

# **“Financial Deepening Dynamics and Implication for Financial Policy Coordination in a Monetary Union: the case of WAEMU”**

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#### **Abstract**

This article aims to investigate the implication of financial deepening dynamics for financial policy coordination in the WAEMU sub-region. For this purpose we adopted a hypothetical-deductive theoretical approach and an empirical investigation in both static and dynamic panel data econometrics that has allowed us to identify some stylized facts on this issue and have led to the following global recommendations based on our empirical investigation: The converging dynamics is evident in the sub-region and implies that after five years, financial policies harmonization would have an optimal impact; This highlights the feasibility of common effectiveness monetary policy targeting indirectly financial depth in the sub-region; However member states should work within five years towards harmonizing cross-country differences in structural and institutional characteristics that hamper the effectiveness of financial policies. Especially they should implement a financial policy whose main aim is to increase the level of savings rate, GDP per capita growth rate and density and reduce the level of reserves in the sub-region.

*Keywords:* Economic convergence; Financial deepening; Panel data econometrics; WAEMU sub-region; Principal component analysis.

*JEL classification :* E44, F15, F42, F36, G10, O16, O50, P52.

#### **Introduction**

It is absolutely known that regional integration suppose economic convergence as a good framework for policy coordination. Indeed the convergence is a process which implicitly supposes the reduction of heterogeneity and creates an environment in which policy maker can coordinate and apply the same policy. This implies that to coordinate financial policy for example you must be sure that the dynamics of financial development is convergent in order to know when the coordination is possible. This theory is more applicable in the specific case where the financial system is less developed. Most studies agree on the fact that the

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WAEMU<sup>1</sup> sub-region countries in particular have an underdeveloped financial system and especially with shallow depth. The results of several research projects, particularly those of Meisel et al. (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 deducing the fact that the financial development problem in CEMAC zone could be reduced to financial deepening problems relatively to 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), Gries et al. (2011) ... etc.] confirmed a positive influence of financial deepening and bank development on economic growth per capita.

If we stick to the results of these theoretical and empirical investigations, we can conclude the importance of the problem of low financial depth in the CEMAC zone and importance of financial policy coordination its dynamics implies. The handling of this major concern assume that we may be able to undertake the analysis of dynamic behavior of financial deepening at the individual level in the sub-region which would be a great help for the formulation of

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<sup>1</sup> West African Economic and Monetary Union. Countries: Benin, Burkina Faso, Ivory Coast, Bissau Guinea, Mali, Senegal, Togo.

harmonized financial policies. It will be enough to verify the convergence of financial policies in order to legitimate or not their harmonization and coordination. More specifically, we plan to (i) Construct a financial deepening indicator; (ii) Present the impact of ongoing financial policy in the sub-region and (iii) Study the dynamics of financial deepening in the WAEMU zone. The literature review and the presentation of the theoretical model will be also undertakes..

**I) Financial deepening dynamics and financial policy coordination in a monetary union:**  
**A literature review**

Globally the empirical literature on this issue is very rare and almost absent in the case of Africa specifically. However, several studies, both theoretical and empirical have been implemented on economic policies coordination problems, financial deepening dynamics and financial policies impact on financial development.

Heterogeneity and convergence problems in Africa have highlighted the relevance of taking into account the problem of economic policies coordination according to several authors. The problem of heterogeneity in an economic and monetary union has been highlighted by several theoretical and empirical studies. Nguena (2011) for example have undertake the problem of Individual Heterogeneity applied to Sub Saharan African context by verifying improvement in terms of specification and estimation of economic growth model, linked to the consideration or not of individual heterogeneity; He found that taking into account individual heterogeneity improves the quality of the model; Thus this implies that the same economic policy may lead to different results in different countries and that it is desirable that economic policy decision for several countries must consider countries individual characteristics before implementation. Asongu (2012) by undertaking the issues of convergence in financial performance dynamics in the African continent found partial support for the existence of absolute convergence in some dynamics; According to him only sub-Saharan Africa reveals conditional convergence in relation to per capita number of listed companies. Nguena (2013) by verifying the homogeneity of saving-investment causality sense arrived to the conclusion that we have three groups of countries in the WAEMU zone: The first group of countries (Ivory Coast and Senegal) for which causality from savings to investment is long-term. The second group consists of countries for which the reverse causality prevails (Benin and Mali) and the third group of countries for which no causality is statistically significant (Burkina Faso, Guinea Bissau and Togo). These findings allow him to conclude the existence of saving-investment

causality heterogeneity which amplifies difficulty in the implementation of coordinate fiscal policy in the monetary union.

Compared to the literature on financial deepening dynamics and convergence and financial policy coordination issue, the one on empirical studies of the impact of financial policy on financial deepening is relatively numerous. 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 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. Chinn and Ito (2006) through a study applied on a sample of 108 countries, shows that capital account openness and institutional environment have a significant effect on financial markets development. In the same way, Baltagi, Demetriades and Law (2007) shows that financial development is influenced by trade liberalization and economic institutions.

Dehesa and 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, control inflation and reduce macroeconomic volatility should be a priority. Ang (2008) studying the effect of financial sector policies on financial system development in Malaysia during the period 1959 to 2005 found that economic development, control of interest rates and liquid capital requirements positively affect the financial development. However greater trade openness, high reserve requirements and the presence of managed credit programs appear to be destabilizing for financial system development.

Moboladji and Ndako (2008) by verifying the impact of globalization on financial development in Nigeria over a period from 1960 to 2005 found a positive relationship between them. Dutta et al. (2011) verified how culture, he assumed to an informal institution, can affect the level of financial development of a country applied on a sample of 90 countries with the assumption that a country cultural dimension may have an impact on its financial system; They found that culture significantly affects the level of financial development in Malaysia.

With 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 thesis assumes that government restrictions on the operations of the financial system can inversely affect the quality and quantity of investment and thus negatively affect financial development. So they called 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) highlight the possibility that financial liberalization could also negatively impact financial development.

## **II) Financial Deepening Dynamics and Implication for Financial Policy Coordination in WAEMU: an empirical investigation**

### **II-1) Construction of a financial deepening indicator in the WAEMU zone:**

#### **II-1-1) Empirical literature review on the construction of financial deepening indicator:**

Several studies have focused on empirical studies of financial development and have built several indicators of financial development.

Dehesa (2007) in his study considers the ratio of private sector credit to GDP (Gross Domestic Product) as an indicator of financial deepening. Ang (2008) to construct a financial deepening indicator takes into account the ratio of private credit to GDP as the primary measure and the money supply relative to GDP as an alternative measure. Ndebbio (2004), considering that financial deepening means an increase in assets and providing level of financial services to the economy, highlights the importance of developing some measures of these financial assets including currency. This requires identification of these financial assets, determination of their measurement and summation. This total amount of financial assets will constitute an optimal measure of financial deepening according to him. Those financial assets considered in the study include currency, non-bank financial assets, treasury bills, market capitalization ... etc. However, this method is confronted with data availability problem especially in Sub-Saharan Africa where the financial market is underdeveloped. It is also difficult to have consistent annual data on all financial assets with the exception of money supply. Considering this lack of information, he uses the money supply M2 as a proxy for the financial deepening measure.

Moreover in view to quantify deepening financial, the choice of financial intermediation degree measurement approximated by M2/GDP and the level of per capita nominal or real cash growth rate has also been made by several authors like Arestis, Chortareas and Desli (2006) and Levine (2004) among others and earlier by Fry (1978). Recently Karahan et al. (2011) for purposes of analyzing the impact of financial deepening in economic growth have used only simple indicator which is the ratio of money supply to GDP.

Several other indicators were used to approximate the financial deepening, but actually there is no consensus about the superiority of each of these indicators relative to others. However, in order to gather all the information about financial deepening in one quantitative indicator, some authors have opted for a composite indicator. Practically, to these simple changes in macroeconomic aggregates in order to be used as simple indicators of financial deepening are added other composite indicators using methods such as multivariate statistical data analysis and quadratic transformations. Gries et al. (2011) in his scientific research work on the causality between financial deepening, trade openness and economic growth, build a financial deepening composite indicator using the principal component analysis. He applied this method to the ratios "Commercial banks assets relative to central bank assets", "Liquidity relative to GDP", "Private credit with the currency of bank deposits relative to GDP" and "Bank deposits relative to GDP" from the new database on financial development of Beck et al. (2000). Cezar (2012) focuses on the construction of financial development composite indicator sensitive to financial systems development level. The technique he used is principal component analysis used to condense the information of seven indicators of the efficiency of resource allocation. In addition to traditional indicators such as the measure of private credit, he also takes into account indicators of the quality of available information, the regulatory and legal system. Its composite indicator collected the following variables: private credit, liquid liabilities, bank assets, bank, information and rule of law index.

With this plethora of quantitative method of approximation of financial deepening, we are going to decide to use all of them or to choice the method to use for the construction of financial deepening indicator taking into account mainly economic and financial characteristics and specificities of the sub WAEMU sub region.

### **II-1-2) Formulation of financial deepening indicator in the WAEMU zone:**

The purpose behind the construction of a composite indicator is the ambition to have an accurate quantification that brings the maximum of possible information on the economy

concerned. For this purpose, several techniques exist for the construction of an indicator such as data analysis, quadratic analysis and weighed mean method. Like Gries et al. (2011), we are going to use the technique of principal component analysis, which is the most popular for the construction of the composite index of financial deepening. This is a widespread technique and more used in the 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 possible to use data on six countries of WAEMU region during 32 years. Further financial markets deepening aspect has been neglected since the sub-region financial market is still in its infancy and there is a lack of statistical data.

The first financial indicator measures the amount of credit involved in the private sector relative to the size of the economy; Specifically the variable domestic credit to the private sector 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 axes 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. 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.

## **II-2) Model construction and estimation:**

### **II-2-1) Model selection and specification:**

#### **➤ Data :**

The sample for this empirical evaluation is constituted by the following six countries of WAEMU sub-region over the period 1980-2011: Benin, Burkina Faso, Ivory Coast, Bissau guinea, Mali, Senegal and Togo. The annual data where 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.

➤ *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 sub region is essentially constituted by banks and we think that a coherent study of financial deepening dynamics must consider the banking system.

For this purpose the theoretical model presented by Dehesa (2007) is borrowed augmented by taking into account the stylized facts in the WAEMU sub-region; This model explains the theoretical link between financial deepening and factors related to sector banking 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 rate loan 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 does not depend on the effort of the entrepreneur.

However, banks outstanding monitoring and recovery costs as a posteriori, at the end of the project, 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  $\gamma^i$  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 start) 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 of  $\gamma_i$ , 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) costs recovery becomes infinitely large, whereas with  $c = 1$  the specific verification of the project and reprise costs are lowest.

**B. Impact on interest rates**

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

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

The first term of equation (1) is expected returns in the case of debt reimbursement (the product of the due amount and the probability that the value of the project exceeds that amount). The second term is the expected value of the good in case of bankruptcy (i.e if the project value is insufficient to reimburse the debt). The third term is the expected cost of checking the project value and restitution in case of bankruptcy (calculated as the product of monitoring and restitution costs and bankruptcy probability). In this model, entrepreneurs always reimburse the debt if they have sufficient funds and banks do not need to check the results of successful projects.

The high monitoring and recovery costs (interesting and perhaps a little-against-intuitively) lower the optimal interest rate. The intuition here is: an attempt to apply a higher interest rate increases the probability of insolvency of the contractor (in line with the increase of contractor obligations at the end of period). As higher values  $\frac{\gamma_i}{c}$  imply a higher expected cost of Contractor insolvency to the bank, the losses due to the prospective insolvency have more than offset gains from higher interest payments where the project is profitable. Therefore, the bank targets a lower probability of bankruptcy by imposing a lower interest rate.

### C. Impact on financial deepening

However, the optimal interest rate that the bank can offer (as defined in equation (2)) 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 to that on a risk-free asset):

$$\rho_i(r_i^*, \gamma_i) \geq i \dots \dots \dots (3)$$

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  $\gamma^*$  as follows:

$$(3) \Leftrightarrow \rho_i(r_i^*, \gamma_i) - i \geq 0$$

$$\begin{aligned} \Leftrightarrow \rho_i(r_i^*, \gamma_i) - i &= \frac{1}{2b} \left[ -\frac{(b + \mu - \frac{\gamma_i}{c})^2}{2} + \left(b + \mu - \frac{\gamma_i}{c}\right)^2 + (\mu - b) \left(\frac{\gamma_i}{c} - \frac{\mu - b}{2}\right) \right] - i = \\ &= \frac{1}{4bc^2} [\gamma_i^2 - 4bc\gamma_i + 4bc^2(\mu - i)] \geq 0 \end{aligned}$$

If  $\frac{\gamma_i}{c} \geq 2b$ , the monitoring and recovery costs exceed the difference between the best and worst result of the project. Therefore, 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:  $\gamma^* = 2bc \left(1 - \sqrt{1 - \frac{\mu - i}{b}}\right)$

Where:  $\gamma^* = 2bc \left(1 - \sqrt{1 - \frac{\mu - i}{b}}\right)$  which is the critical value of tracking and recovery cost  $\gamma^*$ .

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 ( $\gamma$ ) is independent of the returns on investment distribution of ( $p$ ), the share of approved demand  $D$  can be expressed as follows:

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

$$\text{Where } D = \frac{bc}{\mu-i} \left( 1 - \sqrt{1 - \frac{\mu-i}{b}} \right) \dots\dots\dots(5)$$

$D$  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 projects average returns and the risk-free assets returns ( $\mu - i$ )). However, these factors do not act independently of each other. In fact, the marginal efficiency of creditor rights protection is declining in 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. Variable 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 work of Abdullahi (2013), Ang (2008) and enriched by taking into account the specificities of the WAEMU 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 financial policy indicators and control variables. Different specifications will highlight the construction of

several models closely related to the latter one.  $\mu_i$  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 WAEMU sub-region in particular have been used to specify the model considering all the explanatory variables below:

✓ *Trade openness:*

Trade openness is measured by the sum of imports and exports relative to GDP. This variable has been used as financial deepening determinant by several authors (Baltagi et 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 more a country's external trade, the more it stimulates investment and both internal and external financial activities and therefore financial deepening.

✓ *Financial openness:*

Some authors such as Ang (2008) argue that as 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.

✓ *Inflation :*

The low financial depth can be explained by this factor and therefore by monetary policy. 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.

✓ *Interest rate:*

Such as Demetriades et al. (2001), Odhiambo (2006), Tanimoune (2007) and Ang (2008) we keep the real interest rate as one of the potential factor of financial deepening in the WAEMU 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:*

Weakness and small incomes in Africa in general and in the WAEMU sub-region in particular may explain the low level of financial depth. 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:*

One thing is clear: the savings rate is very low in the WAEMU sub-region; Indeed, the observation of aggregate data puts Africa at the forefront among the continents that the largest part of private wealth is held abroad (Collier and Hoeffler Pattillo (2001), Boyce and Ndikumana (2001)). 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:*

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 Africa; This observation may be valid for the WAEMU 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 WAEMU sub-region countries have a significantly lower density of population compared to other developing countries; It would have an impact on financial deepening. The expected sign of this variable is a positive in the sense that high population density would improve the level of financial depth.

✓ *Real exchange rate:*

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 FDI<sup>2</sup> and hence financial activity.

✓ *Reserves:*

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

✓ *Transfers:*

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 financial deepening that we have built.

The general model can be present as follows:

- Static form:

$$\ln (APFIN)_{i,t} = \beta_0 + \beta_1 \ln (OUV)_{i,t} + \beta_2 \ln (TXINT)_{i,t} + \beta_3 \ln (TXEP)_{i,t} + \beta_4 \ln (TXCHA) + \beta_5 \ln (DENS)_{i,t} + \beta_6 \ln (RES)_{i,t} + \beta_7 \ln (TRANS)_{i,t} + \beta_8 \ln (KAOPEN)_{i,t} + \beta_9 \ln (INF)_{i,t} + \beta_{10} \ln (TXPIBPT)_{i,t} + \alpha_i + \varepsilon_{i,t} \dots \dots \dots (1)$$

- Dynamique form:

$$\ln (APFIN)_{i,t} = \gamma + \beta_0 \ln (APFIN)_{i,t-1} + \beta_1 \ln (OUV)_{i,t} + \beta_2 \ln (INT)_{i,t} + \beta_3 \ln (TXEP)_{i,t} + \beta_4 \ln (TXCHA) + \beta_5 \ln (DENS)_{i,t} + \beta_6 \ln (RES)_{i,t} + \beta_7 \ln (TRANS)_{i,t} + \beta_8 \ln (KAOPEN)_{i,t} + \beta_9 \ln (INF)_{i,t} + \beta_{10} \ln (TXPIBPT)_{i,t} + \alpha_i + \varepsilon_{i,t} \dots \dots \dots (2)$$

Taking into account the preceding three dependent variables will be based on the specification of the three models.

**II-2-2) Estimation procedure of different models and specification tests:**

- 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.

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<sup>2</sup> Foreign Direct Investment.

The choice of panel data analysis gives us the advantage of having time series acceptable size for analysis, which could not be performed on each of the individual countries. The double dimension of panel data allows us to account simultaneously the dynamic behavior and their possible heterogeneity between countries, which is not possible with the time series or cross-sections.

To estimate the dynamic model specification, Arellano and Bond (1991) proposed the two stages GMM method of estimating in where 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 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. And Arellano and Bover (1995) and Blundell and Bond (1998) introduce the system GMM estimator, where the differences regression 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 Boubakri et al. (2009) and earlier with Blundell and Bond (1998) for the exogenous variables in levels to been appropriate instruments, it is necessary to take into account the additional moment condition.

- 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:* For the three models by observing the chi 2 value, it is found that the calculated value is greater than the readed value; The main consequence of this

observation is the validation of presence of heteroscedasticity problem. In the light of these results we cannot consider the fixed effect and random effect estimation results and for estimating the static model we will consider the results of estimation with correction of this problem.

- *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 for all our dynamic models estimated by the system GMM indicate respectively the absence of errors autocorrelation and validity instrumented at the 10% variable.

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.

### **II-2-3) Results and interpretation of the model estimation:**

Table 1: Presentation of the second model estimation results.

	<b>Dependent variable: Index of financial deepening</b>		
	<b>FGLS</b>	<b>GMM Difference</b>	<b>GMM System</b>
<b>LNAPFIN1 (L1)</b>		-0.5244689**	0.2063719*
<b>LNOUV</b>	0.0904576	-0.2040687**	0.0052771
<b>LNINF</b>	0.0452789	0.0011572	0.0100277
<b>LNTXINT</b>	-0.1245839	-0.0100249	-0.1004973
<b>LNPIBPT</b>	0.0245678**	0.1004977*	0.0094472**
<b>LNTXEP</b>	0.0104457	0.0996115*	0.1700935*
<b>LNDENS</b>	0.0530425	0.0082477*	0.0994100***
<b>LNTXCHANGE</b>	-0.1004586	-0.094482**	-0.0086297***
<b>LNRESERV</b>	-0.2200145*	0.0051197	-0.0500967**
<b>LNTRANS</b>	-0.0071196	-0.018005**	-0.0193885
<b>LNKAOPEN</b>	-0.1900456	-0.0008207	-0.0028399
<b>Constante</b>	0.02456897*		0.0055437*
<b>Test de Wald</b>		0.000	0.000
<b>Test de sargan</b>		0.207	0.182
<b>Test</b>		0.009	0.019
<b>d'autocorrélation</b>			

Notes: \*, \*\*, \*\*\* respectively represented the critical values of acceptance of Student's t at 10%, 5% and 1%. The explanatory variables are in order: the lagged variable, trade openness, inflation, interest rate, per capita GDP rate, savings, density, exchange rate, reserves, transfers and financial openness.

Source: Observation results by the authors on STATA.

### **- Static-Model:**



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

**- 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.

\* *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 sub region; One explanation for the fact that this result is contrary to theoretical predictions would be the capital flight it has generated, economic agents preferring for precautionary reasons send their financial assets to the rest of the world in general. A study of 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 in the contrary with the results of Ang (2008) analysis, reserves have a negative impact on financial deepening. The implication of this result is the recommendation of an implementation of a financial policy whose mainly aim to reduce the level of these reserves in the WAEMU sub-region.

It is also noted 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 system on financial deepening. The WAEMU sub-region countries authorities would gain to develop financial 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 system. The mobilization of these savings is more beneficial for the host country than the sub region economies.

To this financial deepening factor 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 factor highlighted the fact that policy maker in the WAEMU sub-region should apply expansionary financial policy to increase the level of three factors namely savings rate, GDP per capita growth rate and density. We intend now to study the dynamics of financial deepening in the region.

#### **II-2-4) Study of the dynamics of financial deepening in the WAEMU zone:**

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

Table 2: The result of the analysis of financial deepening dynamics.

<b>Lagged variable (Financial deepening index)</b>			
	<b>Coefficient</b>	<b>Standard error</b>	<b>P&gt; z </b>
<b>LNAPFIN1 (L1)</b>	0.2063719*	0.1232794	0.094

(\*) represents significativity 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 positive impact on its current value. It has a positive sign and confirms the positive dynamics of financial deepening in the sub-region. The coefficient of initial financial deepening is significantly positive (equal to 0.20637) at 10%. This means that an initial level of financial deepening even if it is low, is conducive to the improvement of the financial deepening index over the time.

In other hand, the good news is that this result means that the fact of starting from a low level of financial deepening, which is indeed the characteristic of WAEMU sub-region economies, increases the chances of the sub-region to move toward higher financial deepening over the time. The coefficient of the initial financial deepening is significantly positive at the 10%. This result is particularly interesting because it is an only one year lagged variable which means that we can assume it as a short-term dynamics. We can therefore ensure the principle of convergence to its long term equilibrium state, either between WAEMU zone countries, or for each country. The coefficient value (0.20637 \*), guarantees an appreciation of 20 % of any exogenous shock on financial deepening, within a period of one year. By assuming an arithmetic evolution over the time (with the supposition that all other things remain equal), thus, after any disturbance, a return to long-run equilibrium values can be achieved in a period of 5 years (100% impact). One of the other remarkable implications of this result is that once the total convergence achieved, financial policies could be implemented regardless of countries and localities specificities; The converging dynamics is therefore evident in the sub-region and there is possibility of financial policies harmonizing in the WAEMU zone.

### **Conclusion and economic policy recommendation:**

The purpose of this article was to highlight the dynamics of financial deepening in the WAEMU sub-region and its implication for financial policy coordination; the factors of financial deepening in the same zone have also been implicitly presented. The estimation of our model have led to the main following results:

Econometric analysis of the first model highlighted three factors of financial deepening in WAEMU Sub Region namely savings rate, GDP per capita growth rate and density. These factors constitute the macroeconomic variables and target on which WAEMU sub-region authorities should encourage a positive dynamic.

These results imply the following overall recommendation: the WAEMU sub-region authorities should implement expansionary financial policies on GDP growth rate, density, savings rate and exchange rate. As we know after the economic and banking crisis facing by WAEMU 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 dimension; Our empirical investigation shows that this recommendation should be questioned since we found that trade openness negatively affect financial deepening and hence economic growth. However, financial openness affects positively financial deepening. 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 due to the fact that in other research we have implemented a simultaneous hypothesis test which has leaded us to the same conclusion.

Regarding the dynamics, 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 is favorable to the improvement of the financial deepening index over the time in the WAEMU zone. After five years, the implementation of harmonized financial policies in the sub-region without distinction of locality or country will therefore have an optimal impact. The only condition is for country member to work toward reducing reduction of country specificity by maintaining the previous policy recommendation, with the supposition that all other things remain equal.

However it is useful to mention that the use of average data 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 we

make the assumption of existence of countries 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 specificity for further analyses.

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