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VARIATIONS IN EXTERNAL CAPITAL FLOWS AND GROWTH IN THE CEMAC ZONE

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ABSTRACT

This article explores the various channels of transmission of the effects of changes in external capital flows on growth of countries in the CEMAC zone in sub-Saharan Africa. To do so, it highlights the economic and financial relationship that countries in the region have with the global financial economy from the different ways of financing development from 1970 to 2010. Panel data cointegration analysis on the six countries is mobilized and completed with an error correction model (VCM) to test not only the long-term relationship, but also the short-term effects of these variables in the long period. The density of the transmission channels is measured by effects of the absolute value of the change in the logarithm of GDP per head to the variation of a particular flow of funding. The results show that not only the effects identified and vary from one channel to another. It appears that the density of impacts is not the same for every country because of country fixed effects. On the whole the study revisits the issue of financing development through public or private international capital flows.

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KEYWORDS

foreign capital flows, transmission channels, financial crisis, growth, development financing.

1. INTRODUCTION



One of the concerns raised by the recent international financial crises has been the likelihood they include to have a negative impact on growth prospects in Sub-Saharan Africa. Assuming plausible that they would lead to an unfavorable reallocation of financial flows towards the region, many studies have highlighted the fact that different external capital flows constitute various channels through which the negative impact of crises transits (Rodrik, Subramanian, 2009). But the supposed concern, although prompted by these recent crises, extends all the consequences that the different variations of external capital flows may have on the growth of these countries in the context of greater openness and financial markets development. This dynamic raises, implicitly, the problem of financing development through foreign capital flows and the effects of their variations.

Theoretically, the analysis of the effects of the movements of external financing flows is seated on the relationship between foreign capital and growth. Indeed, over the past four decades, many theoretical works have highlighted the positive relationship between the growth of real Gross Domestic Product (GDP) and foreign capital flows. In particular, it is noted that these flows do not only come in support of domestic capital, but also have the ability to create an environment conducive to effective activity. Thus, depending on the type of capital, which can be official development assistance, external debt, bank loans or foreign direct investment, external capital flows to recipient economies provide technology transfer, gains in reduced costs of required capital or organizational efficiency of the productive system. These virtues of foreign capital in developing economies are expected to intensify with the advent of financial markets in some countries in the mid 90s. In support of these theoretical analyzes, many empirical investigations have confirmed or denied the alleged theoretical positive relationship, putting ahead the effects of the nature of the flow as well as the actual capacity of the recipient economies.

More specifically, these empirical studies generally used cointegration analysis on time series to put ahead the long-term relationship between capital flows and the real product per capita data from the countries concerned. In countries with emerging financial markets, the investigations involved "classic" flows such as bank loans, foreign direct investment, external debt flows, as well as "modern" flows introduced by the advent of the financial markets, namely equity portfolio investment and international bonds. However, not only the quality and quantity of data needed to sufficiently establish a long series remains a real headache in sub-Saharan Africa in general and the CEMAC zone in particular, but analysis through time series does not take into account the common features that may exist among the countries of this area. The panel data analyses, often well received in such circumstances, has unfortunately remained the issue of isolated works.

In fact, it is clear that the addition of the individual dimension to the usual temporal dimension not only overcomes the low power of cointegration tests in small sample time series, but it also allows to integrate the properties of long term sets whose probability is high as they are common to several countries. By increasing the number of data including information on different countries, a multi-country analysis is carried out within the same methodological framework. Thus, beyond the simple addition of the individual dimension to the temporal dimension, the option of panel provides important technical properties required for precision. So, the panel is more than just a collection of independent individuals, but a structure subjected, for example, to the influence of both observable and unobservable common factors. Panel option is no longer a choice in the place of time series analysis, but a necessity dictated by the desire to model factors common to several countries.

The purpose of this article is therefore to examine the economic and financial relationship that CEMAC countries have with the global economy through the different ways of financing development from 1970 to 2010. Cointegration analysis by recent models on panel data from the six countries of the CEMAC zone and a vector error correction model (VECM) are mobilized to test not only the long-term relationship, but also the short-term effects of these variables. The rest of the paper is structured as follows: Section II, the evolution of external financial flows and growth in the countries of CEMAC (II), Section III methodology highlighting the long and short-run relationships between such flows and growth in panel data (III), section IV, the results of estimations on panel data from the CEMAC zone (IV) and section V expose the density of different channels (constituted by the capital flows involved) of transmission of the effects of the financial crisis of 2008 to growth as an illustration.

2. EVOLUTION OF EXTERNAL FINANCIAL FLOWS AND GROWTH IN THE COUNTRIES OF THE CEMAC ZONE

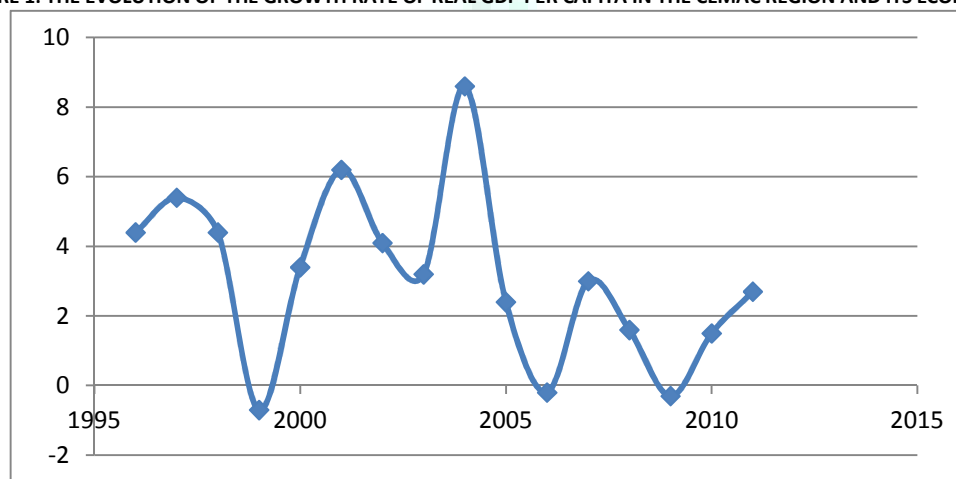
External financing flows towards sub-Saharan Africa in general and in particular the CEMAC zone have undergone profound changes since the 70s. These changes have increased since the mid-90s with the birth of pioneer capital markets in this economic area which is still lagging behind. With a little foresight, they go hand in hand with the issue of financing growth in developing countries by foreign capital (Rodrik, Subramanian, 2009). Should these funds be public or private? Should we let the financial markets or do they still benefit from proactive states and international financial institutions? What is the density of the flows of each type? These few questions, beyond the concerns raised by the international financial crisis, by nature transient, bring reflection on the issue of quality and defects of external financing and their ranking in terms of density in the transmission of the effects of the international economy.

We note in the CEMAC zone that next to the sub-regional stock exchange in Libreville, there exists the Douala Stock Exchange, which is more national, and that they have not yet reached the level of capitalization or number of quotes sufficient to enhance the locomotive economy of the sub region. As such, "classical" financing means such as external debt, private bank loans, official development assistance, and private foreign investment continue to serve as major sources of

external financing. Not only have these "traditional" means not evolved homogeneous since 1970, we can also observe that they have by no means remained safe from international economic and financial movements.

Indeed, the crises of the 70s characterized by unprecedented shocks of commodity prices have contributed to the growth of the external debt; the fall in prices of commodities in the 80s was accompanied by the slowdown in the overall capital flows to Africa in general. Conditions of the 90s nourished in terms of liberalization has promoted various structural reconstruction of the evolution of external funding streams while crises of the first decade of the millennium 2000 have raised new concerns about the various capital flows that are related with the resumption of growth. These concerns are in proportion to hopes based on the growth contribution to the fight against poverty. With a poverty incidence of 35%, this region is among the poorest in the world, and a mortgage on growth is necessarily a source of anxiety and even panic. Trends show that the rate of growth of real national product per head for the whole CEMAC region has an average of 3.1% in the 70s, 4.5% for 80s, 4.1% for 90s and finally 4.3% for the decade 00. Troughs of these trends in growth rates were observed in 1989, 1999 and 2009 respectively, reaching 1% -0.7% -0.3% and finally for different countries, these were hollow 3.9% for Cameroon, 2.72% for the Central African Republic, -11.2% for Gabon, -2.7% for the Congo, -0.6% for Chad and finally 23.2% for Equatorial Guinea. The fact that there appears as a synchrony in these movements, suggests the existence of common factors in the development of these economies. Yet there also exist strong heterogeneities as can be seen from the diversity of the activities that characterize them. Figure 1 shows this evolution in growth.

FIGURE 1: THE EVOLUTION OF THE GROWTH RATE OF REAL GDP PER CAPITA IN THE CEMAC REGION AND ITS ECONOMIES



Accompanying the evolution of real GDP per capita, changes in external capital flows and their structural composition also suggest the existence of common and specific factors in the economy. First, the economies of the region benefit from the flow of external debt since 1970, yet their debt ratio still seems negligible. And second, they also enjoy private bank loans and foreign direct investment over the period of analysis. However, these flows do not have the same volume or the same consistency. Although the proportion of foreign direct investment flows in the direction of the area is negligible in comparison with other countries in sub-Saharan areas, we note that Cameroon and Gabon totaled the largest amounts, same for bank loan.

Despite some differences in the evolution of chronic growth rates of GDP per capita and that of external capital flows in the direction of the CEMAC countries, a more robust explanation of the relationship between these variables is urgent. Such an explanation is all the more urgent that the economies of the CEMAC zone must identify the density effects transmitted through different channels by these external flows for purposes of funding policy. These results are interesting in that they provide a basis for a comparative analysis with those achieved in other areas in sub-Saharan Africa. Finally, the theory of external financing and economic growth, through this, there is another opportunity to lend refutability.

3. METHODOLOGY HIGHLIGHTING THE LONG & SHORT-RUN RELATIONSHIPS BETWEEN FLOWS AND GROWTH IN PANEL DATA

To highlight the effects of changes in external capital flows on growth of economies in the CEMAC zone, we assume that they are open to the outside and bear significant public expenditures. Variables retained for the analysis are; bank loans (BANK), foreign direct investment (FDI) flows and external debt (FDEXT). To these financial variables, it is necessary to add public spending (GOV noted) because they represent the burden on GDP of the economies, but also the importance of the issue of public deficits in recent debates on financial crises. Finally we had to also take into consideration the degree of openness of economies (denoted TRADE), in order to capture it through the indirect effects of crises via channels that are not necessarily financial.

The approach is to first establish the existence of a long-term relationship between the variables representing the flow of foreign capital and the logarithm of real GDP per capita of different economies. Then the effects of the movements of external financing flows can be identified, the causal link between them and the variations of the logarithm of real GDP per capita has been specified in the meantime. Finally, the significant coefficients of the estimated short and long-run relationships are used to measure the density of different channels of transmission of the crises. The option taken for analysis and specification of the panel selected model will first be justified as well as the data used and their sources. The procedure for analyzing cointegration in panel will then be exposed.

3.1- PANEL DATA, THEIR SOURCES AND THE RATIONALE FOR THE PANEL OPTION FOR COINTEGRATION

Panel data are, by construction, a stack data incorporating both individual and temporal dimensions. This double dimensions account simultaneously to the dynamic behavior through the intra-individual dimension and their possible heterogeneity across the inter-individual dimension. The influence of unobservable characteristics of individuals on their behavior by controlling the heterogeneity observed (actual measurements of variables) and that of unobserved heterogeneity (specific effects) is usually the charm of this option of analysis.

Since the pioneering work of Levin and Lin (1992), the literature on the econometrics of non-stationary panel data - and, in particular, cointegration tests - has continued to grow. Many empirical studies on using panel data unit root tests in the context of univariate and / or cointegration tests in a multivariate context came to support subsequent theoretical developments. Double panel dimension not only provides enrichment to cointegration analysis, but also a change in the statistical consequences of the situation of no cointegration between non-stationary variables, that is to say, the situation of spurious regression (Phillips and Moon. 1999). The tests performed in this study are those proposed by Pedroni (1995, 1997), Kao (1999) and Bai and Ng. (2001). This is analogous to the residual tests proposed by Engel and Granger (1987) in the context of time series.

The data used in this analysis are mostly derived from the Global Development Finance World Bank 2011 edition. We selected the five countries of the CEMAC zone, real GDP per capita in constant dollars of 2005. Equatorial Guinea suffers from a lack of data over very long periods for most variables. Other variables, namely net banking flows, foreign direct investment flows of external debt which we added government spending and openness. The data are from 1970 to 2010. Most of the data were compared and supplemented with those found in the publications of the African Development Bank. This is what justifies that we seek first the homogeneity or heterogeneity of the data, and confirm that test the validity of the stack panel. This is a confirmation of the validity of the panel built that justifies the option taken for testing cointegration in panel which should explain the first opportunity and the procedure.

3.2- TEST PROCEDURE FOR PANEL DATA COINTEGRATION AND VECTOR ERROR CORRECTION

Pedroni (1995, 1997) proposed seven tests to understand the null hypothesis of no intraindividual cointegration for both homogeneous and heterogeneous panels. Critical values given in this work are related to the presence of a single regressor in cointegration relationships. Pedroni (1999, 2004) proposes an

extension to the case where cointegration relationships include more than two variables. As the unit root tests of Im, Pesaran and Shin (2003), Pedroni's test takes into account heterogeneity through parameters that can differ between individuals. Thus, under the alternative hypothesis, there is a cointegration relationship for each individual, and the parameters of this relationship are not necessarily the same for each individual panel. Taking into account such heterogeneity is an undeniable advantage since in practice. It is rare that the cointegrating vectors are identical from one individual to another in the panel. Under these conditions, an incorrectly imposed homogeneity of the cointegrating vectors would result to a non-rejection of the null hypothesis of no cointegration even when the variables are cointegrated (see Pedroni, 1998).

The seven tests proposed to highlight the existence of a cointegrating panel are divided into two categories. The first four tests are associated with the dimension within, while the last three are associated with the dimension between. The within tests are performed with statistical coefficients of the autoregressive models of the unit root process of the different countries. The Between test can be considered as the average of tests carried out on the individual countries. The first are called "panel cointegration tests", and the second cointegration tests are called "panel group cointegration test." Formally and to put it simply, in light of all available data, the cointegration test of Pedroni after estimating the long-term relationship:

$$Y_{it} = \beta_i + \delta_i t + \alpha_{1i} x_{1,it} + \alpha_{2i} x_{2,it} + \dots + \alpha_{Mi} x_{M,it} + \varepsilon_{it} \quad (1)$$

Where $i = 1, \dots, N$ is the individual, $t = 1, \dots, T$, is the time of observation of the variable, $m = 1, \dots, M$, the m th variable x of the analysis. Variables β_i and $\delta_i t$ respectively characterize the individual specific effects (fixed effects) and time-specific effects, an appropriate test to validate the specification adopted. The equation underlying the different tests can be written:

$$\varepsilon_{it} = \rho_i \varepsilon_{it-1} + u_{it} \quad (2)$$

ρ_i is the autoregressive coefficient. The two categories of Pedroni's test based on the null hypothesis of no cointegration: $\rho_i = 1, \forall i$. The distinction between the two categories is based on the formulation of the alternative hypothesis:

For the four tests in the first category based on the within dimension. The alternative hypothesis is: $\rho_i = \rho < 1, \forall i$

For the three tests of the second category based on the Between dimension, the alternative hypothesis is: $\rho_i < 1, \forall i$. This shows that the test based on the between dimension is broader in the sense that it allows the presence of "heterogeneity among individuals under the alternative hypothesis.

In these seven tests, statistics are constructed based on the residuals of cointegrating relations and a number of estimators of nuisance parameters. The number of lags used in the ADF type regressions (Augmented Dickey-Fuller) may vary between individuals. The five steps of the execution of Pedroni's tests are:

- Step 1. We estimate the long-term relationship and recover the estimated residuals $\hat{\varepsilon}_{it}$.
- Step 2. For each individual, we differentiate the series y_{it} and calculate the residuals from the following regression:

$$\Delta y_{it} = b_{1i} \Delta x_{1,it} + \dots + b_{Mi} \Delta x_{M,it} + \eta_{it}$$

- Step 3. We estimate the variance of long-term: \hat{L}_{1i}^2 de $\hat{\eta}_{it}$.

- Step 4. Using the estimated residuals $\hat{\varepsilon}_{it}$, we choose the appropriate regression:

i) For non-parametric tests, except for tests of type t Augmented Dickey-Fuller, we estimate the relation $\hat{\varepsilon}_{it} = \hat{\rho}_i \hat{\varepsilon}_{it-1} + \hat{u}_{it}^*$ and the long run variance

\hat{u}_{it}^* is calculated and noted $\hat{\sigma}_i^2$. We then deduce $\hat{\lambda}_i = \frac{1}{2}(\hat{\sigma}_i^2 - \hat{s}_i^2)$ where \hat{s}_i^2 denotes the variance of \hat{u}_{it}^* .

ii) For parametric tests, we estimate the relationship:

$$\hat{\varepsilon}_{it} = \hat{\rho}_i \hat{\varepsilon}_{it-1} + \sum_{k=1}^{K_i} \hat{\rho}_{ik} \Delta \hat{\varepsilon}_{it-k} + \hat{u}_{it}^* \quad \text{then calculates the variance } \hat{u}_{it}^*, \text{ noted } \hat{s}_i^2$$

- Step 5. Using the calculations made in the previous steps, it is possible to build one of the seven statistics presented.

Pedroni (1995, 1997) showed that, under appropriate normalizations based on functions of Brownian motions, each of the seven statistics follows a standard

$$\frac{\kappa N, T - \mu \sqrt{N}}{\sqrt{v}} \xrightarrow[N, T \rightarrow \infty]{} N(0,1)$$

normal distribution for T and N large enough: :

Returning to the case of the CEMAC zone, and following the approach initiated in Pedroni (1997, 1999, 2001) for panel data into a single equation, equation (1) becomes:

$$y_{it} = \mu_i + \alpha_1 BANK_{it} + \alpha_2 IDE_{it} + \alpha_3 FDEXT_{it} + \alpha_4 GOUV_{it} + \alpha_5 TRADE_{it} + \varepsilon_{it} \quad (1')$$

where $i = 1, \dots, 5$ indicates an individual or country, and $t = 1970, \dots, 2010$, the year of the observation variable. It is obvious that this specification captures the heterogeneity of countries since the model is individual fixed effects.

Estimate equation (1') assuming that the variables are cointegrated is making the assumption that these variables are themselves individually integrated of order 1, that is to say stationary in first differences. More precisely, if there is cointegration between the logarithm of real gross domestic product per capita variables and determinants of external capital flows of this relationship, the analysis of movements between these variables and the logarithm of real GDP per capita can be conducted through a model of balance vector error correction model (VECM) of the type:

$$\Delta y_{it} = c + \alpha_i y_{it-1} + \beta_1 \Delta BANK_{it} + \beta_2 \Delta IDE_{it} + \beta_3 \Delta FDEXT_{it} + \beta_4 \Delta GOUV_{it} + \beta_5 \Delta TRADE_{it} + \theta \varepsilon_{it} + u_{it} \quad (3)$$

Where the variables Δx_{it} are the first differences of variables in the model lagged one period, for each country, ε_{it} is the correcting mechanism at the equilibrium and u_{it} is the error term. Under these conditions, θ is the coefficient characterizing the response speed of correction or restoring force balance. Under the assumption of cointegration, the coefficient θ is negative and statistically different from zero. And fluctuations of different modes of financing growth have a long term impact on the latter. The coefficients β_i meanwhile simply express the short-term impact. In other words, if all the coefficients are significantly different from zero, they express both the long-term relationship than short term.

It is important in this case to test the direction of causality between the independent variables and the dependent variable according to the method of Granger through the following system:

$$\Delta y_{it} = c + \alpha_i y_{it-1} + \sum_{m=1}^5 \beta_m \Delta x_{m,it-1} + \theta \varepsilon_{it} + u_{it} \quad m = 1, \dots, 5 \quad (4)$$

$$\Delta x_{m,it} = c + \alpha_i y_{it-1} + \sum_{m=1}^5 \beta_m \Delta x_{m,it-1} + \theta \varepsilon_{it} + u_{it} \quad m = 1, \dots, 5 \quad (5)$$

However, if there is no cointegration, the analysis of the effects of independent variables on changes in real domestic product per capita can be conducted from the following specification:

$$\Delta y_{it} = c + \alpha_i y_{it-1} + \beta_1 \Delta BANK_{it} + \beta_2 \Delta IDE_{it} + \beta_3 \Delta FDEXT_{it} + \beta_4 \Delta GOUV_{it} + \beta_5 \Delta TRADE_{it} + u_{it} \quad (6)$$

The latter specification expresses only a short-term relationship. Since cointegration analysis is between sets themselves integrated of any order, the logical procedure is to start with a unit root test on the variables implicated in the study.

4. ECONOMETRIC RESULTS OF TESTS ON PANEL DATA OBSERVATIONS ON THE COUNTRIES OF THE CEMAC ZONE

Of the five countries with the displacement data from 1970 to 2010, the first job was to test the appropriateness of establishing a panel. The test of such an opportunity is achieved through the within and between estimators which give respectively the intra variability attributable to the series individually and interannual variability due to the crossing of individuals made by different countries in this context. This test also serves as a test of homogeneity and / or heterogeneity in individual behavior of the panel. The implications of this are important to test the model specification to be used for the estimates. If individuals are homogeneous, the panel becomes useless. An initial diagnosis revealed that 31% (= 0.1465 within) variability is attributable to intra individual behavior then 69% of variability attributable to the heterogeneity of individuals (between = 0.3285). In other words, not only is the appropriate panel, all panel analysis is warranted.

4.1- UNIT ROOT TESTS ON PANEL DATA

The data available for each country included in the analysis permit an analysis of cointegration for everyone. The option for a panel analysis is justified in order to highlight possible interactions between country data as well as the specific effects of each. These features are in addition to other benefits given by the panel dimension in the analysis of the dynamic behavior of individuals in relation to certain phenomena. Table 1 gives the results of this testing stationarity in the panel dimension. It is clear that the series of different countries are stationary in first difference. This result corresponds to what is generally accepted as regards economic and financial series.

TABLE 1: RESULTS OF UNIT ROOT TESTS WITH PANEL DATA

Tests	LPIB		BANK		IDE		FDEXT		GOUV		TRADE	
	Stat	p-value	Stat	p-value	Stat	p-value	Stat	p-value	Stat	p-value	Stat	p-value
Levin-Lin-Chu	-1,26	0,10	-6,78	0,00	1,42	0,92	-3,50	0,00	2,86	0,997	-0,74	0,22
Breitung	-1,17	0,11	-2,67	0,00	-4,19	0,00	-3,04	0,00	-2,45	0,00	0,07	0,53
Hadri	2,51	0,00	2,76	0,00	4,98	0,00	3,70	0,00	6,30	0,00	8,38	0,00
Im-Pesaran-Sh	-1,10	0,13	-7,11	0,00	2,28	0,98	-4,13	0,00	2,37	0,99	0,56	0,71
ADF – Fisher	15,19	0,12	67,43	0,00	21,29	0,01	38,22	0,00	5,29	0,87	8,67	0,56
ADF - Choi	10,74	0,37	62,10	0,00	31,84	0,00	48,82	0,00	4,94	0,89	7,91	0,63
	Δ LPIB		Δ BANK		Δ IDE		Δ FDEXT		Δ GOUV		Δ TRADE	
Levin-Lin-Chu	-7,42	0,00	-12,18	0,00	-16,08	0,00	-10,95	0,00	-12,50	0,00	-14,30	0,00
Breitung	-8,18	0,00	-9,98	0,00	-9,51	0,00	-11,53	0,00	-9,39	0,00	-11,79	0,00
Hadri	-0,33	0,63	-0,89	0,81	3,04	0,00	-0,12	0,54	0,02	0,49	-1,50	0,00
Im-Pesaran-Sh	-8,01	0,00	13,86	0,00	-12,53	0,00	-13,88	0,00	-11,66	0,00	-13,72	0,00
ADF – Fisher	76,14	0,00	140,8	0,00	129,0	0,00	143,26	0,00	117,55	0,00	140,21	0,00
ADF - Choi	74,83	0,00	148,18	0,00	119,77	0,00	159,91	0,00	111,24	0,00	132,14	0,00

The calculations presented in this table were performed with the software Eviews 7.1. the assumption of individual fixed effects was used with an automatic selection of lags based on maximum information criterion Aitke with a band selection Newey-West using Bartlett kernel statistics.

All variables are integrated of order 1, that is to say, $I(1)$, we can proceed to the cointegration tests of Pedroni.

4.2- PANEL DATA COINTEGRATION TEST

The results of panel cointegration test are presented in table 2. The results were obtained by assuming the existence of a deterministic constant. The choice of the number of lags was made automatically based on the information criterion Aitke modified with a maximum lag of 2, the selection is applied Newey-West with Bartlett kernel statistics. Results in bold indicate situations in which the null hypothesis of no cointegration was rejected.

TABLE 2: COINTEGRATION RESULTS

	statistique	p-value	Weighted stat	p-value
Dimension within				
Panel v-statistic	23,4	0,000	2,36	0,025
Panel rho statistic	1,08	0,223	2,36	0,023
Panel PP-statistic	-4,89	0,000	-3,81	0,000
Panel ADF statistic	-6,77	0,000	-7,91	0,000
Dimension between				
Panel rho statistic	3,26	0,000		
Panel PP-statistic	-5,45	0,000		
Panel ADF statistic	-7,18	0,000		

The calculations presented in this table were performed with the software Eviews 7.1. the assumption of individual fixed effects was used with an automatic selection of lags based on maximum information criterion Aitke with a band selection Newey-West using Bartlett kernel statistics.

A reading of the results presented in Table 2, it appears that five out of seven tests reject the hypothesis of no cointegration between the real gross national product per capita variables representing net banking flows, net foreign direct investment, external debt flow, public expenditure flows, and the degree of external openness. It must be remembered in this connection that the null hypothesis is rejected if the statistics are significantly negative, with the exception of the statistics v (v-statistic), which, if it is significantly positive, the null hypothesis is rejected. Moreover, when the sample of individuals (countries) is reduced as in this case (5 countries), the ADF tests is the most powerful Pedroni tests. We can therefore conclude that the existence of a cointegration relationship between real gross national product per capita variables representing net banking flows, net flows of foreign direct investment, flows of foreign debt, flow of public

expenditure and the degree of external openness and use it to estimate the long-term relationship and estimate the density of the transmission channels of the effects of foreign capital movements.

5. THE DENSITY OF DIFFERENT CHANNELS OF TRANSMISSION OF THE EFFECTS OF THE FINANCIAL CRISIS OF 2008

The density of the transmission channels of the effects of crisis is apprehended through the estimation of relationships between long and short term national product per capita and various external capital flows included in the analysis. In this section, these estimates are presented and the assumed densities are deducted. Table 3 shows the different results.

TABLE 3: THE RESULTS OF THE ESTIMATION OF THE LONG-TERM RELATIONSHIP

Variables	coefficients	t-statistique	p-value
Constante	6,4117	229,684	0,0000
BANK	0,00325	1,99817	0,0471
IDE	0,00160	0,04655	0,0962
FDEXT	0,01850	2,68238	0,0079
GOUV	0,00142	3,15121	0,0019
TRADE	0,02850	2,65212	0,0087
Country fixed effects			
Cameroun	-0,1955		
Centrafrique	-0,8388		
Tchad	-1,2797		
Congo	0,4076		
Gabon	1,9006		
R-squared	0,3606	Akaike info criterion	-1,0000
Adjusted R-squared	0,3311	Durbin-Watson	0,67079
F-statistic	12,223		
Prob(F-statistic)	0,0000		

The calculations are made from the econometric software Eviews 7. The estimation was performed by the method of ordinary least squares incorporating country fixed effects.

Estimated parameters show the different external capital flows have a positive effect on the logarithm of per capita national product. However, the effects of foreign debt flows and trade openness are not significant; this result corroborates that of cointegration test showing already a long-term balance between the different variables and the real domestic product per capita, although the multiple cointegration test, it is positive. The redundancy test fixed effects is negative and confirms the relevance of the specification adopted. Therefore, the long-term relationship can be written:

$$\text{Log (PIB)} = 6,411787 + 3,25\text{BANK} + 1,60\text{IDE} + 1,85\text{FDEXT} + 1,42\text{GOUV} + 2,85\text{TRADE} + U_i + \epsilon_{it}$$

For each country, should be added to replace the term representing the fixed effect value u_i .

Cointegration between the logarithm of real GDP per capita and the different flows means that the residuals ϵ_{it} are stationary and, so by estimating autoregressive with a number of lags equal to 1, it represents the correction mechanism adjusting the national product per capita trajectory equilibrium. Table 4 gives the results of the unit root test of the residuals. They show that these residues are indeed stationary and we can therefore estimate the same model relationships long and short terms.

TABLE 4: TEST UNIT ROOT RESIDUES OF THE ESTIMATE OF THE LONG-TERM RELATIONSHIP

Tests	Statistique	P-value
Levin – Lin – Chu	-1,26	0,01
Breitung	-1,17	0,00
Hadri	2,51	0,00
Im – Pesaran – Shin	-1,10	0,00
ADF – Fisher	15,19	0,12
ADF – Choi	10,74	0,37

The calculations are made from the econometric software Eviews 7. The estimation was performed by the method of ordinary least squares incorporating country fixed effects.

The choice of the number of lags was done automatically based on Akaike information criteria modified with a maximum lag of 2 for testing without individual fixed effects and 3 for tests with individual fixed effects. These results confirm, of course, the existence of a long-term relationship between the logarithms of real gross national product per capita and variables representing different external capital flows. But it is obvious that cointegration does not mean causation, even though it appears as a necessary condition of causation. It can not be causal without cointegration. Thereby highlighting the density of transmission channels effects behaviors of foreign capital is particularly interesting because it identifies from the direction of causality flows from listed to the behavior of the national product per capita. Given equations (5), the direction of the relationship long term and short term will be tested through the following models:

$$\Delta y_{it} = \mu_1 + \phi_1 \Delta y_{it-1} + \sum_{m=1}^5 \beta_{m1} \Delta x_{m,it-1} + \theta_1 VCM + u_{1it}$$

$$\Delta x_{m,it} = \mu_j + \phi_j \Delta y_{it-1} + \sum_{m=1}^5 \beta_{mj} \Delta x_{m,it-1} + \theta_j VCM + u_{j,it}$$

$$j = 1, \dots, 5; \quad (5')$$

With $x_{m,it-1} = \text{bank}_{it-1}, \text{IDE}_{it-1}, \text{Fdext}_{it-1}, \text{Gouv}_{it-1}, \text{Trade}_{it-1}$

The estimation results are presented in Table 6. They are all significant at a margin of error of 1%. The lagged logarithm of GDP has a short-term impact of more than 100% of its current value, then the impact is negative, significant and equal to 0.2% for a positive change in the flow of debt by 1%. This result is logical, since an increase in debt leads to a rise in the debt service for future periods.

TABLE 5: RESULTS OF ANALYSIS OF ENDOGENEITY, LONG-TERM RELATIONSHIP AND SHORT-TERM

Variables indépendantes	Variable dépendante ΔLpib_{it}		
	coefficients	t-statistique	p-value
Constante μ_1	0,0052	9,931	0,000
$\Delta \text{Lpib}_{it-1} (\varphi_1)$	0,49204	2,36	0,000
$\Delta \text{bank}_{it-1} (\theta_{11})$	-0,02441	-0,093	0,000
$\Delta \text{IDE}_{it-1} (\theta_{21})$	0,0471	0,011	0,000
$\Delta \text{Fdext}_{it-1} (\theta_{31})$	-0,00207	-0,094	0,000
$\Delta \text{Gouv}_{it-1} (\theta_{41})$	-0,0764	-0,5252	0,000
$\Delta \text{Trade}_{it-1} (\theta_{51})$	0,00887	0,0750	0,000
$\text{VCM}_{it-1} (\theta_{71})$	-0,8748	-0,614	0,000

The calculations are made from the econometric software Eviews 7. The estimation was performed by the method of ordinary least squares incorporating country fixed effects.

The results show that the movements of external financing flows all have an impact on the logarithm of real per capita gross product. In particular, the variables in first differences lagged one period have an impact on the logarithm of per capita GDP with different intensities. The coefficient of the correction mechanism at the equilibrium is significantly negative and therefore shows that the restoring force balance plays its full role. We can estimate, based on the coefficient calculated that the adjustment time is 1.149 years (1/0, 874)

Table 6 shows the estimation results of the last three equations of system (5'). It appears that the coefficient of the correction mechanism to balance is not significant for any of the three. This allows considering the total exogeneity of the independent variables.

Thus on the basis of the relationship of short and long term, the density of the transmission channels of the impact of movements in external financing to GDP countries of the CEMAC zone can be highlighted. Indeed, considering equation (7), the density estimates of the transmission channels of the impact of movements in external financial flows are given in order of importance in Table 7 below.

TABLE 6: CLASSIFICATION OF THE TRANSMISSION CHANNELS OF THE EFFECTS ACCORDING TO THEIR DENSITY TRANSMISSION CHANNELS

Channel of Transmission	IDE	BANK	TRADE	FDEXT
Channel density	0,0471	0,0244	0,00887	0,00207
Short run impact	0,0471	-0,0244	0,00887	-0,00207

And FDI is the channel most densely transmission impacts of movements in international financial conditions CEMAC zone. They are followed by bank loans whose short-term impact is negative. In the light of this result, external private capital exposes more savings in this area to international financial turbulence. Then the degree of openness of economies appears to constitute significant channel flow while external debt with their negative impact, however, arrive last.

6. CONCLUSION

Investigations on the effects of changes in external financial flows and growth in the CEMAC zone helped to highlight the nature of the relationships established between the logarithm of real GDP per capita and the "traditional" means of external financing that are bank loans, foreign direct investment flows and external debt. To achieve this, an analysis of cointegration panel data has been mobilized to detect the nature of the long-term relationship between the variables involved. To highlight the supposed effects of external capital flows on growth, an empirical model of open economy integrated public expenditure has been considered.

All unit root tests in panel showed that all variables are integrated of order 1 and therefore their stationary first differences. This result has motivated the use of a specification with variables of the same order of integration. Estimates then showed that the logarithm of per capita GDP and external financing variables are cointegrated both individually and globally. The long-term relationship was estimated with fixed effects in different countries.

The estimated error correction model to balance showed that external capital flows towards countries of the CEMAC zone have varied impacts on the logarithm of real GDP per capita in the short term with lagged variables of a period. The sign of the coefficient of the correction mechanism to balance not only confirmed the long-term relationship, but it also showed the speed with which the logarithm of real GDP per capita would return to its equilibrium path in response to a particular shock.

The results thus enrich released by relativizing those achieved by Reisen and Soto (2001), concerning the countries of UEMOA and finding no significance of the positive impact of FDI on real GDP, as well as those of Durham 2003, and Malek Mansour Gheereart 2005 or Vita and Kyaw, 2009, opposing the first. By contrast, they also confirm those achieved by Rodrik, Subramanian (2009), in which the sign of the effects of the 2008 crisis is significantly positive across the different variables representing capital flows outside transmission channels or expected effects of international financial conditions.

But even more, beyond these results, the calculation of densities of the transmission channels of the effects of variations caused by the international financial situation allows for a ranking of transmitting the flow more easily to changes in real GDP. Thus, the fact that private foreign capital are at the forefront of this ranking back on the table the issue of external funding for growth in developing countries.

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