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An Analytical Examination of the Degree of Capital Mobility in Iran Reappraisal of Feldstein-Horioka Relationship

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ABSTRACT

Our goal in this paper analysis the dynamics of national saving investment relationships between 1978 and 2017 in the economy of Iran to determine the degree of capital mobility. For this purpose, the validity of the Feldstein-Horioka hypothesis was tested by relying on the ARDL Bounds testing approach to co-integration and vector error correction model. The authors interpret the close relationship between national saving and investment in the long run as a reflection of a lack of capital mobility. These results suggest that the Feldstein-Horioka Hypothesis is applicable for the Iran economy in the period analyzed. The analysis of the time series characteristics of the current account balance shows that the current account balance does not have a unit root and the link between Iran's economy and international capital markets is not significant. We observed that trade openness, can't help explain the investment. Our findings for Iran suggest that home bias in the allocation of domestic savings significantly declines when domestic investment is financed by domestic savings alone. Furthermore, the empirical results indicate that the Feldstein-Horioka puzzle does not hold for the Iran economy.

Keywords:

Capital Mobility, Feldstein-Horioka Hypothesis, openness, home bias, Iran

1. Introduction

The degree of international capital mobility is a crucial issue for economic policy implementations in developing countries. A nearly universal assumption in international economic analysis is that capital flows freely among countries to keep the return to capital equal in all places. The implications of this assumption of perfect capital mobility are not only extremely important but are also contrary to most economists' beliefs about the behavior of national economies. But risk considerations, institutional barriers, and government policies impede that flow. Further, government policies may seek to encourage or prevent capital inflows or outflows during long periods (Feldstein 1983). Measuring the degree of capital mobility in any country, therefore, becomes imperative for its strategic role in policy implementation. Such resolve triggered lots of empirical investigations into the field. Measuring capital mobility, however, has proved to be problematic. On the one hand, one might follow Frankel (1992) and use covered interest parity (CIP) as the most appropriate indicator of the degree of financial integration. Essentially, this direct approach for a country like Iran however, the presence of markets that are illiquid and difficulties in asset comparability contribute towards data limitations that inhibit the formal testing of CIP (Holmes 2005). One of the most important approaches to measuring international capital mobility was developed by Feldstein-Horioka (1980) (hereinafter referred to as F-H), known as the Feldstein-Horioka puzzle. This solution alternative, to consider an indirect approach that concentrates on the relationship between domestic savings and investment. Be called a puzzle because, if capital is perfectly mobile across countries, one might expect that saving and investment should not be correlated across countries and that saving should flow to wherever the best investment opportunities are. But levels of saving and investment are correlated across countries even though global financial markets appear to be integrated (Horioka and Ford 2017).

F-H identifies a close cross-section association between period-average data on annual national saving and investment rates for a sample of 16 OECD economies from 1960 to 1974 and interprets it as evidence of low international capital mobility. However, they argue that a systematic relationship between national saving and investment would not be expected if each country faced a large international capital market to which it supplied its national saving. As noted by Baxter and Crucini (1993), one of the most stable regularities observed in the data is the fact that national saving rates are highly correlated with national investment rates, both in time-series analyses of individual countries and in cross-sections in which each country is treated as a single data point. The controversy around what has been dubbed the F-H puzzle lies not on the two authors' findings, but more on the interpretation given to the high coefficient (Cyrille 2010). Therefore, the idea to learn about international capital mobility from saving and investment data remain appealing (Hoffmann, 2004). This robust finding of positive saving–investment correlations has launched a debate regarding the degree of financial integration and openness within the industrialized world. In this way, the international mobility of capital depends on other exogenous variables (trade openness, country size, demography, etc) (Fouquau et al 2007). Horioka and Ford (2017) believe that solving the riddle and bridging the gap between the practical and theoretical dimensions of this issue is a very simple task. Their the solution which is that even though global financial markets appear to be integrated, levels of saving and investment are correlated across countries because financial markets cannot, by themselves, achieve net transfers of financial capital. This is because net transfers of financial capital require the integration not only of financial markets but also of goods markets and because there are substantial frictions in goods markets (e.g., transport, marketing, and distribution costs, technical standards, certification procedures, tariffs, and non-tariff barriers, etc.). As soon as this analysis is understood, the F-H puzzle melts. In reality, the net transfer of financial capital from one country to another is done by the aggregate of the trade transactions. Thus, we might appreciate that trade transactions (and an imbalance in these) are necessary to permit the net transfer of financial capital between countries. Further, we can appreciate that financial capital can be transferred between countries only at a limited rate, this being the rate at which a trade imbalance is occurring.

The F-H results are criticized empirically to the estimation methods and models, omitted variables bias, and variables' measurement. On the other hand, Tesar (1991), Coakley et al. (1996), Johansen (1995) attribute the long-run saving-investment association to

the current account solvency rather than the degree of capital mobility F-H cross-section regression captures. Since the current account is defined as the difference between investment and saving series which seem to be I(1) in the OECD countries, the solvency constraint implying the stationarity, in other words, sustainability, of the current account balance reveals the cointegration relation between investment and saving irrespective of the degree of capital mobility (İyidoğan and Balikçioğlu 2010). This paper contributes to revision in the result of previous research for Iran in two ways. First, the standard F-H representation is Will be reviewed by add two variables for Iran: an interactive time trend with the savings rate takes into account the impact of policy measures on savings behavior and intra-national capital mobility, and trade openness variable to estimate the effect of openness on investment rate is Used. Secondly, Simultaneous we investigate the dynamics of the current account as an important issue in macroeconomics Iran.

The plan of the paper is as follows. Section 2 reviews the theoretical basis of the F-H puzzle and reviews of empirical studies with a focus on providing solutions for the F-H Paradox. In Section 3 of the paper, we estimate models that we believe address F-H modeling inconsistencies in the country. The 4 sections will discuss the data and methodology employed in the paper and present the empirical results. Section 5 is the conclusion. Section 6 provides practical recommendations.

2. Theoretical basis of the F-H puzzle and review of empirical studies

F-H states that $I = \beta S$, where I and S are the investment and saving rates, respectively, and β is the F-H coefficient. As national investment can be expressed as $I = I_p + I_g$, that is, the sum of private and public investment, and that there exist sectoral F-H relationships of the form $I_p = \beta_p S_p$ and $I_g = \beta_g S_g$, the national F-H coefficient can be written as $\beta = \beta_p \left(\frac{S_p}{S}\right) + \beta_g \left(\frac{S_g}{S}\right)$, namely, a weighted average of sectoral coefficients, with the weights being the proportions in national saving. This gives an intuitive answer that clashes with the empirical results: a country cannot be more financially constrained than its domestic institutional sectors. It must necessarily hold for the country as a whole, once the national saving and investment rates are just the sum of the sectoral rates all coefficients, national and sectoral, must be closed to zero. Likewise, if each sector finances its investment solely with its own saving (the sectoral coefficients are one), the national coefficient must also be one. It is possible to rationalize the coexistence of a high national and low sectoral F-H coefficients. Of course, under this framework, we may observe a national coefficient higher than the sectoral ones, the reason being that the independence between saving and investment for any particular sector (implying a low sectoral β) will be partially mirrored, with the opposite sign, by one or both of the other sectors, thus causing a high national β. We in this research suppose there is international capital mobility equal to total capital mobility across sectors. we aim to present some stylized facts about these investment-saving correlations at the international level.(Bebczuk and Schmidt 2010).

Thus, our starting point is the quantitative criteria for assessing capital mobility is the seminal paper Feldstein and Horioka (1980) which the saving-investment correlation presented a direct test of the perfect capital mobility. The model as specified in the F-H work is in the form:

$$\left(\frac{I}{Y}\right) = \alpha + \beta_1 \left(\frac{S}{Y}\right) \qquad (1)$$

Where $\left(\frac{I}{Y}\right)$ is the domestic investment ratio, $\left(\frac{S}{Y}\right)$ is the saving ratio, and the subscript denotes a country, α is the intercept and β_1 is the rate of changes of domestic investment as saving rate changes by one unit, referred to as the saving-retention coefficient. In the presence of capital mobility, the value of β_1 is expected to be low (close to zero), indicating a low correlation between domestic saving and domestic investment. On the contrary, in the absence of cross-border capital mobility, the value of β_1 is expected to be high (close to unity) Hassan et al (2014).In the former case, since the capital can flow to the countries with higher returns, the domestic saving is not a determinant of the domestic investment while the latter reflects a closed economy exhibiting one-to-one saving-investment association. Even though the anomaly, so called F-H puzzle had led to a great deal of debate in the literature, no consensus has been reached yet.

İyidoğan and Balikçioğlu (2010) Using bounds testing procedure and 1968-2008 sample for Turkey, explored the validity of a level relationship between saving and investment. The results of the merger analysis confirmed the claim of no long-term relationship. They believe since the saving-investment association is so complicated that cannot be simply come down to the F-H relationship, some other aspects of the related interaction should also be considered. Firstly, as the domestic saving and investment have two components containing public and private sector, it makes sense to examine the saving-investment interaction separately for these sectors. Secondly, since the result of no cointegration can be an indicator for the unsustainability of current account deficits rather than the evidence of capital mobility, the saving-current account balance interaction should also be investigated. In this framework, the presence of cointegration indicates the weakness of the saving-investment relationship.

Apergis & Tsoumas (2009) explained various reasons for academics and policymakers who are interested in understanding how and why savings and investments move in their previous way. The first reason is due to its relation with current account dynamics, which is a central issue in open economy macroeconomics. The second reason is due to the need to evaluate the degree of capital mobility. The third reason is due to a host of other policy-related including overseas balances to investigate which parts of the puzzle have been resolved, which parts remain to be addressed, and where future research is heading (Razak & Masih 2017).

F-H findings of a high correlation between domestic savings and domestic investment as evidence of low international capital mobility lead to the controversial conclusion of the existence of strong home bias in the way domestic savings are allocated. Obstfeld (1986) argued that productivity shocks may cause both savings and investment rates to rise simultaneously, thus giving an appearance of a home bias. Explicitly accounting for such shocks could therefore reduce the F-H correlation and it fills the gap between theory and practice in the F-H hypothesis.

The seminal contribution of F-H showed that there is a home bias in the allocation of domestic savings. This result is known as the F-H puzzle and has been replicated by several authors, including Tesar (1991), Mussa and Goldstein (1993). According to this result, it may be the case the high correlation between savings and investment is the result of movements in omitted macroeconomic variables or productivity shocks, thus undermining the large savings-investment correlation (Georgopoulos and Hejazi 2005).

High savings-investment correlation can arise from excessive capital control, which inhibits the across-border movement of portfolio and direct investment. On the other hand, financial market liberalization reduces the cost of investing abroad, and, thus, domestic savings are financed wherever it can earn the highest marginal returns in the world. So, this process of economic openness can weaken the savings-investment correlation. However, it is also reasonable to assume that some home bias in the allocation of domestic savings is inevitable due to information constraints and perceived risks associated with investment abroad (Younas and Chakraborty, 2010).

There is a further set of studies that consider more technical issues in studies of the F-H puzzle. The empirical estimates are sensitive to the estimation method used. For example, Krol (1996) establishes that improvements in the estimating procedure can be obtained by the use of a more general approach than OLS, such as a fixed-effects panel regression procedure. These estimating techniques result in a reduction in the F-H correlation, thus reducing the estimated home bias (Georgopoulos and Hejazi 2005).

Using developed ARDL bounds testing procedure, De Vita & Abbott (2002) find that the U.S. saving and investment rates cointegrate for US quarterly data from 1946 to 2001. But the saving–investment correlation weakens after 1971, suggesting that the Feldstein–Horioka approach provides an at least partially informative measure of capital mobility.

In paper Fouquau et al (2007) proposes an original framework to determine the relative influence of five factors on the Feldstein and Horioka result of OECD countries with a strong saving-investment association. Based on panel threshold regression models, they establish country-specific and time-specific saving retention coefficients for 24 OECD countries over the period 1960-2000. They propose to test the relevance of breaking down the Feldstein and Horioka (F-H thereafter) regression parameters (or saving-retention coefficients) into classes giventhe values of five main factors generally quoted in this literature: (i) economic growth, (ii) demography, in particular dependency ratios, (iii) degree of openness, (iv) country size and(v)

current account balance. The results show that; degree of openness, country size, and current account to GDP ratios have the greatest influence on the investment-saving relationship.

Bineau (2014) investigated the regional savings-investment correlation between 1999 and 2009 within the small and highly open economy of Bulgaria. Results confirm the low correlation between regional savings and investment rates and openness has a positive effect on regional investment. he also finds that intra-national capital mobility has been increasing. A negative estimate of an interactive time trend with savings is included indicates that regional capital mobility increases during the period.

The study by Paine and Kumazawa (2005) included several alternative panel estimation methods to examine the effect of domestic savings, foreign aid, the evolution of capital mobility over time, and the degree of openness to investment rates for 29 sub-Saharan African countries from 1980 to It was 2001.The empirical evidence suggests the presence of capital mobility and that capital mobility has gradually increased over time. Moreover, foreign aid and openness both have positive and significant impacts on investment rates.

Bahmani-Oskooee and Chakrabarti (2005) believed any policy that is designed to stimulate saving, will also stimulate investment and found that results from a panel of 126 economies over the period 1960–2000 provide strong support for systematic effects of country-size as well as openness on the saving-investment relationship.

Mastroyiannis (2007) examined the degree of integration of the Greek economy into international capital markets using the proposed Feldstein-Horioka analytical framework. He used the time-series features of data on current account balances and national savings for the period 1960-2004.

Structural breaks were explicitly considered and were shown that structural breaks in the data could be the answer to the Feldstein-Horioka puzzle. The experimental results in this study showed that the Feldstein-Hurika puzzle is not compatible with the Greek economy.

Natalya's (2010) paper investigates investment savings relationships in 26 OECD countries. Therefore panel estimations using annual data for the period 1970-2008 are made for different groups of developed countries, such as the OECD, EU15, NAFTA, and G7. The empirical findings reveal that the Feldstein-Horioka puzzle exists only in the panel of G7 countries.

Research by Litsios and Pilbeam (2015) provided new evidence that current account balances in Greece, Portugal, and Spain have become non-stationary after the adoption of the euro implying that there is no long-run stable relationship between savings and investment contrary to the Feldstein Horioka puzzle. This can be taken as evidence of unsustainable current account balances and loss of solvency for the underlying economies. Their results suggest that the way that investment is financed should be a key policy concern as it impacts on current account imbalances and this, in turn, has raised questions about these countries' continued membership of the Eurozone.

Gundlach and Sinn (1992), have shown that if a country's current account balance expressed as a ratio to GDP contains a unit root, then there is no long-run stable relationship between its saving and investment rates, and the country is linked to the international capital market. This paper develops a new approach to testing whether a country is linked to the international capital market. Their results for the whole period from 1950 to 1988 indicate that at least Germany, Japan, and the United States are part of the international capital market. Their testing approach explores the possibility that the current account balance of different OECD countries contains a unit root. They show that if the ratio of the current account balance to GDP is found to be integrated of the order of one, the existence of a stable long-term relationship between the saving and investment rates of that country is unlikely. Therefore any inferences based on such a specification may be regarded as spurious. It cannot be concluded, however, that a country is shut off from the international capital market if its current account balance is found to be 1(0).

Younas and Chakraborty (2010) propose Capital account liberalization and the integration of world financial markets should increase capital mobility across countries. Their research uses the F-H savings–investment methodology to examine the impact of economic globalization on the degree of capital mobility in 99 countries over the period 1970 to 2005. Their findings suggest that economic openness and financial market integration have led to increased capital mobility in developed as well as developing

countries. However, their effect appears to be larger for the latter.

Coakley and Kulasi (1997) question the concept of measuring capital mobility using saving-investment correlations. They empirically confirm that savings and investment tend to be cointegrated, but this fact is evidence for current account solvency or the interim budget constraint of an economy and is not a reason for the incomplete realization of capital. Hence, long-run correlations of saving and investment cannot be taken as evidence of low capital mobility. While low short-run correlations can be interpreted as indicators of capital mobility (Buch 1999).

Mastroyiannis 2007 investigate the degree of integration of the Greek economy into international capital markets using the analytical framework proposed by F-H. He examines the time-series properties of data on current account balance and national savings for the period 1960-2004. Mastroyiannis with evidence that the ratio of current account balance ratio is a stationary series and the national savings rate is a non-stationary series indicated that the Greek economy does not participate in international capital markets. The empirical results his add another piece of evidence to the literature on the Feldstein-Horioka puzzle, indicating that the Feldstein-Horioka puzzle does not hold for the Greek economy.

Kumar & Bhaskara (2011) estimated the Feldstein–Horioka equation from 1960–2007 with a panel of 13 OECD countries with the Pedroni method. It is found that the Feldstein–Horioka puzzle exists in a weaker form. Structural break tests indicated that there was a break in the mid-1970s or in the early 1990s. These break dates seem to capture the effects of the last decade of the Bretton Woods agreement and the early years of the Maastricht agreement. In the post-break periods, this relationship is weaker and the saving retention coefficient has declined, implying that capital mobility has increased between these OECD countries. It is likely that these two agreements may have decreased investor uncertainty and improved capital mobility.

Baltaci and Ayaydin (2013) study estimates saving and investment correlations for the Central and Eastern Europe (CEE) transition economies and the G-20 countries to assess the degree of capital mobility. Employing GMM, this study uses financial openness, financial freedom, and foreign aid over the period 1990–2011. The study finds that the saving-investment correlation for G-20 countries is lower than that for CEE transition countries. Our findings suggest that financial openness and financial freedom significantly increase capital mobility in the CEE transition countries, but do not have a significant impact on capital mobility in the G-20 countries.

In the study of Ehsani and Taheri Bazkhane (2018), the examine of the Feldstein-Horioka puzzle using the Markov switching approach in Iran during the three periods before and after the victory of the Islamic Revolution (1356: 4 - 1339: 4 and 1391: 4 - 1357: 1)) and also It has been done during (1391-4: 1347: 2). The conclusions obtained from this approach indicated that implies that Feldstein--Horioka Puzzle does not hold.

Akkoyunlu, (2020) examines the saving-investment nexus and the level of capital mobility for the BRICS and Fragile Five countries within the scope of the Feldstein-Horioka(1980) puzzle that asserts a substantial correlation between domestic investment and domestic savings in spite of the increasing capital mobility in the world. It is used the Autoregressive Distributed Lag (ARDL) bounds test approach for the period 1980-2018 on a country-by-country to identify the nature of the saving retention coefficient. The findings of the paper reveal the Feldstein–Horioka (1980) puzzle holds for China, South Africa, and Turkey period examined while there is not any long-run relationship between savings and investment in Brazil, India, and Indonesia. Based on the saving-retention coefficients range from 0.46 to 0.74 for the four countries in which there is a cointegration between saving and investment, there is moderate to low capital mobility in these countries.

The saving-investment interaction has a vital role in shaping the economic policies intended to generate high economic growth. The empirical results as of F-H point out that saving promoting policies have significant effects on the level of investment, thus stimulate economic growth. Contrarily, the policies aiming to increase economic growth via domestic saving are ineffective in an open economy. Thus, it can be concluded that the motivation behind the efforts for solving the F-H puzzle stems from the desire of raising the performance of the economic policies.

The basic aims of this research paper are Included:

1. To present some empirical evidence on applying a method based on the relationship between savings

and investment in determining capital mobility, formulated by Feldstein and Horioka (1980) and developed with a degree of openness (as a proxy for reduced trade frictions) and time trend.

2. Testing for cointegration current account rates that can account for switching behavior in the savings-investment in determine the degree of capital mobility.

3. Data and Methodology

This study uses annual macroeconomic data from 1978 to 2017. It should be noted that all data were collected from the annual reports of the Central Bank of the Islamic Republic of Iran. To develop an econometric model in assessing the level of capital mobility in the country, a rewrite of the main F-H equation has been adapted from the study of Bineau (2014) and Younas (2007). This rewrite includes defining an interactive time process and entering the openness variable in the F-H equation as follows:

$$\left(\frac{I}{Y}\right) = \alpha + \beta_1\left(\frac{S}{Y}\right) + \beta_2\left(T \times \frac{S}{Y}\right) + \beta_3 OPEN + \mu \quad (2)$$

The definitions and sources of data for the variables in the paper are presented in Table 1.

Table 1: Data definition and sources

Symbol	Variables	Definitions	Source
$\left(\frac{I}{Y}\right)$	In Equation 2: Log ratio of Gross fixed capital formation to GDP In Equation 3: ratio of Gross fixed capital formation to GDP	In the system of national accounts of Iran, the formation of total gross fixed capital in machineries and equipment includes both private and public sectors.	Economic Time series Database of Central Bank of the Islamic Republic of Iran
$\left(\frac{S}{Y}\right)$	In Equation 2: Log ratio of national savings to GDP In Equation 3, 4: ratio of national savings to GDP	National savings are the same as gross national savings	National Accounts of Central Bank of the Islamic Republic of Iran
$\left(T \times \frac{S}{Y}\right)*$	Log interaction variable	The variable is multiplied by a time trend (T)	-
OPEN	Log degree of trade openness	sum of exports and imports of goods and services divided to GDP	Economic Time series Database of Central Bank of the Islamic Republic of Iran
$\frac{CA}{Y}$	In Equation 3,4: ratio of current account to GDP	the ratio of the deficit between exports and imports of goods and services to GDP	
Note: (1) * The time trend is defined by T. In model building as Clive Granger (2001) indicates, a time trend as an interaction variable in the model can be used to introduce time-varying coefficients and, thus, approximate unobserved functional structure in economic models. ; (2) interaction variable = T×(S/Y).			

According to Wong (1990), openness can influence the savings retention coefficient. The openness variable is constructed as the product of the average of trade flows as a percentage of regional GDP and gives information about the effect of trade on the investment ratio. A positive estimate of β3 indicates that any changes in the degree of trade openness exert a similar impact on (I/Y). It should be noted that in equation 2, we proceed with a logarithmic conversion to create a series stationary in its variance. The degree of international capital mobility is defined by the value of β_1. If the estimate of $\beta_1$is high (low), then the link between $\left(\frac{S}{Y}\right)$ and $\left(\frac{I}{Y}\right)$ is important (not important) and international capital mobility is low (high). We utilize standard unit root tests the Augmented Dickey-Fuller (ADF) test to assess the stationarity of the variables and to test for long-run relationships amongst the

variables. The ADF test the null hypothesis of a unit root, against the alternative that it is stationarity. This model was selected based on research by De Vita & Abbott (2002) to test the Feldstein and Horioka hypothesis in determining capital mobility, using the ARDL framework developed by Pesaran and Shin, (1999) and Pesaran, Shin, and Smith (2001). If there is a long-term relationship, then we can use the correction error model (ECM).

For the conclusion about the statements of Feldstein and Horioka, we have used the analysis of Equation (4), the idea of which is from the studies of Feldstein (1983), Gundlach & Sinn (1992), Mastroyiannis (2007), and Litsios & Pilbeam (2015). According to Gundlach & Sinn, since the capital mobility controversy focuses on long-run equilibrium relationships, the cointegration approach seems to offer some practical guidelines for the conduct of the time series analysis of this issue. Our test procedure is based on testing for cointegration between saving and investment rates.

To clarify the relationship between fiscal policy and the current account, we use the current account identity, which Obstfeld and Kenneth (1995) called the interim flow account model, according to which the current account balance (CA) is equal to the difference between domestic savings (S) and domestic investment (I),

$$\frac{CA}{Y} = \frac{S}{Y} - \frac{I}{Y} \qquad (3)$$

By expressing Equation 3 to Y and replacing Equation 3 with Equation 1, Equation 1 can be rewritten:

$$\frac{CA}{Y} = -\alpha + (1-\beta)\frac{S}{Y} + U \qquad (4)$$

We examine the behavior of the Iran current account balance within a time series framework. Apart from reflecting the nature of exports and imports and international trade policies, the dynamic behavior of the current account balance also reflects the decisions of economic agents regarding savings and investment. Now suppose that the ratio of the current account balance ($\frac{CA}{Y}$) is found to be I(1). If we stick to the implicit Feldstein-Horioka assumption that the error term e is iid with (0, δ_e^2), then the current account balance can exhibit I(1) behavior only in the case where β does not equal 1. Here the I(1) result would indicate different reactions of the saving and the investment rate to shocks. That is, in this case, the saving and the investment rate can be interpreted as following independent random walks. If the $\frac{CA}{Y}$ is a stationary series I(0) and the national savings $\frac{S}{Y}$ is a non-stationary series I(1), the saving retention coefficient (β) must be equal to one. This implies no relationship between changes in the national savings rate and changes in the country's international transactions which, in turn, indicates that domestic investment is primarily financed by national savings and the economy does not participate in international capital markets. In contrast, if both $\frac{CA}{Y}$ and $\frac{S}{Y}$ are non - stationary series then $\beta \neq 1$. In this case, there is no long-run stable relationship between saving and investment rates and, consequently, the country is linked to international capital markets.

4. Empirical Results

a. Unit Root Tests

Owing to the fact that the study uses a time series data and to avoid spurious regression, the series is first checked whether they are stationary or not. We start our work with standard unit root tests to assess the stationarity of the variables. The ADF testing at the level I (0) and the first difference I(1) will include both intercept and trend, no intercepts and no trends, and only intercept. Lag length is selected according to Schwarz Information Criterion (SIC) value. The results from the ADF test, shown for the four variables of the equation in Table 2. From the analysis of the under results, three variables are integrated of order one while one is integrated of order zero, i.e., I(0).

Table 2: Unit Root Tests Results

Variable	Level			First Difference			Order of Integration
	Intercept	Trend & intercept	None	Intercept	Trend & intercept	None	

I/Y	-1/46	-2/38	-0/74	-4/43***	-2/57	-4/36***	I(1)
S/Y	-1/87	-2/73	-0/54	-6/89***	-3/05	-6/99***	I(1)
T×(S/Y)	-0/89	-2/54	-1/60	-5/82***	-5/73***	-6/47***	I(1)
OPEN	-1/44	-3.92**	-1/08	-3/64***	-9/12***	-2/90***	I(0)

Note: (1) In ADF tests, H0= there is unit root in the series; (2) *, **, *** denote significance at 10%, 5% and 1% respectively

Source: Authors' calculations

b. ARDL Bounds Testing Approach

The adoption of the ARDL cointegration technique does not require protests for unit roots, unlike other techniques. Given that the most important hypothesis of the ARDL method, that the variables should be combined in I(0) or I(1) or a combination of both methods, the use of the ARDL model in this study can be valid. The ARDL cointegration approach was developed by Pesaran and Shin (1999) and later by Pesaran et al.(2001). It has got three advantages in comparison with other previous and traditional cointegration methods that were in use. The first one is that the ARDL technique does not need that all the variables under study must be integrated of the same order. The second advantage of the model is that the ARDL test is relatively more efficient in the case of small and finite sample sizes of data. The third advantage is that by applying the ARDL technique we can obtain unbiased estimates of the long-run model (Harris and Sollis 2003, Raghuramapatruni and Surya 2020).

In order to select the appropriate model of the long run underlying equation, it is necessary to determine the optimum lag length by using proper model order selection criteria such as; the Akaike Information Criterion(AIC), Schwarz Bayesian Criterion (SBC), or Hannan-Quinn Criterion (HQC). To the lag length, we choose the AIC information criterion which suggests 4 lags for the time series data as the least value of AIC. As shown in the figure1, the optimal lag length is ARDL(1,0,4,4).

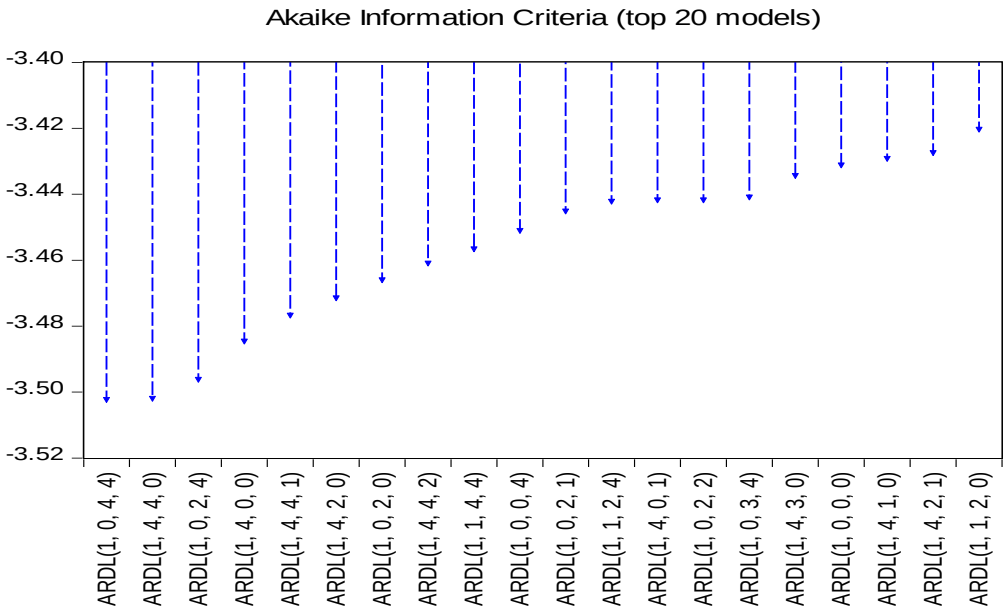

Figure 1: Akaike Information Criteria

Source: Authors' calculations

The first test in the model of ARDL is the test for Cointegration. Pesaran et al.(2001) developed the ARDL Bound test for exploring cointegration between and among different variables which are either I(0) or I(1) or mixed order I(0) and I(1) for the validity of this model. There should be at most one cointegrating equilibrium involving the dependent variable, where only the dependent variable, and not the regressors, responds to deviations from this equilibrium (Baral 2020). Table 3 reports the results of the ARDL bounds testing approach to cointegration.

The bound test result of the F statistics value is the key to making a decision of whether it is greater or smaller than the critical values of the upper bond. The results indicate the existence of a unique cointegrating equation when (I/Y) is the dependent variable. The bounds test F statistic of 3.50 exceeds the upper bound critical values at a 10% confidence level based on Pesaranet al (2001). The null hypothesis of no cointegration H0=0 is thus rejected for the alternative hypothesis of cointegration H0≠0. We thus consider (S/Y), (T×S/Y), and OPEN as the long-run forcing variables of (I/Y) in Iran from 1978 to 2017.

In this section, residual diagnostic tests were performed as a formal condition in econometric analysis. In order for the results to be presented in a way that is economically significant and reasonable, the proposed model must comply with the identification of econometric requirements. For this purpose, the residual diagnostic tests were performed as a formal condition in econometric analysis, and the results are found to be provided in table 4. We did it some Diagnostic tests Including: serial correlation, Ramsey 's RESET test, normality, heteroscedasticity. The results from this table with all p-value larger than 0.05 reveal the accepted null hypothesis of no serial correlation, no heteroscedasticity, and normal distribution and form function 's model with Ramsey 's RESET test is right. the results are found to be satisfactorily provided in this table and therefore can say that result of the research has economic significance.

Table 3: Bounds test (F-version) for Co-integration

Lag Optimal (1,0,4,4); Included observations: 36					
Variables : F(I/Y | S/Y, T×(S/Y), OPEN)					
k	**F-statistic**	**Level of Significance**	**Critical Values**		**Decision**
			Lower Bound I(0)	**Upper Bound I(1)**	
3	3.50*	10%	2.37	3.2	Cointegration exist
		5%	2.79	3.67	
		2.5%	3.15	4.08	
		1%	3.65	4.66	
Note: (1) *, **, *** denote significance at 10%, 5% and 1% respectively; (2) Null Hypothesis: No long run relationships exist.					
Source: Authors' calculations					

Table 4: Diagnostic Test Results

(A)	Heteroscedasticity (Breusch-Pagan-Godfrey)	F-statistic	0.925485	Prob	0.5389
		Obs*R-squared	11.72262	Prob	0.4682

(B)	Specification Test (Ramsey RESET)	F-statistic	0.253713	Prob	0.8021
		Likelihood ratio	0.064370	Prob	0.8021
(C)	Serial Correlation LM Test (Breusch-Godfrey)	F-statistic	1.797106	Prob	0.1904
		Obs*R-squared	5.261060	Prob	0.0720
(D)	Normality Test (Jarque-Bera)	Jarque-Bera	0.888471	Prob	0.6413

Note: (A) Ho for heteroskedasticity test is no heteroskedasticity in the model; (B) Ho for the linearity test is a; (c) Ho for the test is no autocorrelation in the model linear model;(D) Ho to test normality is model has normal distribution.

Source: Authors' calculations.

In the following, we have examined the stability of the long-run parameters together with the short-run movements for the equations. As prescribed by Pesaran and Pesaran (1997), the stability of the short-run and long-run coefficients have been checked through the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) test given by Brown et al. (1975). Figure 1 indicates the residuals' performance or pattern with respect to their stability If the plots of the CUSUM and CUSUMSQ statistics stay within the critical bounds of the five percent level of significance, the null hypothesis of all coefficients in the given regression is stable and cannot be rejected. Examination of plots in Figure 2 shows that CUSUM and CUSUMSQ statistics are well within the 5% critical bounds implying that short-run and long-run coefficients in the ARDL-Error Correction Model are stable.

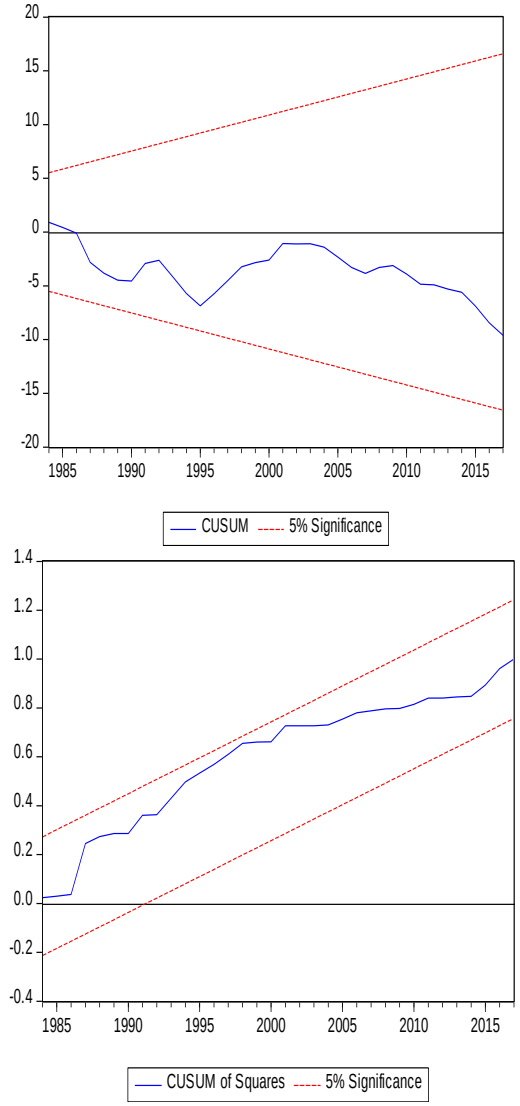

Figure 2: Plot of CUSUM and CUSUMQ of Recursive Residuals

Source: Authors' calculations

c. Estimating Long Run and short-run ARDL Model

The estimated long-run elasticity of the ratio total investment to the ratio of national savings, interaction variable; trade openness ratio; are presented in Table 5. This table shows the results of the long-run ARDL based on the Akaike information criterion. Based on the results of model ARDL, our main findings can be summarized as follows:

First, we notice that, except for the trade openness, another two variables are statistically significant determinants of the ratio total investment. Our results show that there is a significant but positive relationship between ratio investment total and the interactive time trend with savings. This evidence, which is in no line with previous research (Bineau 2014), explanatory that a negative estimate of β2 indicates that capital mobility increases during the period. A likely explanation if β2 is significantly negative is the fact that is perceived as a crucial feature for international capital mobility. The positive nature of this variable is a reason for the lack of capital mobility in Iran.

Second, the trade openness ratio has a negative and unstatistically significant elasticity, this evidence, isn't in line with some previous researches (Wong 1990, Younas and Chakraborty 2010, Payne and Kumazawa 2005, Bahmani-Oskooee & Chakrabarti 2005). Trade openness is explained as a variable Ineffective in the ratio investment total. Therefore the unelasticity of the variable ratio of investment total to trade openness ratio is an expression of the immobility of international capital in Iran.

Finally, The estimate of the long-run parameters of the ARDL model shows a strong causal effect directed from the ratio of national savings towards ratio investment total. The estimated long-run elasticity of the ratio total investment to the ratio of national savings is very high (%0.85), suggests that capital mobility is very weak. Any changes in the savings rate have a large positive impact on the investment rate. The F-H puzzle does not exist in Iran. The non-existence of the F-H puzzle in Iran was confirmed by the study of Ehsani and Taheri Bazkhane (2018). Therefore, it can be concluded that with the liberalization of the financial market and economic openness around the world, capital mobility in Iran will not occur over time. The results of long-run relationship estimation show that the size, sign, and significance of the coefficients of all model variables that measure the amount of international capital mobility over time are consistent with each other.

Table 5: Estimated Long Run Coefficients the ARDL Approach

ARDL (1,0,4,4) Selected Based on Akaike info criterion (AIC)				
Dependent variable: I/Y				
Variable	**Coefficient**	**Std. Error**	**t-Stat**	**Prob**
S/Y	0.85***	0.34	2.46	0.02
OPEN	-0.43	0.32	-1.32	0.19
T×(S/Y)	0.03***	0.00	3.65	0.00
C	-0.07	0.14	-0.48	0.62
R -Squared= 0.81; DW-statistic = 2.79 ; F-stat=8.20 Prob=000				

Note: *, **, *** denote significance at 10%, 5% and 1% respectively
Source: Authors' calculations

The error correction model was examined to evaluate the short-run dynamic relationship between the ratio of domestic investment and its determinants (the ratio of national savings, interaction, and trade openness), and to confirm the reliability of the long-term coefficient. It was estimated by normalizing the long-run estimates. The different components in the ARDL equation were substituted with the ECM item. Table 6 shows the results of short-run coefficients of ARDL.

Results of short-run ARDL show that the coefficients of interaction and trade openness in the first and third lag have the expected sign and statistically significant impact on ratio investment in Iran in the short run. But the ratio of national savings in long term is statistically significant at a 1% level of significance. But the national savings ratio in the short run is not statistically significant and has no role in determining the investment ratio

The ECM coefficient carries a negative sign and is statistically significant at the one percent level which is preferable. Thus, the short-run model was consistent. The estimated ECM coefficient (- 0.45) also determines the speed of the correction towards an equilibrium relationship. Further, the ECM also indicates that any divergence from the long-run relation in the current period should be adjusted by around 45 percent in the following period implying that adjustment is acceptable.

The degree of openness coefficient With the lag one and three indicated that a one percent increase in the degree of openness rate, increases the elasticity of the ratio of domestic investment in Iran by 27%-33% . Our results are the same as Fouquau et al (2007). our outcome confirms in the reasoning that International mobility of capital Instead of a savings-investment correlation, depends on other exogenous variables (trade openness, country size, demography, current account balance, etc.).

Table 6: Error Correction Representation (ECM) for ARDL Model

ARDL (1,0,4,4) Selected Based on Akaike info criterion (AIC)				
ECM = I/Y - (0.8501* S/Y -0.4347* OPEN + 0.0317* T×(S/Y) -0.0718)				
Dependent variable: ΔI/Y				
Variable	**Coefficient**	**Std. Error**	**t-Stat**	**Prob**
ΔOPEN	0.01	0.10	0.16	0.87
Δ(OPEN (-1))	0.33***	0.11	2.94	0.00
Δ(OPEN (-2))	0.02	0.13	0.20	0.84
Δ(OPEN (-3))	0.27*	0.12	2.13	0.04

Δ T×(S/Y)	-0.00	0.00	-0.36	0.71
Δ(T×(S/Y) (-1))	-0.02***	0.00	-2.83	0.00
Δ(T×(S/Y) (-2))	-0.00	0.00	-1.16	0.25
Δ(T×(S/Y) (-3))	-0.02***	0.00	-3.27	0.00
CointEq(-1)	-0.45***	0.10	-4.53	0.00
R -Squared= 0.81; DW-statistic = 2.79 ; F-stat=8.20 Prob=000				

Note: *, **, *** denote significance at 10%, 5% and 1% respectively.
Source: Authors' calculations

d. Dynamics of Current Account and Saving

We examine the time-series properties of data on current account ratio and national savings ratio using two tests to evaluate the capital mobility: the Augmented Dickey-Fuller (ADF) test. The results are presented in Table 7.

Using the full sample period the hypothesis that S/Y is a realization of a stochastic series containing a unit root could not be rejected. In contrast, the null hypothesis of nonstationarity for CA/Y is rejected at a 10% level of significance. The results indicate that the Iran economy has not been integrated into international capital markets. We have to say, this result is similar to the result obtained from the ARD Bounds and Error-Correction models. In the long run, there is a stable relationship between savings and domestic investment rates. This can be considered evidence of a stable current account balance and capital mobility stagnation. Of course, for Iran, net oil exports are an important factor in explaining the current account balance. Analyses results of equation 4 for Iran are the same as the results of Mastroyiannis (2007) for Greece and Iran is not a part of the international capital market. In confirmation of the results of Gundlach and Sinn (1992) research, given that both variables I/Y, S/Y in equation 3 are I(1), we saw a long-run relationship between saving and investment rates, with a stationary current account.

Table 7: Stationarity results in Level

Variable	Level			First Difference			Order of Integration
	Intercept	Trend & intercept	None	Intercept	Trend & intercept	None	
I/Y	-1/67	-2/54	-1/62	-4/54***	-2/74	-4/51***	I(1)
S/Y	-1/96	-2/12	-0/53	-6/32***	-5/16***	-2/84***	I(1)
CA/Y	-3/19**	-5/16***	-3/23***	-5/43***	-5/34***	-5/47***	I(0)

Note: (1) In ADF tests, H0= there is unit root in the series; (2) *, **, *** denote significance at 10%, 5% and 1% respectively; (3) The variables in this table are not in logarithmic format; (4) Lag length is selected according to Schwarz Information Criterion (SIC) value.

Source: Authors' calculations

5. Conclusion

This paper examines the links of the Iran economy with international capital markets and the degree of capital mobility by using the approach of Feldstein and Horioka. We examined the validity of the relationship between savings and investment rates using the ARDL model and the ECM method. The results support the F-

H hypothesis that the strong correlation between savings and investment is the reason for the lack of capital mobility and the F-H puzzle does not exist for Iran. In the long run, a change in the degree of openness doesn't cause a change in the domestic investment.This is in the context that in the short run, only the lagged values of the trade openness variable are valid, while the national savings ratio variable has no role in determining the domestic investment ratio. Therefore, it is clear that in Iran, openness does not increase international competition and can not significantly stimulate investment rates. It can be argued that since openness cannot affect savings, it cannot provide information about the impact of trade on investment. Therefore, bias at home has no role in how domestic savings are allocated, and to analyze the relationship between savings and investment capital in Iran, one must follow the traditional F-H model. In a closed economy in Iran, domestic investment is not financed by the pool of worldwide savings. Therefore, a conclusion about the degree of capital mobility based on its correlation with domestic savings would be appropriate. Therefore, the coefficient for the national savings rate accurately indicates the extent to which domestic savings are used to finance domestic investment, and domestic investment is only very sensitive to national savings. In addition, economic openness, has not increased capital mobility. This means that the country can not experience a large current account deficit due to a lack of access to foreign loans, to be able to compensate for the lack of domestic savings for investment. We have shown that the current account balance does not have a unit root, so its savings-investment relationship is a stable and long-term one, and it has no connection to the international capital market. This analysis confirms the results obtained from the ARDL model estimate.

6. Practical recommendation

1) Foreign aid will complement domestic savings to invest in Iran. For the country to have more access to foreign capital markets , financial liberalizations are recommended.
2) Establishing well-functioning financial markets and systems, which attract more savings international , should be a policy priority for economic policymakers
3) In order to benefit from the stability and technology and skills embodied in the inflow of foreign capital, the country must also be sufficiently equipped in terms of infrastructure.
4) Another important recommendation to increase capital mobility is the country's independence from oil revenues, as the profits and losses of oil revenues strongly affect patterns of saving and investment.
5) Given that an open economy can weaken the link between savings and investment, policies to promote international capital mobility are recommended by increasing the degree of openness of non-oil trade.

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