



Analysis of Factors Influencing Bank Profitability: Evidence from the West African Economic and Monetary Union Banking Sector

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Abstract

This paper investigates the factors that influence bank profitability. Using static and dynamic panel data techniques, a sample of 86 banks from eight countries making up the West African Economic and Monetary Union over the period 2006-2014 is utilized. In the static framework, the size effect is investigated for both determinants of profitability and CAR models, while the time effect is incorporated in the dynamic framework. In regards to the determinants of bank profitability, the results show evidence of significant effects of bank-specific factors, as well as bank-industry and macroeconomic factors on profitability in WAEMU except two bank-specific factors (ratios of liquid asset to total deposit and nonperforming asset), which are insignificant. Also, due to less competition in the banking sector, the results point to a significant persistence of profit from year to year. Furthermore, the analysis of the bank size effect confirms evidence of significant economies and diseconomies of scale in the banking sector.

1 Introduction

A function of a financial system is to intermediate between lenders and borrowers so that transaction and information costs for both parties can be reduced. Financial institutions known as financial intermediaries perform brokerage and asset transformation functions. Considered as the important financial intermediary, banks permit credit and liquidity provisions through credit channels and protect companies and households against unexpected needs for cash, they permit rapid economic development through the financing of different sectors of the economy such as agriculture, industry, and trade, and help the promotion of entrepreneurship that leads the private sector to participate effectively to economic growth (Aziakpono,2005, Rosengren, 2008). They cannot play this important role if they are not profitable and well capitalized. A profitable banking sector is better able to withstand negative shocks and contribute to the stability of the financial system (Jiang et al., 2003). The profit is important for all participants in the economy and depends on such factors as received and paid interest on bank transactions, the share of non-interest income, current expenditures and the structure of assets and liabilities (Myktybekovich, 2013). The main aim of the analysis on profitability is to uncover the main center of bank performance and factors that affect the increase in profits and profitability of the bank based on the effective management of revenues and expenditures.

Moreover, in countries with no strong financial markets or with a weak financial system the banking sector constitutes the key to the economic growth.

What is the situation about the banking sector in the West African Economic and Monetary Union?

Eight developing countries, including Benin, Burkina Faso, Ivory Coast Guinea Bissau, Mali, Niger, Senegal and Togo comprise the WAEMU banking sector, where banks mostly constitute the backbone of the financial system. Despite the fact that the regional stock market (BRVM) exists, the regional financial system remains weak Banks in the WAEMU countries and most other African countries are for the most part private businesses that have to attract capital from the public to fund their operations. If profits are inadequate or if the risk is excessive, they will have greater difficulty in obtaining capital, and their funding costs will grow, which will erode profitability.

What is the situation of banks from under-developed countries with weak financial system?

WAEMU countries are developing countries that have a weak financial system dominated by banks. Bank performance (commercial banks mostly) has been relatively poor, and it is characterized by low levels of economy financing (it represents on average 20 % of GDP in 2012), and private credit (high growth potential sector (industry), high levels of non-performing loans, poor asset quality, operational inefficiencies, among others (Berger et al., 2005; Bonaccorsi and Hardy, 2005; Imam and Kolerus, 2013; and Panayiotis et al., 2005). Also, there is a lack of information about African banks in general and about WAEMU banks in particular (Bourke, 1989; Demerguc-Kunt and Huizinga, 1999; Short, 1979; and Molyneux and Thornton, 1992).

In line with the aforementioned problems, the objectives of this study are to highlight the factors that influence bank profitability between the period 2006 and 2014 with a view to proposing some recommendations to decision makers and regulatory authorities. In the pursuance of these objectives, the following research questions were administered: What are the factors that influence the profitability of the West African Economic and Monetary Union Banking sector during the period 2006-2014? Do small and medium size and large size affect bank profitability in WAEMU?

These questions will lead this study to provide the appropriate answers, capture and highlight the importance of banks and gauge their role in WAEMU's zone in these recent years.

2. Literature review

2.1 Factors influencing bank profitability

The available empirical evidence tends to show that studies on banking have extensively been concentrated more on developed and a few developing countries and limitedly on WAEMU. There is thus insufficient information on the determinants of bank performance in Africa in general, and in WAEMU, in particular, that would require further investigation (Short, 1979; Bourke, 1989; Molyneux and Thornton, 1992; Demerguc-Kunt and Huizinga, 1999). Determinants of bank profitability can be divided between those that are internal and those that are external. Mercia, et al. (2002), Toddard, et al. (2004), and Panayiotis et al. (2005) showed that bank profitability is a function of internal and external factors. Internal factors include bank-specific; while external factors include both industry-specific and macroeconomic factors. Internal determinants of bank profitability can be defined as

those factors that are influenced by the bank management decisions and policy objectives. The key factors of bank profitability performance are as following:

(i) Bank-Specific Factors.

In view to understanding bank performance in the global context, studies on profitability have largely used returns on bank assets (ROA), net interest margin (NIM) and return on equity (ROE), as common measures. Bank-specific determinants include financial statement ratios in four areas: (1) capital; (2) earnings, profitability, and efficiency; (3) liquidity; and (4) asset quality (Golin, 2001). The details of these variables are presented in table 1 and 2

(ii) Industry-Specific Determinants

Bank industry determinants are external factors that may relate to bank profitability, such as the extent of industry concentration and the size of the banking system in relation to the size of the economy as a whole. Industry concentration is the degree to which the industry in a market is served by just a few or by many banks. When a banking market is more concentrated, customers have fewer choices, competition is less, and the market power of individual banks is greater. The common variables include Market concentration, Stock market capitalization, bank assets, Herfindahl-Hirschman index and others. The details of the latter can be found in table 1 and 2

(iii) Macroeconomic Determinants

The last group of profitability determinants deals with macroeconomic control variables. .. Economic growth is thought to impact bank profitability favorably, by increasing loan demand, decreasing loan default rates, and allowing banks to charge more for their services. This may be offset by increasing the supply of banking services, as expansions and new entrants are encouraged by perceived favorable conditions. This variable is assessed by the year's real change in gross domestic product (GDP) for the nation the bank is located in, sometimes on a per capita basis. The common variables include inflation rate, the long-term interest rate, rate of economic growth (Panayiotis et al., 2005) other variables. The detail of these variables are found in tables 1 and 2. Factors influencing bank profitability is summarized in table 1.

Table 1: Summary of some main studies related to bank profitability

Author	Sample	Research Method	Bank specific variable	Bank variable	Sector	Macro-economic variables	Key findings
Demirguc-Kunt & Huizinga (1999)	Commercial bank in 80 countries in the World 1988-95	Panel OLS	Shareholder's equity, size, noninterest income, Overhead/total assets, loan loss provisioning, Loans/total assets (liquidity), Customer and short-term funding/total asset, Foreign ownership dummy	Market concentration, Stock market capitalization/bank assets		GDP per capita, Growth rate, Inflation rate Real interest, Taxation Reserves Tax rate	The Findings show that a larger ratio of bank assets to gross domestic product and a lower market concentration ratio lead to lower margins and profits, controlling for differences in bank activity, leverage, and the macroeconomic environment.
Kosmidou, et al., (2005).	32 UK Commercial Bank, 1995-2002	Panel Fixed Effect Model	cost to income ratio, ratio of liquid assets to customer and short term funding, ratio of loan loss reserves to gross loans, ratio of equity to total assets, Total asset (size)	total assets of the five largest banks /the total assets of all banks operating in the market, stock market capitalisation (rate of GDP growth and inflation	The results show that the capital strength of these banks has a positive and dominant influence on their profitability, the other significant factors being efficiency in expenses management and bank size.
Panayiotis et al., 2005	Geeck Commercial banks 1985-2001	Structure-Conduct-Performance (SCP) hypothesis, Panel GMM Technique(Unbalanced Panel)	Returns on average bank assets (ROA), Return on equity (ROE, Equity / assets (EA) , Credit risk (Loan loss provisions / loan), Operating expenses / assets	Herfindahl-Hirschman index (HHI)		Inflation Cyclical output	All bank-specific determinants, with the exception of size, affect bank profitability significantly in the anticipated way. However, no evidence is found in support of the SCP hypothesis. Finally, the business cycle has a positive albeit asymmetric effect on bank profitability, being significant only in the upper phase of the cycle.
Athanasoglou et al., 2006	South Eastern European credit institutions over 1998-2002	Unbalanced Panel data: Random Effect model	equity to assets ratio, overheads efficiency ratio , ratio of loans to assets, loan loss provisions to total loans ratio, banks' assets (logarithm), binary dummy variable for foreign bank	the 3-firm concentration ratio (CR3) and the Herfindahl-Hirschman Index (HHI)		inflation and real per capita income	The estimation results indicate that, with the exception of liquidity, all bank-specific determinants significantly affect bank profitability in the anticipated way. A key result is that the effect of concentration is positive, which provides evidence in support of the structure-conduct performance hypothesis
Al-Hashimi (2007)	10 Sub-Sahara African countries	Panel regression analysis	Operating cost, liquidity, capital			Inflation, GDP growth	The study indicated that credit risk and operational inefficiencies explain most of the variation in net interest margins across the region, with macroeconomic factors, having less influence on performance
Alper & Anbar, 2011	10 Commercial banks. 2002 - 2010 . Turkey	Balance panel Data (Panel regression analysis)	Equity to total asset (Capital adequacy), loans to total assets, loans under follow-up (net) to total loans, liquid assets to total asset, Deposits , net interest margin and non-interest income			Real interest rate, Inflation rate, Annual real GDP growth rate:	Their findings show that asset size and non-interest income have a positive and significant effect on bank profitability (ROA, ROE). However, size of credit portfolio and loans under follow-up have a negative and significant impact on bank profitability. With regard to macroeconomic variables, only the real interest rate affects the performance of banks positively

Macit, 2012	4 banks 2005-2010 (quarterly data) Turkey	Regrssion analysis	non-performing loans to total loans and log of real assets, equity to total assets, the ratio of net loans to total assets,		GDP growth, level of foreign exchange rate, consumer ináation, and real interest rate	The findings suggest that bank specific determinants of profitability such as the ratio of non-performing loans to total loans and log of real assets are respectively positively and negatively significant on profitability .The ratio of equity to total assets is highly significant for both indicators but it has different effects on ROA and ROE. Macroeconomic variables such as the level of exchange rate and the real interest rate are significant and positive on bank profitability .
Turgutlu, 2014	Commercial banks 2006-2012 Turkey	dynamic panel data model (SGMM)	total equity to total assets, Logarithm of the assets, total operating costs to total income, total loans in logarithm, natural logarithm of the off-balance-sheet liabilities of the banks,	Panzar and Rosse H-statistic	GDP growth, money market rate	The findings indicate the validity of the persistence of profit hypothesis. Moreover, bank profitability has been mostly affected by the capital ratio which could have further implications through the Basel III period. The results also indicate positive impact of improvement in financial soundness of banks on profitability
Ayaydin & Karakaya, 2014	23 commercial banks 2003-2011. Turkey	Two-Step System Generalized Method of Moments technique	Equity to total assets, Loan loss reserve rate, (Loan loss reserve to gross loans) , Loans (Net loans to total assets) Liquidity rate , (Liquid assets to customer and short-term deposits) . Foreign ownership (the percentage of foreign ownership)	Concentration((HHI),	Inflation, GDP growth, Global financial crisis	The results show effect of increasing bank capital on risk is significantly positive and negative, supporting the regulatory hypotheses and moral hazard hypothesis, respectively. The results also suggest that there is a positive and negative relation between the capital and profitability. Thus, the sample supports also structure-conduct-performance hypothesis
Amoah and Gyamerah (2015)	Foreign and local banks 1999-2010 Ghana	Panel regression	size, liquidity, expenses, credit risk, and Ownership, Productivity	capital adequacy, HHI, Market depth	inflation (CPI), and growth in money supply, Real GDP, Market Dvt	The findings suggest that cost management has an inverse relationship with profitability, bank size and credit risk show a positive association with profitability
GAMMADI GBE Vigninou (2012)	WAEMU Banks 1990-2010	GMM Dynamic panel	Doubtful receivables , The net provisioning effort, overhead costs, Personnel costs, the average lending rate on loans granted to customers		Inflation, Real GDP, Growth , The State's debt to primary banks ,Discount rate of the central bank, The overall budgetary balance	The results show that banks of the Union are more vulnerable to monetary shocks than real activity. They support especially soundness of the banking sector as a whole in respond to changes in its macroeconomic environment, so that the risk of degradation of profitability related to impact of the real economy are contained.
Gammadigbe V. (2013)	5 banks from Togo	GMM panel Dynamic	Non performing credit, growth of bank lending interest rate, average lending rate, growth of deposit rate, growth of non-productive assets	Concentration ratios	CPI, Interbank Market average interest rate (3 months),Monetary market interest rate, Industrial production Index	Using generalized additive models (GAM) and the generalized Method of Moment (GMM) in dynamic panel , he found that strong banking concentration goes hand in hand with high lending rates. In other words, the more bank activity is concentrated among fewer banks, the higher the cost of credit.

3. Research methodology

3.1. Data Collection.

The overall sample consists of 86 active banks in the WAEMU'zone. Out of the 86 banks, 92% are commercial banks, and 8% are quasi-commercial ¹banks where attention was focused on the commercial bank in order to avoid problems of comparison between different types of banks and to provide homogeneity in the comparison between countries. Also, the study covers the time period of 2006-2014 with a balanced panel in order to have an acceptable, relevant and recent sample in line with the study's objectives and also to be able to get enough data to carry out the econometric analysis. The data are taken from the West African Central Bank (BCEAO) website www.bceao.int where banks' annual financial statements are published, so are macroeconomic indicators Furthermore, all the bank financial ratios were calculated because the financial statements are raw data.

3.2 Research Methodology

3.2.1 Dependent Variables

Return on assets (ROA), Return on equity (ROE), and Net interest margin (NIM) are the three measures of profitability supported by the literature review (see Growe et al. 2014, Alberttazzi and Gambacorta, 2009, Angbazo, 1997, Demirguc-kunt and Huizinga, 2008, Golin and Delhaise (2013). Return on assets (ROA) is used as a primary measure of bank profitability. In calculating ROA, and ROE, the average assets and equity in the denominator respectively were considered. ROA is preferred for some reasons that assets directly reflect both income and expense levels (Olson & Zoubi, 2011), and also ROA does not vary according to the amount of leverage employed, as does ROE (Golin & Delhaise, 2013). The drawback of ROA is that it takes into account the off-balance assets. But, these off-balanced assets are negligible in WAEMU bank balance sheet.

¹ Most of non-commercial bank act like commercial bank. Because in WAEMU, commerce activities are dominant when comparison is made with the other sectors. Due to this; some noncommercial bank use to combine their first domain intervention activity with the commerce in order to survive.

Table 2: List Of Bank Financial Variables Examined For Profitability³⁸

Dependent Variables	Ratios		Definitions
Profitability	Return on Asset (ROA)		The ratio of net income to average total assets. This ratio is the most important ratio using to measure the bank profitability. This is mainly because it considers returns generated from assets financed by the bank. (Groveve <i>al</i> (2014), Francis (2013), Gul <i>et al.</i> (2011), Karimzadeh <i>et al.</i> (2013), Lee (2012), Mamatzakis and Remoundos (2003)
Independent variable (Factors)	Variables (Ratio/Proxies)	Expected relationship	Definition
Bank-specific factors			
Capital	Shareholder's Equity/Total assets (SHER)	Positive	This ratio measures the ability of the bank to withstand losses. A declining trend may signal increased risk exposure and possibly a capital adequate problem. More capital means less need for external funding and a lower cost of capital when it is sought. Bankruptcy risk costs will be less due to the larger safety net in case of negative developments (Bourke (1989, Molyneux and Thornton (1992), Zimmerman (1996, Demirguc-Kunt and Huizinga (1999)
Liquidity	Liquid Assets / Total Deposit Ratio : (LiDR)	Positive	This is a deposit run-off ratio. It focuses mainly on the percentage of customers and short-term funds that must be met if they are withdrawn. Higher liquid is the bank and the less vulnerable to a run.
	<i>Liquid Assets / Total Assets Ratio: (LiAR) .</i>	Negative	A key liquidity ratio is the liquid assets ratio (Liquid assets/Total assets. Liquid assets' components may vary across countries, but generally include cash, government securities, interbank deposits, and short-term marketable securities (Golin & Delhaise, 2013). Lower liquidity means higher risk. The portfolio theory suggests higher risk leads to higher profitability. In accordance with this perspective, it is expected à negative effect of this ratio on the profitability since WAEMU bank are highly liquid.
	<i>Loans / Deposits Ratio : LOANS (LDR)</i>	Positive	This ratio called also credit risk is another measure of bank liquidity. Credit risk is the main source of bank-specific risk in WAEMU. So weak legal environment, weak enforcement and insufficient information expose banks to high credit risk. Apparently, a high figure denotes lower liquidity (a ratio between 70 and 90%). But a level a ratio under 70% can make conclude that the bank is conservative. So; in the WAEMU banking sector case; the positive effect on the profitability is expected. (Flamini <i>et al.</i> , 2009; Sohail <i>et al.</i> , 2013).
	<i>Loans /Total Asset Ratio(LAR) Ratio</i>	Positive	This liquidity ratio, a widely used liquidity measure, indicates what percentage of bank assets is tied up in loans. Loans are less liquid than the other main component of a bank's asset portfolio _ investment securities. Hence, higher values of this ratio denote less liquidity. (Francis (2013), Gul <i>et al.</i> (2011), Karimzadeh <i>et al.</i> (2013),
Efficiency	Cost/ Income Ratio (NIR)	Negative	In the earnings, profitability, and efficiency area, a key ratio is the efficiency or cost to income ratio (Noninterest expense/Total income). Administrative, compensation, marketing, and property costs constitute the elements of noninterest expenses. Higher numbers indicate a bank is operating less efficiently. Its relationship with profitability is almost uniformly negative. Almumani, 2013 .Cerci <i>et al.</i> , 2012, Francis, 2013, Heffernan & Fu, 2008, Kosmidou <i>et al.</i> , 2005, Trujillo-Ponce, 2013,Turgutlu, 2014
	Cost / Asset Ratio (NAR)	Negative	Non-interest expense/Average Total asset. This ratio gives a measure of the cost side (overhead plus loan loss provisions) of the bank performance relative to assets invested. The lower this figure is, the better is the profitability. (Alp <i>et al.</i> , 2010; Athanasoglou <i>et al.</i> , 2005, 2006; Demirguc-Kunt & Huizinga, 1999, Wahidudin <i>et al.</i> , 2013

Asset quality	Non interest income /revenues ratio (NIIR)	Positive	Noninterest revenue including bank fees, service charges, dividend income, securitization, and trading profit/loss has become increasingly significant in recent years. Noninterest income ratio. (Noninterest income/Operating income or revenues) was found positive and significant relate to profitability Alper & Anbar, 2011; van, 2011.)
	Nonperforming asset/Total Asset (NPAR)	Negative on ROA, ROE, NIM	This ratio provides indications of difficulties with a bank's loan portfolio. Problems with a bank's asset quality are usually assumed to decrease profitability. ((Lee, 2012; Macit, 2012; Ongore & Kusa, 2013; Poposka & Trpkoski, 2013, Trujillo-Ponce, 2013).
	Natural logarithm of total assets (log size)	Positive or negative on ROA, ROE, NIM	The size of the bank, as measured by the logarithm of total assets. The log of assets is used instead of assets in order to reduce the scale effect. Increased size is presumed to confer benefits which can enhance profitability. Included are greater market power, improved technological efficiency, and the ability to secure funding at a lower cost. (Alp et al. 2010; Athanasoglou et al. 2006; Ayadi & Boujelbene, 2012; Gul et al., 2011; Jabbar, 2014;). However, increasing size beyond a certain point may lead to scale inefficiencies as the organization's bureaucracy impedes communication. This variable controls for cost differences related to bank size and for the greater ability of larger banks to diversify. (Pasiouras & Kosmidou, 2007; Perera et al., 2013; Rachdi, 2013)
Bank industry factor	Bank Concentration ratio: Total bank assets/Total sector Assets (BCR) ²	Positive-t-on profitability	Industry concentration is the degree to which the industry in a market is served by just a few or by many banks. The relative size of the banking system to the entire total sector asset (Total bank assets/Total sector Asset) has also been related to overall profitability. In less developed countries, greater financial system development can enhance efficiency and profitability.(Raza et al.,2013, Tana & Floros, 2012)
	Stock market capitalization/ bank industry Total assets (SMR)	Negative on Profitability	This ratio of stock market capitalization to the total assets of the banking system is another industry-based indicator. This ratio has a different effect as the stock market is from the developed or less developed country. The negative effect is expected here.(Growe. et al, 2014, Ben Naceur & Goaid, 2008; Kosmidou et al., 2005)
Macroeconomic factor	Per capita Real Gross Domestic Product Growth (PRGDPG).	Positive on Profitability	This variable is assessed by the year's real change in gross domestic product (PRGDP) percapita for the nation in which the bank is located on a per capita basis. Economic growth (wealth) is thought to impact bank profitability favorably, by increasing loan demand, decreasing loan default rates, and allowing banks to charge more for their services. (; Lee & Kim, 2013; Shen et al., 2009; Trujillo-Ponce, 2013, Turgutlu, 2014)
	Inflation rate (Change in Price Index: CPI)	Positive effect on Profitability	Inflation is measured by the change in Price Index (CPI). WEAMU countries are mainly exporters of raw materials. So taking CPI as inflation rate fits the study. When anticipated, banks can adjust their rates to offset it. If it is not anticipated, costs may increase faster than revenues and profits will decline. It has been suggested that, because of banks, in their maturity transformation role, lend money for longer periods than they borrow, for this, inflation tends to decrease their margins and profits. But in WAEMU countries, inflation rate is very low (lesser than the standard limit which is 2) (Athanasoglou et al, 2005, 2006; Guru et al., 2002; Demirguc-Kunt & Huizinga, 1999; Flamini et al., 2009;)

² In spirit of Flamini et al, (2009) the researcher had decided to avoid other measures of concentration that are standard in the industrial organization literature, such as the Herfindahl-Hirschman index (HHI) or the three-firm-concentration ratio, because these measures require complete information about all banks and can be misleading. But following Raza et al.,(2013); Tan & Floros, (2012) he choose the relative size of the banking system to measure WAEMU's bank-industry concentration.

3.3 Research Tools and Techniques

3.3.1 Econometric Model

Panel data analysis is a method of predicting relationships using time series with cross-sectional series (Greene, 2003, p.612). The general model of balanced panel estimation is written as follows:

$$Y_{it} = \alpha + \sum_{k=1}^k \beta_k X_{it}^k + \varepsilon_{it} \quad \varepsilon_{it} = v_i + u_{it} \dots (1)$$

where Y_{it} is the dependent variable of bank i at time t , with $i = 1, \dots, N$; $t = 1, \dots, T$, α is a constant term, X_{it} are k explanatory variables and ε_{it} is the disturbance with v_i the unobserved bank-specific effect or random effect and u_{it} the idiosyncratic error. This is a one-way error component regression model, where $v_i \sim IIN(0, \sigma_v^2)$ and independent of $u_{it} \sim IIN(0, \sigma_u^2)$.

3.3.1.3. Dynamic GMM Panel Method

The development and application of Generalized Methods of Moments (GMM) estimation for panel data have been extremely fruitful in the last decade. In the empirical growth literature, GMM estimation has become particularly popular. The Arellano and Bond (1991) estimator in particular initially benefited from widespread use in different topics related to growth. The Arellano and Bond model is as follows: The original estimator is often entitled difference GMM

$$y_{it}^3 = \beta_1 + \rho y_{i,t-1} + X_{it} \beta_2 + u_i + \varepsilon_{it} \dots, v_{it} = \dots u_i + \varepsilon_{it} \quad (.2)$$

The first difference transformation removes both the constant term and the individual effect:

$$\Delta y_{it} = \rho \Delta y_{i,t-1} + \Delta X_{it} \beta_2 + \Delta \varepsilon_{it} \quad (3)$$

The DPD (Dynamic Panel Data) approach is usually considered by the work of Arellano and Bond (Rev. Ec. Stud., 1991), who have popularized the work of Holtz-Eakin, Newey, and Rosen (Econometrica, 1988). Generalized Method of Moments (GMM) is more efficient estimates of the dynamic panel data model. As the DPD estimators are instrumental variables methods, it is particularly important to evaluate the Sargan test results when they

³ With $E(\mu_i) = 0$, $E(v_{it}) = 0$, and $E(\mu_i v_{it}) = 0$ for $i = 1, 2, \dots, N$ and $t = 1, 2, \dots, T$

are applied. Also, another important diagnostic in DPD estimation is the AR test for autocorrelation of the residuals.

Sargan -Hansen Test

The standard test for testing the validity of moment conditions used in the GMM estimation procedure is the Sargan test of overidentifying restrictions (Sargan 1958) and the development of Hansen (1982). For the GMM estimator in the first-differenced model, this test is given as follows by :

$$Sarg_g = \frac{1}{N} \widehat{\Delta\mu}' Z d W_n Z d' \widehat{\Delta\mu} \quad (.4)$$

Where W_N is the optimal weight matrix and $\widehat{\Delta\mu}$ are two step in the differenced model. When the number of moment conditions is greater than the dimension of the parameter vector, the model is said to be *over-identified*. Over-identification allows the study to check whether the model's moment conditions match the data well or not. The hypotheses for Sargan test are as follows:

H0: Overidentifying restrictions are valid

When the null hypothesis is accepted, then it is concluded the instruments are valid. In other words, the higher the p-value ($p > 0.05$) of the Sargan statistic, the better. In robust estimation, Stata reports the Hansen J statistic instead of the Sargan with the same null hypothesis.

Arellano-Bond Test for Autocorrelation

The hypotheses for Arellano-Bond test are as follow:

Ho: No Autocorrelation: The Arellano – Bond test for autocorrelation has a null hypothesis of no autocorrelation and is applied to the differenced residuals.

- a) The test for AR (1) process in first differences usually rejects the null hypothesis
- b) The test for AR (2) in first differences is more important because it will detect autocorrelation in levels.

3.3. Estimation Models

3.3.1. Analysis of Bank Profitability Factors.

For profitability model, the study uses cost-efficiency frontier model (Battese and Coelli, 1992 ; Marko , 2006 ; Munyambonera , 2013) which is a technical efficiency concept based on a production function that is used to measure bank cost efficiency. Cost efficiency

is derived from the cost function and is a modified form of Cobb-Douglas function. Cost efficiency reflects the position of particular bank relative to the cost frontier. In fact, after the transformation of the stochastic cost frontier function into a log-linear generalized production function framework which is destined to estimate bank profitability. Concerning bank profitability estimation, this study adopts almost a similar framework as applied by Wilson et.al. (2004) on European banks; Naceur (2003) on Tunisian banks; and Panayiotis *et al.* (2005) on Greece banks. The only differences are that balanced panel and more explanatory variables than the latter were used. So the final general linear⁴ model is written as following.

$$\Pi_{ic,t} = \alpha + \sum_{j=1}^J \beta_j X_{ic,t}^j + \sum_{m=1}^M \beta_l X_{c,t}^m + \sum_{n=1}^N \beta_n X_{c,t}^n + \quad (5)$$

Where $\Pi_{ic,t}$ is the profit of bank i in country c for period t ; α is the regression constant; $X_{ic,t}^j$ and $X_{c,t}^m$ denote vectors of bank-specific and bank - industry determinants, respectively; $X_{c,t}^n$ refers to macroeconomic factors specific to each country; and ε_{it} is the idiosyncratic error. $\varepsilon_{it} = v_i + u_{its}$ and ε_{it} is the disturbance with v_i the unobserved bank-specific effect or random effect and u_{it} the idiosyncratic error. So models used are as follows:

ROA_t=

$$\alpha + [\beta_1 SHER_{ic,t} + \beta_2 LiDR_{ic,t} + \beta_3 LiAR_{ic,t} + \beta_4 LDR_{ic,t} + \beta_5 LAR_{ic,t} + \beta_6 NIR_{ic,t} + \beta_7 NAR_{ic,t} + \beta_8 NIIR_{ic,t} + \beta_9 NPAR_{ic,t} + \beta_{10} LogSize_{ic,t}] + [\beta_{11} BCR_{c,t} + \beta_{12} SMR_t] + \beta_{13} CPI_{c,t} + \beta_{14} PRGDP_{c,t} + \varepsilon_{it} \quad (\text{Model 1})$$

In the line of the objective to check the effect of bank size on the profitability, the sample is divided (see table 3.) into two part such large bank (LogsizeLarBK) and Small and Medium bank (LogsizeSmBk) based on the criteria used in the WAEMU banking sector concerning the bank size classification⁵. The first factor will lead to negative coefficients if increased diversification leads to lower risk and thus, lower the expected returns, and the second factor will lead to the positive coefficient for profitability if there are significant economies

⁴ The literature generally comes to the conclusion that the appropriate functional form for testing is a linear function although there are dissenting opinions. Short (1979) investigated this question and concluded that linear functions produced as good results as any other functional form.

⁵ Large Bank: bank with total asset > 100 millions of CFA (The commons unit of money used in WAEMU zone), Medium size Bank with total asset between 50 and 100 millions of CFA, Small size bank with total asset < 50 millions of CFA

of scale. In the models, all the other variables have been kept intact. The models are here after

$$ROA_{ic,t} = \alpha + [\beta_1 SHER_{ic,t} + \beta_2 LiDR_{ic,t} + \beta_3 LiAR_{ic,t} + \beta_4 LDR_{ic,t} + \beta_5 LAR_{ic,t} + \beta_6 NIR_{ic,t} + \beta_7 NAR_{ic,t} + \beta_8 NIIR_{ic,t} + \beta_9 NPAR_{ic,t} + \beta_{10} \text{LogSizeLarBk}_{ic,t}] + [\beta_{11} BCR_{c,t} + \beta_{12} SMR_t] + \beta_{13} CPI_{c,t} + \beta_{14} PRGDP_{c,t} + \varepsilon_{it} \quad (\text{Model 2})$$

$$ROA_{ic,t} = \alpha + [\beta_1 SHER_{ic,t} + \beta_2 LiDR_{ic,t} + \beta_3 LiAR_{ic,t} + \beta_4 LDR_{ic,t} + \beta_5 LAR_{ic,t} + \beta_6 NIR_{ic,t} + \beta_7 NAR_{ic,t} + \beta_8 NIIR_{ic,t} + \beta_9 NPAR_{ic,t} + \beta_{10} \text{LogSizeSmbk}_{ic,t}] + [\beta_{11} BCR_{c,t} + \beta_{12} SMR_t] + \beta_{13} CPI_{c,t} + \beta_{14} PRGDP_{c,t} + \varepsilon_{it} \quad (\text{Model 3})$$

Moreover, in order to capture the tendency of profits to be persistent over time, (due to market structure imperfections or high sensitivity to auto correlated regional or macroeconomic factors) the general model was reestimated using a dynamic panel GMM model by lagging the dependent variable among the regressors. The Arellano-Bover/Blundell -Bond (1995, 1998) generalized method of moments (GMM) which includes additional moment conditions and shows the absence of autocorrelation in the idiosyncratic errors was used. The dynamic model can be written when based on equation (5) as follows:

$$\Pi_{ic,t} = \alpha + \delta \Pi_{ic,t-1} + \sum_{j=1}^J \beta_j X_{ic,t}^j + \sum_{m=1}^M \beta_l X_{c,t}^m + \sum_{n=1}^N \beta_n X_{c,t}^n + \varepsilon_{it} \quad (6)$$

$$\varepsilon_{it} = v_i + u_{it}$$

Where $\Pi_{ic,t-1}$ is one-period lagged dependent variable and δ measures the speed of mean reversion. Also, it is possible that, given the relative large time frame of the dataset and the reforms that took place in the WAEMU banking sector during the sample period, it is very crucial to include dummy time variables in the model. Failing to account for these may bias the estimates in unknown magnitudes and directions. So time effects exist in the error component of the model, as follows:

$$\Pi_{ic,t} = \alpha + \delta \Pi_{ic,t-1} + \sum_{j=1}^J \beta_j X_{ic,t}^j + \sum_{m=1}^M \beta_l X_{c,t}^m + \sum_{n=1}^N \beta_n X_{c,t}^n + \varepsilon_{it} \quad (7)$$

$$\varepsilon_{it} = v_i + \lambda_t + u_{it}$$

Where λ_t is the unobservable time- effect. The joint significance of the unobservable time-effects is tested by the H_0 hypothesis: $H_0: \lambda_2 = \lambda_3 \dots = \lambda_T = 0$.

The relevant LM test (Table 5) indicates that H_0 is rejected at the 95% confidence level for model 4, implying that it is necessary to include year-specific dummy variables to account for λ_t . All the coefficient of dummy variables are significant for all the years for model 4, Therefore, the researcher extend expand equation (7) as following:

$$\Pi_{ic,t} = \alpha + \delta \Pi_{ic,t-1} + \sum_{j=1}^J \beta_j X_{ic,t}^j + \sum_{m=1}^M \beta_l X_{c,t}^m + \sum_{n=1}^N \beta_n X_{c,t}^n + \gamma D_t + \varepsilon_{it} \quad (8)$$

$$\varepsilon_{it} = v_i + u_{it}$$

Where D_t are the dummy variables for the years (2006.....2014).

In fact, the LM test for model (4) doesn't reject H_0 (see Table 5) and thus the study proceeds with the estimation of this model. This yields the following models specification:

$ROA_{ic,t} =$

$$\alpha + \delta ROA_{ic,t-1} + [\beta_1 SHER_{ic,t} + \beta_2 LiDR_{ic,t} + \beta_3 LiAR_{ic,t} + \beta_4 LDR_{ic,t} + \beta_5 LAR_{ic,t} + \beta_6 NIR_{ic,t} + \beta_7 NAR_{ic,t} + \beta_8 NIIR_{ic,t} + \beta_9 NPAR_{ic,t} + \beta_{10} LogSize_{ic,t}] + [\beta_{11} BCR_{c,t} + \beta_{12} SMR_t] \gamma D_t + [\beta_{13} CPI_{c,t} + \beta_{14} PRGDP_{c,t}] + \gamma D_t + \varepsilon_{it} \quad (\text{Model 4})$$

4 Results and Discussion

4.1. Descriptive Statistical Results Analysis

The analysis of the descriptive statistics results (Appendix 1.) shows that the three indicators of profitability, return on assets (ROA), return on equity (ROE) and net interest margin (NIM) all have an average positive mean of 0.7%, 2.8%, and 6.8% respectively. These results show low profitability index for WAEMU banks, particularly for ROA and ROE. In sum, the low level of profitability of banks can be explained by the excessive operating expenses occurred by banks that swallowed an important part or all their profits. Also, the shareholders 'equity ratio stood on average for 7.6% during the period covered by the study. A Shareholder's equity Ratio (SHER) indicates an average value of 7.8%. In regards to capital adequacy, range from a maximum value of 36.13% to a minimum value of -14.72 % shows that most banks in WAEMU do not respect the minimum capital adequacy during the period covered by this study.

Concerning liquidity variables, a liquid asset to deposit ratio (LiDR), a liquid asset to asset ratio (LiAR), loan to deposit ratio (LDR), loans to asset ratio (LAR) indicate a mean value of 108.5%, 89.4%, 64%, 59.5%. The union's bank sector recorded a high liquidity ratio during 2006-2014.

When based on the efficiency factors, it points that Cost to income ratio (NIR), cost to asset ratio (NAR) have an average value of 80.5% and 11.8% respectively. NIR is ranged from a maximum value of 852% to a minimum value of 26.5%. This explains the high level of banks 'operating expenses in WAEMU. In regards to asset quality factors, nonperforming asset ratio (NAR) has a mean value of 13.3% which seems to be high. This ratio with a maximum value of 59.4% and a minimum value of 0.1%, indicates that most banks have a higher value than the mean of 13.3%. While the bank size variable (logsize) records an average value of 13.31.

Relatively to bank-industry variables, bank concentration ratio (BCR), stock market capitalization ratio (SMR), stands respectively for an average value of 60.8% and 9.7%.

Furthermore, when focused on macroeconomic factors, inflation (CPI), and real GDP growth per capita have an average value of 0.1%, and 0.13% respectively. The level of inflation stands at its lowest level in WAEMU during 2006-2014. This proves the effectiveness of monetary policy implemented in the zone.

4.2. Econometric Empirical Results Analysis.

In this work, panel data regression models have been applied. These models are some static panels and others dynamic panel models. In order to prevent the occurrence of false associations among variables, panel unit root tests such as common unit root process test of Levin, Lin and Chu (2002); and individual process unit root test of Im, Pesaran and Shin (2003) and Augmented Dickey-Fuller(ADF) panel unit root test for all series have been performed. The analysis of results of the unit root tests (Appendix 2) shows that all the series do not have unit root ($p < 0.05$). The results show the calculated p-values are lesser than the critical value of 0.05 for all the variables. For this, the null hypothesis that the series have unit root is rejected for all the variables for the three-unit root tests. The analysis of the results are discussed in the following subsections.

4.2.1 Analysis of Factors of Bank Profitability.

A) Analysis of Results Based on Bank 'Size Effect (Panel Static)

Before performing the analysis, some precondition tests have been performed. For the model 1 (original model), model 2 (large size bank) and 3 (small and medium-size bank), Chow test with a p-value < 0.05 reports that the fixed effect model is the appropriate model. After the Breusch Pagan test has been performed and with the calculated p-value < 0.05 , it indicates that the random effect model is more appropriate than the pooled regression. With p-value < 0.05 , Hausman test indicates that, between fixed and random model, the fixed effect model is the efficient and consistent model for the model 1 and 3. Concerning the model 2 (large bank size), Hausman test indicates that random effect model is the appropriate one with p-value > 0.05 . Also concerning Model 1, 3, Panel Corrected Standard Error (PCSE) is performed because of the presence of the autocorrelation and variance problems, while PCSE is not performed for model 2 because of the absence of the autocorrelation and variance problem after performed modified Wald variance test and Wooldridge test of autocorrelation. The results of model 1, 2 and 3 are found in the Table .4. The model 1, show that the profitability is positively and significantly affected by the bank size. The model 2 indicates that the profitability has been negatively and significantly affected by the coefficient of large size of banks ($\text{Logsize}_{\text{largeBk}}$) at the level of 1%. In theory, increased size is presumed to confer benefits which can enhance profitability. However, increasing size beyond a certain point may conduct to scale inefficiencies as the organization's bureaucracy impedes communication. Larger size may allow banks to diversify, affecting both risk and profitability and decision making. This is called the theory of diseconomies of scale. So, the findings are in line with Staikouras and Wood (2004) and others scholars (Chronopoulos et al., 2012; Flamini et al., 2009. This confirms the non-linearity between size and profitability and the ambiguity of size.

The model 3 indicates that the profitability is significantly and positively affected by the small and medium size ($\text{Logsize}_{\text{SmBK}}$) of banks at the level of 10%. According to the theory of economies scale, increased size is presumed to confer benefits which can enhance profitability. So in accordance with this theory and some studies (Staikouras and Wood (2004 and others,) Small and medium size of banks in WAEMU zone are positively related to profitability.

Table 3 Distribution of Sample into Large and Small and Medium Size Banks

Country	Large size bank	Small and Medium size bank	Total
Benin	5	6	11
Burkina Faso	6	4	10
Cote d'Ivoire	9	6	15
Guinea			
Buisseau	0	4	4
Mali	6	5	11
Niger	4	5	9
Senegal	9	6	15
Togo	3	8	11
TOTAL	42	44	86
Criteria	Bank with Total Asset>100 million FCFA	Bank with Total Asset<=100 millions FCFA	

Source: Researcher compilation

Table 4 Bank's Size Effect on Profitability. This table reports results of general model 1 and those of the effect of a large bank (model 2) and small and size bank (Model 3) on Profitability. Panel static method (fixed effect and random) was performed after checking some precondition tests such as Chow, Breusch Pagan, Hausman, Modified Wald, Wooldridge tests. And after Panel Corrected Standard Error(PCSE) was performed to correct variance and autocorrelation problems

	Model 1: ROA PCSE		Model 2: Large Bank Random Effect		Model 3: Small bank PCSE		
	t-test	Prob	t-test	Prob	t-test	Prob	
SHER: Sharholder's Equity Ratio	3.37*	0.001	0.26	0.793	6.11*		0.000
LiDR: Liquid asset/deposit Ratio	1.02	0.308	2.01**	0.044	0.79		0.431
LiAR: Liquid asset /Tot asset Ratio	2.54**	0.011	-2.47**	0.013	3.43*		0.001
LDR : Loans /T. Deposit Ratio	1.31	0.189	3.49*	0.000	1.33		0.182
LAR: Loans to T. Asset Ratio	1.56	0.119	4.26*	0.000	2.02**		0.043
NIR: Cost / Income Ratio	-9.31*	0.000	-43.25*	0.000	-5.19*		0.000
NAR: Cost / liquid asset Ratio	-4.02*	0.000	4.67*	0.000	-2.23**		0.026
NIIR: Non interest income Ratio	5.41*	0.000	8.76*	0.000	4.08*		0.000
NPAR: Non performing Asset R.	0.26	0.795	1.01	0.315	-1.02		0.308
Logsize : Logarithm of Total Asset	1.68***	0.094					
LogsizeLarB :Large bank			-2.48**	0.013			
LogsizeSmB : Small med. bank					1.84***		0.066
BCR: Bank concentration Ratio	0.29	0.774	0.46	0.644	0.8		0.424
SMR : Stock market capitalisation	-1.04	0.297	-2.01**	0.045	-0.56		0.574
CPI/ Inflation	-0.13	0.899	-1.38	0.167	-0.01		0.988
PRGDP/ percapita GDP growth	-0.06	0.953	-0.40	0.693	0.04		0.965
Constant	-2.45**	0.014	5.53*	0.000	-3.23*		0.001
R²	0.6231		0.7835		0.593		
F-statistics					31.7*		0.000
Wald Statistic X²	689.20	0.000	3676	0.000			
Modified Wald X²	19.107	0.000			11.10 ⁹		0.000
Wooldridge	19.073	0.000	0.100	0.7532	21.18		0.00
Chow Test	27.1	0.000	114.2	0.000	41.87		0.000
Breusch-Pagan	3.91	0.024	229.54	0.000			
Hausman test	48.40	0.000	7.82	0.898	25.94		0.010
Observation	774	774	374	374	400		400

Note '*' '**' '***' showed respectively statistical significance at levels of 1%, 5% and 10%.

a) Analysis of results based on panel dynamic model

In order to find out whether profits are persistent or not in WAEMU banking sector by following Flamini V, McDonald C. and Schumacher L., (2009), Athanasoglou, et al. (2006b,) and others)), the generalized method of moments (GMM) approach was applied. In this study the dependent variables ROA was lagged one period and, the instrument (endogenous) variables are lagged 2 through 2 to override the endogeneity problems. When related to the literature and following Grove et al. (2014), Roodman (2009), all the bank-specific variables were used as endogenous variables among the explanatory variables which are first differenced, while bank-industry and macroeconomic variables are used as exogenous variables but are not first differenced and considered as control variables. Among control variables, Stock market capitalization ratio was considered as external instrument variable. That is why it is not figured in the outcomes. Also, a robust test was conducted by using two-step GMM estimator. More so, time dummies were used to control time invariant for Models. Table 6 reports the results for Model 4. The GMM estimator is consistent only if the lagged values of the explanatory variables are valid instruments. The Sargan (Johansen) test presented evidence that the underlying overidentifying restrictions are valid with $Pr(J) > 0.05$ and the Arellano-Bond test for serial correlation in the first-differenced residuals presents no evidence of model misspecification. The test has rejected the null of zero autocorrelation in the first differenced errors at order one ($AR(1) < 0.05$). However, the value test for the second order autocorrelation ($AR(2) > 0.05$) indicated that the moment conditions of the model are valid. Model 4 reported in Table 6 indicates that in addition to the significance of lag dependent variable ROA, eleven variables included bank-specific, bank-industry and macroeconomic variables and all the time dummy variables have significantly affected the dependent variable. These variables are Shareholder's equity ratio (SHER), Liquid asset / Total Asset Ratio (LiAR), Loans/total deposit ratio (LDR), Loans/ total asset ratio(LAR), Cost/ Income Ratio(NIR), Cost / Asset Ratio (NAR) Non-interest income /revenues ratio(NIIR), Natural logarithm of total assets (Logsize), Bank Concentration ratio measured by Total bank assets/GDP (BCR), Inflation rate (Change in Price Index (CPI)) and Real GDP growth per capita (PRGDP). While only two bank-specific variables such as the ratio of a liquid asset to deposit (LiDR) and ratio of Nonperforming asset/Total Asset (NPAR), do not have

significant effects on profitability. Moreso, dummy variables are positive and significant over the period except those of the year 2006 and 2007 which have been removed in the model. This indicates that most reforms performed in the banking sector during the period of study have a significant effect on bank profitability. Mostly those of 2014, have positively affected bank profitability.

When based the analysis on the direction of the relationship, it indicates that the lag dependent variable ROA has positively and significantly impacted the dependent variable at the 5% level. The coefficient of 0.021 indicated that profits of banks in WAEMU are persistent but with weak magnitude. The dynamic nature of the model is confirmed by the significance of the coefficient of the lagged ROA. This estimated coefficient of 0.021 has tended to reveal the existence of market power in the WAEMU banking sector pointing out a relatively competitive market structure. This shows that profits tend to adjust fast to their equilibrium level in WAEMU. Furthermore, other Studies of bank profitability have found lagged profitability to be significantly predictive of current profitability (; Athanasoglou et al. (2005 Ayaydin & Karakaya, 2014; Chronopoulos et al., 2012; Dietrich & Wanzenried, 2011; Garcia-Herrero et al.). The low value of this coefficient reflects a high degree of adjustment or adaptability of the banking industry to changes in its macroeconomic and financial environment (Athanasoglou et al., 2008). Moreover, the finding is also consistent with Gammadigbe (2012) who found the persistence of profit in the WAEMU banking sector. The analysis of bank-specific factors shows the results as follows:

Shareholder's equity ratio considered as a key proxy of capital has positively impacted the return on an asset at the level of 1% significance. This result is in line with theory and empirical evidence. Studies showing a positive relationship between capital levels and profitability include Alp et al. (2010), Ameer and Mhiri (2013), Athanasoglou et al. (2005, 2006); Bourke (1989), Demirguc-Kunt and Huizinga (1999), Flamini et al. (2009). . However, the positive sign of this coefficient does not mean that WAEMU financial system is a perfect market. In other words , in spite of the relative perfect market shown by the one-period lagged ROA model , WAEMU financial system is far from being characterized as a perfect capital market with symmetric information, under which the impact of increased capital on profitability will be negative (Berger, 1995b, Athanasoglou, et al, 2006, Flamini

et al., 2009)

The coefficient of Liquid asset to Total deposit ratio have the expected positive effect on profitability, but it stands insignificant. The higher liquid is the bank and the less vulnerable to a run. Higher liquidity may act to increase profitability by reducing insolvency risk costs. The results are in line with some empirical evidence (Almumani, 2013; Ayaydin & Karakaya, 2014) that found this ratio to be no significantly related to profitability.

Despite the negative expected effect of the coefficient of Liquid asset / Total Asset, it stands positive and highly significant at 1% level. According to portfolio theory higher risk leads to higher profitability. Lower liquidity means higher risk. This theory is in the line of some authors (Alp et al., 2010; Goddard et al., 2004;) who find a negative effect on profitability. They point out that Liquid assets typically earn a lower rate of return than the longer term loans banks make. However, some authors ((Bourke, 1989; Kosmidou et al., 2005; Shen et al., 2009) have found a positive effect on profitability. They have argued that the rationale offered is that more liquid banks have less need to resort to costly external funding. In other words, less expensive funding meant increased income. The findings are consistent with most of the previous empirical evidence in banking literature. So in line with some authors, banks are highly liquid⁶ in WAEMU banking sector.

Regarding coefficient of (Loans/total deposit ratio) credit risk, it shows an expected positive association with profitability at the 1% level significance. Theoretically, a high figure means lower liquidity. Flamini et al. (2009) have pointed out that credit risk is the main source of bank-specific risk in SSA. According to Golin & Delhaise, (2013), a figure in the 70_90% range is seen as optimal (with higher numbers being on the risky side, and below this range is conservative). In this thesis, the average value of this ratio stands at 64.5% in WAEMU banking sector. So this ratio stands below 70%. This can be explained that on average, WAEMU banks are conservatives in their credit risk levels. The results are consistent with studies of Flamini et al. 2009; Sohail et al., (2013) who find positive and significant relationships between this ratio and profitability. Both of these studies have

⁶ The average ratio of liquid asset/total asset is 105.8% as the descriptive statistic has indicated.

reported averages on this ratio below 70%. This is also in line with financial models where risk-averse banks require larger earnings to compensate for higher credit risk.

Basing on the coefficient of Loans/ total asset ratio (widely used to measure liquidity), there is evidence of expected positive and significant relationship between this ratio and profitability at 5% level. Loans are less liquid than the other main component of a bank's asset portfolio _ investment securities. Some authors (Francis (2013), Gul et al. (2011) find that the larger the share of loans on the balance sheet the greater will be the bank's profitability. So Higher liquidity may act to increase profitability by reducing insolvency risk costs. Thus, the results i are in line with most of the latter previous empirical banking literature.

In regards to Cost/ Income Ratio considered as a key of efficiency ratio, its coefficient is highly negative and significant at 1% level. Theoretically, higher numbers indicate that a bank is operating less efficiently. Its relationship with profitability is almost uniformly negative. The findings are consistent with theory and most empirical studies (Alexiou & Sofoklis, 2009; Almumani, 2013; Bourke, 1989; Francis, 2013; Heffernan & Fu, 2008; Kosmidou et al., 2005) .The results can be interpreted that banks in WAEMU are relatively incapable of passing on their costs to their customers completely.

Moreover, there is also evidence of a strong negative effect of Cost to Asset Ratio on profitability at 1% level significance. This ratio is less important than cost to income ratio considered as the most efficiency ratio. Also, the relative weak magnitude of this coefficient also points to potential large gains in profitability if banks manage to reduce their operating expenses better. The results are consistent with several studies which have found that high values of this ratio lower profitability (Alp et al., 2010; Athanasoglou et al., 2005, 2006; Demirguc-Kunt & Huizinga, 1999; Staikouras & Wood, 2004; Sufian, 2011.

Meanwhile, the coefficient of Ratio of Non-interest income /revenues (NIIR) has a positive and significant effect on profitability at 1% level. The expected positivity and significance of this ratio can be interpreted that in WAEMU, banks have been given through technological changes or innovations to enlarge their activities into nonbanking activities. But this cannot last like can do the interest income. Therefore, in WAEMU zone, banks' most important revenues are from interest income. This is line with Golin & Delhaise, (2013) who underlined that this ratio is seen to be less sustainable and of lower quality

than interest income. Therefore, the results of this study are consistent with these authors (Alper & Anbar, 2011; van, 2011) who find this ratio to be positively significant.

The coefficient of bank size (Logsize) was highly positive and significant on profitability at 1% level. Theoretically increased size is presumed to confer benefits which can enhance profitability. The fact that large banks carry out activities in the very less competitive market permit them to make efficiency gains that can be captured as higher earnings. This coefficient had the expected sign according to the economies of scale market power hypothesis. The results were in line with the followings studies (Flamini et al.2009; Athanasoglou et al., 2006;) that found size to be positively significant related to profitability.

The ratio of Nonperforming asset/Total Asset has no direct effect on profitability. Despite the negative sign of this coefficient, it has not significantly impacted profitability. This ratio provides indications of difficulties with a bank's loan portfolio. Problems with a bank's asset quality are usually assumed to decrease profitability. Many studies show that this ratio is negatively and significantly related to profitability ((Lee, 2012; Macit, 2012).

When based the analysis on the bank-industry factors, it shows that the coefficient of Bank concentration ratio (BCR) has a positive relationship with profitability as expected. This coefficient is weak and highly significant at 1% level. Contrary to the theory which states that when the banking sector is larger, it can be expected to be more competitive, which lowers the profitability of individual banks. But this is linked to developed economies. However when based on less developed economies with developed banking system this ratio used to be positively significant to profitability. This is the case in this study. WAEMU remains less developed economies which have fairly developed banking system. The findings are consistent with Raza et al., 2013; Tan & Floros, 2014 who have pointed out that in less developed countries greater financial system development can enhance efficiency and profitability. The small magnitude of the coefficient can be interpreted that, despite that WAEMU zone is from less developed economies, its banking system remains relatively developed when making a comparison with that of some developing countries.

In regard to macroeconomic factors, there is evidence of positive effect of inflation (CPI) on bank profitability as expected. The coefficient of 5.89 is highly strong and significant. This can be interpreted that banks in WAEMU zone foresee changes in inflation successfully and

promptly enough to adjust interest rates and margins. Furthermore through this result, one can find mathematical evidence when assuming that the Fisher (1911) equation holds. Let denote by r_L and r_D the real interest rate on loans and deposits, respectively, and π the inflation, bank spreads can be written in nominal terms as follows:

$$(1 + r_L)(1 + \pi) - (1 + r_D)(1 + \pi)$$

This can be rearranged as follows

$$(r_L - r_D)(1 + \pi)$$

Assuming that net interest margins are a major component of bank profits. Therefore this translates into a positive effect of inflation on bank profitability even when there is no attempt by banks to adjust interest rates in order to counter the impact of inflation shocks. The results are consistent with Flamini et al., 2009 who found a positive and significant relationship between inflation and profitability on SSA. Also the outcomes are in line with others studies (Athanasoglou et al., 2005, 2006; Demirguc-Kunt & Huizinga, 1999; Flamini et al) which found inflation to be positively and significantly related to profitability. Moreover, these outcomes is also the result of the lowest level of inflation kept in WAEMU zone during the period that covered this study. This is also the consequence an effective monetary⁷ policy implemented in the union.

Meanwhile, the coefficient of Real GDP Growth per capita (PRGDP) has negatively affected profitability. Despite an unexpected negative sign of this coefficient, it stands highly significant. The negative relationship can be interpreted that when ease of entry and competition increase, profitability is reduced along with GDP growth. Studies (; Ayaydin & Karakaya, 2014;; Staikouras & Wood, 2004) found negative relationship.

Table .5 Tests for Time Effects. This table reports the results of the time effect test for the model 4 covering the period of 2006-2014. This test has analyzed the dummy time variables of D2006.....D2014 in order to see whether the introduction of time dummy variables are necessary for the model 4 due to the many reforms performed in WAEMU banking sector during the period covered by this study.

Model 4	LM test: $\lambda_2 = \lambda_3 \dots = \lambda_T = 0$	P-values
Equation 7	$\chi^2_{P^{2P}}(9) = 4831.$	0.00000
Equation 8	$\chi^2_{P^{2P}}(9) = 14.245.$	0.20455

Source: Researcher calculation

⁷ According to The monetary policy, the standard level of inflation should not exceed 3% in the union. Each country have the duty to respect it.

Table 6 Factors influencing the bank profitability. This table reports results of model 4 for which Dynamic panel GMM first difference method was applied. Sargan test of over identified instruments is valid (p-value >0.05) and Arellano and Bond autocorrelation test shows that the model is not misspecified (R(1) <0.05 and R(2) >0.05) . all the bank –specific variables were used as endogenous variables among the explanatory variables which are first differenced, while bank-industry and macroeconomic variables are used as exogenous variables but are not first differenced. Also, the instrument variables are lagged 2 to 2 while the dependent variable is lagged 1 to 1 Also .For robustness of the model Two step GMM estimator was applied.

GMM first difference	t-test	Prob
Dep variable (ROA(-1))	2.36**	0.019
SHER/ Sharholder's Equity Ratio	9.58*	0.000
LiDR/ Liquid asset/deposit Ratio	0.88	0.380
LiAR/ Liquid asset /Tot asset Ratio	3.65*	0.000
LDR/ Loans /T. Deposit Ratio	3.64*	0.000
LAR/ Loans to T. Asset Ratio	2.47*	0.014
NIR/ Cost / Income Ratio	-13.0*	0.000
NAR/ Cost / liquid asset Ratio	-3.82*	0.000
NIIR/Non interest income Ratio	6.02*	0.000
NPAR/Non performing Asset Ratio	-0.09	0.925
Logsize/Logarithm of Total Asset	9.14*	0.000
BCR/Bank concentration Ratio	3.32*	0.001
CPI/ Inflation	2.38**	0.018
PRGDP/ percapita GDP growth	-3.20*	0.001
D"2008"	-3.68*	0.000
D"2009"	2.3**	0.023
D"2010"	6.94*	0.000
D"2011"	4.04*	0.000
D "2012"	2.2**	0.027
D"2013"	5.04*	0.000
D"2014"	3.52*	0.001
J-Statistic	40.815	
Pr(J Statistic) ¹	0.09006	
Johansen condition	Good	
Arellano-Bond Serial Correlation Test		
AR(1)²	0.0002	
AR(2)³	0.5019	
H0: No Autocorrelation		
Observation	774	774

Note ******* ****** ***** showed respectively statistical significance at levels of 1%, 5% and 10%

1. The test for over-identifying restrictions in GMM dynamic model estimation

2. Arellano-Bond test that average autocovariance in residuals of order 1 is 0 (H₀: No autocorrelation).

3. Arellano-Bond test that average autocovariance in residuals of order 2 is 0 (H₀: No autocorrelation

D:" dummy"

Source: Researcher calculation

5. Conclusions and recommendation

5.1 Conclusions

The topic of this study which is sorting to highlight factors that influence bank profitability in WAEMU has permit to used robust and sophisticated econometric models which lead to getting efficient outcomes. In regards to empirical evidence, the outcomes from the analysis of determinants of bank profitability based on cost efficiency theory, show that the relevant factors that influence the bank profitability in WAEMU are bank-specific factors (capital (SHER), liquidity (LiAR, LAR, LDR), efficiency (NIR, NAR, NIIR), Asset quality (Bank size), bank sector- factors such as bank concentration ratio (BCR) and macroeconomic factors (inflation (CPI) and real GDP per capita)). Out of these factors, the most important and most indispensable factors that need to be addressed by regulatory, authorities; bank executives; professionals and researchers revealed in this dissertation are capital (SHER) which without a required level and without being under the control of regulators will not be able to allow banks to carry out their important role dedicated to them, the loan-to-deposit ratio (LDR) which constitute the main sources of revenue for banks; the cost income ratio which is the factor degrading banks profitability by its excessive level; the inflation which is the main macroeconomic factor that positively affects bank profitability.

The limitation of this study is that it does not take into account all the banks in the regional sector. This because some banks' data do not cover the period (2006-2014) of the study, and some of them are newly created banks and do not possess any data. More so, some banks that cover the period have lacked data or have been merged with other banks or went into bankruptcy.

5.2. Recommendations

Based on the findings of the research, the following recommendations were made. it is recommended for.

Bank executives

- To focus on reducing operating expenses, which killed banking profitability in order to be more efficient source of improving banking effectiveness;

- To allocate and direct a significant share of medium and long-term credits to sectors with high potential for development, such as agricultural processing industries; and others; Inter-state transport projects.

Regulatory and decision-making authorities (BCEAO);

- To promote and strengthen bank penetration within the Union by subsidizing banks to enable the population to open free bank accounts as in the Western countries; the issuance of free debit and credit cards. Thus; debit cards will greatly solve the problem of the fluidity in the banking operations which makes customers wait for a long time. While credit cards will allow banks to have more revenues since the interest rates applied to these cards after being used remain high (between 16 and 18%).
- To ensure that the individual bank data (financial statements: balance sheet and income statements) published on its (BCEAO) database must be produced in Excel format and not in PDF format in order to facilitate the work of the researchers and encourage research on the sector.

For the future research, it may focus on the Analysis of the effect of bank sector performance on the economic growth

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APPENDIX 1 - Descriptive Statistic

	Mean	Median	Maximum	Minimum	Std. Dev	Skewness	Kurtosis	Observations
ROA	0.007	0.009	0.2268	-0.207	0.066	-0.768	21.984	774
ROE	0.028	0.118	0.26632	-0.29749	1.986	-4.058	132.318	774
NIM	0.068	0.064	0.870	0.009	0.043	11.008	181.704	774
RGDPG	0.043	0.042	0.118	-0.044	0.027	-0.062	4.767	774
SHER	0.076	0.086	0.650	-0.1448	0.208	-3.190	22.400	774
LAR	0.595	0.578	22.264	0.014	0.805	25.283	678.667	774
LDR	0.647	0.669	1.611	0.005	0.227	-0.181	4.575	774
LiAR	0.894	0.920	1.114	-0.033	0.105	-4.431	29.292	774
LiDR	1.085	1.061	3.137	0.096	0.248	3.084	26.183	774
NAR	0.111	0.084	0.880	0.022	0.090	3.578	21.125	774
NIR	0.805	0.740	8.520	0.262	0.629	5.697	53.070	774
NIIR	0.443	0.434	0.772	0.046	0.148	0.354	3.706	774
NPAR	0.133	0.118	0.595	0.001	0.091	1.387	5.893	774
Logsize	11.307	11.460	13.835	7.852	1.265	-0.384	2.446	774
LosizeLarBK	12.372	12.290	13.835	11.518	0.559	0.376	2.153	774
LosizeSmBK	10.310	10.481	11.659	7.852	0.866	-0.623	2.516	774
BCR	0.608	0.383	130.521	0.009	4.712	27.169	748.726	774
SMR	0.097	0.097	0.120	0.073	0.016	-0.100	1.628	774
PRGDP	0.013	0.012	0.139	-0.068	0.029	0.521	6.758	774
CPI	0.001	0.001	0.002	0.000	0.001	0.005	2.408	774

APPENDIX 2- Unit Root Tests.

	Unit root tests	Level		First difference	
		Statistic	Prob**	Statistic	Prob.**
ROA	Levin, Lin&Chu	-30.0517	0.0000		
	Im, Pesaran and Shin W-stat	-9.27885	0.0000		
	ADF-Fisher Chi-Square	395.024	0.0000		
ROE	Levin, Lin&Chu	-19.1934	0.0000		
	Im, Pesaran and Shin W-stat	-7.34830	0.0000		
	ADF-Fisher Chi-Square	387.305	0.0000		
NIM	Levin, Lin&Chu	-19.9560	0.0000		
	Im, Pesaran and Shin W-stat	-5.52427	0.0000		
	ADF-Fisher Chi-Square	307.814	0.0000		
SHER	Levin, Lin&Chu	-20.9398	0.0000		
	Im, Pesaran and Shin W-stat	-6.64020	0.0000		
	ADF-Fisher Chi-Square	334.343	0.0000		
LAR	Levin, Lin&Chu	-10.4306	0.0000		
	Im, Pesaran and Shin W-stat	-5.13653	0.0000		
	ADF-Fisher Chi-Square	318.981	0.0000		
LDR	Levin, Lin&Chu	-12.1533	0.0000		
	Im, Pesaran and Shin W-stat	-5.14735	0.0000		
	ADF-Fisher Chi-Square	307.010	0.0000		
LiDR	Levin, Lin&Chu	-26.0827	0.0000		
	Im, Pesaran and Shin W-stat	-7.20489	0.0000		
	ADF-Fisher Chi-Square	324.670	0.0000		
LiAR	Levin, Lin&Chu	-27.0415	0.0000		
	Im, Pesaran and Shin W-stat	-9.72874	0.0000		
	ADF-Fisher Chi-Square	377.606	0.0000		
NAR	Levin, Lin&Chu	-17.1193	0.0000		
	Im, Pesaran and Shin W-stat	-3.71638	0.0001		
	ADF-Fisher Chi-Square	261.613	0.0000		
NPAR	Levin, Lin&Chu	-3.90743	0.0000		
	Im, Pesaran and Shin W-stat	-3.90743	0.0000		
	ADF-Fisher Chi-Square	266.102	0.0000		
Logsize	Levin, Lin&Chu	-8.19614	0.0000		
	Im, Pesaran and Shin W-stat	-3.64569	0.0001		
	ADF-Fisher Chi-Square	329.301	0.0000		
BCR	Levin, Lin&Chu	-26.1916	0.0000		
	Im, Pesaran and Shin W-stat	-4.19710	0.0000		
	ADF-Fisher Chi-Square	375.391	0.0000		
SMR	Levin, Lin&Chu	-23.4122	0.0000		
	Im, Pesaran and Shin W-stat	-9.27594	0.0000		
	ADF-Fisher Chi-Square	402.775	0.0000		
PRGDP	Levin, Lin&Chu	-20.0346	0.0000		
	Im, Pesaran and Shin W-stat	-7.37148	0.0000		
	ADF-Fisher Chi-Square	370.342	0.0000		
CPI	Levin, Lin&Chu	-10.58201	0.000		
	Im, Pesaran and Shin W-stat	10.01945	0.0000		
	ADF-Fisher Chi-Square	265.616	0.000		

*Note: For all three tests, the hypotheses are as following: H₀: p>0.05 The series have a unit root. H₁: p<0.05 the series does not have a unit root.