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Macroeconomic Factors and Dynamics of Financial Deepening: An empirical Investigation applied to the CEMAC Sub-region

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Abstract

This article empirically estimates a micro-founded model with the aim to investigate the leading macroeconomic determinants and dynamics of financial deepening in the CEMAC sub-region. For this purpose, we adopted an empirical investigation in both static and dynamic panel data econometrics which has led to the following global recommendations: firstly, the CEMAC sub-region authorities should implement expansionary policies of GDP growth rate, population density, savings rate and exchange rate. Secondly, they should review their policy of trade liberalization since it appears to be negatively related to financial deepening. Concerning the dynamic aspect, a convergent dynamic and the feasibility of common monetary policy targeting depth in CEMAC sub-region have been highlighted.

Keywords: Financial deepening, panel data econometrics, CEMAC, principal component analysis, economic growth.

I) INTRODUCTION:

Most studies agree on the fact that the CEMAC¹ sub-region countries in particular have an underdeveloped financial system and more precisely, with a shallow depth. The results of

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several research projects, particularly that of Meisel and Mvogo (2007) highlight the need to take the problem of low financial depth in the sub-region seriously compared to other aspects of financial development. Through an estimate of financial development level in the countries of the franc zone, they have found that the most problematic aspect due to its low degree is financial deepening. Their results allow for deducing the fact that the financial development problem in the CEMAC zone could be reduced to financial deepening problems rather than other financial development aspects.

Financial deepening is a multi-faceted process that involves the interaction of a number of markets (primary, secondary and retail), instruments (deposits, loans, foreign exchange, bonds and debt securities) and stakeholders (banks, contractual savings institutions, companies). It can be defined as a process in which institutions and financial markets: i) facilitate goods and services exchange (e.g. payment services), ii) mobilize and pool savings of a large number of investors iii) acquire and process information about the companies and the potential investment projects and therefore allocating public savings to the most productive uses, iv) follow investments and exert corporate governance, and v) diversify and reduce liquidity risk and inter-temporal risk (Levine, 2005; King and Levine, 1993). In other words, financial deepening can be understood as a process by which the range of products and players widens, deadlines extend and services play a role in risk coverage and diversification.

In the world, financial system has always played an important role in supporting economic activity. Indeed no need for a complex analysis to see what is obvious: all developed countries have one thing in common which is a developed financial system. Moreover in the world and especially sub-Saharan Africa countries, several empirical investigations (Ndebbio, 2004; Odiambho, 2006; Grieset al., 2011; Asongu, 2011ab; Asongu, 2012; Asongu, 2013abcd]

¹Central African Economic and Monetary Community.

confirmed a positive influence of financial deepening and bank development on economic growth per capita.

If we consider the results of these theoretical and empirical investigations, we can conclude the importance of low financial depth as a current issue in the CEMAC zone. The handling of this major concern assumes that we may be able to list and quantify the actual determinants of financial deepening in the sub region through theoretical and empirical investigations; additionally the analysis of dynamic behavior at the individual level of financial deepening in the sub-region would be of great help for the formulation of harmonized financial policies. As Asongu (2014ab) did, it will be enough to verify the convergence of financial policies in order to decide whether legitimize their harmonization.

Such an investigation has a fourfold interest: First, we use recent data which can highlight the implications of prevailing policies. It is then linked to its specificity from a methodological point of view, since the implicit issue of financial deepening determinants and dynamics has not yet been understood in the CEMAC sub-region, and there are almost no studies with the same methodology addressing this issue in the CEMAC zone. This work therefore contributes to existing literature on this subject. Also on the positive side, such an analysis can be the basis of legitimation or not, implementation and / or revision by governments and IFIs of financial policies in the CEMAC sub-region. Finally on the logical side, the CEMAC sub-region environment, characterized by relatively stable but low economic growth, cohabiting with underdeveloped financial system reinforces the importance of this work.

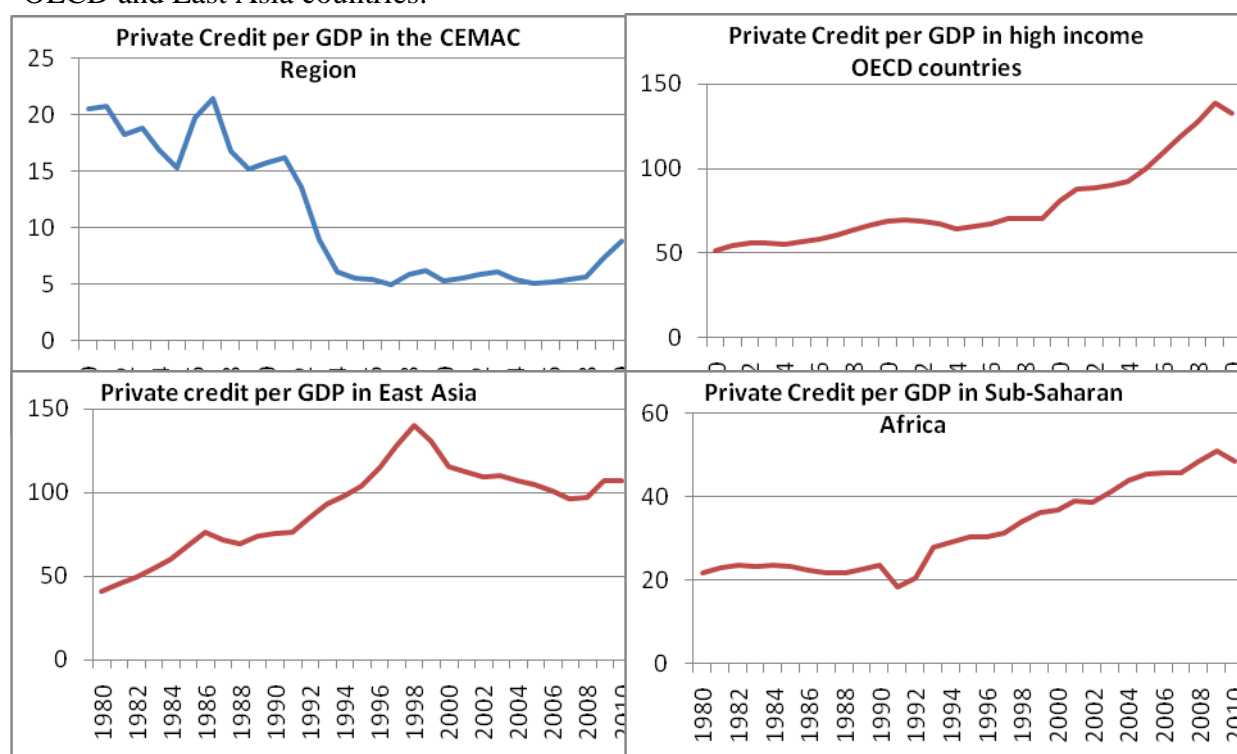
The rest of the paper will be organized as follows: Section II and III will present the research background and literature; thereafter, section IV will present the theoretical framework and methodology used in the paper; while Section V will contain the results presentation and finally, section VI will conclude the paper.

II) FINANCIAL DEEPENING AND INSTITUTIONAL, LEGAL AND REGULATORY TRENDS IN THE CEMAC SUB REGION.

II-1) Financial deepening trend in the CEMAC zone:

Here, we intend to present the qualitative and quantitative evolution of financial deepening in the sub-region using a comparative approach.

Figure 1: Comparative evolution of private credit per GDP for CEMAC, sub-Saharan Africa, OECD and East Asia countries.



Source: Updated sets of Beck et al. (2011) and author's calculations.

As shown in the graphs on page 3, if we consider the evolution of the average ratio of private credit / GDP, we can see that the CEMAC countries have less banking systems depth over the past twenty years since their size remains small and are decreasing compared to high-income countries like the OECD, East Asia and even some countries in sub-Saharan Africa. The average growth rate of credit to the private sector in the CEMAC sub-region which has almost halved since the mid-1990s has been slower than in high-income OECD countries, East Asian countries and even some countries in sub-Saharan Africa.

Interesting, in comparing the graphs we realize that in developed countries, high-income and / or emerging countries (OECD, East Asia ... etc.), the ratio of private credit sometimes reaches about 140 % of GDP as opposed to 50% in sub-Saharan Africa (which is the highest so far) while it has never attained 25% of GDP in the CEMAC sub-region.

II-2) CEMAC zone institutional, legal and regulatory contexts:

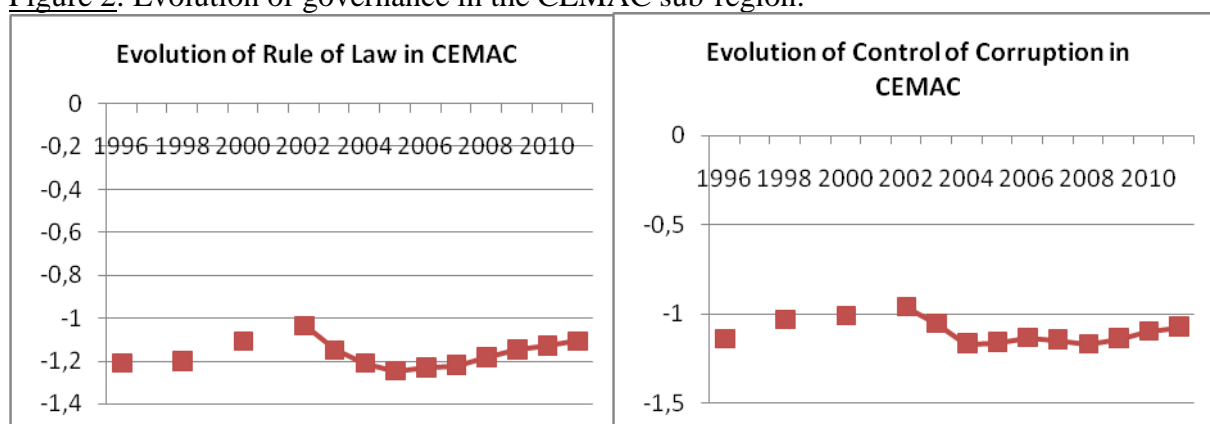
The challenges of the CEMAC sub-region financial sector are not new. The informality of member economies, small economies, volatility and governance problems materialized by the scarcity and high cost of credit are well documented (Beck et al., 2011). The institutional, legal and regulatory characteristics of an economy usually provide the context in which financial institutions and markets operate. These characteristics are likely to determine or more precisely to explain the degree of financial depth. Indeed, the financial deepening style may vary depending on the condition and the strength of four variables: governance, investment protection, bank capital regulation, and degree of financial integration. Therefore based on the World Bank updated database of Kaufmann et al. (2010) on governance Indicators, we will describe and compare the evolution of these variables for the countries of the CEMAC sub-region and developed countries.

II-2- 1) Quality of governance:

Poor governance not only affects the provision of financial services in accordance with the market laws, but also affects reform and state intervention tentative to overcome market deficiencies (Beck et al., 2011). Furthermore, poor governance can affect the ability of financial institutions and markets to manage systemic risks and those related to local circumstances. It is then understandable that the low levels of governance in the countries of the CEMAC sub-region actually co-exist with low financial depth, while the developed countries with good governance have relatively developed financial systems.

By observing the graphs on governance evolution in the CEMAC zone depending on the evolution of the variables “rule of law” and “control of corruption”, we realize that developed countries with a good level of governance have a deeper financial system than those of the CEMAC sub-region.

Figure 2: Evolution of governance in the CEMAC sub-region:



Source: updating the database Kaufmann et al. (2010) of the World Bank and author's calculation.

Note: The estimate of governance is in the following range: -2.5 (implying weak governance) and 2.5 (which requires strong governance).

Indeed, developed countries with better governance had a deeper banking system over the period of 1996-2010 compared to CEMAC countries with weak governance as shown in the above graph.

II -2-2) Protection of private contractual rights:

Countries with high standards of investor protection tend to have higher ratios of private sector credit and bank deposits to GDP, compared to countries where standards of investor protection are less restrictive. Similarly, countries that have stringent requirements of bank capital have greater financial depth than countries whose capital requirements are lower. Indeed, CEMAC sub-region countries with low protection of private contractual rights than those of emerging countries have generally low ratios of private sector credit and bank deposits to GDP.

II-2- 3) Financial Integration:

In the process of integration into international financial markets, countries can benefit from a wide range of instruments and tools for risk allocation, financing institutions and risk management, thereby increasing the depth and scope of domestic financial systems (Gregorio, 1996). It is observed from financial integration degree indicators, that CEMAC sub-region countries are financially less integrated into international markets at regional and international level; similarly the weak integration coexists with low financial depth. On other hand, developed countries with strong national and international integration (e.g. the European Union) have deeper banking sectors than those of underdeveloped countries in general and of the CEMAC sub-region in particular.

This analysis of the financial deepening situation in the CEMAC sub-region highlights the clear problem of the low level and develops a problematic on the effectiveness of financial policies implemented so far. These policies which are generally imported should nevertheless obey local specificities (Robinson, 2009; Beck et al., 2011).

After this global description and discussion of the CEMAC region financial system (in terms of key variables/indicators trends, institutional and policy developments), we are going to present the literature review concerning the previous issue.

III) FINANCIAL DEEPENING DETERMINANT: A LITERATURE REVIEW.

In order to build a theoretical framework and empirical research of the key determinants of financial deepening in the CEMAC zone, an analysis is included in this section in the form of literature review of the factors likely to explain financial deepening.

Compared to the literature on the importance of financial deepening, that on empirical studies of the determinants of financial deepening is relatively recent. In addition, there are almost no studies on sub-Saharan African countries in general and Central Africa, including the CEMAC sub-region in particular.

The pioneers Demetriades and Luintel (1997, 2001), focusing on the issue through an empirical investigation applied to India found that financial liberalization, real interest rate and economic development were important determinants of financial development. These results have motivated a growing literature on the subject in recent years. This makes this issue become actual in terms of an economic problem that torments the minds of researchers around the world. Tanimoune (2007) analyzed the impact of an increase in credit interest rate on the distribution of bank credit in a dual financial environment. Based on the extension of the theory developed by neo-structuralists like Van Wijnbergen (1983) who argues that in developing countries a financial policy must take into account the relative importance of all funding structures, he arrived at the main result of highlighting banks' activism in the financing of a global economy with dualistic financial system. It helps to explain the status of excess liquidity of many banks in the African franc zone since the early nineties. Chinn and Ito (2006) through a study applied on a sample of 108 countries show that capital account openness and institutional environment have a significant effect on financial markets development. In the same way, Baltagi, Demetriades and Law (2007) show that financial development is influenced by trade liberalization and economic institutions.

Ang (2008) by studying the effect of financial sector policies on financial system development in Malaysia during the period of 1959 - 2005 found that economic development, control of interest rates and liquid capital requirements positively affect financial development. However greater trade openness, high reserve requirements and the presence of managed credit programs appear to be destabilizing for financial system development. Dehesa et al. (2007) by analyzing the determinants of financial deepening found firstly that a high ratio of credit / GDP is associated with stronger borrower right and low inflation, and secondly that the marginal effect of improving borrower rights is decreasing gradually as

inflation rate increases. Therefore they suggest that in a high inflation environment, inflation control and reduced macroeconomic volatility should be a priority.

Moboladji and Ndako (2008) by verifying the impact of globalization on financial development in Nigeria from 1960 to 2005 found a positive relationship between them. Several other researchers on financial deepening determinants as Laporta et al. (1997), Jappelli and Pagano (2002), Galindo and Micco (2004), Djankov et al. (2005) have highlighted cultural, institutional and legal aspects. Using a sample of 129 countries Djankov and al. (2005) found that the credit / GDP ratio depends positively on the level of protection of borrower's rights and the availability of historical information on credit and GDP. Galindo and Micco (2004) found that solid borrower's rights also help reduce the volatility of credit to the private sector. Dutta et al. (2011) verified how culture (in an informal institution) can affect the level of financial development of a country applied on a sample of 90 countries, assuming that a country's cultural dimension may have an impact on its financial system. They found that culture significantly affects the level of financial development in Malaysia.

From a theoretical point of view, most of the empirical reflections on the factors of financial development start with the McKinnon (1973) and Shaw (1973) theory of financial liberalization. This theory assumes that government restrictions on the operations of the financial systems can inversely affect the quality and quantity of investment and thus negatively affect financial development. So they asked to reject financial repression policies in order to boost financial development. Additionally Moore (1986) found that high inflation would have a negative impact on financial deepening and highlights the importance of macroeconomic stability as an important determinant. However, this theory should be relative since there are also counter arguments to it. Indeed, Stiglitz (1994) highlighted the possibility that financial liberalization could also negatively impact financial development.

IV) THEORETICAL FRAMEWORK AND METHODOLOGY

IV-1) The model and econometric strategy:

This empirical investigation is based on a theoretical model of microeconomic study of the banking sector. Indeed, the financial sector in the subregion is essentially constituted of banks and we think that a coherent study of financial deepening determinants must consider the banking system.

For this purpose, the theoretical model presented by Dehesa (2007) is borrowed and augmented by taking into account the stylized facts in the CEMAC sub-region. This model explains the theoretical link between financial deepening and factors related to the banking sector and real economy operation by focusing on the credit market since there is a small proportion of lending over deposits and excess liquidity banks in the sub-region.

A. Banking market functioning and financial deepening:

The model is based on traditional bank loan with monitoring costs borrowed from Williamson (1987). Consider a market where entrepreneurs and banks are matched at the beginning of the period, so that banks enjoy monopoly power vis-à-vis their clients. A bank decides to give a contractor a fixed loan rate to finance a risky project. The initial investment is normalized to unity. The p_i return on investment of the entrepreneur is randomly distributed with a density $f(p)$. For analytical simplicity, we assume a uniform distribution on the interval $(\mu - b; \mu + b)$. The parameter $\mu (\mu > 1)$ is expected at the end of the performance period, and the parameter $b (b > 0)$ reflects the degree of uncertainty surrounding the project outcome, since the variance of the return is $\frac{b^2}{3}$.

Within this framework, entrepreneurs have the same ex-ante information about the distribution of project results with the banks, excluding the adverse selection and eliminating

study costs. Moral hazard is also excluded since project results do not depend on the effort of the entrepreneur.

However, banks outstanding monitoring and recovery costs as a posteriori, information on their outcome become asymmetric. Although it is available to the contractor free of charge, the lender must pay $\frac{\gamma^i}{c}$ to learn the true value of the project carried out. The parameter γ^i is independent for a random variable uniformly distributed in the interval $(0, 2(\mu - i))$. This parameter is specific to the project and can be interpreted as the cost of checking the quality of the borrower's assets (after the project starts) and the repossession of contractor goods. In the event of bankruptcy, if the contractor fails to reimburse the debt (for a total r_i including interest), the bank incurring the cost γ_i , can establish the true assets value p_i and appropriate the project.

Although monitoring and recovery costs are specific to the project, the average magnitude of these costs depends on the level of protection of creditor rights and the efficiency of the judiciary in a given country. These considerations are illustrated by the parameter c ($0 < c < 1$), so that higher values of c correspond to higher rights of creditors in the economy: with creditors rights absent, (c close to zero) recovery cost becomes infinitely large, whereas with $c = 1$ the specific verification of the project and recovery costs are lowest.

B. Impact on financial deepening via interest rate:

The expected return of the bank's loan for a contractor $i(\rho_i)$ is given by:

$$\rho_i = r_i \left(1 - \int_{\mu-b}^{r_i} f(p) dp \right) + \int_{\mu-b}^{r_i} p f(p) dp - \frac{\gamma_i}{c} \int_{\mu-b}^{r_i} f(p) dp \dots \dots \dots (1)$$

However, the optimal interest rate that the bank can offer (as defined in equation (1)) may not be high enough to justify the loan to an entrepreneur characterized by high monitoring and recovery costs. A risk-neutral bank does not approve an application if the expected return on

the loan is the minimum performance i on a risk-free asset (Assuming that $\mu - i < b$, if not the return on a risky project is always higher than that on a risk-free asset):

$$\rho_i(r_i^*, \gamma_i) \geq i \dots \dots \dots (2)$$

Where r_i^* is the optimum value of the interest rate.

This relationship is used to determine the critical value of tracking and recovery cost γ^* as follows:

$$(2) \Leftrightarrow \rho_i(r_i^*, \gamma_i) - i \geq 0$$

$$\Leftrightarrow \rho_i(r_i^*, \gamma_i) - i = \frac{1}{2b} \left[-\frac{(b + \mu - \frac{\gamma_i}{c})^2}{2} + (b + \mu - \frac{\gamma_i}{c})^2 + (\mu - b) \left(\frac{\gamma_i}{c} - \frac{\mu - b}{2} \right) \right] - i \geq 0$$

If $\frac{\gamma_i}{c} \geq 2b$, the monitoring and recovery costs exceed the difference between the best and worst result of the project then the bank will assume that the project fails and always refrain from lending to customers with $\gamma_i \geq 2bc$.

In nontrivial cases we have $\gamma_i < 2bc$ and $b > \mu - i$, and therefore the solution to this inequality is $\gamma_i \leq \gamma^*$, where: $\gamma^* = 2bc \left(1 - \sqrt{1 - \frac{\mu - i}{b}} \right)$ which is the critical value of tracking and recovery cost.

The bank will provide loans to all entrepreneurs characterized by lower recovery costs ($\gamma_i \leq \gamma^*$) and reject all applications when $\gamma_i > \gamma^*$.

Assuming that the monitoring and recovery costs distribution (γ) is independent of the returns on investment distribution (p), the share of approved demand D can be expressed as follows:

$$D = \frac{r^*}{2(\mu-i)} = \frac{bc}{\mu-i} \left(1 - \sqrt{1 - \frac{\mu-i}{b}} \right) \dots\dots\dots(3)$$

D is well defined (i.e. $D \in [0, 1]$), since:

$$\lim_{b \rightarrow (\mu-i) + \frac{bc}{\mu-i}} \left(1 - \sqrt{1 - \frac{\mu-i}{b}} \right) = c \text{ with } 0 < c \leq 1.$$

The share of approved demand can be widely interpreted as the depth of the credit market. We also assume that: $\frac{\partial D}{\partial b} < 0$, $\frac{\partial D}{\partial c} > 0$, $\frac{\partial^2 D}{\partial b \partial c} < 0$.

This assumption implies that credit markets are deeper when projects are on average less risky ($\frac{\partial D}{\partial b} < 0$) and when creditors' rights are strong ($\frac{\partial D}{\partial c} > 0$) (It may also be demonstrated that financial deepening is increasingly the difference between the risky project's average returns and the risk-free asset's returns ($\mu - i$)). However, these factors do not act independently of each other. In fact, the marginal efficiency of creditor rights protection is declining with the overall risk level ($\frac{\partial^2 D}{\partial b \partial c} < 0$). In other words, the same improvement in the level of creditors' rights protection will have a greater impact on financial deepening when the overall risk level in the economy is lower than when it is high. Similarly, the marginal effect of reducing the overall risk level is higher when creditor rights are stronger. Variables closely related to the process of selecting and funding projects extended to real block which may influence financial depth variables are interest rates, inflation, real exchange rate volatility, openness rate, savings rate ... etc. To these variables, we can add real variables such as GDP (logarithm of GDP per capita), population density and governance to control the level of economic development.

Regarding the econometric strategy adopted, we use a log-linear model inspired by the works of Ang (2008) and Abdullahi (2013), enriched by taking into account the specificities of the CEMAC sub-region. In general our model will be as follows:

$$Y_{i,t} = \alpha + \beta X_{i,t} + \mu_i + \varepsilon_{i,t} \dots\dots\dots(1)$$

Where $Y_{i,t}$ is the endogenous variable (financial deepening) and $X_{i,t}$ the potential determinants variables. Different specifications will highlight the construction of several models closely related to the latter. μ_i shows the specific effect of each country and which remains unchanged in time; while $\varepsilon_{i,t}$ is a random disturbance in which the form is generated by a first order autoregressive process.

The previous literature review and the study of stylized facts of African countries in general and the CEMAC sub-region in particular have been used to specify the model considering all the explanatory variables below:

✓ *Trade openness: (OUV)*

Trade openness is the sum of imports and exports relative to GDP. This variable has been used as a financial deepening determinant by several authors (Baltagiet al. (2007), Ang (2008), Moboladji (2008) ... etc.). The expected sign of the parameter is positive. Indeed, the literature review conducted brings us to assume that the greater a country's external trade, the more it stimulates investment, (both internal and external financial activities) and therefore financial deepening.

✓ *Financial openness: (KAOPEN)*

Some authors such as Ang (2008) argue that like trade openness, financial openness is a potential determinant of financial deepening. The expected sign is positive. We will use the

(KAOPEN) index of Chinn and Ito (2006) updated which offer a measure of financial openness by measuring the economy capital account degree of openness.

This allows quantifying the financial openness of all countries in the world on a one year basis. It is important to mention in an international comparative perspective that the most opened continent is North America and Central Europe especially African countries of the CEMAC sub-region are relatively less open to countries in other continents.

✓ *Inflation : (INF)*

The low financial depth can be explained by this factor. Indeed, it is shown that low and stable inflation is important for the financial activity viability. By offering a relative monetary certainty, it positively influences financial transactions including long-term contracts and thus saving and long-term investment. Several empirical studies such as those of Boyd, Levine and Smith (2001) have shown that monetary stability and financial development are generally negatively correlated.

High inflation reduces financial activity and the attractiveness of a country with respect to foreign investment by creating uncertainty among consumers and investors through the decline in the real value of income and savings. On the contrary, a low inflation helps to create a favorable climate for financial activities, thus financial deepening. This variable was used as a determinant of financial deepening by authors such as Dehesa (2007). According to the previous literature review and considering the context of empirical investigation, the expected sign of the parameter is negative.

✓ *Interest rate: (TXINT)*

Just like Demetriades et al. (2001), Odhiambo (2006), Tanimoune (2007) and Ang (2008) we keep the real interest rate as one of the potential determinants of financial deepening in the CEMAC sub-region. Indeed by influencing in a real point of view the portfolio choice of

agents, this variable is able to determine the amount of monetary and financial assets circulating at any given time. The expected sign of the parameter is positive given the empirical and theoretical predictions.

✓ *GDP per capita growth rate:* (TXPIBPT)

Small incomes in Africa in general and in the CEMAC sub-region in particular may explain the low level of financial depth. According to Beck et al. (2011), it is difficult to develop financial markets in Africa. The current difficulty in the CEMAC sub-region is linked to the fact that small-scale economies, by preventing the providers of financial services to benefit from scale economies, inhibits development thereby widening the gap between the potential and the effectiveness of the system. This small size of African economies including the CEMAC sub-region in terms of GDP (which is synonymous to the level of wealth is explained generally by low income levels). This tends to limit requests for savings, insurance and credit even for simple means of payment related to transactions. Other sources of explanation for this situation are: low level of technology, the issue of governance, the high dependence of these economies on the exportation of raw materials and the fact that the greater majority of the population lives in rural areas in Africa and operates in the informal sector.

The expected sign of this parameter is positive (Demetriades et al. (2001) Ang (2008)). Indeed, in case of decreasing activity, investors will seek opportunities for more profitable investments in other countries and will be responsible for the financial activity decline and vice versa.

✓ *Savings rate:* (TXEP)

It is obvious that savings rate is very low in the CEMAC sub-region. This situation can be explained by the existence of volatile and low income, and the demographic structure of the

population which is predominantly young, with a rate of high illiteracy and low life expectancy. This problem can also be explained by capital flight. Indeed, even if the quantitative importance of capital flight is relatively unknown due to informal methods generally applied to domestic savings transfers, the observation on aggregate data puts Africa at the forefront as the continent having the largest part of private wealth held abroad (Collier and Hoeffler/Pattillo (2001), Boyce and Ndikumana (2001)²). This could have an impact on the level of financial depth in the sub-region.

This variable which may determine the financial depth level in the sub-region should potentially have a positive sign.

✓ *Population density:* (DENS)

According to Allen et al. (2010) and Beck et al. (2008), the population density is found to be another important driver of financial deepening, especially in Africa³. This observation may be valid for the CEMAC sub-region in particular. In fact a fairly dispersed population (low density) is more difficult to use and more in a context where road infrastructure is almost non-existent and of poor quality. The CEMAC countries have a significantly low population density compared to other developing countries. This would have an impact on financial deepening.

The expected sign of this variable is positive in the sense that high population density would improve the level of financial depth.

✓ *Real exchange rate:* (TXCHA)

²Boyce and Ndikumana (2001) in their work have estimated capital flight from 25 sub-Saharan African countries over a period of 1970 to 1996 at 193 million U.S. Dollars. In another study published in 2008, these authors estimate the capital flight in 40 sub-Saharan Africa countries over the period 1970-2004 at 420 billion U.S. Dollars. This tends to make these countries, including the countries of the CEMAC sub-region, net creditors compared to the rest of the world.

³To illustrate the importance of population density factor in financial deepening we can take the example of Burundi and Zambia. Indeed despite the low level of income and permanent conflict, Burundi shows a private credit to GDP ratio much higher than that of Zambia which has been socio-economically and politically stable for more than 50 years but has a low population density compared to Burundi.

This variable is likely to explain the level of financial depth in the sub-region because it determines the inputs and outputs of financial assets and somehow the choice of holding a type of financial asset or another. The expected sign of the parameter is positive. Indeed the loss of value of a currency makes exports more competitive, stimulating in this way flows of FDI⁴ and hence financial activity.

✓ *Reserves:*(RES)

As pointed by Ang (2008) in his study on the impact of financial policies on financial deepening, the level of reserves may negatively affect the level of financial deepening.

✓ *Transfers:*(TRANS)

Indeed empirical studies show that transfers and remittances are likely to influence financial deepening. From a theoretical point of view we expect a positive impact. The net annual value of current transfers extracted from the part of the balance of payment recording entry and exit of goods, services and financial income will be used. Indeed all transfers from abroad which are not considered as capital are considered as current transfers. The current transfers include transfers of income between economy residents and the rest of the world.

In this study, the endogenous variable is the financial deepening index that has been constructed before.

The general model can be presented respectively in static and dynamic specifications as follows:

$$\ln(APFIN)_{i,t} = \beta_0 + \sum_{j=1}^n \beta_j X_{i,t} + \varepsilon_{i,t} \dots \dots \dots (1)$$

$$\ln(APFIN)_{i,t} = \ln(APFIN)_{i,t-1} + \alpha_0 \sum_{p=1}^m \alpha_p Y_{i,t} + \varepsilon_{i,t} \dots \dots \dots (2)$$

⁴Foreign Direct Investment.

Where $\ln(APFIN)_{i,t-1}$ is the lagged endogenous variable and $Y_{i,t}$ and $X_{i,t}$ are the vector of determinants (Trade openness, inflation rate, interest rate, GDP per capita rate, savings rate, density, exchange rate, reserves, transfers and financial openness rate).

IV-2) Estimation procedures of different models and specification tests:

IV-2-1) Presentation and justification of the methodology:

The various tools used in the analysis target to establish as accurately as possible the conditions of validity of estimation methods of our models. The choice of panel data analysis gives us the advantage of having a reasonable size of time series data for analysis, which could not have been performed on each of the individual countries. The double dimension of panel data allows us to take simultaneously into account the dynamic behavior and their possible heterogeneity across countries, which is neither possible with time series nor with cross-sectional data.

To estimate the dynamic model specification, Arellano and Bond (1991) proposed the two stages GMM method of estimation wherein the disturbance terms are assumed to be independent and homoskedastic across countries and over time. In the second stage such hypotheses is relativized, where a consistent estimate of a variance-covariance matrix is constructed by using the residuals from the first stage (Ahmed and Suardi, 2009). However, it should be noted that the effectiveness of the method of instrumental variables estimation (even in the context of two-step GMM) may be relatively low. Numerous studies show that lagged levels of the variables are often considered as poor instruments for first differences. Arellano and Bover (1995) and Blundell and Bond (1998) introduce the system GMM estimator, where the regression in first difference is combined to the level estimator, "in a system" to form a more efficient estimator using a large number of different instruments. In this form, the system GMM estimator improves efficiency and is an estimation technique

which is highly recommended in the analysis of cross-country growth (Blundell et al., 2000). This last approach that we will remember while providing better control of certain econometric problems such as endogeneity is indeed impartial and gives more accurate results. However, as we have seen with Boubakriet al. (2009) and earlier with Blundell and Bond (1998) for the exogenous variables in levels to be appropriate instruments, it is necessary to take into account the additional moment condition.

IV-3) Construction of a deepening financial indicator in the CEMAC zone:

Several factors may explain the low level of financial depth in the CEMAC sub-region and therefore constitute themselves as potential determinants: income size and level, savings rate, inflation, population density and governance. Reasons behind the highlighting of these as financial deepening potential determinants will be given in the paragraph devoted to the description of the model's explanatory variables.

Considering the fact that the concept of financial deepening is defined by services provided to the economy, it can be measured with quantitative indicators related to the financial systems size, efficiency, liquidity and scope. Such measures are generally specific to different segments of the financial sector specialized in various financial services. It is included here to build the financial deepening indicator that will be used for econometric investigation.

The purpose of constructing a composite indicator is the ambition to have an accurate quantification that taps the maximum possible information of the economy concerned. For this purpose, several techniques exist for the construction of an indicator such as data analysis, quadratic analysis and weighted mean method. Like Gries et al. (2011), we are going to use the technique of principal component analysis, popularly used in the construction of the composite index of financial deepening. This is a widespread technique mostly used in multivariate analysis. Moreover, this methodology is one of the oldest in multivariate statistical analysis, initially introduced by Pearson (1901) and Hotelling (1933).

Three indicators were selected, which made it possible to use data on six countries of the CEMAC region during 32 years. Furthermore, financial market deepening aspects have been neglected because the sub-region's financial market is still in its infancy worsened by the lack of statistical data⁵.

The first financial indicator measures the amount of credit involved in the private sector relative to the size of the economy. Specifically, the domestic credit to the private sector ratio measures all private resources used to finance the private sector divided by GDP. The second indicator, "Bank Credit" is closely related to the first one but specifically takes into account the ratio of domestic credit provided by the banking sector relative to GDP. The third indicator used in the construction of the financial index measures the overall size of financial intermediation or financial depth. In fact, these variables are sensitive to the size, diversification and efficiency of financial intermediation and thus of financial deepening.

The results of the factor analysis show that the first axis explains 70.31% of the total variance of the sample during the period, which fully justifies the extraction and use of this single component for the construction of our index (See Asongu, 2014c). Indeed this axis corresponds to an eigenvalue greater than 1 as a condition of the choice of a single component with reference to Kaiser (1974) and Jolliffe (2002) analyses.

To better understand the statistical behavior of such constructed indicator, we performed a statistical study of it.

Table 1: Statistical analysis of financial deepening index.

⁵Among the selected indicators, we do not find two of the most used indicators in the literature: the ratio of market capitalization to GDP, which is sensitive to the size of financial markets, and the ratio between the values of shares traded in the period and market capitalization, which is a measure of market liquidity. These two indicators measure the stock markets development and are used by various studies in the identification of developed financial systems (see for example Beck and Levine, 2004). These markets are an option for banks to finance investment and investment savings plans; they are an integral part of the financial systems. On the other hand, despite the heavy use of these indicators in the literature, none of these two measures reflects the amount of funding actually received by companies, since it concerns the secondary market measures.

Operator	AF CAM⁶	AF CAR⁷	AF CHAD	AF CONGO	AF GE⁸	AF GABON
Mean	14,9370138	11,1019631	8,86776969	11,6599463	9,29136652	13,5717544
Strddev.	5,15673782	2,27978522	3,32002503	6,09210517	9,84202492	3,89782624

Source: Authors' calculations.

By observing table 1, we discover that generally there is a disparity between the calculated values of our operators. The means are substantially the same across countries but with a higher value respectively for Cameroon and Gabon. A clear disparity in the standard deviation of each country is also observed. The index value is respectively more volatile for Equatorial Guinea, Congo and Cameroon in an increasing order. However financial deepening evolution in CAR, Chad and Gabon is less volatile.

IV-4) Data:

The sample for this empirical evaluation is comprised of the following six countries of the CEMAC sub-region over the period 1980-2011: Cameroon, Central African Republic, Equatorial Guinea, Gabon, Congo and Chad. Data frequency is annual. We have therefore 192 observations per variable.

The data derived from the databases of the IMF (International Monetary Fund) - International Financial Statistics, the World Bank and the new updated IMF database on financial development. These databases present most recent country data compiled annually on most of the world macroeconomic indicators.

V) ECONOMETRIC STUDY OF THE DETERMINANTS OF FINANCIAL DEEPENING IN THE CEMAC ZONE:

The purpose of this section is first to highlight macroeconomic determinants and secondly to study the dynamics of financial deepening.

⁶ Cameroon.

⁷ Central African Republic.

⁸ Equatorial Guinea.

V-1) Results of econometric tests:

- *Stationarity test of Im-Pesaran-Shin (1997) panel data:* The observation of the test results shows that when the trend is not taken into account, our series (OPEN, INF, TXINT, TXEP, DENS, TXCHANGE, RESERV and KAOPEN) are not stationary - they are first order integrated. However the series TXPIBPT and TRANS are stationary. But when the trend is taken into account, we reject the hypothesis of non-stationarity: all these series are stationary around a deterministic trend.

-*Test of heteroscedasticity:* In observing the chi-squared value of the three models, it is found that the calculated value is greater than the observed value. The main consequence of this observation is the validation of the presence of the heteroscedasticity problem. In the light of these results we cannot consider the fixed effect and random effect estimation results; and in estimating the static model we will consider the results of estimation with heteroscedastic problem correction.

-*Specification test of autocovariance, Sargan and Hansen:* The verification of the robustness of dynamic models estimation pass through the implementation and monitoring of the results of autocovariance Sargan / Hansen tests. The Arellano-Bond residue autocorrelation tests and the Hansen validity of instruments test of all the dynamic models estimated by the system GMM, indicate the absence of errors autocorrelation and validity instrumented at the 10% variable respectively.

In addition, endogeneity and specification tests were conducted with more or less conclusive results. However, this situation is negligible because of the consideration of dynamic specification estimation in these cases.

V-2) Presentation of estimation results and interpretation:

Table 2: Presentation of the results of the three model estimation.

	Model 2: Index of financial deepening		
	FGLS	GMM Difference	GMM System
LNAPFIN (L1)		-0.443**	-0.206*
LNOUV	0.090	-0.176**	0.067
LNINF	-0.009	0.026	0.009
LNTXINT	-0.039	-0.037	-0.019
LNPIBPT	0.011**	0.011*	0.018**
LNTXEP	0.007	0.058*	0.027*
LNDENS	0.044	0.421*	0.073***
LNTXCHANGE	-0.148	-0.317**	-0.257***
LNRESERV	-0.015*	0.001	-0.029**
LNTRANS	-0.001	-0.006**	-0.003
LNKAOPEN	-0.033	-0.059	-0.034
Constante	0.412*		0.890*
Test de wald		0.001	0.000
Test de sargan		0.147	0.163
Autocorel. test		0.053	0.007

Notes: *, **, *** represent acceptance level at 10%, 5% and 1%, the explanatory variables are in order: the lagged variable, trade openness, inflation rate, interest rate, per capita GDP rate, savings rate, density, exchange rate, reserves, transfers and financial openness rate.

Source: Results observation by the authors.

V-2-1) Static-Model:

The analyses of the results of previous tests lead us to consider the model estimation with heteroscedasticity problem correction; though endogeneity tests are not convergent. These results should be considered as a step towards the main dynamic panel estimation by system GMM.

V-2-2) Dynamic-Model:

* **First difference:** Trade openness, exchange rate and transfers are associated with negative coefficients in terms of impact on financial deepening, while GDP per capita growth rate, savings rate and density are associated with positive coefficients. We can therefore consider that GDP per capita growth rate, savings rate and density are determinants of financial deepening.

* **System:** The results show that we now have five significant variables which are GDP per capita growth rate, savings, density, exchange rate and reserves.

Exchange rate and reserves have a negative impact on financial deepening. Exchange rate liberalization would have a negative impact on financial deepening in the subregion. The non-coherence between the result and theoretical predictions could be attributed to the capital flight it has generated. As a matter of fact, economic agents preferring for precautionary reasons send their financial assets to the rest of the world in general. A study by Beck (2011) has also shown that most Africans have foreign financial assets. This empirical investigation results therefore require a control of this aggregate variation. Also, contrary to Ang's (2008) results, reserves have a negative impact on financial deepening. The implication of this result is the recommendation for the implementation of a policy whose main aim is to reduce the level of these reserves in the CEMAC sub-region.

It also notes that savings rate is a financial deepening determinant in the sub-region. This result is very interesting in that it confirms the strong positive impact of the level of savings of domestic financial systems on financial deepening. The CEMAC country authorities would benefit from developing policies which tend to increase the level of domestic savings. This need is more important due to the fact that economic agents tend to direct their savings to other financial systems. The mobilization of these savings is more beneficial for the host country than the sub region economies.

To this financial deepening determinant we can add GDP per capita growth rate and density. These results confirm those of Demetriades et al. (2001), Ang (2008) and Beck (2011). In summary the econometric analysis of financial deepening (single index) determinants applied to the CEMAC sub-region context has highlighted three factors namely savings rate, GDP per capita growth rate and density. We can now study the dynamics of financial deepening in the region.

V-2-3) Study of the dynamics of financial deepening in the CEMAC zone:

Using the “*lincom*” command, the financial deepening coefficient and its significance appears in the following table:

Table 4: Financial deepening dynamic study result.

Lagged variable (Financial deepening)			
	Coefficient	Standard error	P> z
LNAPFIN1 (L1)	-0.2063719*	0.1232794	0.094

(*) represents significance at 10%.

Source: Results observation by the authors.

The lagged or initial variable (one year) of financial deepening contributes significantly to the explanation of the current financial deepening. In fact, this lagged variable has a negative impact on its current value. It has a negative sign and confirms the negative dynamics of financial deepening in the sub-region. The coefficient of initial financial deepening is significantly negative (equal to - 0.20637) at 10%. This means that a low initial level of financial deepening is conducive for the improvement of the financial deepening index overtime.

In fact, this result implies that the act of starting from a low level of financial deepening, (which is indeed the characteristic of the CEMAC economy), increases the chances of financial deepening over time. The coefficient of the initial financial deepening is significantly positive at the 10%. This result is particularly interesting because the variable is lagged by only one year which means that we detect short-term dynamics. This result ensures the principle of convergence to its long term equilibrium state, either between CEMAC countries, or for each country. The coefficient value (-0.20637 *), guarantees a depreciation of 20% of any exogenous shock on financial deepening, within a period of one year. Thus, after any disturbance, a return to long-run equilibrium values can be achieved in a period of 5 years. The converging dynamics is also evident and implies that after five years, there is the possibility for fiscal policy harmonization in the CEMAC zone. This result is different from

the one of Asongu (2013), which by questioning the existence and speed of convergence found that there is not any form of convergence in the CEMAC zone. However it should be noted that his specific case was not financial deepening and his study was not oriented towards the identification of determinants.

VI) CONCLUSION AND ECONOMIC POLICY RECOMMENDATIONS:

The purpose of this article was to highlight the determinants and dynamics of financial deepening in the CEMAC sub-region. The estimation of three different models according to different endogenous variables indexing financial deepening, including nominal monetary cash per capita rate, simple index of financial deepening and financial gap has led to the following results:

Econometric analysis of the first model highlighted two factors namely exchange rate and savings rate as determinants of financial deepening (nominal monetary cash per capita rate) in the CEMAC zone. The second analysis of financial deepening (single index) determinants applied to the CEMAC sub-region has highlighted three factors namely savings rate, GDP per capita growth rate and density. For the third model it has been found that GDP per capita growth rate and exchange rate are determining factors for widening financial gaps in the sub region. On the contrary, reserves and financial openness remains a smoothing factor of financial gaps and thus constitute the macroeconomic variables on which CEMAC sub-region authorities should encourage a positive dynamic.

These results imply the following overall recommendations: the CEMAC sub-region authorities should implement expansionary policies on GDP growth rate, density, savings rate and exchange rate. As we know, after the economic and banking crisis faced by the CEMAC sub-region economies during the mid-80s under the Bretton Woods institutions, these countries were put under structural adjustment programs and total economy liberalization in its financial and commercial sectors. Our empirical investigation shows that this

recommendation should be questioned since we found that trade openness negatively affects financial deepening and hence economic growth. However, financial openness affects financial deepening positively. This leads us to affirm that the simultaneity of the two types of liberalization is relatively bad for financial deepening in the sub region. Sufficient confirmation of this conclusion is drawn from the fact that in other research we have implemented a simultaneous hypothesis test which has led us to the same conclusion.

Regarding the dynamics, for all models in general we have had the conclusion that there is a convergent dynamic which means that a high or lower initial level of financial deepening (depending on our endogenous variable) is favorable for the improvement of the financial deepening index over time in the CEMAC zone. Financial policy harmonization is therefore possible and can be applied or enhanced without distinction of locality or country in the next five years. However it is useful to mention that the use of mean instead of annual data would have been interesting for further convergence analysis to avoid short term disturbance according to GMM estimation theory. Similarly, if we change the explanatory variables specification or if we make the assumption of existence of country - specific macroeconomic shocks, it is possible that this result may not be the same. Even if we assume that this remark is negligible, the same study could be undertaken by taking into account those last specificities for further analyses.

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