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Is the Feldstein-Horioka Puzzle Valid in OECD Countries?

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Abstract

Investments and savings are regarded as critical components in the evolution of economic performance. Both are employed to stimulate economic development and growth. Based on international capital movements, the Feldstein-Horioka puzzle investigated the relationship between savings and investment. The validity of the Feldstein-Horioka puzzle was investigated in this investigation for the years 1990-2021, covering OECD countries.

Keywords
Feldstein-Horioka Puzzle, Saving, Investment, Westerlund (2007) Cointegration Test

JEL Kodu
E20, E22, F21

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Feldstein-Horioka Bulmacası OECD Ülkelerinde Geçerli mi?

Öz

Yatırımlar ve tasarruflar ekonomik performansın gelişiminde kritik bileşenler olarak kabul edilmektedir. Her ikisi de ekonomik kalkınmayı ve büyümeyi teşvik etmek için kullanılmaktadır. Feldstein-Horioka bulmacası, uluslararası sermaye hareketlerini temel alarak tasarruf ve yatırım arasındaki ilişkiyi incelemiştir. OECD ülkelerini kapsayan bu araştırmada Feldstein-Horioka bulmacasının geçerliliği 1990-2021 yılları için araştırılmıştır.

Anahtar Kelimeler
Feldstein-Horioka Bulmacası, Tasarruf, Yatırım, Westerlund (2007) Eşbütünleşme Testi

JEL Kodu
E20, E22, F21

1. Introduction

Following the liberalization of the economy after 1980, capital movements became free. The degree of capital mobility has been regarded as an essential factor in assessing the macroeconomic situation and determining policy measures. Private investments can be more easily excluded when governments have a structure with high public deficits. Because of the inactivity of the capital, national resources can prevent the entry of foreign capital into the country (Lapp, 1996).

Investments are essential in boosting growth rates in developed and developing countries. Savings are an effective argument for increasing investments in the growth process. Especially after the 1980s financial liberalization, countries invested with domestic and foreign savings (Pehlivan, 2022). Savings-backed investments can drive economic growth. To boost economic growth in these countries, it will be necessary to strengthen the investment environment, boost corporate confidence, and enact policies that stimulate entrepreneurship. Investing in infrastructure, education, and technology may assure long-term, sustainable economic growth. This conclusion underscores the importance of these countries considering the relationship between savings and investment when developing policies that direct international investments and foreign economic ties. While assessing the impact of foreign investments on the country's economic growth, local savings rates can assure balanced and sustainable economic growth (Gül & Acar, 2016).

Investments have an essential role in developing a country's growth performance. Savings are viewed as a powerful tool for the development of investments. As a result of financial deregulation after 1980, countries began to invest using domestic and international savings. Türkiye began to adopt similar reform moves in 1989 as well. Many new financial policies have

been implemented since the end of exchange control (Oktayer & Susam, 2007). Due to the liberalization in Türkiye's financial structure, the starting year of our study was determined as 1990.

The lifting of constraints on capital movements following globalization movements resulted in capital liberalization in the international arena. Investments and savings both play essential roles in maintaining economic growth. Domestic investments and domestic savings are likely to have a low association if capital flows are fully mobile. This suggests that higher investment rates in countries with open policies will lead to increased overseas investment (Çağlayan Akay & Türküz, 2016).

If the globe has complete capital mobility, there will be no relationship between domestic savings and domestic investments. In countries with full capital mobility, domestic investments will be financed by global capital, and domestic savings will be opened to the globe for more appealing investment options. Feldstein and Horioka attempted to reveal the degree of capital mobility in the context of the savings-investment relationship in their research using empirical findings from OECD countries. It generated data that contradicted the capital mobility hypothesis, with the majority of domestic savings remaining in the country. The findings of this study piqued the interest of many academics in the subject, resulting in the creation of substantial literature on the savings-investment link (Şeyranlioğlu, 2023).

Many theories and predictions have been advanced and discussed in the economic literature in the aftermath of globalization and liberalization. The Feldstein-Horioka puzzle, proposed by Feldstein and Horioka, has been one of the most studied topics in literature. Domestic investments can be financed by a worldwide pool of savings in an economy with full capital mobility, and domestic savings seek global investment opportunities with the highest return. Feldstein and Horioka used this inference to conduct a cross-sectional analysis. The study found domestic savings and investment were strongly related, and the relationship did not weaken over time. This demonstrates that capital in OECD countries is immobile. The findings strongly contradict the excellent situation of capital mobility achieved in industrialized countries due to financial market deregulation and the liberalization of capital controls. The F-H puzzle is the name of this contradiction (Yildirim & Orman, 2018).

Based on a regression of investment in savings for OECD nations from 1960 to 1974, Feldstein and Horioka allege the absence of perfect capital mobility. According to Feldstein and Horioka, the slope parameter on saving significantly differs from zero but not from one, implying that domestic investment primarily depends on domestic saving. Feldstein and Horioka interpret these findings as long-run capital immobility and poor integration of foreign capital markets. This so-called Feldstein-Horioka problem has sparked numerous discussions about international capital mobility (Ko & Funashima, 2016).

Feldstein and Horioka's 1979 study attempted to explain the relationship between domestic savings and investment in OECD countries. In this investigation, the equational representation of the relationship between domestic savings and investment is as follows:

$$(I/Y)_i = \alpha + \beta(S/Y)_i \quad (1)$$

The $(I/Y)_i$ value represents the ratio of gross domestic investment to GDP in country i, while the $(S/Y)_i$ value represents the ratio of gross domestic savings to GDP in country i. The value in the equation represents the constant term. The value is explained as the savings rate coefficient value. Furthermore, it was stressed that the ß coefficient in the equation should have a value between 0 and 1. A value close to one indicates that capital mobility is low. In other words, there is a strong correlation between domestic savings and investments (Frankel, 1979).

The validity of the Feldstein-Horioka puzzle in OECD countries was investigated using panel cointegration analysis. For the subject, a study covering 1990-2021 was conducted, which was investigated theoretically and empirically. The first section of the survey provides theoretical information about the subject. Following that, a literature review on the subject was conducted. The study's empirical findings are presented and interpreted in the final section. The study is expected to contribute to the literature because of how it is handled, the use of current techniques, the chosen country group, and the time period. The research effort attempted to answer the following questions and add to the literature:

1) Based on recent analyses and data, Is the F-H puzzle still valid for OECD countries?
2) In which OECD nations is the F-H puzzle valid, and how?

The initial part of the study provides background information on the subject. The second section contains studies on the subject. The final section uses empirical analysis to determine whether the F-H puzzle is valid for OECD countries.

2. Literature

The Feldstein-Horioka puzzle has been studied using time series or panel analysis. Studies on the F-H puzzle expanded after 1990. Over time, different variables have been added to the theory's primary variables: domestic savings and domestic investment. The subject's scope has been broadened, and the F-H puzzle has been investigated over multiple periods. The time series and panel analyses for the F-H puzzle were studied independently while researching the literature for this work. The following time series studies are examined:

Alan Hussain et al. (2011) researched the Pakistan economy. They examined the connection between domestic investments and savings from 1972 to 2008. The two variables employed in the study, for which time series analysis was applied, were shown to have a short—and long-term relationship.

The effectiveness of the Feldstein-Horioka puzzle in the Mexican economy was investigated by Alan Ríos et al. (2021). The study, which conducted time series analyses for 1950–2017, demonstrates that capital mobility did not exist before 1982. This indicates that up until 1982, there was a solid saving-investment relationship before it started to deteriorate. The findings contradicted the preexisting paradox.

Esen et al., (2012) used ARDL analysis to evaluate the validity of the Feldstein-Horioka puzzle in their study for Türkiye. A study was undertaken during the years 1975-2009. The investigation revealed that the Feldstein-Horioka hypothesis is correct for the Turkish economy.

Gómez et al. (2015) used time series analysis to investigate the relationship between domestic savings and domestic investments in the Colombian economy. The investigation, which spanned from 1925 to 2011, discovered cointegration between investment and savings during the study period. According to the study, rises in domestic savings rates restrict the movement of financial capital in Colombia.

In their investigation of the Turkish economy, Akadiri et al.(2016) used time series analysis to evaluate the relationship between domestic savings and domestic investments. From 1960 to

2014, the investigation discovered a long-term association between the series and a catastrophic structural breach in 1993. Furthermore, the study used the cointegration test to conclude that there is considerable capital mobility in Türkiye.

In their study for Türkiye, Caglar & Yavuz (2017) conducted research for the years 1960-2016. The DOLS test revealed the coefficients of the study variables used in the ARDL analysis. The investigation revealed that the Feldstein-Horioka puzzle was appropriate for Türkiye within the time frame considered.

Yildirim and Koska (2018) investigated the validity of the Feldstein-Horioka puzzle in Türkiye between 1960 and 2014. Throughout the period under study, the Turkish economy's political and economic issues impacted domestic savings and investments. The research revealed a link between the variables, which fluctuated in strength at different times.

Akadiri et al. (2020) used a range of variables in their inquiry for Nigeria to assess the validity of the Feldstein-Horioka puzzle. In addition to domestic savings and investments, the study also considered variables like globalization, real income, foreign direct investments, and urbanization. While domestic savings, real income, and foreign direct investments positively affected domestic investments, the study, which covered the years 1981–2018, revealed that globalization and urbanization had both short- and long-term negative consequences.

In his study for Turkiye in 2020, Akkoyunlu (2020) employed the Feldstein-Horioka puzzle to examine the connection between domestic savings and domestic investment. The relationship between the study's variables was explored by dividing the data set into three sub-periods: 1950–2017, 1950–1989, and 1990-2017. The F test showed that the variables were positively correlated from 1950 to 1989, which was the time of restrained capital mobility. According to the study, the parameters did not significantly correlate across the entire capital mobility period (1990–2017).

Pehlivan (2022) conducted research for Türkiye from 1990 to 2019. The study examined the relationship between domestic savings and domestic investments through time series analysis. According to FMOLS (Full Adjusted Least Squares Method) and DOLS (Dynamic Least Squares Method) data, international savings significantly impact investments.

Some of the studies conducted in panel analysis were examined as follows:

Sachs (1982) investigated the effectiveness of the Feldstein-Horioka puzzle for OECD countries in their study. The current account balance variable was included in the model during the investigation, and an analysis was performed. It has been discovered that the current account balance affects investing due to the factors stated.

Fujiki & Kitamura (1995) used panel analysis to analyze the Feldstein-Horioka puzzle for 23 different countries. The variables of domestic net savings, domestic net investment, and GDP were analyzed in the study. Due to the heterogeneities between the countries described in the Feldstein-Horioka paradox, strong results could not be obtained due to the investigation.

In their research published in 1998, Vamvakidis & Wacziarg evaluated the Feldstein-Horioka puzzle's applicability in OECD nations. The data covering 1970–1993 shows a strong correlation between domestic investment rates and savings across OECD nations.

Corbin (2001) used panel analysis in his study of OECD nations to assess the value of the Feldstein-Horioka puzzle. The study spans the years 1885 through 1992. The investigation has led to the acceptance that, rather than low capital mobility, a high estimated savings-investment coefficient may be caused by the presence of specific individual country effects.

Fouquau et al. (2008) used a panel analysis to demonstrate whether the Feldstein-Horioka puzzle is valid for 24 OECD countries. The study determined a link between the factors evaluated from 1960 to 2000.

Balavac (2011) investigated the Feldstein-Horioka puzzle in transition economies. His study, which spanned 1995 to 2007, used panel analysis to evaluate the puzzle's validity. The puzzle was found to be valid in transition economies over the time period studied.

Yalcinkaya & Huseyni (2016) investigated the relationship between domestic savings and domestic investment in 28 OECD nations. The Feldstein-Horioka puzzle was the foundation for research from 1980 to 2013. The panel test investigation classified 19 nations with a savings surplus and nine countries with a savings deficit as two distinct categories. Furthermore, a third group was constructed in the study without considering the savings-investment balance of 28 nations and was treated in this manner in the analyses. The analysis found that the domestic savings parameter was positive and statistically significant in countries in the OECD-9, 19, and 28 groups, as expected.

Suruga & Rahman (2016) studied the SAARC economies from 1980 to 2013. The FEM (Fixed Effect Model), REM (Random Effect Model), and POLS (Pooled Model) tests, which are panel estimators, were utilized in the study, and it was concluded that both gross savings and trade openness had a favorable effect on domestic investments.

Tuncsiper & Bicen (2016) used panel analysis to investigate the validity of the Feldstein-Horioka puzzle in E7 countries. The study, which spanned 1990 to 2014, employed SUR analysis. The investigation discovered that the problem was invalid in Mexico, Russia, Türkiye, and Brazil but valid in Indonesia, India, and China.

Pata (2018) carried out a study for the E7 nations. Between 1989 and 2015, the validity of the Feldstein-Horioka puzzle was investigated using panel cointegration and causality approaches. The CCMEG (Common Correlated Effects Mean Group) and AMG (Augmented Mean Group) estimators provide long-term Feldstein-Horioka puzzle panel coefficients of 0.792 and 0.758, respectively. The Feldstein-Horioka puzzle was valid in all E7 nations in the investigation.

Duran & Ferreira-Loper (2023) studied 13 major economies. The writers employed panel analysis in their investigations. The panel GMM (Generalized Method of Moments) estimator was used to interpret the coefficients of the variables for the nations in the research, which spanned the years 1996 to 2016. The global financial crisis has been proven to affect capital liberalization negatively. The analyses indicated that the Feldstein-Horioka puzzle was resurrected, and capital mobility declined during the 2008/2009 recession.

The Feldstein-Horioka puzzle has been studied in the literature from various angles, particularly the panel and time series. In this study, the validity of the Feldstein-Horioka puzzle in OECD countries is investigated using long-run relationship estimation methods. The period following 1990, when Türkiye's financial reform began, was discussed for the subject. A study was undertaken that explored both theoretically and empirically the years 1990–2021. The study is intended to contribute to the literature because of how it is handled, the use of contemporary procedures, the chosen country group, and the historical period. Other variables may be neglected when examining the relationship between savings and investing. This can give analysts more detailed knowledge than a simple correlation between two variables. This strategy can be used to further assess the link between variables and obtain more reliable results.

3. Data, Model, and Methods

The study will examine whether the Feldstein-Horioka hypothesis is valid for OECD countries between 1990 and 2021. The data regarding the variables were obtained annually from the World Bank database. The study has three subgroups (N=38, N1 = 19, N2 = 19) and a 32-year (T =32) data set. The first group (N1) consists of Australia, Austria, Belgium, Canada, Switzerland, Chile, Colombia, Costa Rica, Czech Republic, Germany, Denmark, Spain, Estonia, Finland, France, England, Greece, Hungary, and Ireland. The second group (N2) consists of Iceland, Italy, Israel, Korea, Japan, Lithuania, Latvia, Luxembourg, Mexico, Norway, Netherlands, New Zealand, Portugal, Poland, Slovakia, Sweden, Slovenia, Türkiye, and the USA. This distinction is based on the levels of economic development, geographical proximity, and the findings of similar studies in the literature. In addition, the first group generally consists of high-income and developed countries. These countries tend to have high savings and investment rates. The second group includes middle- and high-income, economically developing, or transition economies. The countries in the first group have more developed and integrated financial markets and stand out regarding the freedom of capital movements and the depth of financial markets. The countries in the second group represent economies where financial markets are less developed or in transition. These countries may have more restrictions on capital movements and less depth in financial markets. In the first group of countries, the relationship between investment and savings rates is generally stronger and more stable. Capital markets and financial institutions are more developed in these countries, which makes investment and savings decisions more predictable. The relationship between investment and savings rates may be more variable in the second group of countries due to economic instabilities and transition processes. These countries show differences in investment and savings behaviors. Following the studies of Feldstein and Horioka (1979), the following model will be estimated in this study:

$$(I/Y)_i = \alpha + \beta(S/Y)_i + \varepsilon_i \quad (2)$$

Here, I/Y is the dependent variable and indicates the share of gross investments in the relevant period in GDP. S/Y is the independent variable of the model and indicates the ratio of gross savings to GDP in the relevant period. α is the constant term, β is the savings retention rate, and ε is the error term.

The literature shows that grouping countries according to their economic development levels and financial market structures provides more consistent and meaningful results in testing the Feldstein-Horioka hypothesis. Therefore, dividing the countries into two groups allows us to evaluate the validity of the hypothesis more accurately. Based on these economic foundations, dividing the countries into two groups increases the model's effectiveness and ensures the results' reliability and validity. The main reason for dividing the countries into two groups is to create more homogeneous groups by taking into account economic, geographical, and regional similarities. In this way, it is aimed to increase the effectiveness of the econometrics method and to obtain more consistent results.

4. Findings

The study was first aimed to provide summary statistics of the variables on a country basis, and the relevant findings are presented in Table 1.

Table 1

Summary Statistics

Countries	Variables	Mean	Maximum	Minimum	Standard Deviation
Australia	Investment	0.261	1.001	0.0001	0.39
	Saving	21.99	25.82	18.17	1.54
Austria	Investment	1.42	2.01	0.74	0.36
	Saving	26.43	29.13	23.42	1.13
Belgium	Investment	0.305	0.508	-0.06	0.13
	Saving	25.93	28.77	23.5	1.14
Canada	Investment	0.52	0.906	0.12	0.19
	Saving	20.42	24.61	14.104	2.75
Chile	Investment	2.17	2.79	1.66	0.31
	Saving	23.14	27.73	19.78	2.02
Columbia	Investment	1.63	4.54	-2.106	1.66
	Saving	17.02	22.96	12.63	2.57
Costa Rica	Investment	1.61	3.56	0.93	0.608
	Saving	15.04	19.35	13.09	1.39
Czech Republic	Investment	2.17	5.53	1.16	0.82
	Saving	27.34	31.27	22.46	2.35
Denmark	Investment	1.65	2.54	0.61	0.51
	Saving	25.91	31.65	21.64	2.98
Estonia	Investment	3.69	4.903	2.21	0.71
	Saving	23.83	29.86	13.32	4.091
Japan	Investment	1.28	1.55	0.76	0.16
	Saving	31.06	45.95	24.89	5.57

Korea	Investment	1.406	2.31	0.82	0.44
	Saving	35.46	39.03	31.45	2.01
Latvia	Investment	3.06	5.35	1.21	1.35
	Saving	19.57	30.29	12.22	4.75
Lithuania	Investment	2.22	3.72	1.25	0.53
	Saving	16.39	23.08	10.51	3.13
Luxembourg	Investment	2.38	3.17	0.94	0.46
	Saving	26.46	36.85	11.8	6.64
Mexican	Investment	0.55	1.17	-0.16	0.32
	Saving	21.96	24.99	16.44	1.98
Netherlands	Investment	1.33	1.94	0.49	0.42
	Saving	28.07	31.79	25.7	1.59
New Zeland	Investment	2.79	11.97	-4.29	3.65
	Saving	57.2	173.8	15.71	59.3
Norway	Investment	2.362	3.68	1.51	0.56
	Saving	33.6	41.88	24.9	5.1
Poland	Investment	1.63	3.14	0.17	0.66
	Saving	18.8	21.7	14.34	2.09
Finland	Investment	1.68	2.51	0.904	0.39
	Saving	24.86	31.96	16.97	4.07
France	Investment	1.54	2.08	0.78	0.34
	Saving	22.56	24.49	20.97	0.99
Germany	Investment	0.56	0.83	-1.81	0.44
	Saving	25.39	29.79	21.79	2.63
Greece	Investment	3.65	5.82	0.67	1.23
	Saving	13.94	35.08	-1.7	8.15
Hungary	Investment	2.54	4.72	1.201	1.02
	Saving	20.15	27.66	11.87	4.40
Iceland	Investment	1.68	2.55	0.74	0.39
	Saving	16.27	24.03	1.55	5.86
Ireland	Investment	1.13	2.239	0.40	0.48
	Saving	26.74	37.38	15.32	5.87
Israel	Investment	0.79	1.46	0.32	0.29
	Saving	22.93	29.71	19.91	2.18
Italy	Investment	0.98	1.54	-0.02	0.29
	Saving	20.23	22.52	17.27	1.49
Japan	Investment	1.286	1.55	0.76	0.16
	Saving	31.06	45.95	24.89	5.57
Portugal	Investment	1.87	3.67	-1.43	1.41
	Saving	17.85	28.00	10.61	4.46
Slovakia	Investment	3.02	5.46	1.002	1.18
	Saving	22.73	25.36	18.05	1.96
Slovenia	Investment	2.46	3.46	1.82	0.36
	Saving	24.93	28.72	20.36	2.00
Spain	Investment	1.05	1.83	-0.11	0.48
	Saving	21.10	23.62	17.85	1.59
Sweden	Investment	2.02	3.18	-0.55	0.83

	Saving	26.53	32.55	16.05	3.98
Switzerland	Investment	0.869	1.12	0.60	0.13
	Saving	35.31	40.91	29.18	2.72
Türkiye	Investment	2.01	4.51	1.07	1.03
	Saving	22.99	30.15	18.18	2.86
England	Investment	1.41	2.07	0.61	0.32
	Saving	14.52	16.87	11.67	1.41
USA	Investment	1.05	1.93	0.22	0.61
	Saving	18.56	21.37	13.82	1.74

In Table 1, the highest mean value belongs to Estonia for the investment variable and to New Zealand for the saving variable. Among all countries, it was observed that both variables had the minimum standard deviation value in Belgium, while it was determined that only the investor variable had the minimum standard deviation value in Switzerland. Finally, it was concluded that both investment and saving variables had the maximum standard value in New Zealand.

In the study, it was first aimed to investigate whether there was cross-sectional dependence in the variables. The findings obtained separately for the three groups are given in Table 2.

Table 2

Cross-Sectional Dependency Test Results for Variables

N=38				
Variable	**Breusch-Pagan LM**	**Pesaran scaled LM**	**Bias-corrected scaled LM**	**Pesaran CD**
Saving	3603.559*** (0.0000)	80.48862*** (0.000)	79.89185*** (0.0000)	13.58638*** (0.000)
Investment	3214.518*** (0.0000)	69.82896*** (0.0000)	69.23218*** (0.0000)	5.498533** (0.0340)
N1=19				
Variable	**Breusch-Pagan LM**	**Pesaran scaled LM**	**Bias-corrected scaled LM**	**Pesaran CD**
Saving	789.2950*** (0.0000)	33.43356*** (0.0000)	33.12711*** (0.0000)	9.147187*** (0.00000)
Investment	904.1145*** (0.0000)	39.64229*** (0.0000)	39.33584*** (0.0000)	5.974101** (0.0300)
N2=19				
Variable	**Breusch-Pagan LM**	**Pesaran scaled LM**	**Bias-corrected scaled LM**	**Pesaran CD**
Saving	1297.629*** (0.0000)	60.92113*** (0.0000)	60.61468*** (0.0000)	5.308294** (0.0000)
Investment	737.8665*** (0.0000)	30.65263*** (0.0000)	30.34618*** (0.0000)	5.625042** (0.0342)

Note. Significant values are represented by the symbols *, **, and *** for 10%, 5%, and 1%, respectively

As is known, cross-sectional dependence is expressed as the relationship between the error terms in each equation (Baltagi, 2005). According to the Breusch-Pagan (Lagrange Multiplier-LM) test results used to test the existence of cross-sectional dependence for the models considered in the two subgroups investigated in the study, it was determined that cross-sectional dependence existed in the variables. The CADF test's structure differs from that of the normal ADF unit root

test. In this exam, we discover the prolonged status of the delay levels using cross-sectional averages and the initial differences in the individual series. The cross-sectional augmented IPS (CIPS) test provided novel asymptotic conclusions for both individual CADF statistics and their simple averages. In the application of the CADF test, unlike the previous test, it was determined that the first difference of the ADF regression was not the correlation between units. Hypotheses of the test; It is formed as H_0: $\beta i = 0$ (There is a unit root) and H_1: $\beta i < 0$ (There is no unit root). The basic equation is as follows; (Pesaran, 2007).

$$y_{it} = (1 - \phi_i)\mu_i + \phi_i y_{i,t-1} + u_{it} \quad (3)$$

At this stage of the study, the second generation unit root test, which takes into account the cross-sectional dependency, was used to investigate stationarity. The findings obtained are presented in Table 3.

Table 3

Unit Root Test Results

N=38			
Variable	**CIPS Test Statistic**	**CV 5%**	**CV 10%**
Investment	0.496 (0.690)	-2.110	-2.050
Saving	1.910 (0.972)		
ΔInvestment	-18.841*** (0.0000)		
ΔSaving	-9.528*** (0.0000)		
N1=19			
Variable	**CIPS Test Statistic**	**CV 5%**	**CV 10%**
Investment	-1.667 (0.684)	-2.110	-2.050
Saving	-1.731 (0.572)		
ΔInvestment	-4.471*** (0.0000)		
ΔSaving	-4.351*** (0.0000)		
N2=19			
Variable	**CIPS Test Statistic**	**CV 5%**	**CV 10%**
Investment	-1.680 (0.662)	-2.110	-2.050
Saving	-1.807 (0.432)		
ΔInvestment	-4.082*** (0.000)		
ΔSaving	-4.326*** (0.000)		

Note. Significant values are represented by the symbols *, **, and *** for 10%, 5%, and 1%, respectively.

According to the findings obtained from Table 3, we decided that all variables for N, N1 and N2 were stationary at the first difference. And then, we investigated the homogeneity and cross-sectional dependence of the models and presented the findings in Table 4.

Table 4

Homogenity and Cross-Sectional Dependency Test for Model

	N=38	**N1=19**	**N2=19**
Swamy	5193.38*** (0.0000)	3167.09*** (0.0000)	1429.01*** (0.0000)
Δ	14.037*** (0.0000)	10.681*** (0.0000)	9.082*** (0.0000)
Δ̃	14.746*** (0.0000)	11.220*** (0.0000)	9.540*** (0.0000)
Breusch-Pagan LM	3083.269*** (0.0000)	959.7957*** (0.0000)	681.9127*** (0.0000)
Pesaran scaled LM	66.23277*** (0.0000)	42.65319*** (0.0000)	27.62699*** (0.0000)
Pesaran CD	2.335115** (0.0195)	5.055140** (0.0400)	5.575177** (0.0352)

Note. Significant values are represented by the symbols *, **, and *** for 10%, 5%, and 1%, respectively.

In case of cross-sectional dependency and heterogeneity in parameters, Westerlund (2007) cointegration test can be used to investigate the long-term relationship between variables. The intent is to evaluate the long-term relationship between the series using the panel cointegration approach published by Westerlund in 2007. If the test series are cross-sectionally dependent, the findings will be significant. The primary assumption of this test is that the dependent variable is stable at the I(1) level, and if the independent variables are stationary at the I(1) or I(0) levels, panel cointegration analysis is done. In addition, this test considers common criteria (Westerlund, 2007). In the study, long-term relationship was investigated separately for three groups and the findings are presented in Table 5.

Table 5

Westerlund (2007) Cointegration

N=38			
	Value	**P-Value**	**Bootstrap P-Value**
Gt	-6.536***	0.000	0.000
Ga	-3.931***	0.000	0.000
Pt	-6.585***	0.000	0.000
Pa	-13.817***	0.000	0.000
N1=19			
	Value	**P-Value**	**Bootstrap P-Value**
Gt	-2. 592	0.000	0.200
Ga	-10.188	0.008	0.590
Pt	-11.080	0.000	0.490

Pa	-15.378	0.000	0.140
		N2=19	
	Value	**P-Value**	**Bootstrap P-Value**
Gt	-2.519	0.000	0.270
Ga	-11.127	0.001	0.840
Pt	-8.669	0.013	0.510
Pa	-10.386	0.000	0.570

In case of heterogeneity from the Westerlund (2007) test results, Gt and Ga statistics are taken into account. In addition, bootstrap p-value gives more reliable results than p-value. While interpreting the findings obtained from the study, bootstrap p-value values were taken into account. According to the results of Table 5, there is a long-term relationship between the variables for the N sample group. However, there is no long-term relationship between the variables for the N1 and N2 sample groups. After determining the existence of the long-run relationship for the N, we wanted to estimate the long-run coefficients and used the DOLSMG estimator to estimate the long-run coefficients. The DOLSMG test, which takes into account cross-sectional dependence, can be used to estimate the long-run coefficients (Tatoğlu, 2018). The estimation of the long-run relationship between the series was analysed using the Dynamic Ordinary Least Squares Mean Group (DOLSMG) estimator, which takes into account parameter heterogeneity. The DOLSMG estimator, developed by Pedroni (2001), is robust to cross-sectional dependence and provides more efficient results by providing reliable results for heterogeneous panels (Ozbay and Duyar, 2022; Celik et al., 2024). The results are given in Table 6.

Table 6

Long-Term Coefficient

	Australia	**Austria**	**Belgium**	**Canada**	**Switzerland**	**Chile**
$\boldsymbol{\beta_1}$	-0.1396***	0.1346***	-0.04953*	-0.03332***	-0.01393	-0.06723*
t-statistic	-4.498	4.156	-1.851	-3.066	-0.8572	-1.958
	Colombia	**Costa Rica**	**Czech Republic**	**Germany**	**Denmark**	**Spain**
$\boldsymbol{\beta_1}$	-0.07782	0.08778	0.09908	0.01393	0.08142***	-0.0805
t-statistic	-0.6015	1.058	0.3793	0.7257	3.144	-1.037
	Estonia	**Finland**	**France**	**United Kingdom**	**Greece**	**Hungary**
$\boldsymbol{\beta_1}$	-0.01309	0.02228	0.06278	0.01932	0.1371	0.08979
t-statistic	-0.4566	0.8999	1.361	0.4191	6.881	2.171
	Ireland	**Iceland**	**Israel**	**Italy**	**Japan**	**Korea, Rep.**
$\boldsymbol{\beta_1}$	0.01991	0.0445***	-0.09963***	-0.1255***	0.03297**	0.05746
t-statistic	0.651	3.847	-4.336	-2.811	2.531	0.7271
	Lithuania	**Luxembourg**	**Latvia**	**Mexico**	**Netherlands**	**New Zealand**
$\boldsymbol{\beta_1}$	0.02777	0.02357	0.1266***	-0.069*	0.04086	0.01249
t-statistic	0.7489	1.472	3.108	-1.673	0.8005	0.8621
	Poland	**Portugal**	**Slovak Republic**	**Slovenia**	**Sweden**	**Türkiye**
$\boldsymbol{\beta_1}$	0.1106	0.1492	-0.1632	-0.07127*	0.06431**	0.1424*
t-statistic	0.595	1.064	-0.8039	-1.739	2.477	1.946
	United States	**All Panel**				

$\boldsymbol{\beta_1}$	0.1649	0.0206***				
t-statistic	1.405	2.916				

Note. $\boldsymbol{\beta_1}$ represents the coefficient of savings retention rate. The t table value are 1.646; 1.962 and 2.584 for 10%, 5% and 1% significance level, respectively. And also the significant values are represented by the symbols *, **, and *** for 10%, 5%, and 1%, respectively.

The coefficient analysis revealed theoretical relationships between the values of Australia, Austria, Belgium, Canada, Chile, Denmark, Iceland, Israel, Italy, Japan, Latvia, Mexico, Slovenia, Sweden, Türkiye, and the All Panel. Countries with valid theories or a high savings-investment link can be explained by disparities in financial integration and economic architecture. The link between savings and investments in various countries may differ based on capital mobility and local economic circumstances. The fact that these countries are developed, have high capital mobility, economic institutions and policies, and engage in global economic interaction strengthens the theoretical validity.

5. Conclusion

The connection between investment and savings should be appropriately assessed while formulating economic policies. Following 1980, liberalization initiatives contributed to developing both investment and the resources required for investment. Countries have begun to see changes in areas such as growth and employment due to foreign investments and savings. After the liberalization movements, the relationship between the two factors became more important and was examined in many studies. The most notable of these was the effort that became known as the Feldstein-Horioka puzzle. Feldstein and Horioka explored the relationship between OECD countries' investment and savings. They discovered a substantial association between saving and investing due to their research.

This study provided an essential analysis of the relationship between investment and savings while accounting for the consequences of liberalization trends. This analysis, conducted primarily in OECD countries, provides economic policymakers with a valuable viewpoint. Understanding the impact of liberalization movements on economic dynamics is crucial for more effective economic policy creation and implementation. This study helps economic policymakers make more mindful judgments by discussing the relationship between investment and savings in the current setting. This analysis can potentially add to the economic literature and shed light on future policy changes.

Within the framework of the basic hypothesis, the Feldstein-Horioka puzzle was investigated for OECD countries in this study. The literature from which the variables in the study were determined was considered. Especially in the literature, Esen et al. (2012), Suruga & Rahman (2016), Pata (2018), and Akadiri et al. (2020) studies were used. Its goal is to investigate the fundamental hypothesis using current data and analysis methodologies. The data set is divided into two groups based on economic development, geographical proximity and literature findings: The first group consists of high-income and developed countries and the second group consists of developing or transition economies. The findings for Colombia, Hungary, Sweden, Latvia, and Türkiye were both positive and statistically significant. The Feldstein-Horioka puzzle is valid in Colombia, Hungary, Sweden, Latvia, and Türkiye. Increasing the number of variables to be examined in future studies and examining the Feldstein-Horioka puzzle using alternative analysis approaches will add to the body of knowledge.

The results obtained were analyzed in the literature by Hussain et al. (2011), Esen et al. (2012), Akadiri et al. (2016), Sachs (1982), Vamvakidis & Wacziarg (1998) and Duran & Ferreira-Loper (2023). According to the findings of this study, there is a substantial, significant, and positive association between savings and investment in countries such as Colombia, Hungary, Sweden, Latvia, and Türkiye. This result has serious implications for economic policymakers. The positive link observed provides economic policymakers with a crucial indication that the increase in savings in these countries can be supported by an increase in investment. Increasing savings rates and diverting these funds to local investments to support economic growth can help these countries' economic development. At this juncture, it is critical to frame public policies, tax rules, and incentive measures in ways that encourage savings.

The findings of this study can serve as a foundation for future, more detailed analyses and economic modeling. Studies in different sectors, across different time periods, and with larger data sets can help us gain a better understanding of the relationship between savings and investment. These findings can be utilized to improve the formulation and implementation of economic policies in the future, thereby contributing to the economic development of these countries. This type of study can provide a scientific foundation for decision-makers in capital policy planning and implementation. It can also aid in the creation of effective methods for managing capital phenomena. This study was designed especially for OECD countries, and more thorough investigations are required to explore the F-H puzzle link in a broader context. However, this study

is an essential step in understanding the relationship between F-H puzzle components and demonstrating the effect of regional characteristics.

Declaration of Research and Publication Ethics

This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement

The authors contributed equally to the article.

Declaration of Researcher's Conflict of Interest

There are no potential conflicts of interest in this study.

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