

Saving, investment and international capital mobility

An econometric checking of M. Feldstein and C. Horioka's model over the period 1975-2003 in Gabon

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Abstract

This article relates to the econometric checking of M. Feldstein and C. Horioka's model in Gabon. Like the study achieved by these two authors relatively to the measurement of the capital international mobility, it proposes to analyze, on the econometric plan, the relation Domestic Saving (S) – Domestic Investment (I) of Gabon over the period 1975-2003. Within this framework, it shows that Gabonese interior investment was indeed financed, during the period of study, by Gabonese interior savings. This situation supposes imperfect international capital mobility or a weak degree of financial integration, main conclusion to which had also led M. Feldstein and C. Horioka.

Keys words: domestic investment, domestic savings, international capital mobility, degree of financial integration, regression, co-integration test

Épargne, investissement et mobilité internationale des capitaux

Une analyse économétrique du modèle de M. Feldstein et C. Horioka sur la période 1975-2003 au Gabon

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Résumé

Cet article concerne la vérification économétrique du modèle de M. Feldstein et C. Horioka au Gabon. À l'instar de l'étude réalisée par ces deux auteurs relativement à la mesure de la mobilité internationale des capitaux, elle propose d'analyser, sur le plan économétrique, la relation Épargne intérieure (S) - Investissement intérieur (I) du Gabon sur la période 1975-2003. Dans ce cadre, il montre que l'investissement intérieur gabonais a bien été financé, pendant la période d'étude, par l'épargne intérieure gabonaise. Cette situation suppose une mobilité internationale imparfaite des capitaux ou un faible degré d'intégration financière, principale conclusion à laquelle avaient également conduit M. Feldstein et C. Horioka.

Mots clés: investissement intérieur, épargne intérieure, mobilité internationale des capitaux, degré d'intégration financière, régression, test de co-intégration

1. Introduction

Since the end of the decade 1980, one observes an increased liberalization of the capital international market which later led to an international financial globalisation or capital planetary market.

The international capital market is the theatre of much lending and loans operations in various currencies whose formed prices are the interest rates. If the principal actors are banks, multinational corporations but states; its three most important poles are the international bank loans, the international obligations and the instruments of the money market.

The liberalization of this international capital market has been materialized by an increase, in volume and volatility, of the international financial transactions and others capital flows with their multiple corollaries (increase of investment; faster economic growth; increase in the standard of living in many countries; costly financial crises...).

In this context of the international financial globalization, M. Feldstein and C. Horioka sought to estimate the degree of the capital international mobility in the long term this, by the analysis of the link between investment and saving of the OECD countries (Feldstein and Horioka, 1980)¹.

More precisely, they sought to analyze the correlation between the saving rate and the investment rate and therefore determinate if these economies evolved closing (financing domestic investment only by domestic saving) or rather opening (strong international capital mobility and perfect integration of national capital markets).

Facing this international financial phenomenon, the subject of study is « Saving, Investment and capital international mobility: an econometric checking of the M. Feldstein and C. Horioka's model in Gabon. »

The articles and books selected as main references are those of Feldstein and Horioka (1980), Feldstein (1983), Cadoret (2004), Bourguinat (1999) and Bourbonnais (2015) this, for the accuracy of the concepts, the formulation of the research problem and the various theories which must underpin the research hypothesis.

This is therefore a subject of particular scientific interest within the meaning of register through fundamental research contributing to the advancement of generalized, theoretical scientific knowledge on macroeconomic and financial plan.

In this context, by registering under the paradigm of positivism, the presentation of this research is structured around two parties. The first part is devoted to the presentation of M. Feldstein model and C. Horioka's model. The second part focuses on the econometrical application of this international finance model on the Gabonese economy².

¹ *Their research was important because, depending on the degree of capital mobility, the impact of economic policies may be weak or strong. A tax policy in favor of national saving has an effect especially important on domestic investment that the degree of international capital mobility is low. In other words, the observing results in a closed economy (immobility of international capital) should be reflected in equality between domestic saving and domestic investment in volume and variation. In contrast, a high degree of (international) capital mobility will lead the tax policy in favor of saving to have less impact on the country's investment.*

² *M. Feldstein and C. Horioka proposed to analyze the correlation between the domestic rate saving and the domestic rate investment. The purpose being to determine if the economy has a behavior near to this of a closed economy or if, on the contrary, the capital market can be regarded as perfectly integrated. This international finance model will be applied to the Gabonese economy in order to determine if it is a closed or an opened economy.*

2. M. Feldstein and C. Horioka's international finance model

2.1. Macroeconomic relations in open economy

The selected framework is a macroeconomic model in open economies. It is based on the following accounting identities (Cadoret and al, 2004):

$$Y = C + I + G + X - M \quad (1)$$

$$S_{\text{private}} = Y - T - C \quad (2)$$

$$S_{\text{public}} = T - G \quad (3)$$

Equation (1) represents the distribution countable identity of gross national product (Y) between consumer spending (C), investment spending (I), government spending (G) and the current account (difference between exports (X) and imports (M)). Equation (2) shows that private savings (S_{private}) is equal to the difference between the gross domestic product (Y), taxes (T) and consumer spending (C). Equation (3) shows that public savings (S_{public}) is equal to the difference between government revenue (T) and government spending (G).

In this context, it appears that domestic investment (I) is equal to national savings (S_{national}) less the current account (X - M).

$$I = (Y - C - T) + (T - G) - X + M \quad (4)$$

$$I = S_{\text{private}} + S_{\text{public}} - (X - M) \quad (5)$$

$$I = S_{\text{national}} - (X - M) \quad (6)$$

In a closed economy (X - M = 0), domestic investment is equal to domestic savings (I - S). The correlation between these two variables is equal to 1, meaning that a change in domestic savings (S) causes an equivalent change of domestic investment (I).

However, in an opened economy with perfect capital mobility, there is theoretically no more correlation between domestic savings and domestic investment. On the one hand, domestic savings meets the investment opportunities of the global market. And on the other hand, domestic investment is financed by global savings.

If the investment is determined by the real interest rate; according to the principle of the marginal productivities decrease, we should observe, until the marginal productivity of capital is equalized everywhere in the world, large or important capital flows from developed countries towards developing ones.

Indeed, developing countries less well endowed with capital have higher capital marginal productivities than industrialized ones and therefore, higher³ real interest rates also. However, imperfect capital mobility will suggest differences or gaps between interest rates in developing countries and these used in developed ones.

2.2. The specification of M. Feldstein and Mr. Horioka's model

Feldstein and Horioka proposed to measure the degree of capital mobility on the basis of a correlation analysis between domestic savings (S) and domestic investment (I). In this regard, they felt a such regression equation (Bourguinat, 1999):

$$\frac{I}{Y} = a_1 + a_2 \frac{S}{Y} + U \quad (7)$$

I / Y and S / Y respectively represent the share of domestic investment and domestic savings in the national gross product and U, the residue.

In case of imperfect international capital mobility, an increase in the savings rate in the country should induce an increase in investment.

The capital marginal productivity being a decreasing function of the capital stock, the investment increase will initially benefit or profit to the countries less well endowed with capital (the latter is costly in terms of high real interest rates). Consequently, in case of high international capital mobility, an increase in domestic savings does not induce an identical increase in domestic investment.

An estimation of a_2 close to zero leads to consider that there is a strong international capital mobility in so far as it means that the correlation between domestic savings and domestic investment is zero or null. In contrast, an assessment of a_2 near to 1 indicates that a rise in domestic savings induces an identical increase in domestic investment. The additional savings remains in its origin country and the international capital mobility is low.

If the relation (7) can also be interpreted in terms of capital flows; the equation (6), expressed in share of the gross national income, becomes:

$$\frac{I}{Y} = \frac{S}{Y} - \frac{(X - M)}{Y} \quad (8)$$

$$\frac{S}{Y} - \frac{(X - M)}{Y} = a_1 + a_2 \frac{S}{Y} + U \quad (9)$$

³ The optimal capital stock is the one which permits the equalization between the capital marginal productivity and the real interest rate.

$$\begin{array}{c}
 Y \quad Y \quad Y \\
 (X - M) \quad S \\
 \text{-----} = a_1 + (a_2 - 1) \text{---} + U \\
 Y \quad Y
 \end{array} \quad (10)$$

The current account ($X - M$) means the surplus of the national income on the national expenditure.

$$X - M = Y - C - I - G \quad (11)$$

In terms of capital flows, a positive value of this current account means that the country is a net lender vis-à-vis the rest of the world. A negative value indicates that the country spends more than it produces (wins), and borrows from abroad to fill the gap. So, a surplus of the current account means a net exit of capital and a deficit, a net entry of capital on the territory (current account surplus translates into a net capital outflow while a deficit resulted in a net capital inflow in the country).

This situation reflects the budgetary constraints of the nation. The part of the expenditure that does not correspond to an income ($X - M$) must be borrowed from abroad, and conversely. The balance (total) of the payments must always be null. In others words, current account plus capital account plus external monetary position variation (monetary authorities official interventions in foreign exchange market) should be zero.

An estimated coefficient of $a_2 = 1$ implies that domestic savings finances domestic investment but also that, capital net flows do not depend on domestic savings rate.

2.3. The main results of M. Feldstein and C. Horioka's model

M. Feldstein and C. Horioka's purpose (objective) was to test the hypothesis or assumption of strong long-term (international) capital mobility. In the estimated model (Equation 7), the relation between savings and investment is seen as a long-term relation in whom the differences in savings rates between the countries reflect the structural differences. The parameter a_2 represents the impact of a sustained or constant shock of savings on investment. It is seen as a long-term multiplier.

Over the period 1960-1974, the results of the estimate, with the ordinary least squares method (OLS), the equation (7) are those (Feldstein, 1983).

Board 1 : Results of the regression

Period	1960-74
a_1	0.035 (0.018)*
a_2	0.887 (0.074)*
R^2	0.91

Source : M. Feldstein, 1983

* Standard deviation of the estimated coefficients.

From these estimates, they tested the two following assumptions:

$$H0: a_2 = 0$$

$$H0: a_2 = 1$$

Then

$$H1: a_2 \neq 0$$

$$H1: a_2 \neq 1$$

The Student table, for one degree of freedom⁴ equal to 14, indicates a value of the T-Student equal to 2.14 for a risk threshold of first species equal to 5%.

In this context, the confidence interval of a_2 over the period 1960-1974 is $[0.887 \pm 2.14 * 0.074] = [0.73; 1.04]$. It came out from these results that value 0 did not belong to the confidence interval while value 1 appeared in it. The parameter a_2 was so significantly different from zero ($H0: a_2 = 0$ is rejected). In other words, the parameter a_2 was not significantly different from one ($H0: a_2 = 1$ is accepted).

These results contradict the assumption of perfect capital international mobility, an increase in the savings rate inducing an equivalent rise in the investment rate. In other words, the additional savings is invested in the country and international differences in saving rates do not explain the observed capital flows.

Feldstein and Horioka's⁵ empirical work raised much analytical studies which were devoted to him (Habegger, 1980; Tobin, 1983; Caprio and Howard, 1984; Bryant, 1987; Frankel, 1989; Feldstein and Baschetta, 1989; Bordes, 1990; Bayoumi, 1990).

3. The econometric application of M. Feldstein and C. Horioka's model to Gabon

Inspired by M. Feldstein and C. Horioka's⁵ model, we propose to analyze the savings-investment relation of Gabon over the period 1975-2003 except that here, the variables domestic investment and domestic savings will not be related to GDP.

Board 2 : DOMINVEST and DOMSAVINGS in billion francs CFA, 1975-2003

Years	DOMINVEST	DOMSAVINGS
1975	289.8000	297.3000
1976	528.5000	524.8000
1977	400.8000	403.1000
1978	188.8000	268.8000
1979	212.2000	348.1000
1980	249.0000	548.2000
1981	381.5000	619.4000
1982	416.3000	677.0000
1983	454.7000	684.5000
1984	513.0000	807.0000
1985	709.6000	789.0000
1986	555.3000	325.3000
1987	356.4000	331.5000
1988	405.0000	347.2000

⁴ The degree of freedom is the difference between the number of observations and the number of estimated parameters.

1989	351.3000	412.7000
1990	351.0000	597.3000
1991	403.4000	616.7000
1992	332.0000	513.7000
1993	343.6000	561.6000
1994	508.8000	1053.800
1995	541.7000	1074.900
1996	581.2000	1331.700
1997	978.5000	1744.900
1998	1033.900	1017.400
1999	687.3000	1363.400
2000	790.3000	2031.700
2001	888.2000	1692.800
2002	842.5000	1503.200
2003	843.0000	1692.500

Sources: Ministry of Economy and Finance of Gabon, Dashboards of the Gabonese, IMF, International Financial Statistics.

By specifying these two variables (Savings and Investment) as absolute values and not as relative values, this econometric model was established (Dormont, 1999; Bazen and Sabatier, 2007; Pétry and Gélineau, 2009).

$$\text{DOMINVEST}_t = a\text{DOMSAVINGS}_t + C + U_t$$

- DOMINVEST = domestic investment = explained or endogenous variable;
- DOMSAVINGS = domestic savings = explanatory or exogenous variable;
- a = parameter expressing the behaviour of DOMINVEST following a variation of DOMSAVINGS;
- C = constant non null (non-zero constant);
- U = residue;
- T = number of observations = 29;
- k = number of explanatory variables (including the constant term) = 2;
- $\beta = 1 - \alpha$ = threshold of confidence (confidence level) with α = risk of error = 1% = 0.01.

The purpose or objective of this econometric study is to see if Gabonese domestic savings has well contributed to the financing of domestic investment. Its objective is to see if domestic investment were not rather financed by foreign or external savings this, through international capital mobility in search of greater or stronger remuneration.

In this context, it is initially or firstly tested a co-integration relation between DOMINVEST and DOMSAVINGS with a possible estimate of the error correction model (ECM⁵) this, in order to minimize the risk to have a "fallacious" or "spurious" relation and interpret the results in an erroneous way (Bourbonnais, 2015).

Econometric theory, based on the Engle and Granger algorithm in two stages, requires time series to be integrated in a same order (in fact, in I(1)) for supposing a co-integration risk between them. In the contrary case that is to say if the variables are not integrated in a same order and particularly in I(1), the procedure is stopped (Engle and Granger, 1987).

⁵ The fact to series be co-integrated and non-stationary raises a problem of estimation. In direct regression, the use of this model for forecasting will be disastrous. Indeed, the relationship underscored by this regression is not real (she is simply a connection between two trends). The problem is, firstly, to remove the co-integration common relation (the common tendency) and on the other hand, to seek the real relation between the variables. It is the objective of the error correction model (ECM) which is both a static and dynamic model.

To carry out this co-integration test; the procedure, in a first stage, is to study the properties of variables, DOMINVEST and DOMSAVINGS in terms of stationary.

The results of the Dickey-Fuller Augmented (DFA⁶) test indicate that these two variables (DOMINVEST and DOMSAVINGS) are both integrated to order 1 (Dickey and Fuller, 1979 and 1981).

Board 3 : Unit root test results on variables of the model

Variables	Constant	Trend	Value test	Critical value	Critical value 5%	Conclusion
DOMINVEST D(DOMINVEST)	Yes	No	-1.562	-3.685	-2.970 -2.975	
DOMSAVING D(DOMSAVING)	Yes	No No	-1.153	-3.685	-2.970 -2.975	

Board made by results obtained with the Eviews.

So, our variables, DOMINVEST (endogenous variable) and DOMSAVINGS (exogenous variable), being of the same integration order that is to say I(1); the risk of co-integration⁷ between them is presumed.

Consequently, the process can continue with the Johansen test (Johansen, 1998) which is proceeded under the assumption of linear trend presence in the data and more precisely, of linear trend presence in the series and a constancy in the co-integration relation.

Also, from the statistical $\lambda_{\text{trace}} = -n \sum \ln(1 - \lambda_i)$; it is looked for the number⁸ of co-integration relations between DOMINVEST and DOMSAVINGS. According to Johansen and Juselius, this test functions by exclusion of alternative assumptions (Johansen and Juselius, 1990):

- row of the matrix M equal to 0 ($r = 0$), that is $H_0 (r = 0)$ against $H_1 (r > 0)$: if H_0 is refused, it is proceeded to the following test (H_0 is precisely rejected if $\lambda_{\text{trace}} >$ to the critical value read in the table);

- row⁹ of the matrix M equal to 1 ($r = 1$), that is $H_0 (r = 1)$ against $H_1 (r > 1)$: if H_0 is refused, it is carried out to the following¹⁰ test;

⁶ The principle of the unit root test (DFA test) is simple. If the hypothesis $H_0 (\varphi = 1)$ is used in an autoregressive model (of order 1, with constant, with trend), the process is not stationary (If the hypothesis H_0 is verified, the chronic x_t is not stationary regardless of the model used, and conversely if the hypothesis $H_1 (\varphi < 1)$ is checked). When the process is a TS process (Trend Stationnary), it can be made stationary by calculating the residue compared to the trend estimated by the ordinary least squares (OLS). In this context, the estimate of the coefficients and standard deviations of the model by the OLS provides t_φ which is similar to the T-Student statistical (ratio of the coefficient and its standard deviation). If $t_\varphi > t_{\text{tabulated}}$, then there is acceptance of the hypothesis H_0 (there is an unit root and the process is not stationary). Conversely, there is acceptance of the hypothesis H_1 if $t_\varphi < t_{\text{tabulated}}$ (there is not an unit root and the process is stationary). The rejection of H_0 symbolizes this one of a deterministic trend.

⁷ The treatment of long time series imposes to test a co-integration relation between the variables. Indeed, the risk to estimate "misleading" relations and to interpret the results in an incorrect way is very high.

⁸ To determine the number of co-integration relations, Johansen proposes a test based on the eigenvalues, λ_i , from a matrix M of k dimension, k from which is calculated a λ_{trace} statistic = $-n \sum \ln(1 - \lambda_i)$, with n = number of observations and $\lambda_i = i^{\text{th}}$ eigenvalue of the matrix M, k = number of variables, r = rank of the matrix. The λ_{trace} statistic follows a law of probability (similar to a χ^2) tabulated with Johansen and Juselius simulations.

⁹ The number of linearly independent co-integrating vectors is called the rank of co-integration. If the variables are of the same integration order, I (1) in the case, the existence of a single vector co-integration is presumed. However, if the series are not all integrated in the same order, the existence of several co-integrating vectors is presumed, which makes the process of Engle and Granger invalid.

¹⁰ Otherwise, the procedure is stopped and the rank of the matrix is $r = 1$.

- row of the matrix M equal to 2 ($r = 2$), that is H_0 ($r = 2$) against H_1 ($r > 2$): if H_0 is refused, it is proceeded to the following¹¹ test, etc.

If, after refusal of various H_0 assumptions at the end of the procedure, it is tested H_0 ($r = k-1$) against H_1 ($r = k$) and that there is always refusal of H_0 assumption, then the row of the matrix is $r = k$. In this case, there is no co-integration relation because the variables are all integrated in level (they are all stationeries).

Eviews directly provides the whole information (statistic calculated between 1 and k; critical values associated...).

Board 4 : Johansen Cointegration Test

Date: 2016/02/10 Time: 12:54				
Sample: 1975 2003				
Included observations:				
Test assumption: Linear deterministic trend in the data				
Series: DOMINVEST DOMSAVINGS				
Lags interval: No lags				
Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.574973	25.91429	15.41	20.04	None **
0.067519	1.957385	3.76	6.65	At most 1

*(**) denotes rejection of the hypothesis at 5% (1%) significance level

L.R. test indicates 1 co-integrating equation(s) at 5% significance level

The board 4 above shows that the two eigenvalues of the matrix M, estimated by the likelihood ratio, are $\lambda_1 = 0.574$ and $\lambda_2 = 0.067$.

The search for the number of co-integrating vectors is as follows.

First case: row of the matrix M equal to 0 ($R = 0$).

$$\begin{aligned}\lambda_{\text{trace}} &= -n \sum \ln(1-\lambda_i) = -28 [\ln(1-\lambda_1) + \ln(1-\lambda_2)] \\ &= -28 [\ln(1-0.574) + \ln(1-0.067)] \\ &= -28 (-0.8533 - 0.0693) = 25.91.\end{aligned}$$

The critical value (20.04 for a threshold at $\alpha = 1\%$) being lower than the Johansen statistic λ_{trace} ($\lambda_{\text{trace}} = 25.91 > 1\% \text{ C-V} = 20.04$), there is rejection of the assumption H_0 ($r = 0$).

The row of the matrix M is not 0 (the series are not stationeries in level or $I(0)$). In other words, H_0 ($r = 0$) being refused, it is proceeded to the next test.

Second case: row of the matrix M equal to 1 ($r = 1$).

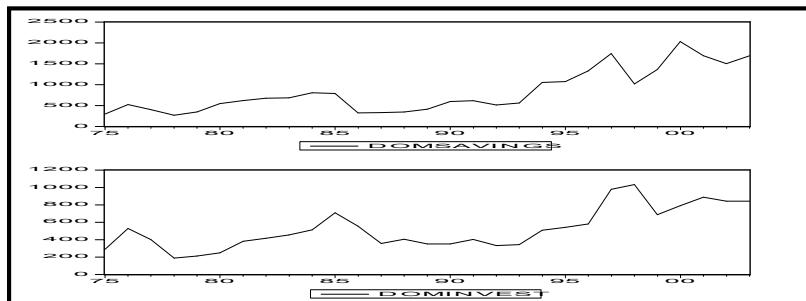
$$\begin{aligned}\lambda_{\text{trace}} &= -n \sum \ln(1-\lambda_i) = -28 [\ln(1-\lambda_2)] \\ &= -28 [\ln(1 - 0.0675)] = -28 (-0.0698) = 1.957.\end{aligned}$$

The critical value (6.65 for a threshold $\alpha = 1\% = 0.01$) being higher than the Johansen statistic λ_{trace} ($\lambda_{\text{trace}} = 1.957 < 1\% \text{ C-V} = 6.65$), there is acceptance of the assumption H_0 ($R = 1$). The row of the matrix M being 1, it is so accepted the assumption or hypothesis of only one co-integration relation between the explained variable (DOMINVEST) and the explanatory variable (DOMSAVINGS) of our

¹¹ Otherwise, the procedure is stopped and the rank of the matrix is $r = 1$.

model. This co-integration relation between INVESTDOM and SAVINGSDOM variables (explosive in level but stationaries in I (1)) seems to be corroborated by this graph.

Graph 1 : DOMINVEST and DOMSAVINGS over the period 1975-2003



Graph made with data included in the board 2.

Consequently, the ECM modelling must continue. If need be, the use of our econometric model at estimate ends can be disastrous.

Also, with a view to always minimize the risk of misleading estimate relation and interpret the results incorrectly; it is proceeded, within the framework of the first stage of Engle and Granger error correction model (ECM), to estimate the long-term relation by the ordinary least squares method (OLS).

Board 5 : Estimation of the long term relation by the least squares method

Dependent Variable: DOMINVEST				
Method: Least Squares				
Date: 2016/03/15 Time: 14:31				
Sample: 1975 2003				
Included observations: 29				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOMSAVINGS	0.375621	0.049053	7.657377	0.0000
C	208.8025	47.78799	4.369350	0.0002
R-squared	0.684710	Mean dependent var		521.9862
Adjusted R-squared	0.673032	S.D. dependent var		232.7751
S.E. of regression	133.1033	Akaike info criterion		12.68660
Sum squared resid	478345.3	Schwarz criterion		12.78090
Log likelihood	-181.9557	F-statistic		58.63542
Durbin-Watson stat	1.348501	Prob(F-statistic)		0.000000

Board made with the Eviews.

From this board, it arise this long term relation.

$$\text{DOMINVEST}_t = 0.375\text{DOMSAVINGS}_t + 208.8 + e_t$$

$$(7.657) \quad (4.369)$$

The economic comments of the results lead to recognize a positive correlation between DOMINVEST and DOMSAVINGS. A domestic savings expansion has well induced a domestic investment rise over the period 1975-2003 in Gabon. The regression coefficient of DOMINVEST on DOMSAVINGS has well the awaited sign ($\hat{\alpha} = +0.375 > 0$, symbol of a positive relation between these two variables).

The statistical comments of the results lead to make these three remarks.

Firstly, the Fisher F-statistic indicates that the model is overall significant or good: for $k = 2$, $T = 29$ and $\alpha = 0.01$, the critical probability (H_0 probability of acceptance) of this test is lower than 1% (prob (F-statistic) = 0.000000 < 1%). The determination coefficient (R^2) corroborates this result good enough (its explanatory capacity is 0.68).

Secondly, the T-Student statistic of DOMSAVINGS has a critical probability lower than 1% (prob (t-Statistic) = 0.0000 < 1%). The regression coefficient of DOMINVEST on DOMSAVINGS is significantly different from 0 (these two variables are significantly and positively correlated). A domestic savings expansion has well involved a domestic investment rise. In other words, the domestic investment has not, for its financing, really called appealed to foreign capital (this situation suggests an imperfect international capital mobility, which is Feldstein and Horioka's conclusion).

Thirdly, the D-Durbin-Watson statistic ($d = 1.348$) is good (it does not predict, with $\alpha = 0.01 = 1\%$, an autocorrelation of the residues; which is synonymous of a good predictive capacity). Indeed, for m (number of explanatory variables, excluded constant term) = 1, T (number of observations) = 29 and $\alpha = 0.01 = 1\%$, it occurs $d_1 = 1.12$ and $d_2 = 1.25$ with $d_2 = 1.25 < d = 1.348 < 4 - d_2 = 2.75$.

In this way, our model leads to the same conclusion as this of M. Feldstein and C. Horioka. It suggests an imperfect international financial integration in the sense that domestic investment was financed by domestic savings. However, given the rather similar trends of DOMINVEST and DOMSAVINGS variables which raises the suspicion of a co-integration relation; it is proceeded, in the order to avoid or exclude the risk of "fallacious regression", to the estimate, by the ordinary least squares (OLS) method, of the dynamic model relation.

$$D(\text{DOMINVEST}_t) = aD(\text{DOMSAVINGS}_t) + \phi \text{RESIDULT}(-1) + U_t$$

To achieve this, it is important, first, to calculate the residue (e_t) resulting from the long-term relation and to test its stationary. From the econometric model with two variables (DOMINVEST and DOMSAVINGS), explosives in level or co-integrated to order 1 ($I(1)$); it was obtained a residue (linear combination of these last ones), stationary in level or $I(0)$.

Board 6 : Augmented Dickey-Fuller Unit Root on RESIDULT

ADF Test Statistic	-3.899426	1% Critical Value*	-3.6852	
		5% Critical Value	-2.9705	
		10% Critical Value	-2.6242	
*MacKinnon critical values for rejection		of hypothesis of a unit root.		
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(RESIDULT)				
Method: Least Squares				
Date: 2016/03/17 Time:				
Sample(adjusted): 1976				
Included observations: 28 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESIDULT(-1)	-0.736594	0.188898	-3.899426	0.0006
C	6.120225	24.69002	0.247883	0.8062
R-squared	0.369017	Mean dependent var		1.040357
Adjusted R-squared	0.344748	S.D. dependent var		161.1725
S.E. of regression	130.4653	Akaike info criterion		12.64884
Sum squared resid	442551.1	Schwarz criterion		12.74400
Log likelihood	-175.0838	F-statistic		15.20552
Durbin-Watson stat	1.734006	Prob(F-statistic)		0.000607

Board made with the Eviews.

The stationarity of this residue leads to the acceptance of a co-integration¹² assumption between the involved variables. The assumption of a single co-integration vector having been accepted; it is carried out to the estimate, by the ordinary least squares (OLS) method, of the dynamic relation (second stage of the Engle and Granger error correction model).

Board 7 : Short term relation by the least squares method

Dependent Variable: D(DOMINVEST)				
Method: Least Squares				
Date: 2016/03/19 Time: 00:54				
Sample(adjusted): 1976 2003				
Included observations: 28 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DOMSAVINGS)	0.098519	0.069880	1.409828	0.1704
RESIDULT(-1)	-0.760230	0.149292	-5.092245	0.0000
R-squared	0.535468	Mean dependent var		19.75714
Adjusted R-squared	0.517602	S.D. dependent var		146.7362
S.E. of regression	101.9155	Akaike info criterion		12.15491
Sum squared resid	270056.0	Schwarz criterion		12.25007
Log likelihood	-168.1688	Durbin-Watson stat		1.325493

Board made with the Eviews.

From the board 7, it arises this dynamic relation.

$$D(\text{DOMINVEST}_t) = 0.098D(\text{DOMSAVINGS}_t) - 0.760\text{RESIDULT}(-1) + e_t$$

(1.409) (- 5.092)

T = 28 R² = 0.535 DW = 1.325 (.) = T-Student.

It appears that the error correction model is valid in the sense that the coefficient of the recall term (ϕ) has the well awaited or expected sign ($\phi = -0.760$). This coefficient (ϕ), force of recall towards balance, is besides significantly different from 0 (prob (t-statistic) = 0.0000 < 1%).

In addition, this model presents a good predictive capacity (there is no, at $\alpha = 0.01 = 1\%$, residues autocorrelation): for m (number of explanatory variables, excluded constant term) = 1, T (number of observations) = 28 and $\alpha = 0.01 = 1\%$, it occurs $d_1 = 1.10$ and $d_2 = 1.24$ with $d_2 = 1.24 < d = 1.325 < 4 - d_2 = 2.76$.

4. Conclusion

Like M. Felstein and C. Horioka's model, our econometric study, essentially limited to Gabon and the capital movements between the latter and the rest of the world, concludes the imperfect international capital mobility.

The results of the various tests led to a positive correlation between variables DOMINVEST and DOMSAVINGS, an overall significance of the model corroborated by R², a significance of the regression coefficient.

Furthermore, in order to eliminate or avoid any risk of "fallacious regression" because of a co-integration relation between DOMINVEST and DOMSAVINGS underlain by Dickey-Fuller and

¹² The estimated econometric model is at risk of "spurious regression" and misinterpretation of results that will be annihilated by estimating the dynamic relation or short term relation.

Johansen and Juselius tests; the estimate, by the OLS model, of the dynamic model (short term relation) also provided or gave good results.

Indeed, the error correction model (ECM) is valid in the sense that the coefficient of the recall term (ϕ), significantly different from 0, has the well awaited negative sign (it is a sign of a recall or return force towards equilibrium).

In the same way, like the long term model, it has good predictive power (serial independence of residues).

In sum, like M. Feldstein and C. Horioka's model, our econometric study applied to Gabon over period 1975-2003 leads to the same imperfect international financial integration from the various tests conducted or performed.

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