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International capital mobility in West Africa: A panel cointegration approach

Ibrahim Bakari Hassan[1]*

Abstract: The study investigates the status of international capital mobility in West Africa using the saving retention coefficient of Feldstein–Horioka hypothesis. The hypothesis is predicated on the fact that, with perfect capital mobility, domestic investment does not depends on domestic savings but depends on the pool of international savings. Panel data on domestic savings and domestic investments of 13 West African countries, spanning from 1980 to 2011 are used to run a series of long-run relations. After establishing the presence of cointegration relationship between the two variables, the saving retention coefficient is estimated using the pooled mean group (PMG), fully modified OLS (FMOLS) and the dynamic OLS (DOLS). The results from these long-run estimators show low value of saving retention coefficient, signifying low association between domestic savings and domestic investment and hence higher capital mobility in West Africa. The result also confirmed that the Feldstein–Horioka puzzle does not hold for West Africa. However, the presence of free and higher capital mobility in the continent could be a signal that the use of monetary policy in domestic economic stabilization is increasingly becoming ineffective, especially in the long-run. The finding suggests the establishment of monetary union in the region.

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PUBLIC INTEREST STATEMENT

Free movement of capital resources among countries ensures efficient distribution of societal resources and bridges the gap between demand and supply of investible funds. It also assists in consumption smoothing, risk diversification, and caters for the investment needs of capital-scarce countries. This implies that ascertaining the level of capital movement across countries is vital for policy prescriptions, especially on issues related to monetary policies, import–export policies, and exchange rate determinations. This study investigates the status of international capital mobility across West African countries, using the Feldstein–Horioka approach. Thirteen West African countries are analyzed and the result established evidence of high cross-border capital mobility across the countries and by implication disproved the celebrated Feldstein–Horioka puzzle. The finding further implies that individual country's monetary policy autonomy is reduced, as investment and interest rates cannot be exclusively determined domestically. Formation of monetary union for the region is therefore feasible.

Subjects: Behavioral Sciences; Development Studies; Development Studies, Environment, Social Work, Urban Studies; Economics, Finance, Business & Industry; Humanities; Politics & International Relations

Keywords: saving retention coefficient; domestic investment; domestic savings international capital mobility; panel cointegration

1. Introduction

Movements of capital across countries have been a subject of much concern to policy-makers and international economic observers. It is identified that free capital mobility ensures efficient distribution of societal resources and bridge the gap between demand and supply of capital resources across borders. Excess capitals are easily transferred to meet the incessant demand across countries. Where this occurs, the involving countries are considered to be financially integrated. The integration of financial systems assists in consumption smoothening, risk diversification, and above all, caters for the investment needs of capital scarce areas. On the other perspective, free movement of capitals may lead to contagion effect or spillover of financial crisis across borders. In both the ways, the understanding on the extent of capital mobility is vital for policy-making process and perhaps it is the impetus that triggered substantial depletion of constraints to international capital mobility.

Over the years, governments engaged on efforts at reducing restrictions to capital mobility; policies were promulgated, interest rates and exchange rates were liberalized and financial systems coordinated to provide easy and instant access to investible funds from abroad. Typical example is the structural adjustment programs of 1980s where exchange rates and interest rates in many African countries were liberalized and constraints to capital mobility removed to attract investment and capital flows across borders. A pertinent question is therefore on how government efforts over the years yielded results in terms of extent of financial integration and free capital mobility among countries. Going by the celebrated Mundell–Fleming framework of impossible trinity (Fleming, 1962; Mundell, 1963), such understanding becomes imperative for decisions regarding country's monetary policy implementation.

Against this background, this paper investigates the degree of international capital mobility along the paradigm of celebrated Feldstein–Horioka puzzle (hereafter referred to as FH) with the mean of contributing to the body of literature and policy-making stance. Besides, the substantial number of empirical literatures *inter alia*, Hassan, Azali, and Lee (2014), Katsimi and Zoega (2016) amd Kim, Kim, and Wang (2007) on the area, largely concentrated on developed countries and Asia, little can be found for African countries and perhaps none for West Africa. This study fills the obvious gap by investigating the extent of international capital mobility in West African countries using the quantity-based approach of Feldstein and Horioka (1980).

The Feldstein and Horioka (1980) puzzle study is predicated on the fact that with free capital mobility, domestic investment would not be a function of domestic saving but rather a function of a pool of international savings. Thus correlation between domestic savings and domestic investment would be "zero" in a situation of perfect capital mobility and "one" in a situation of perfect capital immobility. The value of what the F–H study referred to as saving retention coefficient "β" measures the regression coefficient among the domestic saving and investment. The empirical finding of F–H study on 16 countries of Organization for Economic Corporation and Development (OECD) showed that the said β Coefficient is close to one, within the interval of 0.85–0.95 indicating low capital mobility among the countries. This finding generates a lot of concern to researchers as it goes contrary to a priori expectations about capital mobility in OECD countries and for this reason it is anointed a "puzzle". It is a puzzle because OECD countries are expected to have relatively higher capital mobility among themselves, especially going by the extend they went in liberalizing their financial instruments such as exchange rates and interest rates.

The paper is structured into five sections. With the introduction in Sections 1 and 2 presents the theoretical and empirical literatures. While Section 3 discusses the methodology of the study, Section 4 dwelled on result presentation. Section 5 presents conclusion and recommendation of the study.

2. Literature review

The need to understand the degree of financial system integration across countries has triggered lot of empirical investigations employing different approaches. As elaborated in Frankel (1992) and Rajan (2003), three broad categories of measuring financial system integration are identified. The first is the price conditioning; measuring debt, and equity flows (interest parities and the co-movement of stock market returns). It measures the adjustment process of prices, interest rates and exchange rates across countries. The rationale is the fact that with integrations these variables adjust quickly to equilibrate any form of arbitraging opportunities that may exist in a country. This category includes; the real interest parity approach, uncovered interest parity, covered interest parity and the co-movement of stock market returns. Literatures on this aspect can be found in the work of De Brouwer (1997), Frankel (1992), Fu, Li, and Ma (2016), Holmes (2004), Lothian and Wu (2011) and Mahajan and Verma (2015). Non-debt price measure which tries to predict the co-movement of the stock market return can be found in the works of Azman-Saini, Azali, Habibullah, and Matthews (2002), el Alaoui, Dewandaru, Rosly, and Masih (2015) and Thenmozhi and Srinivasan (2016).

The second category which this work emphasized on is the quantity-based approach which directly measures the extent of international capital mobility among countries. The prominent is the saving–investment correlations, consumption correlations, current account dynamics and gross capital flows. Literatures on this aspect can be found in the work of Behera (2015), Feldstein and Horioka (1980), Gil-Alana, André, Gupta, Chang, and Ranjbar (2016) and Hassan et al. (2014).

The third category is the regulatory approach which observes the extent of country's capital control and prudential regulations on institutions such as cross listing of equities and creation of regional capital market. It is featured in the works (Bangake & Eggoh, 2011; Rajan, 2003).

Concentrating on the second category; the international capital mobility along the FH puzzle, it can also be observed that discordant views still exist on the stance of the puzzle. Morley and But re-examine the applicability of FH puzzle in OECD countries by using a recursive approach and panel techniques to compare between the pre and post 2007/2008 financial crisis. The result revealed that saving retention coefficient in post crisis is relatively higher, indicating the revival of the puzzle. Similar study is also conducted in euro zone by Ketenci (2015) to observe if the global financial crisis has any effects on the level of international capital mobility and on the existence of FH puzzle. Using GMM on 27 European countries, the result shows no evidence of the puzzle and in fact capital mobility increases during the period of financial crisis. Katsimi and Zoega (2016) attributes the existence of FH puzzle in euro zone to a situations of case-specifics; correlation between saving and investment depends on the institutional differences, risk variations, differences in growth, and per capita output.

On the other hand, Gil-Alana et al. (2016) disproves the existence of the FH puzzle in South Africa especially at the period after the country's financial deregulation during 1980s. Using the fractional cointegration technique, the work suggests that the implementation of financial deregulation may have loosened the correlation between saving and investment. On the East Asian perspective however, Eslamloueyan and Jafari (2014) shows that FH puzzle is crisis-specific. Using the common correlated effect mean group (CCEMG) the finding revealed high saving–investment correlation during the 1997 crisis and low value, during the 2008 global crisis. Furthermore, applying the Pedroni and Westerlund cointegration tests on newly industrialized countries, Behera (2015) found evidence of cointegration relation between saving and investment indicating absence of capital mobility among the countries, thus the presence of FH puzzle. Hassan et al. (2014) found a contradictory result on saving–investment correlation among High income, OECD and Non-OECD categories. Evidence of High capital mobility across high income countries is found on Non-OECD category and not on OECD countries. The contradictory results seem to exacerbate the FH puzzle.

The above views show that, empirical literatures on cross-border capital mobility were biased toward developed countries; few have concentrated on developing countries especially Africa, and virtually none in the case of West Africa. Moreover, even for the available ones, discordant findings exist as to the actual status of international capital mobility. For example literatures on the quantity-based approach ended up generating a lasting FH puzzle.[1] In the explanation for the possible causes of the FH puzzle, discordant views still emerged. Substantial number of scholars attributes the presence of FH puzzle to the theoretical defects such as the omitted variable cases and the identification problem (Baxter & Crucini, 1993; Coakley et al., 1998); methodological defects such as specification issue, stationarity properties and endogeneity problems (Bayoumi, 1990; Eng & Habibullah, 2006; Kasuga, 2004). The empirical explanations, notwithstanding, the puzzle still exists.

Based on the above literatures, it is sufficed to say that study on saving–investment relations or international capital mobility is inconclusive, especially for the case of African countries and West Africa in particular. With the obvious importance of free capital mobility to economic growth, further empirical investigations become imperative.

3. Methodology

3.1. Data

This study uses secondary data obtained from the World Bank Data Base. The population of the study covers the entire 16 West African countries. However, due to the data paucity on three countries (Mauritania, Liberia and Cape-Verde), the study concentrates on the remaining thirteen (13) countries including; Benin, Burkina Faso, Cote d'Ivoire, Nigeria, Niger, Mali, Ghana, Gambia, Senegal, Guinea, Guinea-Bissau, Sierra Leone, and Togo. The data are extracted in a panel form for the period of 1980 to 2011 for the entire 13 countries. The variables for the analysis include Gross Fixed Capital Formation as a percentage of GDP (proxy to investment ratio), Gross Domestic Savings as a percentage of GDP (saving ratio). The selection of the variables is in line with the Feldstein and Horioka (1980) study where the FH puzzle emanates and which is central to this study.

3.2. Model specification

The model as specified in the FH work is in the form:

$$(I/Y)_{it} = \alpha + \beta(S/Y)_{it} + U_{it} \tag{1}$$

where Y is the output, I; investment, S; saving and the subscript, i denotes a country at time t. α is the intercept, U_{it}, β the rate of changes of investment as saving rate changes by one unit referred to as the "saving-retention coefficient". β is expected to be closer to zero when there is no correlation between saving and investment ratios, and close to unity if the domestic investment is a function of a domestic saving. The value of the coefficients shows the extent of correlation between saving and investment in the group of countries under study and thus international capital mobility or financial integration. Higher value and lower value of β shows lower relationship, and thus, higher international capital mobility.

The dynamic form of the model as presented in Hassan et al. (2014), can be specified as follows:

$$(I/Y)_{it} = \delta_{0i} + \delta_{1i}(S/Y)_{it} + \delta_{2i}(S/Y)_{i,t-1} + \lambda_i(I/Y)_{it-1} + \nu_i + \mu_{it} \tag{2}$$

where $(I/Y)_{it}$ is the gross fixed capital formation as a percentage of GDP a proxy to investment rate, $(S/Y)_{it}$ is the gross domestic saving as a percentage of GDP, ν_i is a fixed effect and μ_{it} is the disturbance term assumed to be independently distributed across i and t with zero mean and constant variance.

After re-parameterization, the error correction representation of Equation (2) would be in the form below:

$$\Delta(I/Y)_{it} = \delta_{1i}\Delta(S/Y)_{it} + \eta_i((I/Y)_{i,t-1} - \emptyset_{0i} - \emptyset_{1i}(S/Y)_{i,t-1}) + \varepsilon_{it} \quad (3)$$

where; $\emptyset_{0i} = \frac{\delta_{io}}{1-\lambda_i}, \emptyset_{1i} = \frac{\delta_{1i}+\delta_{2i}}{1-\lambda_i}$ and $\eta_i = -(1-\lambda)$

The saving retention coefficient is represented by the value $\emptyset_{1i} = \frac{\delta_{1i}+\delta_{2i}}{1-\lambda_i}$ it shows that the level of correlation between domestic saving and domestic investment across countries.

3.3. Technique of analysis

For the technique of analysis, series of long-run estimation techniques are employed including the PMG dynamic panel estimation techniques of Pesaran, Shin, and Smith (1999), mean group (MG) estimator of Pesaran and Smith (1995) dynamic fixed effect (DFE), the FMOLS, and DOLS panel techniques. The rationale for employing the variety of techniques is to ensure robust estimation. The intent of the estimation is to identify the true value of β coefficient which signifies the status of international capital mobility. However, among the three estimation techniques of MG, PMG, and DFE we expect to rely on one result. Based on the differences of their underlying assumptions, the post-estimation Hausman test is applied to the three estimation techniques of MG, PMG and DFE to arrive at a one favorable result for inference. In *apriori,* we therefore expect to have favorable result from the PMG, FMOLS, and DOLS. This is because the three estimation techniques, despite having varied underlying assumptions, they all agreed on the long-run convergence of the estimated variables. This particular assumption looks appealing to this study whose emphasis is on the long-run relations between saving and investment. The PMG assumes same long-run coefficient across the countries and allows short-run dynamics to vary. The FMOLS also assumes common long-run relationships but in cognizance of the degree of variations in dynamic adjustment of the short-run. The DOLS on the other hand is indifferent to the stationarity properties of the series.

4. Results and discussion

This section presents the result and discussion of various estimation processes. At the beginning the stationarity properties of the data series is investigated using variety of panel unit root test. With the establishment of non-stationary nature of the data, the study proceeded with the cointegration test to observe if the data variables share common long-run properties. The rationale for stationarity and cointegration tests is to ensure the absence of spurious regression in the estimations and also to identify the presence of long-run relations among the variables. With the presence of common long-run trending, long-run coefficients are estimated using the series of estimation techniques to ascertain the value saving retention coefficient or the extent of the international capital mobility.

4.1. Panel unit-root test

The unit root test of Breitung t-statistics, Levin, Lin and Chut, Im, Pesaran and Shin and ADF—Fisher chi-square were tested to determine the stationarity level of the data series. The result of the test gives the basis for cointegration analysis, which requires variables to be integrated of the same order. Table 1 presents the result for unit root. Both the saving and investment ratios are non-stationary series but integrated of order one at 1% level of significance. The results show that the null hypothesis of unit root cannot be rejected at level but it is rejected at first difference confirming that the series are non-stationary; integrated of the first order I(1).

Table 1. Panel unit root test result

	Levin, Lin & Chu t		Breitung	*t*-stat	Im, Pesaran & Shi.		ADF—Fisher Chi.	
	Statis.	*p*-value	Statis.	*p*-value	Statis.	*p*-value	Statis.	*p*-value
GFCF	0.0719	0.5286	1.89126	0.9707	−0.0931	0.4629	30.971	0.2294
ΔGFCF	−11.499	0.0000	−1.6948	0.0451	−11.127	0.0000	167.23	0.0000
GDS	−0.8413	0.2001	0.06332	0.5252	−1.6055	0.0542	41.743	0.0261
ΔGDS	−16.769	0.0000	−6.4180	0.0000	−16.931	0.0000	253.19	0.0000

Note: Δ indicate first difference.

Table 2. Pedroni panel cointegration test result

Within-dimension (panel)				Between-dimension (group)		
v-Stat.	**rho-Stat.**	**PP-Stat.**	**ADF-Stat.**	**rho-Stat.**	**PP-Stat.**	**ADF-Stat.**
0.7303	(3.8267)***	−4.302***	−3.671***	−2.114**	−4.149***	−2.680***

Note: Null hypothesis: no cointegration.

**Indicate the *p*-value is significant at 5%.

***Indicate the *p*-value is significant at 1%.

4.2. Panel cointegration test

The presence of unit root in both saving and investment ratios serve as a basis for cointegration test. To that effect Pedroni (2001), Panel cointegration test is conducted with the result presented in Table 2. From the table, it can be seen that both the within and between-group dimensions have shown evidence of cointegration among the series, implying evidence for a long run relationship between the two variables.

4.3. Estimations of saving retention coefficients

Having established the presence of cointegration relationship among the domestic savings and investment variables, we are left with the estimation of the saving retention coefficient; β specified in Equation (1). Recall that the magnitude of the β shows the relationship between the domestic saving and the domestic investment and by extension, the international capital mobility. In the estimation of this value, series of long-run techniques are employed to ensure the robustness of the results.

Table 3 presents the long-run coefficient of the β, the long run adjustment processes, the short-run coefficients and the Hausman test. The Hausman test is used to identify which among the estimated techniques is more efficient with regard to the study data by comparing results from the DFE, MG, and PMG. Results from the Hausman test conducted between the MG and DFE favors MG and between the MG and PMG appeared in favor of PMG since the test failed to reject null hypothesis. With the calculated Hausman statistic 0.83 and the distributed chi-square −0.361, it can be concluded that the PMG estimator is the efficient estimator. Therefore, based on the underlying assumptions of PMG, it implies that counties in West Africa share common long-run values but varied in their short-run adjustments.

To interpret the coefficients (saving retention) of the estimated value, we therefore concentrate on the long-run estimates provided by the PMG, FMOLS and DOLS. The three techniques share common behavior; they pool the long-run features of the variables and allow the short-run dynamic to be country-specific. From Table 3, the saving retention coefficients (β) reads 0.3031 for PMG, 0.4818 for FMOLS and 0.4772 for the DOLS and all are significant at 1% level. Interestingly they all show lower correlation value of less than 0.5, meaning that domestic investments in West Africa countries do not rely on domestic savings but rather relied on international pool of savings. Furthermore, the

Table 3. Long-run estimation results

	DFE	MG	PMG	FMOLS	DOLS
Long-run coeff.	0.3361	0.776	0.3031	0.4818	0.4772
	(0.048)	(−1.24)	(0.000)	(0.000)	(0.000)
Adjustment coeff.	−0.206	−0.3449	−0.3253		
	(0.000)	(0.000)	(0.000)		
Hausman test	33.38		0.83		
	[0.000]		[−0.361]		
Short-run coeff.	0.2015	0.1577	0.1984		
	(0.000)	(0.000)	(−0.002)		

Notes: Values in parenthesis are *p*-values for *t*-statistics. Values in brackets are *p*-values for the chi-square distribution.

estimates of the speed of adjustments are negative and less than one for all the techniques, confirming the viability of our inferences.

Thus, in general, the finding revealed that there is evidence of high capital mobility in West Africa. Having lower value of relationship between the domestic savings and domestic investment implies that investible funds from the West African countries are not exclusively sourced from within their respective domestic economies but equally from outside the counties unhindered. This is only necessitated by abolishing restrictions to capital mobility across the counties and impliedly by the integration of the respective financial systems. In addition, the finding appeared to conform to the a priori expectation that governments' liberalization efforts of financial instruments (in particular the interest rate and exchange rate) over the years could lead to free movement of capital across borders. Theoretically, the finding refutes the presence of FH puzzle in West Africa and empirically appeared in line with Bangake and Eggoh (2011) study for Africa; Baharumshah, Thanoon, and Rashid (2003) for US, Japan, ASEAN-4; Paresh (2005) for Japan.

As a confirmation of efficiency of the above results, estimates of the individual adjustment coefficient and short-run estimates of the PMG are provided in Table 4. The values show which of the countries is responsible for adjustment to long-run values whenever there is deviation from the equilibrium. All the values of the speed of adjustment are found negative and less than one, except for Niger republic and all are significant at 10% level except for Niger and Sierra Leone. The negative values goes in line with the *piori* expectations that the speed of adjustment back to long-run must be negative and less than one. However, the short-run estimates show less significance for most of the countries. This is not a problem considering that our emphasis is on the long-run.

In general, the result confirmed that the countries share common long-run trending in respect to the relationships between their domestic savings and investments. It also implies that whenever there is divergence from the long-run equilibrium, the variables from all the countries adjust collectively to restore the long-run behavior back to equilibrium. This is with the exception of Niger Republic and Sierra Leone who show insignificance relationship. This means that the result of β obtained in Table 3 cannot be attributed to the behavior of a single or few numbers of countries within the group but rather, a reflection of the behavior of the entire 13 West African countries investigated.

Table 4. Individual country PMG result

Country	Adjustment coeff.	Short run coeff.
Benin	−0.4270 (0.000)***	0.4408 (0.000)***
Burkina Faso	−0.4415 (0.027)**	0.2533 (0.059)*
Cote d'Ivoire	−0.2397 (0.001)***	0.0445 (0.565)
Gambia, The	−0.1744 (0.040)**	0.7032 (0.000)***
Ghana	−0.1491 (0.086)*	0.0670 (0.641)
Guinea	−0.8060 (0.000)***	0.1858 (0.123)
Guinea-Bissau	−0.1827 (0.089)*	0.2721 (0.214)
Mali	−0.6872 (0.000)***	0.1838 (0.118)
Niger	0.0483 (0.464)	0.2945 (0.019)**
Nigeria	−0.3268 (0.000)***	−0.0690 (0.107)
Senegal	−0.3167 (0.004)***	−0.2303 (0.177)
Sierra Leone	−0.0016 (0.994)	0.2560 (0.112)
Togo	−0.5244 (0.000)***	0.1783 (0.097)*

*Indicate the *p*-value is significant at 10%.

**Indicate the *p*-value is significant at 5%.

***Indicate the *p*-value is significant at 1%.

5. Conclusion and recommendation

The study identified the status of international capital mobility in 13 West African countries on the paradigm of Feldstein–Horika hypothesis. The aim is to identify if efforts made over the years in reducing restrictions to capital mobility have been successful and if FH puzzle exist in West Africa. Series of long-run estimation techniques with varied underlying assumptions are employed in the estimations. The result shows low value of saving retention coefficient (0.3031) confirming the presence of high international capital mobility in the region and by implication financial integration across the countries. This shows that the result conforms to a priori expectation, the Feldstein–Horioka puzzle does not hold for West Africa.

Higher capital mobility and financial integration implies that the efficiency of individual country monetary stabilization policies is declining, thus central banks or policymakers in these countries have to put into cognizance the fact that monetary policies may not be effective in the long-run. With free and perfect capital movement across countries, the domestic interest rate adjustment by central banks through domestic money demand and supply would not be much effective. It is therefore recommended that Optimum Currency Area or monetary union be established for the West African countries so as to restore the declining monetary policy stabilization role, at least in a broader perspective. Fortunately, the countries share high trading relations satisfying an important condition for the formation of such Optimum Currency Area.

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Note

1. FH puzzle is considered one of the six puzzles identified in the field of international macroeconomics (Obstfeld & Rogoff, 2001). "It is termed a puzzle because it is an awkward empirical fact that refuses to comply with the established theoretical framework" (Coakley, Kulasi, & Smith, 1998).

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