Coefficient β implies saving-retention coefficient and shows degree of capital mobility. If the estimate of β coefficient is zero or close to zero this confirms the standard economic theory since it indicates that in the presence of capital mobility relationship between domestic savings and investment rates deteriorates. However in their study Feldstein and Horioka (1980) find that β coefficient is 0,89 in other words close to 1. This finding contradicts with the standard economic theory. Feldstein and Horioka (1980:321) stress this result on their paper and try to find why this is so with no avail. Feldstein and Horioka's (1980) study displays that at a low level of capital mobility, the correlation between saving and investment should be high. However, capital mobility has increased gradually after 1980s between countries. Because of that Feldstein- Horioka's (1980) findings have been interrogated.

Feldstein- Horioka's (1980) study has drawn criticism from the point of capital liberalization. After this study, Feldstein (1983) publishes another paper, which again is related to this puzzle. Indeed, this paper is an expanded version of the Feldstein and Horioka (1980). First, the ending date of the period analyzed is extended from 1974 to 1979. Second, Feldstein (1983) incorporates relationship between net foreign investment and domestic investment to analysis. New regression equation which presents in Feldstein(1983) is changed into the form below:

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

Feldstein (1983) also finds results similar to the previous study. Both of these studies indicate that although high capital mobility is observed the strength of the relation between domestic savings and investment rates cannot be gainsaid for the benefit of the standard economic theory. It causes great debates and disputes in the literature. As a result of these debates, both theoretical and empirical literature have emerged. Because of that economists have entitled this issue as a puzzle or paradox. Some of the empirical studies support Feldstein- Horioka's findings; some of them not. Next section, we present these studies in line with our purpose. This means that we offer only empirical literature.

Empirical Literature

Feldstein- Horioka puzzle sets forth an important contradiction between the standard economic theory and empirical observations which can be formulated in the form of a simple question: if capital is perfectly mobile, why saving and investment still relate to each other strongly? This simple question has lead great many economists to puzzle over it and hence a large literature arose. There are mainly two strands in this literature. First strand of literature consists of studies that investigate the existence and the strength of the relation for various countries or groups of countries and various time periods. The second strand is basically the studies that try to understand howcome this contradiction in between economic facts and theory arises.

This study focuses especially last two decades. Because of the saving and investment relation is an important for policy implementation, investigation of the policy changes impact on the saving and investment relation (accordingly Feldstein- Horioka puzzle) is also crucial point. In the light of the Feldstein- Horioka puzzle, many economists have investigated this issue empirically. Some of these economist findings show that Feldstein- Horioka puzzle is not valid. Under capital mobility, these studies show that saving and investment are not related to each other in the long-run (Caprio and Howard

(1984); Tang and Lean (2011); Mastroyiannis (2007); Özdemir and Olgun (2008)). Özmen and Parmaksız (2003a), aim to test Feldstein-Horioka Puzzle validity for UK under major policy change in other words structural breaks. Under this assumption, they find that Feldstein-Horioka puzzle is invalid. Özmen and Parmaksız (2003.b) investigate Feldstein-Horioka puzzle existence for French too when there is presence of the structural breaks. They find that Feldstein-Horioka puzzle does not exist. Other study, which allows structural breaks, is made for EU members by Ketenci (2012). She finds that under structural breaks Feldstein-Horioka puzzle does not exist. After this study, Ketenci (2013) tests FH puzzle under structural breaks for OECD countries. In addition OECD countries, she creates sub-groups from OECD countries: G7, NAFTA and EU15. Exception of G7 countries, she finds Feldstein-Horioka puzzle does not exist when there are vicinity of structural breaks. Kejriwal (2008) investigates Feldstein-Horioka puzzle consideration with non-stationary properties and instabilities of variables. He finds that FH puzzle is invalid. However, some economists assert empirically that Feldstein-Horioka puzzle is valid. Narayan (2005) tests Feldstein-Horioka puzzle for China over the periods between 1952 and 1998; 1952 and 1994. Finding of Narayan shows that saving and investment are highly correlated. Some of these studies, find that Feldstein-Horioka puzzle is valid but in a weak form. It means that relationship between saving and investment falls over time. Papapetrou (2006), gets similar findings with Narayan (2005). This paper shows correlation between saving and investment weakens during financial liberalization term for Greece with consideration structural alter. (Kumar, Fargher and Webber (2012); Ho (2002); Caporale, Panopoulou and Pittis (2005); Fouquau, Hurlin and Rabaud (2008); Kumar and Rao (2011)). Akkoyunlu (2020), aims to investigate Feldstein- Horioka puzzle for Turkey consideration with time-series properties of data and structural breaks. She tests this puzzle for whole period of 1950- 2017 and for two sub-periods: 1950-1989; 1990-2017. The results obtained display that Feldstein- Horioka hypothesis is valid for whole period (1950-2017) and sub-period (1950-1989) but not for the other subperiod (1990- 2017). The reason is that whole period and first sub-period are restricted capital mobility period for Turkey. Capital mobility is perfect during second sub-period.

Mastroyiannis (2007) claims that policy regime changes, especially financial field, create structural break in data. Because of this, empirical evidence may be biased. Ho (2002) points out that estimation technique (model and method) may affect result. Kumar and Rao (2011) stress that results of statistical methods utilized to investigate FH puzzle are distorted and find strong relation where there is almost none. Some economists assert that saving and investment series show non-linear dynamics properties (Fouquau, Hurlin and Rabaud (2008)); in addition to this both series also show non-stationary and instability properties (Kejriwal (2008)). Other factors that create suspicions about Feldstein- Horioka puzzle are sample selection and variables' measurement (Apergis and Tsoumas, 2009: 70-72).

Model and Data

Aim of this study analyzes validity Feldstein- Horioka puzzle for 5 big European developed countries, which represent an important part of global wealth. Because of that investigation saving and investment relation is crucial for these countries. We use static panel data analysis in this study. Panel data analysis is basically a combination of cross-section and time series analysis. when considered from this point of view, panel data analysis includes both time and cross-sectional dimensions. However, heterogeneity remains in the forefront of this analysis; in other words panel data analysis focuses on cross-sectional variation (Greene, 2012:345). Therefore, the intended use of panel data analysis obtains a consistent estimator in the presence of cross-section-specific effects (Wooldridge, 2002: 247-248).

In panel data models, we assume that we have N cross-sections and T observations in each section. We separate panel data models as static and dynamic. We define panel data model as follow:

$$y_{it} = x'_{it}\beta + \delta'_i\alpha + \varepsilon_{it}$$

x_{it}, is a term that doesn't include constant term and contains K pieces variables. Cross-sectional heterogeneity or individual effect is expressed by $\delta'_i\alpha$. Also static panel data separates two title: fixed effect and random effect model. The fixed effects model refers to a situation where the data collection process is not random. The random effects model represents a situation where the data collection process is random (Baltagi, 2008:14-17). The test developed by Hausman (1978: 1251) focuses on the relationship between the explanatory variables and the error term. With the help of this test, we can choose optimal estimator.

This study investigates the Feldstein- Horioka puzzle using the original regression equation in Feldstein and Horioka (1980) paper, employing panel data analysis of investment and saving rate series. The regression equation is estimated using two series: gross national investment as a percentage of GDP and gross national savings as a percentage of GDP. Data is gathered form World Bank database. The frequency of the empirical analysis is annual and the period is from 1975 to 2020. Furthermore data set consists of 5 big European developed countries. The countries whom domestic investments and savings series are employed in this study are Germany, England, France, Italy and Spain.

Estimation and Findings

Economic theory mentions the relation of various series in short terms, long terms and even middle terms. However how long short term is or what a long term is always

remains ambiguous. In this paper, we don't prefer models which distinguish short-term or long-term. However, we prefer to use panel data analysis.

We denote gross national investment-gdp ratio and saving-gdp ratio as IY and SY, respectively. We estimate static panel data model both fixed effect and random effect form. The results obtained are presented in the table below:

Panel Estimation Results				
Dependent Variable: IY				
	Fixed Effect Model		**Random Effect Model**	
Variables	Coefficient	P- value	Coefficient	P- value
SY	0.36	0	0.37	0
Constant	0.14	0	0.14	0
Number of Obs.	230		230	
Number of Groups	5		5	
*Heteroscedasticity and autocorrelation problem are taken into account.				
Hausman Test Value: 0.13 (p- value: 0.72); We don't reject null hypothesis. It means that both estimatior can be used.				

IY is dependent variable and SY is independent variable in line with Feldstein-Horioka (1980). Estimation results show us investment-gdp ratio (IY) and saving-gdp ratio (SY) positively correlated. Saving retention coefficient, in other words SY's coefficient, is found to be 0.36 that is low. SY that implies saving retention coefficient is low and this means capital markets integrated to each other. It refers capital mobility between countries are high. Implication of this result display us, capital mobility is high and domestic saving doesn't greatly depend on domestic investment. In other words; we can say that domestic saving cannot be regarded as complete constraint on domestic investment. In the light of this results, Feldstein- Horioka hypothesis is valid but weak form.

Conclusion

Feldstein- Horioka (1980), assert that domestic saving and domestic investment are highly correlated. Some of the studies, which are performed for the period of high capital mobility by scholars, show us these two macroeconomic variable highly correlated to each other but some of them not. These results present Feldstein-Horioka's puzzle and this situation has been argued in the literature yet. Understanding Feldstein- Horioka puzzle is important both economists and policy makers, and empirical studies can contribute this process. For this purpose, this study empirically examined Feldstein- Horioka hypothesis, in other words the relationship between

saving and investment under capital mobility for the period 1975-2020. Capital mobility is crucial because basic debate keeps going on it.

In this study, we performed static panel data analysis. Estimated saving retention coefficient is 0.36. This value is low. It means that capital markets are highly integrated between these countries. Also there are no or few barriers to capital mobility. Domestic investment does not strictly depend on domestic saving in these countries. This result is largely due to financial liberalization especially after 1980 and being a member of European Union. Finally, findings at the end of this study show that Feldstein- Horioka hypothesis is valid but weak form for 5 big European developed countries.

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