Testing the Feldstein-Horioka Puzzle in the Presence of Structural Breaks: Evidence from Algeria

اختبار أطروحة فلدنشتاين–أوريوكا في وجود تغيرات هيكلية: حقائق من حالة الجزائر

Madiha Benamirouche[1,*],. Hicham Benamirouche[2].

[1] PhD Student, *University Ferhat Abbas –Setif-(Algeria),madiha.benamirouche@univ-setif.dz*
[2]*Research Center in Applied Economics for Development(Algeria), h.benamirouche@cread.dz*

Received: 29/04/2021 ; **Accepted :** 11/06/2021 **Published:** 30/07/2021

Abstract:
This paper investigates the Feldstein-Horioka puzzle for Algeria over the period 1970-2019, using time series analysis that allows for structural breaks, and employed Fully Modified Ordinary Least Square (FMOLS) and Dynamic OLS (DOLS) methods. Two breaking date are identified; 2000 and 2009. The estimated saving retention coefficients are 0.99 (0,97), 0.49 (0,49) and 0.87 (0,86) based on FMOLS (DOLS) for the period 1970-2000, 2001-2009 and 2010-2019, respectively. These results means a low capital mobility during the first and the last period. This is due to the importance of oil rent in Algeria's domestic savings, the unaccomplished structural reforms engaged since the second half of 90s, and the low quality of institutions. These results have some policy implications.

Keywords: Investment; Savings; Capital Mobility; Cointegration; Retention Coefficients;
Jel Classification Codes : O16; E21; F21 ; C22;

*Corresponding author,

Introduction:

Increasing capital mobility is a key element of any economic policy since that countries with higher investment needs and low domestic savings can borrow capital from international market. While, Algeria like many other developing countries keeps significant legal restrictions over capital movements and have limited financial market linkages with the world. This situationreflected a low capital mobility and weakened the dynamics of investment in this oil-exporting country.

Feldstein & Horioka(1980) examined capital mobility in the context of savings and investment correlations[1]. According to these authors, a high saving-investment correlation (saving-retention) is indicative of a low capital mobility. This interpretation is clearly a puzzle given that capital mobility among major industrialized countries has reached a very high level (Ghosh, (1995)[2]; Frankel(1992)[3]; Sachs et al.,(1981)[4]), and Obstfeld & Rogoff(2000) considered the Feldstein-Horioka (FH) puzzle as "the mother of all puzzle" in international monetary economics[5]. There have been a growing number of literatures since the publication of the original work of Feldstein & Horioka(1980). These studies can be classified into different categories based on analytical criteria (Industrialization level, geographical region, exports sophistication, etc) or on theoretical model and estimation method used to examine this puzzle.

In this paper, we contribute to the debate of the FH puzzle in Algeria given that it is an oil-exporting country, which faced a serious challenge about investment financing since the last oil prices shocks. A major part of investments in Algeria is financed through the domestic saving, which are derived from the oil rent. Moreover, the country has moved from a command economy and fixed exchange rate regime to the market-oriented and managed floating exchange rate one. These two key elements could have an important effect on capital mobility in Algeria.Massar & Labani(2016) and Sellami(2019) examined the relationship between saving and investment in Algeria over the period 1970-2014[6], and 1970-2016[7]. They argued the inexistence of relationship between the two variables. However, Dahmani et al.,(2016) investigated capital mobility and saving-investment relationship in the Maghreb countries over the period 1980-2015, using an ARDL model and Generalized Method Moments (GMM). They found that saving and investment are cointegrated in Algeria, Mauritania and Libya, which suggests the imperfect mobility of capital in these countries, while there is no evidence on this relationship for Tunisia and Morocco[8]. In our study, we specify structural changes in the model and we employ two estimation methods; Fully Modified Ordinary Least Square (FMOLS) and Dynamic OLS (DOLS) in order to give robust results.

The paper is organized as follows. The next section briefly reviews the literature on the investment and savings relationships. The third section presents the methodology and the data. The fourth section provides the empirical results and discussion. The last section concludes the paper and presents some policy implications.

I-Literature Review:

Many theoretical and empirical studies have attempted to resolve the Feldstein & Horioka(1980)puzzle. Ma & Li(2016)classified this literature into three categories[9]. The first one reconciles the high saving–investment correlation with high capital mobility by constructing new theoretical models and/or providing new explanations. The second one casts doubt on the results about the high saving–investment correlation. The third category employed more advanced econometric techniques to give results that are more robust. Based on this classification, we present in this section some interesting studies carried out for specific countries and for a panel of countries. In follows, we present some interesting studies based on the previous classification.

Yasutomi & Horioka(2011) mentioned that Adam Smith, in his classic "An Inquiry into the Nature and Causes of the Wealth of Nations" (Smith, 1976)[10], pointed out the existence of the

Feldstein-Horioka Puzzle given that it is the pursuit of security rather than the pursuit of profit that leads individuals to promote the good of society as a whole via the "invisible hand"[11].

Kumar et al.,(2012)investigated the relationship between investment and saving in Australia over the period 1960-2007. They argued that the FH puzzle exists in a weak form and saving Granger causes investment both in short and long runs[12].

Yildirim & Orman(2018)examined the validity of the FH puzzle for China in the presence of structural break. They showed that the relationship between saving and investment has undergone some changes[13].

Payne(2005)examined the structural stability of the savings–investment relationship over the period 1960–2002 in Mexico. He found that savings and investment are cointegrated with instability around 1982, which indicated capital mobility during the post-1982 period[14].

Ma & Li(2016)examined the dynamic saving-investment relationship using a time varying cointegration model. They found that saving retention coefficient are high for developed economies, but low for less developed economies, which may be explained by the long-run solvency constraint between the two economies[15].

Bangake & Eggoh(2011)investigated the FH coefficients for 37 African countries using Pooled Mean Group (PMG), Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) panel cointegration techniques for the period 1970-2006. The authors showed that saving and investment are cointegrated and capital was relatively more mobile in African countries compared to OECD countries, with some differences in saving retention coefficients for different country groups in Africa[16].

Khan(2017)investigated the existence of savings and investment relationship for 22 OECD countries by estimating a time varying parameter model through Kalman filtering. He found that the degree of capital mobility is increasing as the world financial markets are becoming increasingly integrated over time, which implies that the savings and investment relationship will go through a dynamic process[17].

Chang & Smith(2014)explained, trough a DSGE model, two aspects of the Feldstein–Horioka puzzle: positive saving–investment correlations in both advanced and emerging economies and significantly lower saving– investment correlations in emerging economies than in advanced economies[18].

Lin & Deng(2020)applied a semi-parametric varying coefficient cointegration approach to test the presence of an uncertainty varying cointegration relationship between saving and investment for US from 1974Q1 to 2014Q4. They found that domestic investment is more constraint by domestic saving at very high and very low levels of uncertainty[19].

Saeed & Khan(2012)examined the evidence of FH puzzle in the presence of Twin deficits for Pakistan during the period 1972-2008. They found evidence in favor of a high degree of capital mobility although the country is not perfectly integrated into the world economy[20].

Verma & Saleh(2011)examined the long-term relationship between saving and investment for Saudi Arabia over the period 1963-2007 using the bounds testing approach and Geogory and Hansen cointegration methods. They found no evidence of a long run relationship between the two variables, which implies that capital is highly mobile in Saudi Arabia[21]. However, Ahmad(2017)examined the FH puzzle for four South Asia developing countries and Saudi Arabia. He found that approximately one to one long run relationship between investment and saving is present in India and Saudi Arabia[22].

Dash(2019)provides a number of reasons for the conflicting and inconclusive results in the literature. The author examined the FH puzzle by using both time series analysis with structural break and dynamic panel error-correction method for 118 countries over the period 1981-2013. He found that ignoring structural break, the type of data and econometric method used could affect the

conclusion about capital mobility in high, middle and low-income countries. The author showed also that the saving estimate is a function of openness's degree[23].

II-Methodology and Data:

Based on the studies presented above, we examine the relationship between investment and domestic savings in the presence of structural breaks given that the correlation between the variables in Algeria might be exposed to two policy regime changes, oil prices shocks and, then, structural breaks. Indeed, there are two main methodologies. The first one relies on exogenously determined structural break and allows for the standard Engle and Granger cointegration test or the autoregressive distributed lag (ARDL) bounds testing approach to cointegration. The assumption that the break date is exogenously determined is quite reasonable in an economic sense, but suffers from a pre-test bias[24]. Based on this argument, the second methodology implements appropriate cointegration tests allowing for endogenous structural break. In this sense, Ozmen & Parmaksız(2003),Verma& Saleh(2011),Ketenci(2012)[25], and Yildirim & Orman(2018)implement the Gregory & Hansen(1996)one-break cointegration test[26].

In our study, we are based on this second methodology to well examine the relationship between investment and domestic savings in Algeria over the period 1970-2019. Then, we employ the Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) approach to perform the cointegrating regression given that the econometric methods may affect the conclusion about this relationship[27]. The two procedures may overcome the problem of serial correlation and endogeneity biases, and allow for robust statistical inference.

II-1- Unit Root Test:

The first step of the selected methodology is determination of the integration order of the series. Time series univariate properties were examined using two unit root tests that are the Augmented Dicky Fuller (ADF)[28] and the Phillips Perron test (PP)[29].These two tests have a low power in the presence of structural break. Perron(1989) showed that in the presence of a structural break in time series, many perceived nonstationary series were in fact stationary around a break[30]. Zivot & Andrews(1992)[31]and Perron(1997)[32] developed a break point unit root test when the structural break is selected endogenously. Following Perron(1989) and Zivot & Andrews(1992), there are three types of break point; the first results from the change in the level of the time series (change in the intercept), the second results from the change in the growth's rate (change in trend), and the third is the result of both (change in the level and in the rate of growth).

$$\Delta y_t = \mu + \alpha y_{t-1} + \beta t + \theta_1 d\mu_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t \dots\dots (1)$$

$$\Delta y_t = \mu + \alpha y_{t-1} + \beta t + \gamma_1 dt_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t \dots\dots (2)$$

$$\Delta y_t = \mu + \alpha y_{t-1} + \beta t + \theta_1 d\mu_t + \gamma_1 dt_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t \dots\dots (3)$$

Where $y_t$denotes the time series of interest, et ε_t is i.i.d. disturbance term, k is the augmentation order that ensures the i.i.d. structure of ε_t , $d\mu_t$is the dummy variable for a mean shift occurring at time TB anddt_t is the corresponding trend shift variable defined as:

$$d\mu_t = \begin{cases} 1 \; if t > TB \\ 0 \; otherwise \end{cases} \text{and} dt_t = \begin{cases} t - TB if t > TB \\ 0 \; otherwise \end{cases} \dots\dots(4)$$

II-2- Cointegration test:

The standard two-step Engle Granger requires at the first step to estimate the long-run equilibrium model.

$$I_t = \alpha + \beta S_t + \varepsilon_t \dots\dots\dots(5)$$

Where $I_t$is the gross domestic investment as a proportion of GDP, $S_t$is the gross domestic saving as a proportion of GDP, α is the constant and ε_t is the stochastic disturbance term. The coefficient β, which is saving retention coefficient, measures the degree of capital mobility.

The second step of the procedure is testing conitegration relationship between investment and saving through the stationarity of the $\hat{\varepsilon}_t$ sequence. However, this approach assumes the no existence of structural break. Because of this limitation, we proceed with the Gregory & Hansen(1996) cointegration test, which account for an endogenously determined structural break.

Given the three models proposed by Zivot & Andrews(1992)to introduce the structural break, Gregory & Hansen(1996)specified three models[33]:

$$I_t = \alpha_1 + \alpha_2 D_t + \beta_1 S_t + \varepsilon_t \dots\dots\dots(6)$$

$$I_t = \alpha_1 + \alpha_2 D_t + \gamma t + \beta_1 S_t + \varepsilon_t \dots\dots\dots(7)$$

$$I_t = \alpha_1 + \alpha_2 D_t + \beta_1 S_t + \beta_2 S_t D_t + \varepsilon_t \dots\dots\dots(8)$$

Where:

D_t is the dummy variable: $D_t = \begin{cases} 0 & if t \leq [T_\tau] \\ 1 & if t > [T_\tau] \end{cases} \dots\dots\dots(9)$

α_1 is the intercept before the shift,

α_2 is the change in the intercept at the time of the shift,

τ represents the relative timing of the change,

T denotes the sample size,

t represents a time trend,

β_1 is the cointegrating slope coefficient before the regime shift, and

β_2 is the change in the slope coefficient.

This cointegration test performs well in the case of a single break. However, in the presence of multiple breaks, the cointegration test proposed by Maki(2012)is considered more suitable. Maki(2012)specified four different models depending on whether the changes affect the intercept, the slope or the trend[34]:

$$I_t = \mu + \sum_{i=1}^{m} \mu_i D_{i,t} + \beta S_t + \varepsilon_t \dots\dots\dots(9)$$

$$I_t = \mu + \sum_{i=1}^{m} \mu_i D_{i,t} + \gamma t + \beta S_t + \varepsilon_t \dots\dots\dots(10)$$

$$I_t = \mu + \sum_{i=1}^{m} \mu_i D_{i,t} + \beta S_t + \sum_{i=1}^{m} \beta_i S_t D_{i,t} + \varepsilon_t \dots\dots(11)$$

$$I_t = \mu + \sum_{i=1}^{m} \mu_i D_{i,t} + \sum_{i=1}^{m} \gamma_i t D_{i,t} + \beta S_t + \sum_{i=1}^{m} \beta_i S_t D_{i,t} + \varepsilon_t \dots\dots(12)$$

Where μ_i, β_i and γ_i represent changes in the level, slope and trend coefficients, respectively, $D_{i,t}$ is a dummy variable taking the value of 1 if $t > TB_i$ $(i = 1, \dots, m)$ and of 0 otherwise, where m is the maximum number of breaks and TB_i represents the time period of the break.

II-3- Estimation of long-run coefficients:

Once structural breaks are specified and cointegration is established, the last step is the estimation of the long run equilibrium model with structural breaks. We employ the FMOLS and DOLS, which derive robust statistical inference compared to OLS approach as cited above.

II-4- Data:

To explore the relationship between investment and saving in Algeria, we use annual time series data, which cover the period 1970-2019. The data has been obtained from the World Development Indicators database of the World Bank. Gross fixed capital formation and Gross domestic savings are used as proxy of investment and savings, respectively. The period 1970-2019 covers the transition of the Algerian economy from a command economy to a market-oriented one. It covers different oil prices shocks and the 2008-2009 global financial crises.

III-Empirical Results and Discussion:

Based on our methodology, three subsections are adopted to present our results; unit root tests, cointegration tests, long-run coefficient estimation.

III-1- Unit root test results:

In order to examine the stationarity of the two series, we conduct, at a first time, the ADF and PP tests. The results are reported in table 01. The results do not reject the null hypothesis of a unit root in both of the series, but each of them become stationary at the first differences.

Table n°1:Unit root test results

	ADF		PP	
	Leve1	1° Difference	Leve1	1° Difference
I	-0,14	-5,19***	-0,08	-6,30***
S	-0,14	-6,44***	-0,11	-6,42***

Note: (***), (**) and (*) denote statistical significance at 1%, 5% and 10% level.
Source: Realized by authors based onresults in Eviews 9.

Given the low power of the ADF and the PP tests in the presence of structural breaks, we employ also the (Zivot & Andrews, 1992)unit root test. Table (02) reports the results of the endogenous breakpoint unit root test.

Table n°2:Endogenous breakpoint unit root test results

	I		S	
TB	2007	1996	2000	2000
k	0	0	0	0
t_α	-3,34	-3,54	-3,60	-3,50

Note: (***), (**) and (*) denote statistical significance at 1%, 5% and 10% level.
Source: Realized by authors based on results in Eviews 9.

Following Narayan(2005), we employ model A and model C proposed by Zivot & Andrews(1992), which allow for a change in the intercept and a change both in intercept and slope, respectively[35]. According to the results, this test reveals non stationarity of the two series at levels.

III-2- Cointegration Test Results:

Given that investment and savings series are stationary at first level (I(1)), we conduct a cointegration analysis based on the standard Engle and Granger cointegration approach, and the Gregory & Hansen(1996)procedure. The results of the two cointegration tests are reported in table (03).

Table n°3:Conintegration test results

	Engle-Granger		Gregory-Hansen	
	ADF	ADF*		
	-	2009	2009	2009
Test statistic	-2,25**	-4,53***	-24,13***	-3,83***

Note: TB denotes the structural break date, (***), (**) and (*) indicate rejection of the null hypothesis of no cointegration at 1%, 5% and 10% significance level.
Source: Realized by authors based on results in Eviews 9.

The Engle-Granger test indicates the existence of cointegration between investment and savings at 5% significance level. In the other hand, the Gregory & Hansen(1996)test indicates also the existence of cointegration between the two variables at 1% significance level, with the presence of one structural break in 2009 (or 2010 based on the ADF test). However, in the presence of multiple breaks, the two previous tests are subject to a substantial power loss. Therefore, we proceed with the multiple-break cointegration test of Maki(2012). We estimate the model (11), which is considered as the extension of the third model (equation 8) proposed by Gregory and Hansen. The maximum number of breaks is equal to i, where $i = (1, \dots, 5)$. The results are reported in table 04.

Table n°4:Multiple-break cointegration test results

TB1	1996	2000	1979	1984	1977
TB2		2009	2000	1991	1984
TB3			2009	2000	1991
TB4				2009	2000
TB5					2009
Test Statistic	-4,68*	-5,47***	-4,99	-5,55	-5,78

Note: TB denotes the structural break date, (***), (**) and (*) indicate rejection of the null hypothesis of no cointegration at 1%, 5% and 10% significance level. T-statistic are compared to critical value in Maki(2012).
Source: Realized by authors based on results in GAUSS 20.

The test indicates the cointegration relationship being exposed to a multiple structural change. The strongest evidence for cointegration is showed with two structural breaks; 2000 and 2009.

III-3- Long-run coefficient estimation results:

We adopt the FMOLS and DOLS estimation procedures, which account for serial correlation and endogeneity problems, in order to observe the effect of the detected breakpoints on the relationship between investment and saving. The results are reported in table 05.

The obtained results from both FMOLS and DOLS are almost identical. According to the FMOLS (DOLS), the saving retention coefficient is 0,99 (0,97) over the sub-period 1970-2000,

which corresponds, practically, to the period of command economy and fixed exchange rate regime. This explains the fact that the majority of saving is returned within the country to finance the investments. Therefore, this means an evidence for low capital mobility, which is argued also by the low FDIs inflows during the same sub-period.

Table n°5:Saving retention coefficients

	FMOLS	DOLS
	0,99***	0,97***
	-0,50***	-0,48***

Note: (***), (**) and (*) denote statistical significance at 1%, 5% and 10% level.
Source: Realized by authors based on results in Eviews 9.

Over the period 2001-2009, the saving retention coefficient being equal to 0,49 according to both the FMOLS and DOLS. This could be explained by the increase of oil rent, which is allowed to the early repayment of external debt and to increase the foreign exchange reserves. Only 49% of savings were mobilized to finance the investment. During this sub-period, the average of savings/GDP ratio had been much higher than that of investment/GDP ratio (49% compared to 25%). In the other hand, this sub-period is marked by a managed floating exchange rate regime and a net increase of FDIs, mainly in energy sector. Consequently, this sub period showed medium capital mobility.

However, after the global financial crisis and due to the high dependency of Algerian economy to the external shocks (oil prices), the estimations results showed an increase in the correlation between investment and savings, with a saving retention coefficient being 0,87 (0,86) over the period 2010-2019. The period of oil prices boom (2010-2014) is marked by a high public investment level in Algeria, but in the same time a decrease of FDIs inflows. This means that domestic investment was mainly financed by domestic savings. The ratio investment/GDP and that of saving/GDP become, in average terms, 37% and 42%, respectively. Since the end of 2014, there was a continued decrease of oil prices, which required a massive use of foreign exchange reserves to finance the previous engaged investments. Consequently, the most part of savings (more than 80% during the period 2010-2019) is engaged in investment projects within the country.

These results suggest that the correlation between domestic savings and investment has undergone some changes during the period 1970-2019. We observed low capital mobility during two sub-periods 1970-2000 and 2010-2019, while there is a relative mobility of capital during the sub-period 2001-2009. These changes are mainly due to the oil price shocks, the structural changes started since the 90s, and the FDI's inflows. Our results go far from those of Massar & Labani(2016)and Sellami(2019), but remain less comparable to those reported by Dahmani(2016). Our results could be more robust given the specification of structural changes and the use of more advanced econometric methods, which suggested by Dash(2019).

Conclusion:

The objective of this paper is to examine the Feldstein-Horioka puzzle based on the correlation between investment and savings for Algeria over the period 1970-2019. To this end, time series analysis that allow for structural break is used. We applied two classes of unit root and cointegration tests, and employed the FMOLS and DOLS estimation methods to deal with heterogeneity problems and to conduct plausible tests.

Our results showed that investment and savings are non-stationary and cointegrated series. Two break dates are identified; 2000 and 2009, which allow for three sub-periods. During the first one (1970-2000), the estimated saving retention coefficient was 0,99 (FMOLS) and 0,97 (DOLS). It

means an evidence for low capital mobility. This sub-period corresponded to the period of command economy and fixed exchange rate regime until the second half of 90s. However, the second sub-period (2001-2009) was marked by a high increase of oil rent that allowed to the repayment of external debt and increasing the foreign exchange reserves. It is also important to notice the practice of managed floating exchange rate regime and the increase of FDIs inflows during this period. Therefore, the saving retention coefficient being equal to 0,49 according to both FMOLS and DOLS methods. This means a relative capital mobility during the period 2001-2009. Finally, the saving retention coefficient being 0,87 (FMOLS) and 0,86 (DOLS) for the sub-period 2010-2019, which reflects an increasing correlation between investment and savings compared to the second period. This could be explained by the financing of high public investment trough oil rent. However, the continued decrease of oil prices since the end of 2014, has required the mobilization of more domestic savings to finance investment and other commodities in Algeria. Then, this last period showed a low capital mobility.

Our findings remain comparable to those observed for some oil exporting countries such Saudi Arabia[36], and some African developing countries[37]. This could be due to the importance of oil rent[38] and to the economic reforms and structural adjustments engaged in these countries.

Our findings have several policy implications. The structural economic and financial reforms that aimed at the liberalization of market must be pursued, in order to not constrain the economic growth by the low level of domestic savings. The high immobility of capital in Algeria should not be interpreted as existence of the puzzle. According to the long run solvency constraint theory of Coakley (1996), it can be interpreted by the lack of good institutions and the less-developed financial markets[39]. Therefore, increasing the quality of institutions could have a positive impact on capital mobility.

Referrals and references:

[1]Feldstein, M., & Horioka, C. (1980). Domesticsavingandinternationalcapitalflows. *The Economic Journal, 90*(358), 314-329. doi:https://doi.org/10.2307/2231790
[2]Ghosh, A. (1995). International capital mobility amongst the major industrialized countries: Too little or too much. *The Economic Journal, 105*(428), 107-128. doi:https://doi.org/10.2307/2235322
[3]Frankel, J. A. (1992). Measuring international capital mobility: A review. *American Economic Review Papers andProceedings, 82*, 197-202.
[4]Sachs, J., Cooper, R., & Fischer, S. (1981). The current account and macroeconomic adjustment in the 1970's. *Brookings Papers on Economic Activities*(1), 201-268. doi:https://doi.org/10.2307/2534399.
[5]Obstfeld, M., & Rogoff, K. (2000). PerspectivesonOECDcapitalmarketintegration:implicationsforU.S.currentaccountadjustment. *Global Economic Integration: Opportunities and Challenges* (pp. 169-208). Wyoming: Federal Reserve Bank of Kansas City.
[6]Massar, M., & Labani, Y. (2016). The relationships between saving and investment in the Algerian economy: econometrics study over the period 1970-2014. *Elbahith Review, 16*(16), 51-59. Récupéré sur https://www.asjp.cerist.dz/en/article/2779.
[7]Sellami, A. (2019). The relationship between saving and investment in Algeria - An econometric approach during the period 1970-2016. *Alijtihald Journal on Legal and Economic Studies, 8*(1), 437-462. Récupéré sur https://www.asjp.cerist.dz/en/article/72409.
[8]Dahmani, M. D., Belgaidi, S., & Ismail, B. (2016). Investigating Capital Mobility and Saving - Investment Relationship in the Maghreb countries: An econometric analysis (1980-2015). *Journal of quantitative economics studies, 2*(1), 177-189. Récupéré sur https://www.asjp.cerist.dz/en/article/9927.
[9]Ma, W., & Li, H. (2016). Time-varying saving–investment relationship and the Feldstein–Horioka puzzle. *Economic Modelling Journal, 53*, 166–178. doi:http://dx.doi.org/10.1016/j.econmod.2015.11.013.
[10]Smith, A. (1976). *An Inquiry into the Nature and Causes of the Wealth of Nations* (Vol. 2). Oxford: The Glasgow Edition of the Works and Correspondence of Adam Smith. Oxford University Press.
[11]Yasutomi, A., & Horioka, C. Y. (2011). Adam Smith's answer to the Feldstein-Horioka Paradox: The invisible hand revisited. *Economic Letters, 110*, 36-37. doi:10.1016/j.econlet.2010.09.018.
[12]Kumar, S., Webber, D. J., & Fargher, S. (2012). Testing the validity of the Feldstein–Horioka puzzle for Australia. *Applied Economics, 44*, 599-605. doi:https://doi.org/10.1080/00036846.2010.511993.
[13]Yildirim, D., & Orman, E. E. (2018). The Feldstein–Horioka puzzle in the presence of structural breaks: evidence from China. *Journal of the Asia Pacific Economy, 23*(3), 374-392. doi:10.1080/13547860.2017.1396640.
[14]Payne, J. E. (2005). Savings–investment dynamics in Mexico. *Journal of Policy Modeling, 27*, 525–534. doi:10.1016/j.jpolmod.2005.05.002.
[15]Ma, W., & Li, H. (2016). Time-varying saving–investment relationship and the Feldstein–Horioka puzzle. *Economic Modelling Journal, 53*, 166–178. doi:http://dx.doi.org/10.1016/j.econmod.2015.11.013.
[16]Bangake, C., & Eggoh, J. (2011). The Feldstein–Horioka puzzle in African countries: A panel cointegration analysis. *Economic Modelling, 28*, 939–947. doi:10.1016/j.econmod.2010.11.011.
[17]Khan, S. (2017). The savings and investment relationship: The Feldstein-Horioka puzzle revisited. *Journal of Policy Modeling, 39*, 324–332. doi:http://dx.doi.org/10.1016/j.jpolmod.2017.02.002.
[18]Chang, Y., & Smith, R. (2014). Feldstein–Horioka puzzles. *EuropeanEconomicReview, 72*, 98–112. doi:http://dx.doi.org/10.1016/j.euroecorev.2014.09.001.
[19]Lin, Y.-C., & Deng, W.-S. (2020). Does the Feldstein–Horioka relationship vary with economic policy uncertainty? *Applied Economics Letters*, 1-8. doi:10.1080/13504851.2020.1804043.
[20]Saeed, S., & Khan, M. A. (2012). THE FELDSTEIN-HORIOKA PUZZLE AND TWIN DEFICITS IN PAKISTAN. *Academic Research International, 2*(2), 525-532.
[21]Verma, R., & Saleh, A. S. (2011). Saving and investment in Saudi Arabia: An empirical analysis. *Studies in Economics and Finance, 28*(2), 136-148. doi:10.1108/10867371111137139.
[22]Ahmad, S. (2017). Investment and Saving Relationship in South Asia. *International Journal of Economics and Financial Issues, 7*(4), 726-729.
[23]Dash, S. K. (2019). Has the Feldstein-Horioka puzzle waned? Evidence from time series and dynamic panel data analysis. *Economic Modelling, 83*, 256–269. doi:https://doi.org/10.1016/j.econmod.2019.02.015.
[24]Ozmen, E., & Parmaksız, K. (2003). Policy Regime Change and the Feldstein-Horioka Puzzle: the UK Evidence. *Journal of Policy Modeling, 25*, 137–149.
[25]Ketenci, N. (2012). The Feldstein-Horioka Puzzle and Structural Breaks: Evidence from EU Members. *Economic Modelling, 29*, 262–270.

[26]Gregory, A. W., & Hansen, B. E. (1996). Residual-Based Tests for Cointegration in Models with Regime Shifts. *Journal of Econometrics, 70*, 99–126.
[27]Dash, S. K. (2019). Has the Feldstein-Horioka puzzle waned? Evidence from time series and dynamic panel data analysis. *Economic Modelling, 83*, 256–269. doi:https://doi.org/10.1016/j.econmod.2019.02.015.
[28]Dickey, D., & Fuller, W. (1979). Distribution of the estimators for Autoregressive time series with a unit root. *Journal of the American Statistical Association, 74*, 427-431.
[29]Phillips, P. C., & Perron, P. (1988). Testing for a unit root in a time series regression. *Biometrika, 75*, 335-346.
[30]Perron, P. (1989). The great crash, the oil price shock, and the unit root hypothesis. *Econometrica, 57*, 1361-1401.
[31]Zivot, E., & Andrews, D. (1992). Further evidence on the great crash, the oil-price shock and the Unit Root Hypothesis. *Journal of Business and Economic Statistics, 10*, 251-270.
[32]Perron, P. (1997). Further Evidence on Breaking Trends Functions in Macroeconomic Variables. *Journal of Econometrics, 80*, 355-385.
[33]Gregory, A. W., & Hansen, B. E. (1996). Residual-Based Tests for Cointegration in Models with Regime Shifts. *Journal of Econometrics, 70*, 99–126.
[34]Maki, D. (2012). Tests for Cointegration Allowing for an Unknown Number of Breaks. *Economic Modelling, 29*, 2011–2015.
[35]Narayan, P. K. (2005). The Saving and Investment Nexus for China: Evidence from Cointegration Tests. *Applied Economics, 37*, 1979–1990.
[36]Ahmad, S. (2017). Investment and Saving Relationship in South Asia. *International Journal of Economics and Financial Issues, 7*(4), 726-729.
[37]Bangake, C., & Eggoh, J. (2011). The Feldstein–Horioka puzzle in African countries: A panel cointegration analysis. *Economic Modelling, 28*, 939–947. doi:10.1016/j.econmod.2010.11.011.
[38]Dahmani, M. D., Belgaidi, S., & Ismail, B. (2016). Investigating Capital Mobility and Saving - Investment Relationship in the Maghreb countries: An econometric analysis (1980-2015). *Journal of quantitative economics studies, 2*(1), 177-189. Récupéré sur https://www.asjp.cerist.dz/en/article/9927.
[39]Coakley, J., Hasan, F., & Smith, R. (1996). Saving, investment, and capital mobility in LDCs. *Review of International Economics, 72*(5), 569–590.