Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345 (Online)
An Open Access, Online International Journal Available at www.cibtech.org/sp.ed/jls/2015/01/jls.htm
2015 Vol.5 (S1), pp. 5529-5536/Falahati et al.
Review Article

RELATIONSHIP BETWEEN NATIONAL SAVING AND DOMESTIC INVESTMENT IN IRAN; THE FELDSTEIN-HORIOKA PUZZLE REVISITED

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ABSTRACT
The main purpose of this paper is to survey the relationship between national saving and domestic investment in the Iran economy with considering Feldstein-Horioka theory by the Johansen- Juselius Cointegration test using Annual data (1965-2011). It also is trying to investigate the causality relationship between national saving and domestic investment using the Toda and Yamamoto causality test. The model estimation results show that there is a positive equilibrium long-run relationship between national savings and domestic investment in the mentioned coursed. That's the reason for low mobility of capital in the Iran economy. Toda and Yamamoto causality Test results show a one-way causal relationship from national saving to domestic investment.

Keywords: *National Saving, Domestic Investment, Johansen–Juselius Cointegration Test, Toda - Yamamoto Causality Test*

INTRODUCTION
Investment is considered as an engine for economic growth and development in economic literatures. And as the capital is one of the important factors of production have been give it a special place and the experience of world economic development shows that with economic growth, there have been increasing path of capital accumulation (Bahrami and Aslani, 2005). On the other hand savings always have a vital role at lifecycle organized communities and producers in various forms. Each product requires preparation and creation tool that is also somehow associated with abstinence from consumption. So, it seems creation tool of human is duplicate initial savings. Which one of savings and investment variables is more important and more fundamental has been a controversial discussion. In this regard Kaldor says: "The whole contention between Keynesian and non-Keynesian theories, is that, whether the investment determines savings or vice versa."This argument implies that in neoclassical models, savings determines the investment and in Keynesian models investment determines the volume of saving. Thus, study the relationship between two variables national savings and domestic investment has fundamental importance and hackling the discussion of this relationship being considered in explaining the behavior of the external sector of the economy more than in analysis of the domestic economy. Despite various comments, there are exiles on the analysis of the relationship between savings and investment. That almost the most economists agree about it and addressing it is considered as fundamental issues within the international economy area. Among that the axis can be noted that the perfect capital mobility between countries exacerbate the gap between domestic investment and national saving. This means that in the absence of obstacles to the movement of capital between countries, each country's national savings can select the most profitable projects around the world and move into it. As a result of that the counter current and heterogeneous trend between savings and investment will experience inside an economy (Hadian, 1999). Numerous studies are conducted in this area that some of them are mentioned here. In analyzing the behavior of savings and investment the manner of relation between these two variables are introduced as the index to measure the degree of capital mobility between countries. Their findings for the study sample indicate that domestic investment is determined primarily by the National Savings and capital mobility between countries is limited. Hussein (1998), the issue of the capital mobility and FH puzzle in 23 developed countries analyzed using ordinary least squares technique. The results showed that in most countries, capital is moving significantly during the past three centuries. In this study, only 5of

the 23 countries were supported by the findings pertaining to the FH puzzle. Narayan (2005) studied the estimated relation by Feldstein and Horioka, about investment and savings for the Japanese economy during the period (1960-1999), and used the ARDL method and reached this result that savings and investment in the Japanese economy for the studied period are co-integrated only if the investment is to be used as the dependent variable, and the direction of causality between the two variables is bilateral. KarimIslam and Mahboobeh (2010), studied savings and investment behavior in 21 Asian countries during the period (1990-2006) by applying the GLS method and concluded that there is a long-term equilibrium relationship between savings and investment in all countries, regardless the degree of trade liberalization. Rama Krishna and Venkateshwar (2012), examined the long-term relationship between savings and investment in Ethiopia, using cointegration tests and concluded that there is no relationship between these two variables in the Ethiopian economy.

This research is an effort that used cointegration test Johansen–Juselius to estimate long-term relationship between national savings and domestic investment in the economy of Iran during the period (1965-2011) and by using Toda –Yamamo to Causality test, direction of causality between these two variables is determined, in order to achieve required strategies for increasing the investment and follow that economic development, by determining the direction of this relationship.

Statistical Analysis of Investment during 1965-2011

Investment in the economy of Iran during the under review period, the most volatile component of aggregate demand and function of changes in quantity and quality frequently of variables such as gross domestic product, lacking political and economic stability, investor pessimism about the future and the interest rate changes.

In this section, the trend of investment for the economy of Iran over the period 1965-2011, is reviewed and analyzed.

For the studied period, regarding the proportion of gross domestic capital formation to gross domestic product and Figure 1, can be realize that mentioned ratio, during the 65 to 76 years, except decline in 66 and 67 years, increased 55 and has experienced its maximum value at level of 53%. This trend had full swing in the period from 76 to 84 years, because of revolution and war that led to the decline in oil revenues and political instability. After 84 year, the ratio of investment to gross domestic product had substantial growth until 1992, but then declined sharply, due to the sharp decline in oil revenues and thus reduce gross domestic product and increasing uncertainty space during the war years, due to the pressing need for investment in order to repair and rebuild, with increase providing the resources of domestic investment through the foreign borrowing and regardless of national savings and based on policies of the first economic development program, and in 95 years fell to lower numeral 22.26. High inflation due to an increase in the money supply and creating uncertainty and instability in the economy and the sharp decline in national savings in order to repayment liabilities prior period can be considered as an effective factors in this decreasing trend. After 1994, this ratio grown with decreasing rate and is reached to (38.23) at the end of studied period (mean at the end of 2011) (Afshari, 1998).

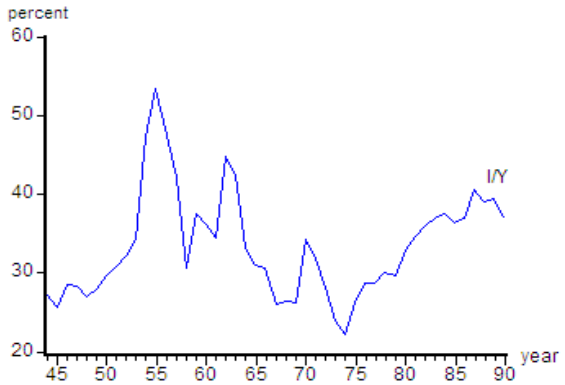

Figure 1: The trend of ratio of the gross domestic investment to gross domestic product

Evaluation the Trend of Savings and its Role in Providing Required Resources for Investment

According to the diagram (2) where S / Y and I / Y, respectively, ratio the national savings and domestic investment to gross domestic product, it can be realized that the share of national savings in gross domestic product until 1976, despite fluctuations, had the upward trend. Especially in 1974, that Iran had vast oil revenues, the share of national savings to gross domestic product had reached to 74 percent, the highest value of this ratio, during the period under study. It seems share of savings in GDP after 1976, although it was associated the fluctuations, but the total decline. Especially with war, the decline was more severe and in the 1986 savings share of GDP reached the lowest 19 percent. By comparison the savings and investments trend graphs the result can be reached that gross domestic savings during the 1965-2011 was the most important factor of providing required resources for investment specially after revolution and always any fluctuation in this variable has create significant fluctuations and changes in domestic investment, this issue become be clearer for recent decades.

Looking at the trend these two variables in diagram (2), we see national savings, such as domestic investment, overall has decreasing growth in recent years. This issue is shown directly its effect on investment. It should be noted that the challenge of saving and investment in the current circumstances economy faces according to weak external outlook in the economy of Iran has intensified over the coming years. And like many of the economies in the Middle East and North Africa, Iran's economy with limited cash flows and of foreign direct investment as result of economic sanctions cannot look at the outside world as a source of revenue during the coming years (Sa'di, 2005).

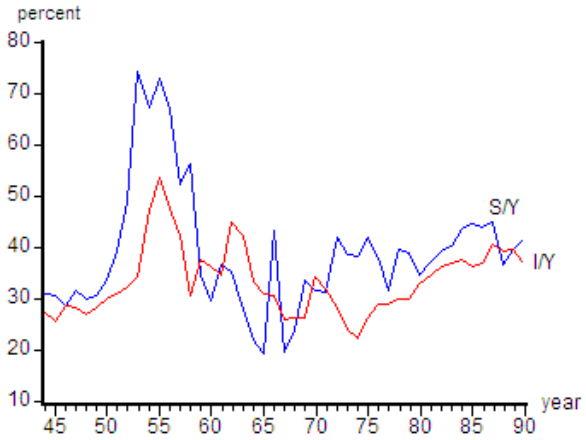

Figure 2: The trend of ratio of national savings and domestic investment to gross domestic product

The Model Stipulates

In this paper, Feldstein and Horioka model is estimated to determine the degree of capital mobility, along with the implement the impact of war on relationship the saving-investment for the economy of Iran.

$$I_t = \alpha + \beta S_t + DUM + \varepsilon_t \qquad (1)$$

I_t: Logarithm of the ratio of gross domestic investment to gross domestic product
S_t: Logarithm of the ratio of gross domestic savings to gross domestic product
DUM: Dummy variable for a number of years of war and non-war years to be zero.
α: Intercept
ε_t: Disturbance term

Estimation of Model and Analyze the Results

Variable Stationary

Before estimating the model, the stationary and non-stationary of model time series is examined. One of the higher priority ways to detect stationary data is Augmented Dickey-Fuller Test.

According to Table 1, I and S variables are non-stationary at level of data. As the test statistic for these variables is less than the MacKinnon critical value. But they will be stationary at their first-difference.

Table 1: Unit Root Tests in level and First Differences

Variable name	With interception and trend				Result
	Variable level test statistic	Critical value	first-difference test statistic	Critical value	
I	-2/546	-3/518	-4/79	-3/52	I(1)
S	-2/07	-3/518	-6/089	-3/52	I(1)

(Numbers are related to critical value at Confidence level of 95 percent.)
Source: research findings

Determining the Optimal lag of VAR Model
One of the main steps in estimating the VAR model is selection of optimal lag of model. The maximum Schwarz-Bayesian and the Akaike statistics is optimal lag VAR model. Maximum amount of Schwarz criterion in this the model is19/5181whichrepresents the optimal lag of 1.
The Significance Test of the Predetermined Dummy Variables
According to the LR statistic (7.1788) and the minimum significance level (0.028) the null hypothesis; that the DUM variable is not significant, is rejected and the opposite hypothesis; that DUM variable is significant, is accepted.
Johansen–Juselius Cointegration test
After determining the optimal lag of VAR model and also be sure about the significance of effects of predetermined variables on model, now the model can be estimated based on Johansen–Juselius test. Generally in the analysis of multivariate time series, there may be more than one long-term cointegration vector. In that case, methods such as Engel-Granger method cannot determine these vectors without any default on the part of an analyst. Johansen and Juselius formulated a method to determine the cointegration vector through maximum likelihood and solved shortcomings of using Engel-Granger method. According to Johansen–Juselius discussion it is needed to know the rank of matrix and the number of variables. And if the rank of the matrix is smaller than the number of variables to determine rank of the matrix, tow test trace(λ_{trace}) and maximum eigen value (λ_{max}) are used (Tashkini, 2005).
Now, Regarding above explanations the convergence coefficients of the model are estimated. Endogenous variables in our model are I and S that both are I (1) and DUM is the exogenous variables in the model.
The next step is to determine the rank of the matrix, that in order to this trace(λ_{trace}) and maximum eigen value(λ_{max}) tests are used.

Table 2: Summary of the matrix rank test results using (λ_{trace})and (λ_{max})statistics

	H_0	H_1	Model
λ_{Max}	r=0	r=1	21/7828 (19/22)
	r≤ 1	r=2	4/4984 (12/39)
λ_{trace}	r=0	r≥ 1	26/283 (25/77)
	r≤ 1	r=2	4/498 (12/39)

(Numbers in parentheses are critical values at 95%)

The results of determining the rank of the matrix are presented in Table 2.
As the table shows, base on the trace and maximum eigen value tests, the existence of one cointegration vector between model variable is confirmed. Because according to the test statistic at 95% the null hypothesis; that there is no cointegration vector is rejected and the opposite hypothesis; there is a cointegration vector among variables is not rejected.

Calculation and Interpretation of the Cointegration Vector

The third step is allocated to determine the long-run relationship between the variables of estimated model by Johansen–Juselius method and the normalized vector to the desired endogenous variable. It should be mentioned that in the choice the long run vector among model variables, it should be noted that the normalized vector to the endogenous variable, in terms of sign, should be consistent with coefficients of economic theories.

Table 3: Summary of results of long run vectors

	Model with unrestricted intercept and restricted time trend	
Variable name	**Cointegration vector**	**Normalized Cointegration vector**
I	0.8280	-1
S	-0.7002	0.8456
Intercept	.....	.....
Trend	-0.0012	0.00145

Based on the above normalized value the following equation can be written:

$$I = 0.8456 * S + 0.00145 * \text{Trend} \quad (2)$$

From the above equation, we find that the coefficient of S a variable is as expected.
In this fitted model, the estimated coefficient of S is 0/84 and it shows that if S rise a unit, I, will increase 0/84 units in the long run.
In fact the normalized long run vector represents positive impact of gross domestic savings on gross domestic investment. Due to the positive relationship and high coefficient of S (84/0), based on work by Feldstein and Horioka mobility of capital in the economy of Iran is low. Because they believed that as the coefficient is closer to1, the mobility of capital is lower and when it is closer to zero, capital mobility is higher.

Vector Error Correction Model

The result of vector error correction model is represented at table (4).

Table 4: Summary of results of vector error correction model

Variable	**Coefficient**	**Standard error**	**t static (prob)**
Intercept	0.11331	0.47713	2.3749(0.002)
Trend	0.5511	0.001408	0.39128(0.698)
ECM*(-1)*	-.40095	0.11357	-3.5352(0.001)
DUM	0.10075	0.0518	1.9428(0.059)

Source: research findings

The coefficient of ECM(-1) equles-0.40095 and its t statistics equals 3.5761, there for is statistically significant at the 95% confidence level and it shows that in each year 40.095 percent of nonequivalent of I for one course will be adjusted in next course.

Stipulated and Diagnostic Test

In this study in order to investigate the violation or non-violation of classical assumptions in estimated model, its need to examine some of the tests, the result are presented in table (5). According to the results of diagnostic tests, resulting coefficients are trusty and reliable.

Table 5: Summary of results of diagnostic test

Diagnostic test	**LM (Prob)**	***(P-Value)Static* F**
Serial correlation test	2.5079(0.113)	0.0456(0.128)
Functional form	0.16484(0.525)	0.0286(0.701)
Normality test	3.8364(0.147)	.....
Hetroscedasticity	0.02846(0.866)	4.149(0.870)

Structural Stability Tests

Structural Stability tests results are presented in Figure (3) and (4), respectively.

Since the Cumulative Sum of recursive residuals and Cumulative Sum of Squares of recursive residuals graphs located between the two straight lines (95% confidence interval), the null hypothesis that there is no structural failure is accepted.

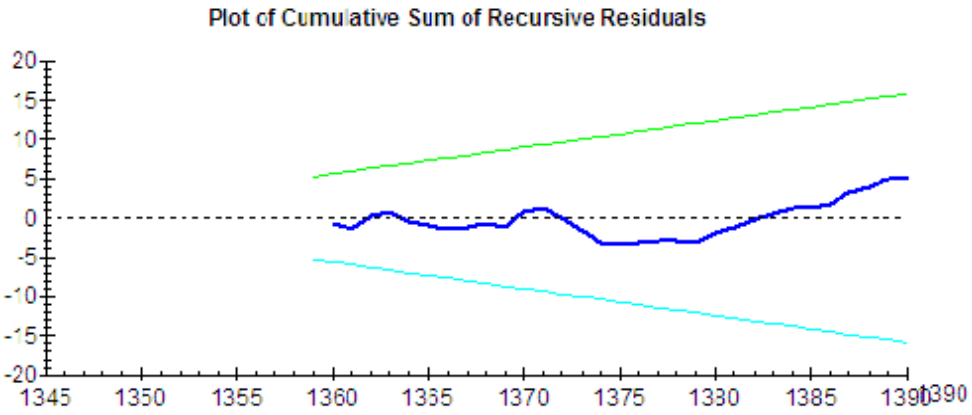

Figure 3: Cumulative Sum of recursive residuals (CUSUM)

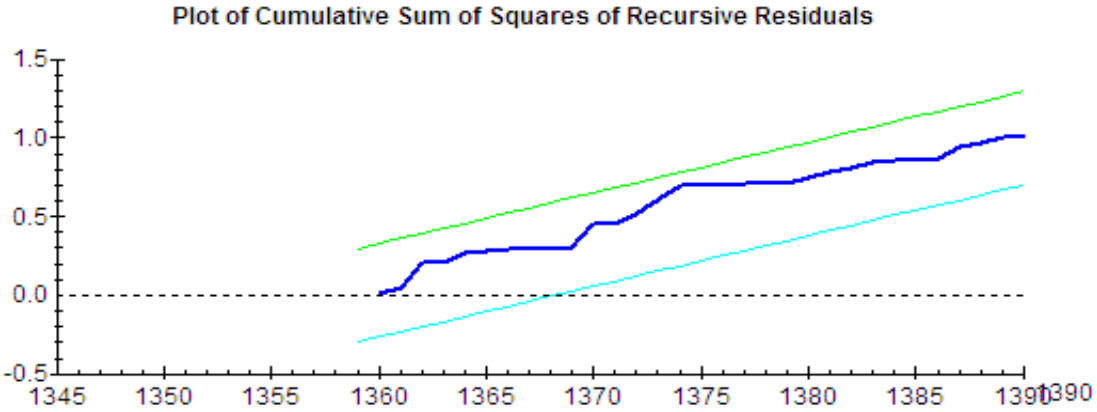

Figure 4: Cumulative Sum of Squares of recursive residuals (CUSUMQ)

Results of Toda -Yamamoto Causality Test

Granger proposed a way to examine causality for the first time in 1969. But one of the problems of Granger method is that the results are sensitive to the number of optimal lags, if variables are not stationary, they may not function properly. That's why this time Toda -Yamamoto (1995) presented a method to solve this problem. The mentioned method will have useable regardless of these variables what degrees of the cumulative are. Another advantage of this method is that, there is no need to know the degree of co-integration of variables, even the condition of presence or absence of co-integration is not

also proposed. In this method, only the information of maximum degree of co-integration and the number of optimal lag are required (Zra'Nejad and Ansari, 2008). In this model, to investigate Granger causality two equations (VAR expanded) are estimated as follows:

$$I = \alpha_1 + \sum_{i=1}^{k+d} \beta_{i1} I_{t-i} + \sum_{i=1}^{k+d} \lambda_{i1} S_{t-i} + V_{t1} \quad (3)$$

$$S = \alpha_2 + \sum_{j=1}^{k+d} \delta_{j1} S_{t-j} + \sum_{j=1}^{k+d} \gamma_{j1} I_{t-j} + \varepsilon_{t1} \quad (4)$$

In the above equations, d, is the maximum degree of co-integration of variables in the model and k is the optimal lag length. As we have mentioned in above section d, is equal to one. And also optimal lag leng this equal to one. As can be seen in this method, despite the fact that the optimal lag leng this equal to k, but it is estimated VAR model with lag of k + d, which is why it is called the expanded VAR. The mentioned model is estimated using VAR method and then the being zero assumption of optimal lag coefficients in each equation are tested by Wald test.

In the first equation, the null hypothesis which is examined by Wald test can be stipulated as follows:

$i=1\ldots k H_0: \lambda_{i1} = 0$

If the null hypothesis be rejected, we can conclude that there is causality from the national savings into gross domestic investment.

Null hypothesis for the second equation is as follows:

In this case, if the null hypothesis be rejected, there will be the causality from gross domestic investment to national savings. Table 6 shows the results of the Wald test. That states the existence of a unilateral causal relationship national savings to gross domestic investment.

Table 6: Results of Wald test

	Result		**prob**	***Wald static***	**Influential variable**	***Dependent variable***
→	*S*	*I*	0.03	0.0099	S	I
↛	I	S	0.364	2.0214	I	S

Source: research findings

CONCLUSION

In this study, using Johansen–Juselius co-integration test and annual data in Economy of Iran over the period 1965-2011, the relationship between national savings and domestic investment is examined. The results suggest the existence of a long-term and significant equilibrium relationship between these two variables. Given to this relationship and high related coefficient to gross national savings (0.84), based on work by Feldstein and Horioka, mobility of capital in the economy of Iran is low. Because they believe that, as the coefficient is closer to one, the mobility of capital is lower and as it is closer to zero, capital mobility is higher. Obtained coefficient of ECM shows per year, 0.4 of imbalance of domestic investment for a period, will be adjusted in the next period. Thus the derived vector coefficient of adjustment term shows moderate speed of convergence to the long-term equilibrium. To examine the causal relationship between national savings and domestic investment Toda -Yamamoto Causality Test is used that the results indicates strong one-way causal relation of national savings to domestic investment in the economy of Iran. According to this result the existence of long-term equilibrium relationship between national savings and domestic investment variables in the economy of Iran is proved. In order to increase investments requirement ground to increase savings should be provided, for this purpose a culture of saving and efficient use of resources should be promoted.

REFERENCES

Afshari Zahra (1998). Estimates of capital flight in Iran. *Proceedings of the Eighth Conference on Monetary Policy and the Currency, Tehran, Institute for Monetary and Banking Studies* 157-168.

Bahrami Javid and Aslani Parvaneh (2005). Study of Effective Factors the private sector savings during the period 1380-1347. *Journal of Economic Studies of Iran* **VII**(23) 119-145.
Eslamlouyan Karim and Jafari Mahbobeh (2010). Capital Mobility, Openness and Saving-Investment Relationship in Asia. *Economic Modeling* **27** 1246-1252.
Feldstain M and Horioka C (1980). Domestic Saving and International Capital Flows. *Economic Journal* **90** 314-329.
Hadian Ebrahim (1999). Reviewing the relationship between savings and investment in Iran's economy. *Journal of Planning and Budget* **45** 200-191.
Hussein KA (1998). International Capital Mobility in OECD Countries: The Feldstein-Horioka Puzzle Revisited. *Economics Letters* **59** 237-242.
Krishna Rama and Rao Venkateshwar (2012). The Long run Relationship between Savings and Investment in Ethiopia: A Cointegration and ECM Approach. *Developing Country Studies* **2**(4).
Narayan KP (2005). The Relationship between Saving and Investment for Japan. *Japan and the World Economy* **17** 293-309.
Sa'di Mohammad Reza (2005). The effects of macroeconomic policies in mobilization of domestic resources to investment in Iran. *Economic Journal* **19** S235-262.
Tashkini Ahmad (2005). *Application Econometric with Microfit Help*, first edition, debagar Cultural Institute of Tehran.
Toda HY and Yamam T (1995). Statistical Inference in Vector Auto Regressions with Possibly Integrated Processes. *Journal of Econometrics* 225-250.
Zra'Nejad Mansour and Ansari Elahe (2008). *Exploring the Granger Causal Relationship between Economic Growth and Higher Education Costs*, year XII (37) 71-53.