

# **DETERMINANTS OF BANK NET INTEREST MARGIN: DOES MONETARY UNION MEMBERSHIP MATTER?**

A Thesis Submitted for the Degree of Doctor of  
Philosophy

By

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# ABSTRACT

The purpose of this thesis is to carry out an empirical investigation into whether membership of monetary union matter in the determination of bank net interest margin. Bank net interest margin is the difference in bank borrowing and lending rates relative to the total interest-earning assets.

We operationalise this study by comparing panels of commercial banks within and outside economic and monetary unions in Europe and Sub-Saharan Africa. For our European analysis we use bank-level data from nine Euro Area countries and seven non-Euro Area economies, in a dynamic empirical model, employing Arellano and Bover (1995)/Blundell and Bond (1998) system GMM estimation method. We find that stronger competition and efficiency, as well as greater macroeconomic stability in the Euro Area reduce bank net interest margins more than in the non-Euro Area. We attribute this to the well-developed single market with a strong socio-economic cohesion underpinning rather than the economic and monetary union

We extend the same level of analysis to the Sub-Saharan Africa, where we contrast our findings in the West African Economic and Monetary Union (WAEMU) with those of twenty non-monetary union Sub-Saharan African economies. Our findings in the Sub-Saharan African context reveal a rather different scenario. While the WAEMU enjoys relatively lower net interest margins than its non-monetary union counterparts, this is attributable to the union's ability to pursue vigorously its primary objective of maintaining price stability by maintaining lower interest rates. Unlike in the Euro Area we do not observe a reducing impact of bank competition and efficiency on bank net interest margin in the West African Economic and Monetary Union (WAEMU) as we do in the non-monetary union Sub-Saharan Africa. We find these results for the Sub-Saharan African analysis puzzling, and attribute it to the absence of a well-developed single/common market which is supposed to drive competition and efficiency with the effect of reducing net interest margins, as it obtains in the Euro Area.

Our conclusion is that it is rather the presence of a well-developed single market that engenders competition and efficiency effects to reduce bank net interest margins rather than membership of a monetary union per se

**Dedicated to my late father:**

***E. K. Adjei, Esq., B.A. (Ed)***

**For by him I am what I am today**

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Lastly, I am grateful to my wife, Emelia, and two wonderful kids, Andy and Angel, for their support and the many sacrifices they made for me throughout the years of my study.

# DECLARATION

I hereby declare that this thesis has not previously been accepted for any degree, award, or qualification by any other university or institution of academic learning, and is not concurrently submitted for any degree other than that of the PhD, being studied at Brunel University. I also certify that this thesis has been written by me and it is entirely the result of my own investigations except where otherwise identified by references and that I have not plagiarised another's work.



## **SEMINAR PRESENTATIONS ATTENDED**

- I presented my fifth chapter on Sub-Saharan Africa in April 2014 at a departmental seminar where members of faculty and departmental PhD colleagues made very useful suggestions which I took on board.
- In November 2015, I presented my fourth chapter on Europe at a departmental seminar where I received very insightful comments, especially regarding my econometric tests and results of my elected competition variables from members of faculty as well as my departmental PhD colleagues, which I took on board.

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# List of Acronyms

BCAP	Bank Capital
BCREDSK	Bank Credit Quality
BLIQ	Bank Liquidity
BMQCI	Bank Management Quality
BSIZE	Bank Size
CEEC	Central and Eastern European Countries
CEMAC	Economic Community of Central African States
CFA	CFA Franc – CFA in English is Financial Cooperation in Africa
CPI	Consumer Price Index
ECB	European Central Bank
ECCU	Eastern Caribbean Currency Union
EMS	European Monetary System
EMU	European Monetary Union
ERM	Exchange Rate Mechanism
ESH	Efficient Structure Hypothesis
EU	European Union
EXRATEPC	Percentage Change in Exchange Rate
FDI	Foreign Direct Investment
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GDPRGR	GDP Growth Rate
GMM	Generalised Method of Moments
HHI	Herfindhal-Hirschman Index
IMF	International Monetary Fund
INFRATE	Inflation Rate



NIM	Net Interest Margin
OCA	Optimum Currency Area
REALINT	Real Interest Rate
SCP	Structure-Conduct-Performance
SFA	Stochastic Frontier Analysis
SSA	Sub-Saharan Africa
USA	United States of America
USD	United States Dollar
WAEMU	West African Economic and Monetary Union

# CHAPTER ONE

## INTRODUCTION

The functions of a banking firm may be varied and complex (Freixas and Rochet, 2008), nonetheless, the definition of what role a bank plays in an economy, often found in the banking literature, consists of the core intermediation function of banks in channelling funds from savers to borrowers. And indeed, while modern banks increasingly engage in other activities such as off-balance sheet and fee for service business it is the core intermediation activity of banks which distinguishes a bank from other financial institutions. For example, Freixas and Rochet (2008) note that the definition used by regulators to determine whether a financial intermediary should submit to the prevailing prudential regulations for banks is: 'a bank is an institution whose current operations consist in granting loans and receiving deposits from the public'. Also in a cross-country study of the role of banks Allen and Carletti (2011) in Berger et al (2014) note that the total amount of intermediation is significant in all economies except the US which has a somewhat less intermediation. This definition of what constitutes a bank in Freixas and Rochet (2008) presupposes that the efficiency with which this function is discharged has economic growth and consumer welfare implications. As a result, the efficiency implications have spawned a lot of studies investigating the factors that are likely to impact the efficiency outcomes of this primary function of a bank, specifically net interest margins. The focus on net interest margin may be justifiably so where for example Heffernan (2005) find in a cross-country study of the US, Japan and the major Western European countries that for most of them at least two-thirds of bank's gross income derive from net interest income from their intermediation role rather than non-interest income. This therefore forms the basis of our motivation in this thesis to also focus on the bank net interest margin than to include non-interest income, which comprises of fees and commissions, from off-balance sheet business like derivatives and letters of credit, for instance.

In focusing on bank intermediation and on bank net interest margins it is also important that we understand them in the context of which of the two

approaches to commercial banking in the economic literature we follow in the thesis.

Two approaches are known in the financial economics literature, by which banks create deposit money. Lipsey and Chrystal (2004) note that while the two approaches offer different ways of looking at the banking industry they both are compatible and therefore necessary for understanding modern monetary control techniques. These are the ratios approach and the competitive model of banking. The first is the ratios approach which shows how, given an amount of reserves, banks create a large volume of deposit money. The weakness of this approach however is that it does not give an accurate picture of how modern banks do operate (Lipsey and Chrystal, 2004). The other is the competitive approach to banking which shows how banks operate in a competitive environment to attract the reserves they need to be able to create deposit money. This model is the modern world view of approach to banking, and gives insights into the competitive forces that are at work between banks themselves on one hand and between banks and other financial intermediation channels like the securities market on the other (Lipsey and Chrystal, 2004). A key assumption of the competitive model is that modern banks do not wait passively to receive deposits before they lend some money as a multiple of the deposit. Rather in the world of the competitive banking model banks wait to find a lucrative loan business opportunity, and then ensure funds are made available to be able to make the loan. The task of looking for the requisite amount of funds to be able to meet a loan opportunity entails either by offering higher interest to depositors, or by borrowing from other banks on the interbank markets.

Under the competitive model of banking which gives an understanding of the way modern banks work, banks strategically make business model choices according to how they structure their balance sheets. We identify three business models which commercial banks strategically adopt to serve the market. These are a retail-funded commercial bank, a wholesale-funded commercial bank, and a capital market-oriented bank. The retail-funded commercial bank is characterised by high share of loans funded by stable funding sources such as deposits. Roengpitya et al (2014) put the proportion of customer deposits to the overall liabilities of the average bank in this category of their sample at two-thirds. The second business model is the wholesale-funded commercial banks,

where banks have asset profile similar to the retail-funded category but are funded predominantly by inter-bank liabilities. And the last category which is the capital markets-funded have half of their assets in the form of tradable securities and funding from the more non-traditional sources of wholesale markets. We would like to state here that in both continental Europe and Sub-Saharan Africa, where we draw our samples the bulk of the commercial banks operate the retail-funded business model. Hence our analyses follow a model where the bank uses customer deposits as the primary means of funding in a competitive market (Ayadi et al, 2011)

One of the factors widely acknowledged in the literature on bank net interest margin as a key determinant is the role played by a bank market structure. Within a monetary union, we anticipate that the dynamics of these impacting factors, particularly the structure of the bank market, may be different from the dynamics in a non-monetary union jurisdiction, particularly as competition and efficiency outcomes may differ between them. Nevertheless, this has never been studied. Within the context of the European Union the establishment of an Economic and Monetary Union served to intensify the competitive conditions<sup>1</sup> and efficiency in the banking industry that had already been set in motion by such strategic drivers as deregulation and technological change that had already altered the face of the banking industry in the European union (Goddard et al, 2001).

While the empirical banking literature which focuses on the European banking sectors have some studies which investigate the effects of the economic and monetary union on different aspects of banking none of them directly investigates the direct effects of monetary union on net interest margins and its determinants. For example, Leroy and Lucotte (2014) examine the implications of banking competition for the interest rate channel in the Eurozone over the period 2003 to 2010. Utrero-González (2007) studies the effects of the adoption of the Single currency on banking market conditions by making a comparative analysis of the market conditions for banking sectors in Spain and France who are members of the Euro Area, and the UK and Denmark as non-Euro Area countries. Therefore, to the best of our knowledge this thesis is the first to directly study the impact of monetary union on the determination of bank net interest margins.

## **1.1 Aim**

Our main aim in this thesis is to contribute to the banking literature by looking at whether membership of a monetary union does matter in explaining variation in net interest margin (NIM). Particularly as we anticipate that the competition and efficiency forces in the banking industry typically generated by the establishment of an economic and monetary union have implications for the level of intermediation costs. We therefore set out in this thesis to look at their impact on net interest margins alongside the other determinants of net interest margins documented in both the theoretical and empirical literature. The EMU being the benchmark monetary union which is mimicked by many prospective monetary unions around the world, naturally becomes our laboratory for such a study, where we elect to limit ourselves to panels of commercial banks as opposed to other bank categorisations. A commercial bank is one whose primary business lies in deposit-taking and making loans. This contrasts with the business of investment banking which consists in securities writing, mergers and acquisitions advisory, asset management and securities trading. Although commercial banks do some investment banking, this is on a limited scale as it is not considered the primary business.

## **1.2 Problem Definition**

Given that the banking industry provides the channel for economic growth, in the sense that it channels funds from lenders to borrowers (Zhuang et al, 2009), it is important that this intermediation role is executed at the lowest possible cost for the realisation of greater social welfare, as the lower the bank net interest margins, the lower the social costs of financial intermediation. It must however be noted that in the European economic and monetary union the lack of a common deposit insurance scheme could negate any lower social costs of financial intermediation that could be afforded by the union. As the establishment of the EMU brought with it heightened competition, disintermediation and consolidation to the European banking landscape, European banking industry authorities and policy makers would be interested to know the quantified effects of the EMU, especially as it impacts cost of financial intermediation. It therefore becomes more compelling to look at how the forces generated by the EMU have shaped competition and efficiency, as well as other

determinants of this all-important intermediation efficiency measure, NIM. Our problem therefore is to investigate whether the dynamics of the determinants of NIM in a monetary union environment particularly as it regards the effects of competition on NIM, are different from those in a non-monetary union environment.

A bank's net interest margin, hereafter referred to as NIM, is defined as a bank's total interest income minus the total interest expense over its total earning assets, and represented in the following equation:

$$NIM = \frac{TOTAL\ INTEREST\ INCOME - TOTAL\ INTEREST\ EXPENSE}{TOTAL\ EARNING\ ASSETS} \quad (1.1)$$

While net interest margin is computed as in equation 1.1 above a simple model of it can be constructed following Barrell et al (2011) where we demonstrate that banks in the course of the discharge of their intermediation function incorporate in the spread between borrowing and lending rates some additional payments they make. These payments are the payment for the risk they take on when they hold capital to absorb the risk inherent in all their potential loans ( $rp$ ), the expected default rate on the loans they make ( $b$ ) which over time fluctuates, depending on the prevailing economic conditions, and finally the administrative costs ( $ad$ ), encompassing staff costs and all other overheads. To give an algebraic expression to this we represent the lending rate ( $rl$ ) as:

$$rl = rd + b + ad + rp \quad (1.2)$$

Where  $rl$  is the lending rate,  $rd$ , the deposit rate,  $b$ , the expected default rate on the loans the bank makes,  $ad$ , the administrative costs incurred for the bank's operations, and  $rp$ , is the capital the bank holds to absorb the risk inherent in all their potential loans.

Therefore, re-writing the above equation for  $NIM$ , expressed as the lending rate ( $rl$ ) minus the deposit rate ( $rd$ ) is:

$$NIM = b + ad + rp \quad (1.3)$$

This perspective is also shared by Haruna (2011) who notes that there are other additional payments for the services offered by banks in the course of the intermediation process. Such other costs may be incurred for example through loan screening and monitoring, savings processing and management, payment services; as well as information asymmetry. And that when these costs are higher in a bank it puts up the net interest margin, and the bank in question is deemed to be inefficient

### **1.3 Background**

During the 1990s a global trend towards financial markets globalisation and disintermediation, intense cross-border financial mergers and acquisitions activity, and financial markets consolidation, afforded by financial liberalisation, and advances in new technological innovations was observed. Within the European Union, this trend was further amplified by the single market programme in 1992, and the coming into force in 1993 of the Single Banking Licence. The Single Banking Licence derived from the Second Banking Coordination Directive which was adopted in December 1989; and fostered a progressively more integrated European financial market with the harmonisation of financial legislation and regulation across member countries. Subsequent to the foregoing developments was the establishment of the economic and monetary union (EMU) in 1999 with the introduction of the Euro purported to eliminate currency risk. This indeed was another catalyst to the whole process of disintermediation, intense cross-border financial mergers and acquisitions activity, and financial markets consolidation. When the European banking sector during this period of cross-border activity in the 1990s could be said to be characterised by consolidation and concentration, what appeared to be an observed phenomenon was that the concentrated nature of the market did not impair the competitive environment. One such observations was made by Goddard et al (2001) who point to the overall decline in net interest margins<sup>1</sup> as an indication of the resilience of the competitive European banking environment in the face of intense banking market consolidation and concentration during this period. Possible explanation to this market development could be attributed to the presence of industry contestability. Contestability is a notion in reference

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<sup>1</sup> They note that net interest margins and earnings for that matter were so depressed to the point that banks resorted to other streams of non-interest income in their bid to achieve growth.

to a market where as a result of relatively lower exit and entry barriers new entrants can withdraw from the market and recover their costs. This threat posed by new entrants forces monopolists to set prices as if they were operating in a highly competitive market. And under such conditions the number of firms in a market has no effect on whether prices are set at perfectly competitive levels (Goddard et al, 2001).

The unfolding disintermediation which also contributed to the heightened competitive conditions in the European banking sector, particularly in the Euro area. manifested itself in the redirection of business away from the banks in terms of savings and surplus from the non-financial sector to non-bank financial firms like pension funds, insurance firms, investment funds, and the capital markets. Again, all of this had the ramifications of thinning net interest margins (NIM)<sup>2</sup>.

In addition to these trends in falling net interest margins, rising competition, disintermediation and other classic factors empirically proven in the banking literature as having an impact on net interest margins (NIM) were also impacted by the advent of the EMU. For example, the ECB at the inception of the single currency anticipated that the EMU would impact on credit risk, among the risks banks would ordinarily incur in the course of their business. It was expected that due to the positive macroeconomic impact deriving from the EMU credit risk in the Euro area for example will be moderated or mitigated. Specifically, it might be expected that as the macroeconomic environment improves businesses flourish and are therefore able to keep up with the repayments on business credits and loans. It must also be said that due to deeper and more liquid markets that come with EMU, banks' liquidity risk, as well as markets' liquidity risks were expected to reduce. Also, while the low interest rate environment induced by the EMU may have served as a disincentive to depositors who might have sought alternative investment products for their funds this may also have forced banks to source funding at rather higher interest rates, and thereby putting up banks' NIM with negative effect on social welfare. Furthermore, with the single currency there was no longer a place for currency exchange between different currencies within the

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<sup>2</sup> Bikker and Bos (2008) however argue that to the extent that the Euro area economy continue to be predominantly small and medium scale-based bank loans and other bank-based products continue to be preferred to market-based financing.



EMU. This was expected to eliminate the loss of funds that would normally come through margins of currency dealers in a competitive market<sup>3</sup>, save individuals and businesses money and help them to flourish and expand. An added effect of the elimination of exchange rate risk was a reduction of systemic risk through the lowering of real interest rate (De Grauwe, 2012). This is because the elimination of exchange rate risk makes the economic environment within a monetary union less risky, in which case investors demand lower risk premium for the same investment, and a lower discount rate for that matter. A ripple effect of this will then be a reduction in systematic risk by way of a perceived sound investment environment, leading to an eventual economic growth and stability. It must, however, be mentioned that the expectation that bank lending business might flourish and credit risk mitigated due to a positive macroeconomic environment afforded by the economic and monetary union, could not be fully realised due to cross-border lending to countries like Greece (ECB, 1999). At this juncture we distinguish between systemic risk and systematic risk. Systematic risk, also called market risk, refers to a situation where all investments are equally affected by an underlying adverse economic factor or external shocks, rendering the full benefits of any diversification unachievable. On the other hand, systemic risk is related to specific problems with a company or industry and therefore idiosyncratic in nature. It is the risk that an event, like financial problems in a particular firm could adversely affect financial markets. For example, a cascading failure in the financial sector, caused by interconnectedness within the financial system, as was the case of Lehman Brothers sparking the 2007/2008 global financial and economic crisis.

The observation by Goddard et al (2001) which suggests an inverse relationship between competition and net interest margin, coupled with its use in the banking literature and in practice as one of the simple proxies for banking competition (Bikker and Bos, 2008) motivates us to investigate if indeed the dynamics of competition as well as other actors known to conventionally explain variations in net interest margins are different in a monetary union from those in

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<sup>3</sup> The EU commission (EU, 1990) projected an average savings in dealers' margins of 0.4%; quite a smaller percentage (0.1%) was however registered in countries with advanced banking systems like the UK where the bulk of currency exchange transaction are through the banking system where the IT resources required to convert currencies are not as costly as involving human contact like small tourist transactions.

a non-monetary union. Specifically, our question is whether monetary union membership does matter in the determination of net interest margins. To the best of our knowledge we are the first to test these dynamics and hence our contribution to knowledge.

As aforementioned, within the European banking literature, there have been a few studies into what factors do cause variation in net interest margins however none of these has specifically investigated the impact of the establishment of the economic and monetary union (EMU), nor has any of them covered to any appreciable extent the period following the EMU, nor studied the Euro Area exclusively. For example, Maudos and De Guevara (2004) studied the factors that explain interest margins in the banking sectors of the European Union, covering Germany, France, the UK, Italy and Spain. Nevertheless, while there was no attempt to distinctly make any comparative analysis between countries of the Euro Area and non-Euro Area, the studied period was 1993 – 2000 when the Euro was not in circulation even though it was introduced in 1999. The same could also be said of the study by Claeys and Vennet (2008) comparing Western European countries with the Central and Eastern European Countries (CEEC) over 1994 – 2001; and Saunders and Schumacher (2000) whose study covered the pre-EMU period, 1988 – 1995, focusing on Germany, Spain, France, Great Britain, Italy, Switzerland and the United States of America (USA).

More recent studies include Louri and Migiakis (2016) who study the determinants of bank margins in the Euro and non-Euro Areas.

## **1.4 Tested Hypothesis**

### **Hypothesis 1**

We hypothesize that the two efficient structure hypotheses, that is, the X-efficiency, proxied by bank cost-to-income ratio (BMQCI) and S-efficiency, also proxied by bank total assets (BSIZE), both have a reducing impact on NIM in the Euro Area than in the Non-Euro Area. The X-efficiency refers to management efficiency, and the S-efficiency also refers to scale efficiency effects. We would however like to note that because the possible collapse of some large and complex banks could generate negative externalities that could cascade into the real economy, for which reason governments and regulatory authorities endeavour to prevent always, S-efficiency could have a positive

impact on NIM. This problem with large and complex financial institutions is what is often referred to in the banking literature as ‘too-big-to-fail’ (Dudley, 2012)

### **Hypothesis 2**

The degree of banking competition measured by the Boone indicator, the Lerner index and the Herfindhal-Hirschmann index (HHI), has a larger reducing impact on NIM in the Euro Area than in the non-Euro Area because of the effects of the EMU. While the H-statistic of the Panzar-Rosse model is the most widely applied competition measure in the banking literature, particularly for its simplicity, we do not include it in our analysis (Leon, 2014). This is because of the unsolved controversy surrounding the continuous nature of the H-statistic. Leon (2014) notes that, although in empirical studies the H-statistic is often considered as a continuum value the question remains unresolved.

### **Hypothesis 3**

We hypothesize that percentage change in exchange rate (EXRATEPC) has a more reducing effect on NIM in the Euro Area than in the non-Euro Area.

## **1.5 Structure of thesis**

For the foregoing purposes and as our laboratory for the tested hypotheses we deem the European Monetary Union (EMU) the natural choice where we contrast the dynamics in the Euro Area with the non-Euro Area. Our choice of the European EMU at this stage of our analysis is motivated by the fact that it has become the benchmark which all Sub-Saharan Africa (SSA) monetary union endeavours mimic and are evaluated (Oshikoya et al, 2010). For example, the Gulf Cooperation Council (GCC) in their monetary union project agreed on five convergence criteria which mimic those employed by the EU in their adoption of the Euro (Oshikoya et al, 2010). Given the general perception of the European monetary union, having been beneficial for its members, it has stimulated interest in monetary unions in regions outside Europe, including in Africa (Masson and Pattillo, 2005; Jefferis, 2007,). In this connection we extend our analysis of the European experience or monetary union project to Sub-Saharan Africa (SSA) where we contrast our findings in the West African Economic and Monetary Union (WAEMU) with the rest of non-monetary union Sub-Saharan Africa (SSA) in a pretty similar fashion. The remainder of the thesis is therefore structured as follows:

**Chapter Two** reviews the extant theoretical and empirical literature on the determinants of net interest margin. The two theoretical frameworks commonly used in investigating the determinants of net interest margin are the Ho and Saunders (1981) Dealer model, and Monti-Klein (1972) monopoly model. Of the two models we review the Ho and Saunders (1981) dealer model since it is the most popular in empirical application, and in the empirical literature section review studies that have extended the model in investigating the determinants of net interest margins.

**Chapter Three** considers that the theory of optimum currency areas (OCA), pioneered by Mundell (1961), McKinnon (1963), and Kenen (1969), is the relevant theory that underpins any discussion on monetary integration in the context of articulating the conditions under which a monetary union thrives, and therefore discuss this and how it did help in shaping the EMU. We as well discuss the costs and benefits of the EMU, particularly in respect of the banking industry.

Recognizing that non-macroeconomic convergence has risk implications for the determination of NIMs, to the extent that the Euro and the non-Euro zones' respective abilities to deal with economic shocks harmoniously will impact on the manner in which the respective macroeconomic environments will impact on the cost of financial intermediation, in this chapter we use the techniques of panel unit root and sigma convergence to test the extent to which the Euro and non-Euro Areas are converged on our selected macroeconomic variables. As a preliminary approach to testing convergence we employ the methods of graphical analyses and pairwise correlation matrices. We observe that while our macroeconomic variables are broadly converged in both zones, their average speed of convergence as measured by  $\beta$  is higher in the Non-Euro Area than in the Euro Area, with the exception of GDP growth rate (GDPRGR) which average speed is higher in the Euro Area than in the Non-Euro Area.

We extend the same analysis to our Sub-Saharan African sample, but here only using the more robust test of panel unit root technique. The result indicate macroeconomic convergence in both the WAEMU and the non-monetary union Sub-Saharan Africa, but a higher speed of convergence in the non-monetary union Sub-Saharan Africa than in the WAEMU.

**Chapter Four** is our first and main empirical chapter aimed at testing the effect of monetary union environment on the determination of bank net interest margins. To this effect we use a total sample of 361 banks from the European Union, made up of 290 banks from the Euro Area, and 71 banks from the non-Euro Area for the period 2002 - 2013, from across 16 countries, namely Austria, Belgium, Germany, France, Greece, Italy, Luxembourg, Netherlands, Portugal, for the Euro Area; and Bulgaria, The Czech Republic, Croatia, Hungary, Lithuania, Poland, and Romania for the non-Euro Area. Our choice of the EU was motivated by the fact that the EU has become the model of monetary union arrangements on which all SSA monetary union endeavours are modelled. We use the Arellano and Bover (1995) system GMM estimator which is robust to endogeneity problems and allows for the inclusion of a lagged dependent variable, and to control for unobserved heterogeneity between banks. We contrast our findings in the Euro Area with the non-Euro Area. Overall, while our hypotheses of a reducing impact on net interest margin from the presence of S-efficiency, X-efficiency, our competition proxies (the Boone indicator, the Lerner index and the Herfindahl-Hirschmann Index) as well as our exchange rate stability proxy, are supported in both the Euro and Non-Euro Areas, we find the magnitude of the impact from these proxies, greater in the Euro Area than in the non-Euro Area. For the rest of our control variables which have a positive impact on NIM the results point to the more competitive environment of the Euro Area which facilitates a more moderating effect on NIM than in the non-monetary union environment, that is, the Non-Euro Area. We find that the competition and efficiency effects that reduce net interest margins in the Euro Area derive from there being a well-developed single market with a strong socio-economic cohesion underpinning rather than the economic and monetary union which was found to be incomplete, because it lacked a fiscal and a political union, and therefore contributed to the European sovereign debt crisis.

In **chapter five** our objective is to use our analysis for the European Union as a benchmark to extend the same level of analysis to evaluate the determination of net interest margins in a monetary union environment versus a non-monetary union environment in Sub-Saharan Africa (SSA). We use a total sample of 185 banks, made up of 45 banks from the WAEMU and 140 banks from the non-monetary union SSA, from across 7 countries of the WAEMU and 20 non-monetary union SSA countries. These are Burkina Faso, Benin, Cote

D'Ivoire, Mali, Niger, Senegal, and Togo for the WAEMU; and Burundi, Botswana, Ethiopia, Gambia, Ghana, Kenya, Lesotho, Madagascar, Mauritania, Mauritius, Malawi, Mozambique, Namibia, Nigeria, Rwanda, Sierra Leone, Swaziland, Tanzania, Uganda, and South Africa for the non-monetary union SSA. Unexpectedly our tested hypotheses of a reducing impact from competition and percentage change in exchange rate on NIM, the presence of S-efficiency and X-efficiency are rather supported in the non-monetary SSA than in the WAEMU. This is puzzling and we attempt to provide answers. We find that it is the absence of a well-developed single market in the WAEMU which explains the unexpected effect of competition and efficiency on net interest margins in the region.

**Chapter Six** summarises our findings in the entire thesis, makes policy recommendations, and sets the agenda for future research. In the final analysis conclude that it is rather the presence of a well-developed single market that engenders competition and efficiency effects to reduce bank net interest margins rather than membership of a monetary union per se.

# **CHAPTER TWO**

## **LITERATURE REVIEW**

### **2.1 The Theoretical Background on Net Interest Margins**

When comparing a bank to an industrial organisation firm we are confronted with conceptual difficulties. For example, Klein (1971) notes that difficulty in being able to appropriately define bank input or output makes it presumptuous to speak of a production function relating the two. Given that, analyses by most models of the bank at the micro-level have solely focused on its intermediation role of allocating funds among competing stocks of assets in an environment characterised by risk or uncertainty (Klein, 1971). This is further reinforced by how regulators define what constitutes a bank when assessing which financial intermediaries need to abide by the prevailing prudential regulations for banks: “a bank is an institution whose current operations consist in granting loans and receiving deposits from the public” (Freixas and Rochet, 2008). In this context it is in the interest of social welfare and bank regulators that this intermediation role is discharged with all the efficiency it requires. And one of the commonly used measures to gauge bank efficiency is the ratio of net interest margin (NIM), which underpinning theoretical and empirical modelling we now review.

The theoretical literature on net interest margins (NIM) postulates two major approaches to modelling it. These are: the work of Ho and Saunders

(1981), who model the intermediation function of the bank as a passive dealer who is assumed to demand one type of deposit and supplies one type of loan, between providers and users of funds. The bank is assumed to make what the model calls “pure spread” which is determined by: (i) the level of risk aversion of bank management; (ii) the market structure of the operating environment of the bank; (iii) the average size of transactions carried out by the bank; and (iv) the variance of interest rates. The alternative model is the Monti-Klein (1972) model which applies standard theory from industrial organization, and uses a monopoly bank in which scenario it can be demonstrated that in the absence of default risk interest rates on loans and deposits can be determined separately (Monti, 1972, and Klein, 1971). In this model the banking firm is viewed in a static setting where demand for loans and supply of deposits are assumed to clear at the same time in the loan and deposits markets. This model was subsequently expounded by Zarruk (1989), Wong (1997) and Barajas, et al (1999).

Of the two models the most widely used in empirical studies on the determinants of NIM which we also use in this thesis has tended to be the Ho and Saunders’ (1981) dealership model, but before we explore it in any further detail we look at the Monti-Klein (1972) monopoly model first.

## **2.2 The Klein-Monti (1972) model**

The Klein-Monti (1972) model of bank behaviour is a prototype model of the so-called Industrial Organization approach to banking, and looks at the way banking firms react to their environment in an optimum fashion. Adapting from Freixas and Rochet (2008) the starting point of the Monti-Klein Model is the assumption that perfect competition may not be seen to be really appropriate for the banking industry given the existence of important entry barriers like regulatory/structural regulation, reputation, required expertise and sunk costs (Freixas and Rochet, 2008). The model considers a representative, profit-maximizing monopolistic bank facing a demand curve for loans  $L(r_L)$  which slopes downward and a supply curve for deposits  $D(r_D)$  with an upward slope. Taking the bank’s level of equity as given, it determines the amount of loans ( $L$ ) and the amount of deposits ( $D$ ), making them the bank’s decision variables. To derive the profit maximisation conditions of the bank its profit function is as follows, assuming the bank takes  $r$  as given, either as issuing from the central



bank or predetermined by the equilibrium rate prevailing on international capital markets:

$$\pi = \pi(L, D) = (r_L(L) - r)L + (r(1 - \alpha) - r_D(D))D - C(D, L) \quad (2.1)$$

The bank's profit can be calculated as the sum of the intermediation margins on loans and on deposits minus management costs. Assuming  $\pi$  is concave, so that the maximum of profits can be characterised by first order conditions, the first order conditions which equate marginal revenue and marginal cost are:

$$\frac{\partial \pi}{\partial L} = r'_L(L)L + r_L - r - C'_L(D, L) = 0, \quad (2.2)$$

$$\frac{\partial \pi}{\partial D} = -r'_D(D)D + r(1 - \alpha) - r_D - C'_D(D, L) = 0 \quad (2.3)$$

By way of introduction we write the elasticities of the demand for loans and the supply of deposits as:

$$\varepsilon_L = - \frac{r_L L' (r_L)}{L(r_L)} > 0 \quad (2.4)$$

and

$$\varepsilon_D = - \frac{r_D D' (r_D)}{D(r_D)} > 0$$

The solution of (2.2) and (2.3), that is, rearranging can be characterised by:

$$\frac{r_L^* - (r + C'_L)}{r_L^*} = \frac{1}{\varepsilon_L(r_L^*)} \quad (2.5)$$

$$\frac{r(1 - \alpha) - C'_D - r_D^*}{r_D^*} = \frac{1}{\varepsilon_D(r_D^*)} \quad (2.6)$$

Equations (2.5) and (2.6) state that the banking firm, having its operations in monopoly competition conditions, determines the prices of its loan and deposit services in such a manner that equates the Lerner indices to the inverse of the interest elasticity of the functions of loan demand and deposit supply. In that way, the less sensitive the functions of loan demand and deposit supply are to variations in interest rate, the greater the bank's margin will be in both loan and deposit-taking operations and, therefore, the greater the bank's

spread. The foregoing equations are just the adaptation of the familiar equalities between Lerner indices, computed as price minus cost divided by price, and inverse elasticities to the banking industry (Freixas and Rochet, 2008). This is such that the elasticity becomes smaller and the Lerner index higher when the bank wields market power in the deposits/loans market. This will mean a monopolistic bank will set the volumes of its loans and deposit in a manner that will equate the Lerner indices to their inverse elasticities. If, nonetheless, on financial markets other banks produce substitutes then intermediation margins will be adversely affected. For example, if households are able to access funds from the money market as substitutes to bank deposits, or similarly when firms are able to access the capital markets instead of contracting bank loans for their operations intermediation margins will be adversely affected.

### **2.3 Ho and Saunders (1981) Dealer Model**

The mechanics of the Ho and Saunders (1981) dealership model were demonstrated in a seminal paper which was born out of the inadequacies of the models at the time in explaining bank behaviour when growing concerns by bankers and regulators over trends in interest rate volatility that harmed banks' interest margins were rife; and as well only a few theoretical models that had been put forward to explicitly analyse the determination of bank interest margins existed<sup>4</sup>. The starting point of the Ho and Saunders (1981) dealer model is that in exercising the function of a dealer, that is, demanding one type of deposit and supplying one type of loan the bank faces a huge uncertainty and therefore cost. This cost derives from the fact that in providing immediacy of loan supply and deposit-taking the bank faces uncertainty engendered by deposit-taking and loan demands that come at different times. Therefore, it becomes necessary that the bank is compensated for this cost by charging an interest spread which is positive for the price of immediacy provision on loan and deposit services. And that even in a highly competitive environment this positive spread would exist for as long as transactions uncertainty exists. Central to the model is the proposition that the interest spread which they call pure spread or margin is the optimal sum of fees or mark-up on deposit-taking and loan supply, and depends on the following four factors: (i) the degree of risk aversion of bank

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<sup>4</sup> The hedging hypothesis and those models with its roots in the microeconomics of the banking firm and reviewed by Pyle (1972) and Baltensperger (1980) were some of such models.

management; (ii) the structure of the market in which the bank operates; (iii) the average size of bank transactions; and (iv) the variance of interest rates (Ho and Saunders, 1981). The dealer model consists of a two-step approach whereby Ho and Saunders (1981) estimate the size of the pure margin by taking account of a number of market imperfections and regulatory restrictions, not explicitly considered in the theoretical model, which are, nonetheless, deemed likely to affect the true spread derived from the bank balance sheet and income statement. These factors are the probability of loan defaults, the cost of implicit interest payments on deposits and the opportunity cost of required reserves. These idiosyncratic factors unique to an individual bank are then used to derive the 'pure' spread or interest margin which is constant across all banks and represented by the intercept of a cross-sectional regression. In the second step using the pure spread as the dependent variable the empirical relationship between the pure spread and (i) the degree of risk aversion of bank management; (ii) the structure of the market in which the bank operates; (iii) the average size of bank transactions; and (iv) the variance of interest rates (Ho and Saunders, 1981) is then tested.

The basic assumption in the derivation of the intermediation margin in this model is that the bank is considered viewed as a risk-averse dealer in the credit market with the function of intermediating between the provision of loan and deposit-taking. A further assumption is a one-period planning horizon whereby the bank is deemed to sets interest rates at the beginning of the period, to remain constant for the whole period, before any deposit or loan business is transacted. The bank is also assumed to aim at maximizing the expected utility of terminal wealth. The risk averse bank has to solve the problem of asynchronous outflow of loans, and inflow of deposits in time and must set interest rates on loans  $r_L$  and deposits  $r_D$  optimally in order to minimise the risk issuing from interest rates uncertainty in the money markets from where funds need to be obtained should there be excessive loan demand or inadequate supply of deposits. The risk of interest rate uncertainty manifests itself as follows: supposing a deposit is made at the bank at some long-term rate  $r_D$ , if this deposit arrival does not meet an instant demand for loans, the bank will need to temporarily invest the funds in the money market at the short-term risk-free rate  $r$ , in which case the bank faces a reinvestment risk at the

end of the decision period should the short-rate fall. Conversely, if a new loan demand is not met by a corresponding deposit flow, the bank would need to fall on to short-term borrowings in the money market at rate  $r$  to fund the loan demand. In this particular instance should the short-term rate  $r$  rise the bank will be facing a refinancing risk at the end of the decision period. Given the two scenarios they as a result set their interest rates as a margin in relation to the money market interest rate  $r$ , that is the expected risk-free or market interest rate, as follows:

$$r_D = r - a \quad (2.7)$$

$$r_L = r + b \quad (2.8)$$

where  $a$  and  $b$  are the margins set by the banks in relation to the money market interest rate for deposits and loans respectively, indeed the risk premia charged to compensate for the transaction risk involved in financial intermediation. In this case the optimal, expected utility-maximizing, deposit and loan rates or deposit-loan interest spread(s) or margin can be written as<sup>5</sup>:

$$s = r_L - r_D = a + b \quad (2.9)$$

In the final analysis Ho and Saunders (1981) demonstrate that the deposit-loan interest spread(s) or margin where the risk-averse profit-maximizing bank maximizes its utility of terminal wealth is a function of the competitive conditions and a risk-adjustment term and can be expressed as:

$$s = (a + b) = \alpha/\beta + \frac{1}{2} R\sigma \frac{2}{1} Q \quad (2.10)$$

The first term or  $\alpha/\beta$  is the ratio of the intercept ( $\alpha$ ) and slope ( $\beta$ ) of the symmetric deposit and loan arrival functions and measures the monopoly rent element in bank spreads or margins. The size of the risk-adjustment term

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<sup>5</sup> Both the Monti-Klein and Ho & Saunders models assume that banks exercise market power in determining the interest rates on loans and on deposits, which is a feature both models share in common (Costa Da Silva et al., 2007)

depends on three factors: (i)  $R$ , bank's management's coefficient of risk aversion; (ii)  $\sigma_1^2$ , interest rate volatility; and (iii)  $Q$ , transaction size. Increased competition or lower market power ( $\alpha/\beta$ ) lowers net interest margin  $s$ . Degree of risk aversion  $R$  determines the size of the risk premium charged. If risk appetite increases, that is,  $R$  decreases, the risk premium charged is smaller and net interest margins decrease.

In sum the model assumes that the most important determinants of bank interest margins are the degree of risk aversion, the market structure, the average size of bank transactions and the variance on the interest rate on loans and deposits.

The Ho and Saunders (1981) model unlike the Monti-Klein (1972) one, assumes that the bank is a risk-averse agent. In other words, the bank's ultimate goal is to maximise the expected utility of profit rather than to maximise expected profit (Costa da Silva et al, 2007). Using Taylor series expansion to obtain the bank's expected utility of wealth ( $U(w)$ ) the first order conditions yield the intermediation margin as demonstrated by Ho and Saunders (1981). We follow Maudos and De Guevara (2004) who rather incorporate the influence of credit risk and operating costs to demonstrate the mechanics although we do not demonstrate the full derivation here. Maudos and De Guevara (2004) demonstrate that the optimum spread ( $s^*$ ) is given by:

$$s^* = \frac{1}{2} \left( \frac{\alpha_D}{\beta_D} + \frac{\alpha_L}{\beta_L} \right) + \frac{1}{2} \left( \frac{C(L)}{L} + \frac{C(D)}{D} \right) - \frac{1}{4} \frac{U''(\bar{W})}{U'(\bar{W})} [(L + 2L_0) \sigma_L^2 + (L + D) \sigma_M^2 + 2(M_0 - L) \sigma_{LM}] \quad (2.11)$$

where  $\alpha_D$  is the linear intercept of a possibility of a deposit at the bank probability function;  $\beta_D$  is the sensitivity of the probability that a deposit is being made at the bank to variations in the deposit interest rate;  $\alpha_L$  is the linear intercept of the probability function of  $a$ ;  $\beta_L$  is loan application sensitivity to variations in the credit operation interest rate;  $C(L)/L$  is the average cost of credit operation;  $C(D)/D$  is the mean cost of deposit-taking operations;  $W$  is

the bank's final stock of wealth;  $-\left[\frac{U''(\bar{W})}{U'(\bar{W})}\right]$  is the bank's absolute degree of risk aversion;  $\sigma_L^2$  is the standard deviation of the yield on loans (a measure of the bank's credit risk);  $\sigma_M^2$  is the standard deviation of the yield on applications/loans on the inter-bank market (a measure of the bank's interest rate risk);  $\sigma_{LM}$  is the co-variance between credit risk and interest rate risk;  $L_0$  is the bank's starting stock of loans; and  $M_0$  is the bank's initial net position on the inter-bank market.

In conclusion, as per the theoretical model employed by Maudos and De Guevara (2004), and abstracting from equation 2.1 the determinants of interest margins are as follows:

- Average operating costs of the bank  $\left(\frac{C(L)}{L} + \frac{C(D)}{D}\right)$ . The logic is that banks will require a positive margin to be able to cover operating costs.
- The competitive structure of the market, which depends on the interest elasticity of the demand for loans, and the supply of deposits. In which case the less elastic the demand for loans or supply of deposits, the less the value of  $\beta$  will be. And the bank will be able to charge high interest margin in the case of the exercise of monopoly power. This explains the inclusion of  $\alpha/\beta$  as a proxy for possible monopoly profits implicit in margins
- The assumption that the bank is risk averse:  $-\left[\frac{U''(\bar{W})}{U'(\bar{W})}\right]$ , and that the more risk-averse banks will charge higher margins.
- The volatility of money market interest rates:  $\sigma_M^2$ . Obviously the more volatile they are the greater the market risk which will reflect in higher margins.
- The credit risk:  $\sigma_L^2$ . The higher the risk of default on loans the higher will be the margin charged by the bank.
- The covariance or interaction between loan risk and interest rate risk captured by the variable  $\sigma_{LM}$ .

- The average size of the credit and deposit operations undertaken by the bank, also captured by the term  $L + D$ , and the total volume of credits:  $L + 2L_0$ .

The model postulates that the unit margins are an increasing function of the average size of operations. This is because for any value of credit risk as well as market risk, a greater size operation would imply a greater potential loss and hence the need for a greater margin. Similarly, for banks with greater volume of loans the potential loss will be greater.

As can be appreciated the Ho and Saunders (1981) model provides a simple, yet formidable theoretical framework that explains the interest rate spread and readily lends itself to application. This notwithstanding it is fraught with some important limitations (Brissimis and Vlassopoulos, 2007). In particular, this model takes no account of the credit risk inherent in loans or the production cost associated with the intermediation process. It also assumes that the bank accepts only one type of deposit and offers only one type of loan. Claeys and Vennet (2008) also state that one drawback of the Ho and Saunders approach is that, although bank-specific variables are used to determine pure bank margins, it does not take into account the possible heterogeneity across banks, both within the same market and over different countries. Subsequent empirical studies address these limitations of the original model, as demonstrated in Maudos and De Guevara (2003) in the foregoing theoretical application, through more comprehensive variations of the dealer model (Brissimis and Vlassopoulos, 2007) which we now turn to in the next section.

## **2.4 Empirical Literature on Net Interest Margins**

Empirical literature on NIM abound and we do not attempt to cover it in full. We will instead focus on results of typical studies which made more comprehensive variations to the dealer model and are relevant to the variables we intend to employ in our study.

Following on from Ho and Saunders's (1981) the intuition that extending their dealership model from a structure with one kind of loan and deposit to loans and deposits with many maturities would lead to further interesting insights into margin determination especially as 'portfolio' effects may become

apparent Allen (1988) presents an extension of the model in which the bank offers numerous types of deposits and loans. Her model shows that the dispersion of the uncertainty-associated risk across more banking products reduces the interest rate spread that such uncertainty can justify. She demonstrated that pure interest spreads may be reduced when cross-elasticities of demand between bank products are considered. And that the resulting diversification benefits may come from a type of portfolio effect whereby there is an interdependence of demands across bank products.

Mcshane and Sharpe (1984) empirically test the dealership model of Ho and Saunders (1981) in the context of Australian trading banks. They find that a non-linear relationship exists between Australian trading bank net loan/deposit interest margins and market power measures, degree of absolute risk aversion, and interest rate uncertainty. This may be due to the fact that when banks become very large, the effect of size could be negative beyond a certain point of initial enjoyment of scale economies, due to bureaucratic or other reasons like agency problems, control problems and all the difficulties and costs associated with managing large institutions.

Employing data for different classes of banks in the US over the period 1989 – 1993 Angbazo (1997) extends the Ho and Saunders (1981) dealership model by incorporating credit risk, interest rate risk and the interaction between these risks into the model to analyse the empirical determinants of bank net interest margins by testing the hypothesis that banks with poor loans quality, as well as exposed to higher interest-rate risk would charge higher net interest margins. Overall, his findings are that bank interest margins are related positively with credit default risk, interest rate risk, core capital, non-interest bearing reserves, and management quality, and negatively related to liquidity. The negative relationship between NIM and liquidity may be due to the fact that as the proportion of funds invested in cash or cash equivalents increases, a bank's liquidity risk declines, thereby warranting a lower liquidity premium in the net interest margins and hence a negative relationship with NIM.

Saunders and Schumacher (2000) also extend the dealership model to a multi-country setting where they find that bank interest margins are made up of regulatory, market structure, and a risk premium components, where they classify the regulatory components as the form of interest-rate restrictions on



deposits, reserve requirements and capital-to-asset ratios and find that they have a significant impact on banks NIMs.

Brock & Saurez (2000) embark on a multi-country study of five Latin American countries made up of Bolivia, Chile, Peru, Argentina and Columbia, over the period 1991 to 1996, employing the Ho and Saunders (1981) two-step framework, and find that for Latin America, interest margins are determined by capital and liquidity risk, at the bank level, and at the macroeconomic level by, inflation, GDP growth and interest rate risk. While they observe differences between the results of the Latin American study and the benchmark results of Western Europe and the United States, they attribute the disparities to distortions caused by regulatory systems which are inadequate and allow weak banks to remain in operation, financial reporting standards which could not be trusted and result in misstated bank capital, and excessive risk-taking on the part of banks motivated by massive government guarantees.

Maudos and Guevara (2004) in a single-stage study of the determinants of net interest income in the banking sectors of Germany, France, UK, Italy and Spain, over the period 1993 to 2000, employ the dealer model where they incorporate operating costs. They find that the “pure” interest margin is impacted by competitive market conditions, the credit default risk, the interest rate risk, the average operating expenses and banks’ risk aversion. They also observe that other determinants not included explicitly in the estimation, such as opportunity cost of reserves, implicit interest payment and management quality also caused variations in interest margin. A distinguishing feature of the study is the incorporation into the modelling of the interest margin the Lerner index as a direct measure of the degree of competition, the influence of operating costs, as well as default risk.

Peria and Mody (2004) also include foreign participation and concentration in a study of bank spreads in Argentina, Chile, Colombia, Mexico and Peru during the late 1990s, employing bank-level data from. They find the spread of foreign banks, particularly the de novo foreign banks to be lower than those that entered through acquisitions, and that the overall influence was achieved via foreign bank participation effect on administrative cost. Again bank concentration was found to have a positive relationship with higher spreads as well as costs.

Again in Latin America Gelos (2006) examine intermediation spreads which he finds are high by international standards. Using bank and country-level data from 85 countries, including 14 Latin American economies he examines the determinants of bank interest margins in that region. Their results point to higher interest rates, less efficient banks, and larger reserve requirements in Latin American banks, having a significant impact on bank spreads, than their peers in other regions. In other areas like inflation and bank profit taxation that are important in the determination of cost of financial intermediation they do not find that Latin American banks differ significantly from their peers.

Valverde and Rodríguez (2007) study the determinants of bank margins in the banking sectors of Germany, Spain, France, the Netherlands, Italy, the United Kingdom and Sweden using a sample of 19,322 banks over the period 1994-2001; extending the model using a multi-output model. With the objective of analysing the relationship between bank margins and specialization, thereby underscoring the importance of non-traditional activities they find a significant relationship between specialization and bank interest margins. Nonetheless this finding is only fully observed when considering such New Empirical Industrial Organisation (NEIO) indicators as the Lerner index proxy for bank margins.

Claeys and Vennet (2008) study the effect of low degree of efficiency, non-competitive market behaviour, controlling for the influences of macroeconomic environment, foreign bank ownership as well as state bank ownership in the Central and Eastern European countries (CEEC). They also do a comparative analysis with the banking sectors of the Western European countries to ascertain whether the determinants of the CEEC economies were converging to those in the Western European economies. The single most important finding in Claeys and Vennet (2008) noted by Chortareas et al. (2011) is that changes in regulation, that is via increased capital requirements, for example, result in banks engaging in riskier activities which increase their margins before the effects of competition reduce them.

Maudos and Solis (2009) model the Mexican net interest margins simultaneously including operating costs and diversification and specialization as determinants. Their results show that in the Mexican context high margins can be mainly attributed to average operating costs and market power, measured by the Lerner index for total banking activity.

From the foregoing studies which extend the Ho and Saunder's (1981) dealership model it could be said that in the literature on bank efficiency and for that matter NIM, it is normally expressed as a function of internal and external factors. The internal determinants emanate from factors specific to a bank over which bank management has control, while the external determinants derive from the industry, economic and legal environments that affect the operations and performance of the bank (Athanasoglou et al., 2008), but outside the control of the bank. Accordingly, variables used to study the determinants of NIM are categorised in the literature as being bank-specific, industry/market-specific, economic and regulatory depending on the nature and purpose of the empirical enquiry. It could also be gleaned from the foregoing empirical investigations that studies documented so far in the literature are either single-country (Mcshane and Sharpe, 1984) or cross-country studies (Saunders and Schumacher, 2000).

## **2.5 Some Documented Econometric Relationships between Typical Variables Used in Empirical Studies of the Determinants of Net Interest Margins**

In the empirical modelling of the determinants of NIM, size is incorporated to account for the inherent economies and diseconomies that obtain in the market. The general perspective in the extant literature is that size is closely related to capital adequacy of a bank, since larger banks seem to raise cheaper capital and by extension able to make more profits because of higher interest margins resulting from the exercise of market power. Claeys and Vennet (2008) incorporate size in their study of the determinants of NIM in the Central and Eastern European countries (CEEC) in the shape of market share which they calculated as bank  $i$ 's share of assets at time  $t$  in country  $j$ 's total bank assets at time  $t$ , to proxy for relative market power<sup>6</sup>. They find that in the accession countries of Central and Eastern Europe the coefficient on the market share variable is not significant, which means, larger banks are not in a position to exploit their market power to achieve higher rents in terms of higher interest margins (Claeys and Vennet, 2008). The most plausible explanation of Claeys and Vennet's (2008) result is the benefit of increased foreign bank participation

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<sup>6</sup> This is not the norm in the extant literature as most studies use the Lerner index

in terms of higher efficiency and competition for CEEC banking sectors following their accession (Poghosyan and Poghosyan, 2010). This finding seems to be corroborated by Berger et al (1987) who suggests that there could only be little cost saving by increasing the size of a bank. This seems to contrast with Short (1979) who is quoted in Athanasoglou et al (2008) as arguing that size is closely related to capital adequacy of a bank since larger banks seem to raise cheaper capital and by extension able to make more profits.

As regards the place of the management of risks in the determination of NIM two types of risks namely, credit and liquidity risks, have been identified in the literature. Credit risk applies to the possibility that an asset or a loan cannot be recovered should there be a default, or the risk of an unexpected delay in a loan repayment (Heffernan, 2005). Heffernan (2005) again defines risk of liquidity as the possibility that there would be insufficient funds to meet the ordinary operating needs of the banking firm. Also to control for risk appetite, empirical works have found several ways to incorporate Ho and Saunders (1981) original idea of absolute risk aversion in a bank's utility function (Gunter et al, 2013). Gunter et al (2013) aver that, in empirical work linking risk appetite to credit risk-related variables like loan loss provisions and/or the nonperforming loan ratio has become common place. Angbazo (1997) also confirms the gains in diversification in bank margins by allowing for multiple and different loan and deposit types. Therefore, this is all the more reason why Gunter et al (2013) suggest that when asset structure is controlled it could help in highlighting the partial influence of other risk appetite variables on interest margins Maudos and de Guevara (2004) suggest that credit risk requires that banks implicitly include a risk premium in interest rates and therefore the net interest margin. In the literature liquidity risk is expected to be positively related to NIM since banks tend to pass their liquidity risks to customers through increasing interest margins (Chortareas et al, 2011). Brock and Suarez (2000) use the ratio of short-term assets to total deposits to proxy liquidity risk and find that liquidity risk, is positively related to the spread for all the studied countries, and statistically significant for Bolivia, Colombia, and Peru, which results reflect the industrialised economy benchmark and also the impact of holding low-yielding short-term assets. This is a finding also arrived at by Chortareas et al (2011) in some Latin American countries.

Also in the empirical literature is found support for the notion that high operating costs raise interest margins and therefore the need to incorporate it into the model of NIM determinants. The idea of bank costs is generally deemed in the literature to be related to the efficiency of management. Sharma and Gounder (2011) for example defined quality of management as the ratio of operating expenses to gross income, that is, the operating costs necessary to generate one unit of gross income; in which case higher bank management quality is associated with higher interest margins, in that a high management quality means the ability to raise low cost liabilities and invest in highly profitable assets (Angbazo, 1997; Maudos and Guevara, 2004). Thus, a rising ratio indicates a falling quality of bank management and therefore a lower NIM and hence a negative expected sign. Athanasoglou et al (2008) also quote Molyneaux and Thornton (1992) as finding a positive relationship between better-quality management and profitability.

On structural effects on NIM two alternative hypotheses come to the fore: the structure-conduct-performance hypothesis (SCP) and the efficient structure hypothesis (ESH) which are rooted in the industrial organization literature on bank structure and efficiency. Berger (1995), Goldberg and Rai (1996), and Vander Venet (2002) have explored the literature on the relationship between the overall bank profitability and market structure within the context of these two hypotheses, giving four different explanations to them. Similarly, Claeys and Venet (2008) extend this analysis to the relationship between bank interest margins and market structure. According to Claeys and Venet (2008) the traditional SCP posits that the positive relationship between margins and market structure is a reflection of non-competitive pricing behaviour in more concentrated markets. The relative-market-power hypothesis (RMP), which is a related theory, also states that the ability to exercise market power in loan pricing to earn higher interest margins can only be displayed by banks with large market shares. Other alternative explanations also available to explain the positive relationship between interest margins and the presence of market concentration or market share are the two efficient structure hypotheses, postulated by Demsetz (1973). On these hypotheses Berger (1995) states that it is efficiency that drives the positive profit-structure relationship and that the relationship in itself is of no direct origin. Formally stated the efficient-structure (ES) hypothesis says that variations in interest margins derive from differences

in either the operational efficiency across banks, designated by X-efficiency (X-ES) or the efficient scale at which some banks produce than their peers, also designated by scale-efficiency (S-ES). The X-efficiency (X-ES) version states that lower cost in some banks may be either as result of superior management or production technologies, in which case such banks are able to offer more competitive interest rates on loans and deposits, resulting in a negative relationship between operational efficiency and interest margins. To the extent that these firms are assumed to gain larger market shares, the market may become more concentrated in the final analysis. The other explanation based on the scale-efficiency (S-ES) version of the ES hypothesis is that some firms produce at a more efficient scale than their peers, which will be in the end translated into smaller margins given the competitive market conditions. If this efficiency leads to increase the market share of the firms assumed to be efficient then it would lead to higher market concentration (Claeys and Vennet, 2008).

To the extent that changes in the macroeconomic conditions affect the banking system as a whole and influence the NIM the last major class of determinants of NIM incorporated in most studies of the literature are macroeconomic control variables. The variables which are commonly employed are the inflation rate, the long-term interest rate and/or the growth rate of money supply. Gunter et al (2013) asserts that most empirical studies use GDP growth as a control variable and is assumed to have a positive correlation. Claeys and Vennet (2008) used real GDP growth as a proxy for business cycle fluctuations and find a positive correlation between the business cycle and bank margins. This means economic boom or higher economic growth is associated with higher bank margins, reflecting more granting of credit and lower incidence of credit default rates in such periods. Claeys and Vennet (2008) note that this finding is typical of the Western European bank markets. Many papers also consider market interest rates of different maturities. Also Chortareas et al (2011) control for average annual market interest rate and find a positive and statistically significant relationship between NIM and the average annual interest rate in Colombia and a negative relationship in Argentina.

Athanasoglou et al (2008) also mention Revell (1979) as introducing the issue of the relationship between bank profitability and inflation. He notes that the effect of inflation on bank profitability depends on whether banks' wages

and other operating expenses increase at a faster rate than inflation. They as well mention Perry (1992) as stating that the effect of inflation on bank profitability is dependent on whether inflation is fully anticipated, so that interest rates could be adjusted accordingly by the management of bank to increase their revenues faster than their costs to achieve higher economic profits. The literature is replete with studies that have evidence of a positive relationship between either inflation or long-term interest rate and profitability. Demirguc-Kunt and Huizinga (2000) find that while the impact of inflation on profitability may not be very significant, it is positive. Claeys and Vennet (2008) also conclude that lower inflation (and decreasing inflation expectations) has a relatively considerable reducing effect on long-term interest rates than short-term interest rate, resulting in a reducing impact on interest margins.

## **2.6 Empirical studies on Africa**

Most of the studies investigating the determinants of net interest margins are focused on the developed countries, notably the US and the Western European countries and to a lesser extent Latin America and Asia. Studies on Africa and Sub-Saharan Africa are relatively few. For example, in a study of bank efficiency in 10 Sub-Saharan African countries using stochastic frontier analysis (SFA) Chen (2009) note that research on emerging economies is quite recent, and that studies on Sub-Saharan African (SSA) banks for example, are relatively few partly as a result of low level of financial development and lack of quality data.

Both cross-country and single-country studies employing the Ho and Saunders (1981) dealership model do obtain in Africa. Notable among these are single-country studies by Naceur & Goaid (2010) in Tunisia, Khediri and Khediri (2011) also in Tunisia, Chirwa and Mlachila (2002) in Malawi, and Beck and Hesse (2009) in Uganda, and Aboagye et al (2008) in Ghana. Among cross-country studies for Sub-Saharan Africa are: Flamini et al (2009), Folawewo and Tennant (2008), Ahokpossi (2013), and Boutin-Dufresne et al (2013).

Chirwa and Mlachila (2004) set out to study the particularly high interest rate spreads in the aftermath of the financial sector reforms in Malawi and find that high monopoly power, high reserve requirements, high central bank discount rate and high inflation were the responsible factors.

Naceur & Goaid (2010) investigate the determinants of bank interest margins and profitability in the Tunisian banking industry for the period 1980-2000. For a considerable portion of the within country variations in interest margins and profitability they find that individual bank-specific factors were responsible. For example, high net interest margins and profitability tend to be positively correlated with banks that hold a relatively high amount of capital, as well as large overhead costs. They also find bank size to be negatively related with profitability, meaning Tunisian banks are operating above their optimum level of profitability. They lastly find macroeconomic variables not to have any impact on the profitability of Tunisian banks.

Ben Khediri and Ben-Khedhiri (2011) investigate the determinants of Net Interest Margins (NIM) in Tunisia employing the dealership model of Ho and Saunders, (1981). They find operating costs and bank capital to be positively correlated with interest margin, and thus showing consistency with the Ho and Saunders (1981) model. Additionally, they find NIM to be positively associated with opportunity costs of bank reserves, implicit interest payments and also negatively associated with management quality.

Using a sample of 456 banks in 41 Sub-Saharan African countries over 1995 to 2008 Ahokposi (2013) demonstrate that bank-specific factors such as credit risk, liquidity risk and bank equity are important in the determination of bank interest margins. As regards the macroeconomic environment, while inflation is sensitive to bank interest margins, economic growth is not.

In a study of bank interest margins in Ghana, Aboagye et al (2008) find that an increase in the following factors increases the net interest margins of banks. Net interest margin is found to be positively related to market power, bank size, staff costs, administrative costs, extent to which a bank is risk averse and inflation. On the other hand, the study finds a negative relationship of bank interest margins with excess reserves of banks, central bank lending rate and management efficiency.

Beck and Hesse (2006) also study the persistently high interest rate spreads and margins in the Ugandan banking system using bank-level dataset. They find that while foreign banks had lower interest rate spreads, interest spread is not sensitive to privatization, foreign bank entry, market structure and banking efficiency. In pretty much the same way, the macroeconomic environment explained little of the over-time variation in bank spreads. Rather



bank-specific variables, namely, bank size, operating costs, and composition of loan portfolio, explained a large proportion of cross-bank, cross-time variation in spreads and margins. These findings seem to run counter to the view expressed by Chirwa and Mlachila (2002), who lament the failure of spreads in developing countries to converge to international levels even after financial liberalization. They suggest that high interest rate spreads in developing countries will persist if financial sector reforms 'do not significantly alter the structure within which banks operate' (Chirwa and Mlachila, 2002), whereby structure refers to the market/industry and macroeconomic environment in developing countries.

Folawewo and Tennant (2008) also study the determinants of spreads between banks' deposit and lending rates in SSA countries from the perspectives of market and macroeconomic environments, employing a dynamic panel model for 33 countries. They find that different market and macroeconomic policy variables, such as the extent of government crowding out in the banking sector, public sector deficits, discount rate, level of inflation, level money supply, reserve requirement, level of economic development, and population size are important in explaining variations in interest rate spreads in SSA countries.

Lastly, Boutin-Dufresne et al (2013) study the determinants of net interest margins across four regional blocks in Sub-Saharan Africa and did a comparative analysis with the Eastern Caribbean Currency Union and find that high operating costs and a high equity capital and institutional actors such as the rule of law, are the most important factors explaining the high interest margins in the East African Community (EAC) compared to other sub-regions.

Overall it might also appear the generally high bank spreads in the Sub-Saharan African region could be explained by high switching costs between banks for bank customers which tend to slack competition among banks resulting in high bank spreads. For example, Cihak and Podpiera (2005) find in the Kenyan banking sector that while competition is predominant among the top tier corporate clients most other customers are often tied to one bank, with very high switching costs.

It is clear from the foregoing review of both the theoretical and empirical literature on the determinants of net interest margin (NIM) that a model incorporating the role of monetary union membership has never been

investigated. In this context we extend the literature by demonstrating that given the competition and efficiency implications for NIM in a monetary union the relationship between bank margins and competition measures varies significantly across banks in a monetary union and a non-monetary union respectively.

In this chapter we have attempted to review the extant theoretical and empirical literature that explain the behaviour of bank net interest margin and its determinants. We first looked at the mechanics of the two main theoretical models namely, the Monti-Klein (1972) model and the Ho and Saunders (1981) dealer model, that are available for the study of bank net interest margins and its determinants. We next looked at how the most popular of the two, that is, the Ho and Saunders (1981) dealer model has been extended variously in empirical investigation in both single-country and cross-country studies. In these studies, we note that generally factors that are found to have impact on bank net interest margin are classified as being bank-specific, market/industry related and macroeconomic in nature. countries. While we note that studies on Africa are scanty, we reviewed some selected few in both single-country and cross-country investigations. Overall results of all the cited empirical investigations of the determinants of net interest margin are mixed across both countries and researchers.

## **CHAPTER THREE**

# **THE THEORY OF OPTIMUM CURRENCY AREA (OCA), CONVERGENCE IN THE EUROPEAN ECONOMIC AND MONETARY UNION (EMU), THE NON-EURO AREA, THE WEST AFRICAN ECONOMIC AND**

# **MONETARY UNION (WAEMU) AND THE NON-MONETARY UNION SUB-SAHARAN AFRICA**

## **3.1 Historical background of the European Economic and Monetary Union**

The Economic and Monetary Union in the European union can be characterised as Europe's desire to achieve full liberalisation of capital movements, the total convertibility of Member States' currencies and the irrevocable fixing of exchange rates. Historically the European monetary and economic union could be traced to the sentiments that swept the United States and Europe during the second world war; one of a desire for the restructuring of international financial relations which gave birth to the Bretton Woods agreements which laid down the rules and procedures governing the world economy in 1944. The Bretton Woods agreements having been born out of the need for international cooperation to avert further suffering caused by the Second World War and the subsequent setting up of the United Nations (UN). In Europe specifically this need for cooperation led to the first foundations of the European Union, in the shape of the three Treaties, the first two bringing together six signatory States (Germany, Belgium, France, Italy, Luxembourg and the Netherlands). These treaties were:

1. The Treaty establishing the European Coal and Steel Community (ECSC), signed on 18 April 1951.
2. The Rome Treaties, that is, the treaty establishing the European Economic Community (EEC) and that establishing the European Atomic Energy Community (EURATOM), signed in March 1957.
3. The Maastricht Treaty of 1992

Further developments led to the desire for a European integration, the pursuit of which culminated in a proposed phased Economic and Monetary Union (EMU) by the Delors Commission in 1989. The proposals made by the Delors Commission were formalised in 1992 in the Maastricht Treaty, which had as its first stage of implementation economic convergence criteria for the

adoption of the common currency. By this provision, countries which were to become part of the union were then those deemed to have met a convergence criteria set out by the treaty. Apart from aspects of this criteria on and respect for human rights, as well as stable democratic credentials the primary economic convergence criteria were nominal convergence of certain macroeconomic indicators to the levels aimed at maintaining macroeconomic stability and the stability of the single currency within the EMU (Kowalski (2003) in Drastichova and Ostrava (2012)). The details of the criteria are that inflation should not exceed the three best-performing member states' economies by 1.5 percentage points; budget deficit should also not exceed 3 percent of GDP; gross public debt should not exceed 60 percent of GDP; and interest rates should be the average of the lowest six countries of the union plus 2 percentage points; all to ensure member states were converged to low fiscal deficits, low rates of inflation and stable exchange rates.

The second stage of the economic integration and monetary union process was the establishment of the European Monetary Institute (EMI) as a precursor to the establishment of the European Central Bank (ECB). With the establishment of the ECB member states had to relinquish their control of monetary policy to it. The treaty described the competencies of the European Central Bank (ECB) and of the governments and central banks of the twelve Euro area countries with regard to the issuing of euro cash. It gave the ECB the exclusive right to authorise the issuance of banknotes within the euro area, but also extended this right of issuance to the national central banks (NCBs). Nevertheless, given that the ECB has no cash operations role, it is the NCBs that actually put the banknotes into circulation and withdraw, process and store them.

The third and final stage of the implementation of the Maastricht Treaty was the introduction of the single currency, the Euro, with conversion rates being fixed irrevocably for the former national currencies and a single monetary policy conducted by the ECB. However, the Euro bank notes and coins did not begin circulation as a legal tender until January 2002. The single currency was in the view of the European Commission complimentary to the single market. The Single Market is a common market for all goods and services in the European Union which, although has its origins in the 1957 Treaty of Rome,

officially launched in 1993. It is a creation which refers to the European Union as one territory without any internal borders or other regulatory obstacles to the free movement of goods and services. Although some of the single market legislation remains to be implemented in member states it is believed to have stimulated competition and trade, improved efficiency, quality, price cuts, and fuelled economic growth. And it is lauded as one of the EU's greatest achievements (europa.eu).

### 3.2 The OCA Theory in Shaping the European EMU

The theory of optimum currency areas (OCA), pioneered by Mundell (1961), McKinnon (1963), and Kenen (1969), is the relevant theory that underpins any discussion on monetary integration in the context of articulating the conditions under which a monetary union thrives. Therefore, the pioneering work of the proponents of the OCA theory and for that matter the inception of the proliferation of literature on the OCA theory dates back to the 1960s; emerging from debates on the merits of fixed versus flexible exchange rate regimes, as well as the comparison of several features of the US and European economies (Mongelli, 2008). An optimal currency area can be defined as the optimal geographical area for a single currency, or for several currencies, whose exchange rates are irrevocably pegged (Mongelli, 2008). Mundell (1961) defines the optimum currency area as a region in which production factors are internally mobile but immobile internationally, to facilitate the intra-regional redistribution of resources in response to demand shifts. Proponents of the Optimum Currency Area theory, Mundell (1961), McKinnon (1963), and Kenen (1969), together with other seminal contributors, such as, Friedman (1953) and Ingram (1962) characterize the Optimum currency area as a region where the following features must as of necessity be observed:

- **Mobility of labour and other factors of production:**

where Mundell (1961) believe that high factor market integration within a group of countries that come together to form a currency union can reduce the need to change real factor prices and the nominal exchange rate between countries in response to shocks (Mundell (1961)

- **Economic openness:**

McKinnon (1963) demonstrates the need for a group of countries contemplating a currency union to show economic openness, where they

are deemed to be open to trade among themselves and with the rest of the world. The assumption is that the higher the degree of openness, the more changes in international prices of tradables are likely to be transmitted to the domestic cost of living. He therefore posited that the extent of economic openness in such countries has the effect of reducing the potential for money and/or exchange rate illusion by wage earners. Furthermore, a devaluation would be more rapidly transmitted to the price of tradables and the cost of living, negating its intended effects; in which case the nominal exchange rate would be less useful as an adjustment instrument.

- **Diversification in production and consumption:**

Kennan (1969) also argues that high diversification in production and consumption has the effect of reducing the likely impact of shocks specific to any sector. In which case, he argues, diversification reduces the need for changes in the terms of trade through the nominal exchange rate and provides a hedge against a variety of disturbances. And that where partner countries are more diversified they are more likely to incur reduced costs from forsaking nominal exchange rate changes between them and find a single currency beneficial.

- **Price and wage flexibility**

The proponents also argue that when nominal prices and wages are flexible between and within countries contemplating a single currency, the adjustment following a shock is less likely to be associated with sustained unemployment in one country and/or inflation in another. This therefore makes the need for nominal exchange rate adjustments redundant (Friedman, 1953). Conversely, if nominal prices and wages are downward rigid some measure of real flexibility could be achieved by means of exchange rate adjustments. And in such a situation the loss of direct control over the nominal exchange rate instrument may not augur well for the countries in question (Kawai, 1987).

**Other criteria include:**

- Similarity of supply and demand shocks and business cycles
- Fiscal integration and similarity of inflation rates (Mongelli, 2002, in Oshikoya et al, 2010). These characterisations are what is referred to in the OCA literature as the 'Old OCA theory'.

Sometime after the seminal contributions on the different properties of the so-called 'old OCA theory' had been digested exhaustively a barrage of criticisms were levelled against it, bringing into sharp focus its inappropriateness in offering any robust analytical framework to define the optimum economic and monetary competencies of a given "area" such as the European Union (Mongelli, 2002). For example, in Mongelli (2002), in what Tavlas (1994) calls 'the problem of inconclusiveness ', he shows how the OCA properties are difficult to evaluate

against each other. Tavlas (1994) believes the OCA theory as a whole stopped short of a unifying framework, which could still make one end up drawing different borders for a currency area by referring to different OCA properties. Therefore, according to Tavlas (1994), a country might, for instance be quite open with respect to reciprocal trade with a group of partner countries indicating that a fixed exchange rate regime is preferable, or even monetary integration, with its main trading partners. Nevertheless, the same country might also exhibit a low mobility of factors of production, including labour, among these trading partners, to rather suggest that a flexible exchange rate arrangement might be desirable.

### **3.2.1 The OCA endogeneity hypothesis and the European EMU**

The endogeneity hypothesis is one that emerged as the assessment of OCA properties became more articulated, particularly by studying the effects of monetary unions. Empirical studies giving birth to the endogeneity hypothesis posit that monetary integration leads to a very significant deepening of reciprocal trade. That is, reciprocal trade between the members of a currency area is likely to increase after the launch of a single currency.

Within the European EMU, the weaknesses and limitations of the OCA theory notwithstanding, some critics of the Delors Report (1989) which made a strong case for a single currency to complement a single market to eliminate exchange rate volatilities and misalignments, nevertheless, argued that it failed to prominently feature the OCA properties. Indeed, the Maastricht Treaty (1991) convergence criteria cannot be said to have satisfied the OCA conditions. While the Maastricht criteria emphasised macroeconomic convergence prior to the beginning of the European Monetary Union (EMU) the OCA stresses

microeconomic and political conditions for a successful monetary union (De Grauwe, 2012). For example, to deal with the fear of inflationary bias inflation convergence was a key requirement in the Maastricht criteria. Similarly, budgetary convergence requirements were stipulated to prevent high deficits and debts countries which had the tendency to increase the risk of more inflation in the future monetary union, specifically the EMU (De Grauwe, 2012). Macroeconomic convergence is the process whereby countries move toward a common macroeconomic climate with similar policies on such macroeconomic variables as inflation, public debts, current accounts, budget deficit, long-term interest rates and so on.

Nevertheless, the likes of Emerson et al (1992) who support the endogeneity of the OCA theory argue that the criteria for the European EMU was more likely to be beneficial than what could be presumed on the basis of the application of the OCA characteristics alone. For instance, while the labour mobility is low in Europe the mobility of capital which can provide an alternative adjustment channel is quite high and rising in Europe. Ingram (1962) also posit that financial market integration, a characteristic which facilitates capital mobility, is an essential criterion that can reduce the need for exchange rate adjustment. The possibility of the capital mobility having been already facilitated by the single market programme which had capital mobility as one of its 'four freedoms'. While this is the case it must however be mentioned that within the EMU this created huge macroeconomic imbalances which were at the centre of the Eurozone crisis (Ederer, 2015). Ederer (2015) explains that domestic demand booms and current account deficits in the South countries financed by large capital flows deriving from current account surplus countries like Germany dubbed North countries, created huge stocks of debt in the South countries. Therefore, at the inception of the financial crisis when capital flows to the South countries stopped suddenly it caused domestic demand in the South countries to plummet. This sudden decline in domestic demand together with the accumulated huge debt stocks, therefore, made recovery at the end of the global financial crisis difficult. The situation got further aggravated when in an attempt to reduce their debt burdens by reducing their expenditures, rather deflated demand, thereby making the economic crisis rather worse.

Mongelli (2002), argues that plans for the establishment of the EMU were meant to complement the single market programme, indeed aimed at



eliminating the risks of destabilising exchange rate volatilities that had on several occasions disrupted the European Monetary System (EMS) and that the main focus was not to explicitly reflect the provisions of the OCA theory in its entirety. The resulting financial integration in the EMU which promises to reduce the costs of a single monetary policy, nevertheless, does support the hypothesis that optimum currency areas are endogenous. From the journey of conception to the eventual establishment of the European economic and monetary union it could be observed that it took the path of the paradigm of a single market fostering the need and conditions for one currency as opposed to the paradigm of a single currency generating the need for a single market. That said, to the extent that broad assessment of the European economic and monetary union shows that reciprocal trade has increased since the introduction of the single currency the OCA endogeneity hypothesis can be supported. Indeed, there is evidence that trade between Eurozone countries has increased after the adoption of the euro compared to trade involving non-Eurozone countries (Nitsch and Pisu, 2008). They point to evidence in the EMU evaluation literature which puts increase in bilateral trade between Eurozone members at between 5 and 20 percent. These figures are also reported by Mongelli (2008) from available empirical evidence.

### **3.2.2 Sub-optimality of the European EMU**

While the proponents of the endogeneity hypothesis seem to have won the day, the unfolding of the 2008 global financial crisis which morphed into the Eurozone debt crisis in 2010/11 raises questions about the optimality of the Euro zone. For example, we ask whether the Eurozone debt crisis of 2010 erupted as a result of lack of socio-economic cohesion and convergence in the EMU in terms of meeting the OCA criteria, fiscal harmonisation with the fiscal capacity for mitigating asymmetric developments in the economic cycle (Andor, 2014); and was therefore inevitable; what the effects were; and what solutions were proposed. Clarke and Daley (2010) argue that a sub-optimal economic and monetary union will always be subject to crises, because it lacks a central body to direct and coordinate activity. This in their view was the case of the Eurozone, where it lacked the political structures to coordinate the economic actions of member states by establishing rules to prevent countries from

pursuing their selfish interest in ways that are inimical to the economic well-being of the union. For example, by the implicit guarantee from the ECB and other Eurozone countries weaker economies like Greece had been encouraged to borrow excessively when the level of their economic growth could not support such borrowings and therefore had less likelihood of paying back. Also within the Eurozone no clear line of responsibility for bank bail-outs, a responsibility for the national government in the case of a sovereign state, had been defined. As a matter of fact, while the stability of some banks might be considered critical to the wider financial stability of the EMU, depositors in one country would naturally be unhappy about having to bail out 'too-big-to-fail banks in other countries. It is clear from the foregoing that critical gaps in the construction of stability of the Eurozone were appreciated post-crisis.

Mullineux (2013) characterises the Eurozone as only a currency union by a sub-group of EU member states coming together to adopt the euro as a common currency. And that to graduate from a currency union to a fully-fledged monetary union there must be in place a significant fiscal harmonisation and fiscal transfers, with the fiscal harmonisation encompassing taxes as well as welfare provision. Indeed, according to the theory of currency unions, for the asymmetries between member states of a monetary union experiencing a downturn and those with economic overheating to be managed there must be a harmonisation of fiscal policy. Within the Eurozone however, while macroeconomic convergence was stressed no provision for the convergence of tax and welfare systems, as well as fiscal transfers were made (Mullineux, 2013). Indeed, in the Eurozone there is no budget to compensate for divergence in economic well-being. That is a budget which will afford the countries within the Eurozone the opportunity to maintain similar levels of economic well-being, based on large-scale redistribution between countries, as well as affording the countries the ability to recover from recession (Andor, 2014). This contrasts with what obtains in the Australian Commonwealth, deemed to be one of the more successful monetary unions in the world. Here provision is made for fiscal transfers from better-performing member states in the union to the less well-performing countries (Mullineux, 2013).

Also of note in the Eurozone is the lack of a banking union, the purpose of which is to provide a common banking supervision, a common deposit insurance scheme, and a common bank resolution mechanism for resolving

cross-border bank failures (Mullineux, 2013). Also lacking was a strong political union that would underpin any desired income equalisation across the Eurozone, and give a strong legal backing to redistributive decisions taken at the union level (Andor, 2014).

While the forgoing and a lot more which made the Eurozone an incomplete monetary union, in the words of Andor (2014), were the case, their impact became apparent only after the Eurozone crisis. Mullineux (2013), asserts that it became apparent after the crisis that significant fiscal, political, as well as economic and financial sector convergence was needed to make the union a trade-enhancing one; and to convert the currency union into a stable and lasting monetary union.

Having said that we would also like to note here, as asserted by Andor (2014), the socio-economic cohesion that underpinned the European single market of the 1980s which preceded the introduction of the single currency was stronger than that obtained under the economic and monetary union arrangements. This is because, as explained by Andor (2014), the instruments for cohesion and convergence in the single market were social legislation which ensured social equalisation, as well as, financial instruments ensuring economic, social and territorial cohesion. Whereas in the case of the EMU the social dimension and its ability to deal with the problems of cyclicity and asymmetry have not been developed (Andor, 2014).

### **3.2.3 Some policy responses following the global economic and financial crisis and the Eurozone debt crisis**

Following on from section 3.2.2, in short, the EMU was in effect an incomplete one and deemed not to be properly functioning. Hence an elaborate policy response had to be set in motion. One of such policy responses was the banking union. The aim of the banking union was to eliminate the hitherto fragmentation that characterised the Eurozone banking markets, by forging integrated banking systems with integrated prudential oversight as the new framework for financial stability. In fact, an arrangement to satisfy the need to establish a joint European banking supervision where the regulation of cross-border banks was to be directed and coordinated at the European level as opposed to the national level (Bremus and Lambert, 2014). A further aim of the

banking union was to break the vicious cycle of sovereign and bank risk; a move which appears to have achieved its aim because to date the Eurozone crisis and reports of bailouts for both banks and governments have subsided (Bremus and Lambert, 2014). In sum a banking union was an arrangement precipitated by the Eurozone debt crisis at its peak in 2012 to complement the economic and monetary union and bring all EU-wide banking rules in the Eurozone under one supranational authority, that is the ECB.

Also among the battery of policy responses to the destabilisation created by the Eurozone debt crisis was the adoption of unconventional monetary policy measures by the ECB in the form of quantitative easing and the use of negative interest rates. Quantitative easing is where because of the economic downturn in the Eurozone and a fall in inflation expectations an asset purchase program was adopted in the Eurozone. This was where the ECB bought government bonds and in so doing put money base into circulation to raise inflation. The rise in inflation coming through the raising of the prices of those financial assets and the lowering of their yield, while at the same time increasing the money supply. While the intended effect has been a fall in real interest rates by reducing the financing costs for businesses and ordinary people, and consequent revitalization of the economy, the reported evaluation of mixed side effects on the profitability of banks including their net interest income. Demertzis and Wolff (2016) for example report of the following three ways by which bank profitability is affected by quantitative easing: (i) Since quantitative easing drives up bond prices it strengthens the balance sheets of banks which hold such bonds. (ii) Quantitative easing has the effect of reducing term spreads through the reduction of long-term yields. This reduces lending-deposit ratio, thereby impacting negatively on the level of net interest income on new loans. (iii) Finally, with improved macroeconomic outlook deriving from quantitative easing new lending business opportunities become available to banks with the attendant reduction in non-performing loan problems. Overall, however the reported evaluation of this non-standard monetary policy stance has been one of an expansionary effect on aggregate demand and inflation, reflective of the experience of other currency areas (Deutsche Bundesbank, 2016). The other unconventional monetary policy tool employed by the ECB was the negative interest rate. Subsequent to the use of quantitative easing was the ECB's implementation of the negative interest rate. Specifically, this was done by the

lowering of its deposit rate to -0.1 percent, as the conventional monetary policy of the theoretical lower bound of zero percent did not appear to be sufficient to stimulate a recovery (Arteta et al, 2016). This unconventional monetary policy stance therefore constituted the adoption of extra monetary policy tool aimed at salvaging the Eurozone from the prospect of further deflationary trends, and support economic growth. The mechanics of this unconventional monetary stance is that rather than being charged interest on deposits, depositors would have to pay money to keep their deposits with the bank. The intention is to stimulate economic growth by motivating banks to lend more freely, and depositors to invest, lend, and spend instead of paying for the safe-keeping of their deposits. Effectively the policy is a tax on the stocking of liquidity by banks to rather motivate them to utilise their excess reserves to increase lending to invigorate the Eurozone economy. For the ECB, a big worry however, is that banks have been increasing their excess reserves. This defeats the very purpose of negative interest rates. Between June 2014 and January 2016, excess reserves shot up more than 400 percent. This shows that banks in the Eurozone still prefer to park extra funds and pay the ECB rather than lending in the current environment of market uncertainty and subdued economic growth. Cross-border lending, which would have helped, has been hit due to differential risks within the Eurozone and cautious national regulators. Indeed, for negative interest rates to make an impact, the banking system's response is critical. Unfortunately, banks are under pressure in the Eurozone due to slow asset growth, economic uncertainty, and rising nonperforming assets. Negative interest rates have added to their discomfort by denting banks' interest income. For example, net interest income as a share of banks' total income fell to 58.7 percent in 2014 from 67.6 percent in 2008 (Barua and Majumdar, 2016).

### **3.3 Monetary Unions in Sub-Saharan Africa**

The last few decades have seen monetary union endeavours on the part of Sub-Saharan African governments to replicate the European-style economic and monetary union through the adoption of parallel institutions, convergence prerequisites, and fiscal governance (Quah, 2016). These endeavours have manifested, since independence of the various countries, as regional groupings engaged in free trade arrangements, with the prospect of becoming regional currency unions. And an eventual common currency for the whole of Africa

seems not too far in sight. While this is the case, at present, the CFA Franc zones and the Common Monetary Area (CMA) in Southern Africa are the only known monetary integration arrangements on the continent (Debrun et al, 2010). That said, the CFA Franc zones of Central and West Africa are the only two existing full monetary unions on the continent.

The Common Monetary Area (CMA) in Southern Africa is regarded as a successful monetary coordination endeavour based on an arrangement between South Africa, Lesotho, Namibia and Swaziland that came into effect in 1992, having evolved over time with the establishment of the South African Reserve Bank in 1921. It follows an informal exchange rate model whereby the currencies of the individual CMA countries are fixed one-to-one to the South African Rand, and the Rand is an acceptable currency in all member states. While the South African Reserve Bank acts as central bank for the entire CMA each member state has its own central bank, with the responsibility for monetary policy and the issuance of its own currency. And there is a strong coordination among the central banks.

In this case, in our analysis, where we compare monetary union institutions versus non-monetary union institutions we therefore find justification in lumping countries of the CMA, that is, South Africa, Lesotho, Namibia and Swaziland together with our elected non-monetary union Sub-Saharan African countries on one hand and the CFA Franc zone in West Africa, WAEMU, as our elected monetary zone on the other.

### **3.3.1 The West African Economic and Monetary Union (WAEMU)**

The West African Economic and Monetary Union (WAEMU) in its current form was originally and historically born out of France's desire since 1929 to back its protectionist posture on foreign trade with a dedicated currency zone for its colonies (Korner, 2002). Eventually in 1945 France introduced the CFA Franc (Franc des Colonies Francaises d'Afrique), issued by the French overseas central bank, in its African colonies as a common currency, which was fully convertible to the French Franc at a fixed exchange rate. The convertibility was guaranteed by a special account maintained by the French treasury, and into which all convertible currency reserves held by the colonies had to be deposited. From its introduction in 1945 until 1994 the convertibility of the CFA

franc to the French franc remained stable at an exchange rate of 0.5 CFA franc to 1 French franc (Kaptouom, 2007).

On attainment of independence by France's African colonies from 1958 France set up two central banks in Paris to manage its newly-independent colonies in West and Central Africa respectively. These were the Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO) for the former West African colonies, and the Banque Centrale des Etats de l'Afrique Equatoriale et du Cameroun (BCEAC), for the former Central African colonies. These central banks were then relocated to Africa in 1972 and 1973, with the BCEAO in Dakar in Senegal and the BCEAC in Yaounde in Cameroun. Since then the two central banks have been issuing their own version of the CFA franc which remained mutually convertible and had the same exchange rate with the French Franc until 1993. As well they have been responsible for the conduct of monetary policy in their respective jurisdictions.

For our purposes, we will confine our discussion to the West African side of the CFA zone, WAEMU, which is our elected monetary union in our Sub-Saharan African empirical analysis. WAEMU in its current shape was formed in 1994 following an IMF-engineered devaluation of the CFA franc of 50 percent to the French franc, as a result of the deteriorated economic situation in which the zone found itself together with its sister Central African zone. The worsening economic situation was attributable to the weakness of commodity prices, the strength of the French franc, coupled with over-expansionary fiscal policies in the zone and the excessive direct and indirect monetary financing of government deficits (Masson and Pattillo, 2005).

While the West African Monetary Union (WAMU) which preceded the WAEMU could pursue a continuous monetary policy of low inflation rate, it fell short on the expected advantages of a monetary union. For example, the promotion of intraregional trade and investment fell short of expectations (Kaptouom, 2007). The sub-optimality in the harmonisation of national policies, stability, and the low level of commercial relations in the francophone West Africa between 1959 and 1994, culminated in a low economic integration. This situation eventually served to inform the conversion of the WAMU to the West African Economic and Monetary Union (WAEMU) in 1994 (Kaptouom, 2007). The launching of the WAEMU in 1994 therefore included Benin, Burkina Faso, the Ivory Coast, Mali, Niger, Senegal and Togo, with the aim, among others, of

establishing a common market which guarantees the free movement of people, goods, services, and capital. Also significant was the objective of harmonising the legislation of the participant states, particularly the tax regime to support the proper functioning of the common market; and also, ensuring the convergence of the different economic policies of member countries. It must be emphasised here that while the WAEMU historically predated the Eurozone, in its current form, especially as regards the necessary monetary and economic arrangements being pursued, it was modelled on the Eurozone.

### **3.3.2 The Optimality of the West African Economic and Monetary Union (WAEMU)**

And therefore, any attempt to assess the WAEMU would naturally be in the context of optimality as hypothesised by the OCA theory, its complementary endogeneities literature, and the overall socio-economic cohesion and convergence which underpin the functioning of the Eurozone. Our approach in using the OCA theory and the endogeneities literature is inspired by Mullineux (2013) and Claeys and Sindzingre (2003), both of whom seem to re-echo the stances of the OCA and the endogeneities schools. Claeys and Sindzingre (2003) point out that the Eurozone and the WAEMU in their respective pursuits of economic integration set off in opposite directions. They assert that while the Eurozone sought to integrate through macroeconomic convergence before adopting a common currency, the WAEMU being a currency union already sought to subsequently become economically integrated. Mullineux (2013) claim that a review of the literature on currency unions in SSA focuses on two perspectives. There is those that are of the view that a country's characteristics are irrelevant when it comes to adopting a common currency. And on the other side of the argument are those who believe in allowing a currency union to mould economic structures through trade, creating reductions in transaction cost and exchange rate uncertainty and monetary policy credibility gains; with monetary policy credibility gains being achieved through a more credible commitment to monetary policy through greater central bank independence (Mullineux, 2013).

Firstly, scoring WAEMU on trade-enhancing properties of currency unions Sy and Sow (2016) assert that the WAEMU has typically had the largest



level of intraregional exports in Sub-Saharan Africa, although falling behind the SADC in 2009. And that overall trade, that is, with imports and exports combined puts the WAEMU second to the SADC. These according to them have been made possible with the sharing of a common currency, a common central bank, a regional real-time gross settlement system (RTGS), and a regional automated clearing house, all of which has the effect of reducing transaction costs and foster intraregional trade. That said, on the global scale, intraregional trade in the WAEMU is comparatively low compared to other customs union around the world. This is 15 percent for WAEMU in comparison to ASEAN's 25 percent and the EU's 60 percent of all their respective trade (Sy and Sow, 2016). Mullineux (2013) however makes reference to an IMF Country Report No. 12/59 (2012), which says that existing trade between the participant countries of the union is not significant. Furthermore, the depth of the financial sectors is shallow; particularly the interbank, domestic government and corporate bond markets are underdeveloped. Also, Mullineux (2013) argues WAEMU is much less integrated economically and financially.

Under the Optimum Currency Area (OCA) theory Mundell (1961) asserts that the mechanism by which equilibrium could be restored in the labour market in a monetary union, following asymmetric shocks, is through labour mobility; while Ingram (1962) and Kenen (1969) also add the dimension of labour flexibility to be fulfilled by countries in a monetary union. Assessing how well the WAEMU has fared on this criteria Quah (2016) concludes that labour market conditions are more rigid in the WAEMU compared to the Eurozone. This means within the WAEMU adaptation of workers to employment shock is not easy, and therefore does not augur well for the union at least in theory.

Also of note is the level of real economic convergence of the WAEMU. Seck (2014) studies the literature investigating the economic convergence of the WAEMU member states towards sustained growth. And the bulk of these studies conclude that the richest countries in the region remain so over time, likewise the poorest. Using sigma convergence and beta convergence Seck (2014) finds no disparity reduction and speed at which the lagging countries were catching up with the leaders. He for example finds a greater disparity in the area of budgetary and economic policy than in the area of monetary policy. What this means is that while the monetary authorities have demonstrated strong control over inflation the region scores low on the provision of fiscal

transfers, the purpose of which is to alleviate the suffering of weaker members and help them integrate.

On the functioning of a single market, while it constitutes a priority objective under the WAEMU Treaty, it has not yet been fully functional (Claeys and Sindzingre, 2003).

Given the foregoing broad-brush assessment of the formidability of the WAEMU as an economic and monetary union it might appear it scores reasonably high in some respects, we would however hold it up against what Mullineux (2013) notes as the qualifications for graduation from a currency union to a monetary union to see if indeed WAEMU is a monetary union in the strictest sense of the name.

Mullineux (2013) asserts that to progress from a currency union to a monetary union a region must be able to demonstrate significant fiscal harmonisation, fiscal transfers, an expanded development bank, banking union to a common bank supervision, and ideally a common deposit insurance scheme and a single bank resolution mechanism. Additionally, a political union that can contain and share the impacts of internal and external shocks is needed. It must be said, nonetheless, that while the WAEMU treaty appears to have replicated all of these characteristics of a full-fledged monetary union from the Eurozone, these have not been fully implemented in the WAEMU. Of the political union requirement for example, Claeys and Sindzingre (2003) state that while political integration is necessary for economic integration this has not been achieved in either the WAEMU nor the Eurozone. And that with respect to the Eurozone political integration remains the most difficult issue, even though it is ultimately necessary for economic institutions.

Setting these findings about the WAEMU against the Eurozone it could be concluded here that the WAEMU by its level of integration can only be described as a currency union, as opposed to an economic and monetary union.

In concluding the dichotomy that can be drawn from our analysis of the socio-economic cohesion and convergence of both the European EMU and the WAEMU is that while both regions do not score highly on the criteria for an economic and monetary union the European EMU is underpinned by a well-developed single market, but not so with the WAEMU. We therefore can say

that any anticipated differences in the behaviour of NIMs could partly derive from these differences.

### **3.3.3 Lessons from the Eurozone crisis for existing and prospective Sub-Saharan African monetary unions**

Given the incompleteness of the European economic and monetary union as exemplified by the eruption and impact of the Eurozone crisis, and the policy responses thereafter, there are great lessons to be learnt by African governments and institutions responsible for the implementation of economic and monetary union pursuits. And these lessons can be summed up thus: that the foundation for a solid socio-economic cohesion and convergence must be clearly articulated and implemented. As noted by Andor (2014), the socio-economic cohesion that underpinned the European economic and monetary union arrangement was not as strong as that which underpinned the European single market of the 1980s. The socio-economic cohesion, according to Andor (2014), being in the form of social legislation which ensured social equalisation, as well as, financial instruments ensuring economic, social and territorial cohesion. And it was this lack which hampered the monetary union's ability to deal with the problems of cyclicity and asymmetry.

It behoves Sub-Saharan African monetary union endeavours therefore, to for example, have a budget to address the disparities in economic performance between member states. This will ensure that in the event of a crisis any achieved convergence between the periphery and the core is not jeopardised. Furthermore, for purposes of giving legitimacy to decisions taken at the union level it is critically important that African monetary unions aim at establishing a political union, which was something lacking in the European economic and monetary union project.

## **3.4 Benefits and Costs of the European EMU**

### **3.4.1 Benefits**

- **Interest rate convergence**

The requirement of convergence of interest rates in the Euro zone by a member state upon accession to a level not exceeding +2% leads to a

convergence and strong declines in the long-term interest rates in otherwise high interest rate member states. This facilitates unhindered currency flows around the Euro zone because it will not be constrained by differing interest rates. Also the low and stable interest rates have attracted investment throughout the zone<sup>7</sup>. For example, in countries like Spain, Ireland, Greece, Portugal, and Italy, interest rates used to be very high prior to joining the euro. However, upon becoming members of the Euro zone they experienced drops in the long-term interest rates which led to strong economic booms (De Grauwe, 2012). Again, Clarke and Daley (2010) note that since 1998 22% of investment within the Euro zone countries with weak currencies before joining the euro was due to their being members of the single currency.

- **Reduction of transaction costs and exchange rate fluctuation and risk, and associated growth effects**

With the single currency, there will no longer be place for currency exchange between different currencies within the EMU. This will eliminate the loss of funds normally through margins of currency dealers in a competitive market<sup>8</sup> save individuals and businesses money and help them to flourish and expand. Also there is the other associated dimension of the elimination of exchange rate risk which in turn reduces systemic risk and thereby lowers real interest rate (De Grauwe, 2012). This is because the elimination of exchange rate risk makes the economic environment within a monetary union less risky, in which case investors demand lower risk premium for the same investment, and a lower discount rate for that matter. In other words, the single currency and consequent elimination of exchange rate fluctuation and risk within the EMU will reduce cost of capital as the prospective capital provider will no longer face the risk that the loan or share will be devalued by an exchange rate fall, increase the flow of foreign direct investment<sup>9</sup> and create reciprocal trade among member countries. Clarke and Daley (2010) however note that there are studies to suggest that since the introduction of the euro cost reduction attributable to

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<sup>7</sup> Translates to lower NIM in the Eurozone.

<sup>8</sup> The EU commission (EU, 1990) projected an average savings in dealers' margins of 0.4%; quite a smaller percentage (0.1%) was however registered in countries with advanced banking systems like the UK where the bulk of currency exchange transaction are through the banking system where the IT resources required to convert currencies are not as costly as involving human contact like small tourist transactions.

<sup>9</sup> Minford (1983) remark that studies which suggest that foreign exchange risk is generally found to be a minor consideration abound.

exchange rate fluctuations are both statistically and economically small; and that the overall beneficial effect on levels of trade being subject to debate<sup>10</sup>.

It is argued that in the final analysis there will be a capital accumulation and the attendant economic growth, as the accumulation of capital increases the productivity of the capital stock per worker and thereby a higher economic growth rate. De Grauwe 2012) however argues that within the Eurozone there is little evidence to suggest that the single currency has boosted economic growth through a significant decline in the real interest rate<sup>11</sup>.

### **Price transparency**

A corollary of the elimination of transaction costs which comes with a common currency is the presence of price transparency. This means prices are quoted in the same currency unit across the monetary union and therefore consumers are better able to make price comparisons. This will in turn lead to lead to financial integration, as may be seen in the next paragraph, and set in motion intense competition which has welfare implications as consumers will have the benefit of lower prices. Goddard et al (2001) note that: “the credible commitment to liberalise European banking markets will continue to make banking practices more uniform, and pricing more transparent. But De Grauwe (2010) notes that this is hardly evident in the Eurozone where price discrimination is very much present<sup>12</sup>.

- **Financial market integration**

Jappelli and Pagano (2008) characterise an integrated financial market as one where securities with identical cash flows command the same price. It refers to comparable prices and rates of return for comparable securities issued in different countries. In effect, across different countries where the law of one price holds. For example, if a firm issues bonds in two different countries or regions, it will pay the same interest rate to both sets of bondholders. Likewise, in the case of equity issuance the firm will pay will pay the same cost of equity

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<sup>10</sup> They suggest that some studies put growth in trade between 3 – 10%.

<sup>11</sup> “The weak link between exchange rate uncertainty, the real interest rate, and growth may also be due to the fact that the reduction in exchange rate uncertainty does not necessarily reduce systemic risk. Less exchange rate uncertainty may be compensated by greater uncertainty elsewhere, for example, output and employment uncertainty, and uncertainty about the sustainability of government debts.” (De Grauwe, 2012).

<sup>12</sup> He puts the price differential between the cheapest and the most expensive country in the Eurozone at 30%, which according to him are much larger than within countries.

capital in both markets<sup>13</sup>. The benefits of such an integration, particularly in the banking industry are that cross-border liberalisation which accompanies financial integration can spur banking competition and in turn lead to the expansion of the credit industry for it to impact growth and investment positively. In a broader context, to the extent that financial integration allows firms access to international capital markets to finance domestic investment and households to invest their savings abroad it offers them the avenue through which to diversify their risks. In this context Jappelli and Pagano (2008) note that the EMU has opened the possibility for the creation of a fully integrated financial market comparable to that of the United States, by removing exchange rate risk which hitherto was a major obstacle to financial integration. Nonetheless, this possibility is constrained by some regulatory barriers that have not been addressed and therefore making full financial integration not fully realised. Daley and Clarke (2010) also note that since the creation of the EMU evidence is rife that there are lower transaction costs for financial firms, as well as for those firms trading in EU bonds or stocks within the EMU.

- **Financial stability**

It is the argument that within a monetary union in the event of a financial crisis, as was the case in the 2007 global economic and financial crisis, the relevant central bank may be able to play its role as a lender of last resort to forestall liquidity crisis far easier than in countries that are not part of a monetary union. The reason is that banking crisis can spill over into a crisis in the foreign exchange market as banks may have accumulated large amounts of short-term foreign currency deposits to be invested in long-term foreign currency assets. And on an occasion like this, in the case of countries that are not part of a monetary union, the central bank may not be able to create the necessary currency liquidity to redeem its banks. Conversely, in a monetary union the central bank will have a much deeper pocket to do just that (De Grauwe, 2012). It must however be noted that in the case of the EMU there was no clear line of responsibility of who was responsible for bank bail-outs before the crisis period. Also problems of macroeconomic imbalances created by the

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<sup>13</sup> In this sense interest rate convergence will be a good measure of financial integration.

North-South capital flows as outlined in section 3.2 undermined the financial stability of the EMU.

### **3.4.2 Costs**

- **Loss of control over national monetary policy**

This is the major cost in participating in a monetary union. In a monetary union countries cede control of monetary policy to a common monetary authority such as the ECB in the case of the EMU. In such circumstances countries and governments for that matter become very much constrained in their policy response options in the event of a devastating asymmetric shock that sets in motion a recession in the participating countries of the monetary union. This means in such an eventuality their ability to devalue to restore competitiveness or effect interest rate reduction, as well as fiscal policy would be curtailed, particularly in the presence of prior agreements which limit annual budget deficits of the participating countries. The only options left to governments in this case would be microeconomic measures to boost the economy, to cause a rise in employment and output in the long run, which may not help in the short-run during a recession.

## **3.5 Effects of EMU on the EU Banking Systems**

Specifically, in this section, we anticipate that any influences of monetary union membership on the banking systems of the EU would invariably affect NIM and its determinants in the EMU, which indeed motivates our next chapter, and therefore now discuss them.

### **3.5.1 EMU Effects of Banking Risks**

The ECB at the inception of the single currency anticipated that the EMU would impact on the risks banks ordinarily incur in the course of their businesses, namely credit risk, market risk, market liquidity risk, credit institutions' risk, settlement risk, operational risk, and legal risk. It was expected that due to the positive macroeconomic impact deriving from the EMU credit risk in the Euro area for example will be moderated or mitigated. Specifically, it might be expected that as the macroeconomic environment improves businesses flourish and are therefore able to keep up with the repayments on business credits and

loans. It must also be said that due to deeper and more liquid markets that come with EMU banks' liquidity risk as well as markets' liquidity risks were expected to reduce. For the legal and operational risks, it was anticipated that this would exist mainly in the short-term and wane in the longer term as banks may appear to grapple only initially with the changes that may be brought to the legal environment by the EMU as well as the operational environment but adjust as time went on.

### **3.5.2 EMU Effects on Banking Activities**

With the replacement of the hitherto national currencies by the Euro it was expected that there would be a reduction in foreign exchange trading in those currencies thereby negatively affecting the revenues deriving thereof. Nevertheless, this shortfall in revenue was expected to be compensated by the likely increase in their money and securities market businesses. Also, while the low interest rate environment induced by the EMU may have served as a disincentive to depositors who might have sought alternative investment products for their funds this may also have forced banks to source funding at rather higher interest, and invariably putting up banks' NIM to negatively affect social welfare.

### **3.5.3 Effects of EMU on Bank Market Structure and Efficiency**

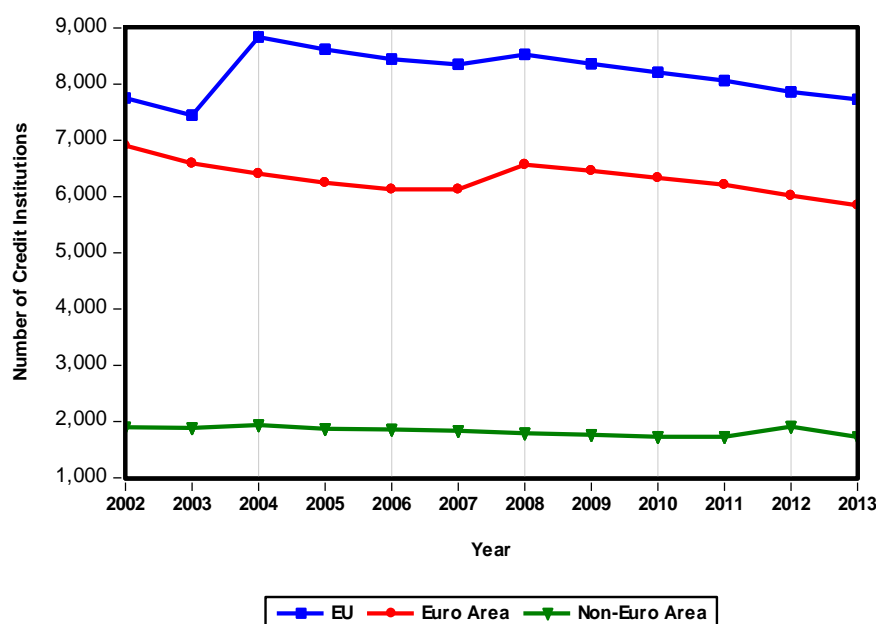
As it pertains to the competitive structure of the banking industry it was observed that with cross-border operations there was to be expected further consolidation of banking firms as they sought to merge to rationalise operations, close up excess capacity that may have existed in some EU banking sectors, take advantage of scale economies afforded by the EMU, compete and to achieve efficiency gains. The ECB (2014) for example note that in 2013 the euro area banking sector continued its consolidation process, which was catalysed by the continued pressure to achieve cost containment, deleveraging and restructuring; a process which resulted in a further reduction of the total number of credit institutions in the euro area, clearly pointing to market concentration over time up to 2013 in the euro area, with positive implications for efficiency.



The consistent consolidation and concentration in the EU banking structure brought about by the EMU is evidenced by figure 3.1 below showing the consistent drop in the number of credit institutions in the EU as a whole, the Eurozone and the non-Eurozone respectively over the studied period, that is 2002 to 2013. It could be seen in the wider EU and Eurozone that while the number of credit institutions inched up slightly between 2007 and 2008 it reverted to its downward trend thereafter. Within the non-Eurozone while this picture is hardly observable we see only a slight drop in the number credit institutions from 2006, continues at level until 2011 when it rises up a bit and begins to drop again from 2012. That the trend in the non-Euro Area seems not quite reflective of the trends in the Euro Area and the broader EU can be attributed to the fact that the considered countries did not start joining the EU until 2004, that is, two years into the period under study. Again, not all the seven considered countries joined simultaneously over the considered period. The consolidation and concentration effects in the EU and the Euro Area are therefore likely not to be captured by our considered non-Euro Area countries.

It would be concluded here that our study of the effects of monetary union membership on NIM and its determinants is motivated by the foregoing discussion of the impact of EMU on the business of banking in the EU.

**Figure 3.1. Number of Credit Institutions in the EU, the Euro Area and the Non-Euro Area, 2002 - 2013**



Source: ECB and author's own calculation

### 3.6 Macroeconomic Convergence in the Euro and non-Euro Areas

In this section we introduce the subject matter of macroeconomic convergence as we, on a global scale, reckon that macroeconomic convergence has risk implications for the determination of NIMs to the extent that the Euro and the non-Euro zones' respective abilities to deal with economic shocks harmoniously will impact on the manner in which the respective macroeconomic environments will impact on the cost of financial intermediation. This is because significant differences in macroeconomic performance between countries have the tendency to elicit different reactions to shocks thereby necessitating country-specific responses which may harm an entire monetary zone (Oshikoya et al, 2010). It happening is indeed a potential source of conflict in a monetary union (Houssa and Leuven, 2004; Blanchard and Quah, 1989 in Oshikoya et al, 2010). It is clear from the foregoing that a source of risk which banks within a monetary union or zone may deem necessary to account for when it comes to the setting of interest rates by way of applying the necessary premium is the risk of asymmetric shocks, which results from macroeconomic divergence.

Specifically, we recognise that a key aspect of the EMU is how well the macroeconomic environments of the constituent member countries are converged in order to foster deeper regional integration, and financial market integration for that matter. The achievement of financial integration means in all

financial markets including the credit markets people should be able to borrow at the same terms across the entire monetary union. In such an environment competition drives efficiency on the part of financial intermediaries, thereby reducing the cost of financial intermediation and net interest margins for that matter.

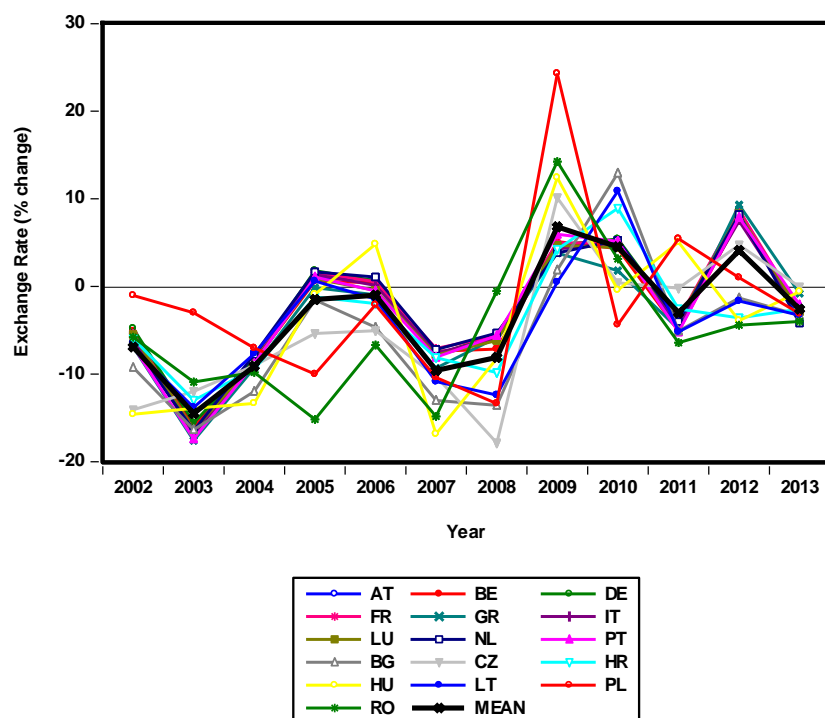
De Santis and Surico, (2013), among a number of studies note that while the business cycle of the Eurozone may be sufficiently synchronized, and the structure of the economies may be sufficiently converged for the transmission of monetary policy to be theoretically homogeneous including price changes in product markets empirical and anecdotal evidence point to the banking industry in the Euro area producing a heterogeneous response in the transmission of monetary policy. Particularly, the response of bank lending to monetary conditions may vary across countries and within the banking sector, thereby making endogenously heterogeneous a common monetary policy. Clearly this assertion points to the fact that the Euro zone is not sufficiently immune to macroeconomic instability emanating from a fairly macroeconomic heterogeneity or divergence of the constituent economies as a potential source of risk banks in the Euro zone have to grapple with. We therefore assess the level of macroeconomic convergence in the Euro and non-Euro zones respectively to give a sense of the level of macroeconomic risks which banks operating within both zones have got to brace themselves with. We in so doing employ the panel unit root test, deemed to be a more robust econometric approach to determining macroeconomic convergence. Since, it is nevertheless the norm in the macroeconomic convergence literature that the less robust methods of correlation matrix and graphical analyses precede any econometric modelling we turn to the use of these methods first in the next section. The idea of using all three approaches of determining macroeconomic convergence or otherwise is to arrive at robust conclusions on the sources of macroeconomic risks which we assume banks in the two respective zones account for.

### **3.6.1 Graphical Analysis**

In figure 3.2 below, depicting the convergence of the Eurozone and the non-Eurozone exchange rate it is evident that between 2002 and 2013, broadly, all 16 countries under study were co-moving, signifying a certain level of

convergence, although in some years, particularly in 2003, 2005, 2010, 2011 and 2012, some non-Eurozone countries were seen to be moving in directions counter to the movement of the rest of the countries.

**Figure 3.2. Convergence Analysis of Euro Area and Non-Euro Area Percentage change in Real Exchange Rates (EXRATEPC).**



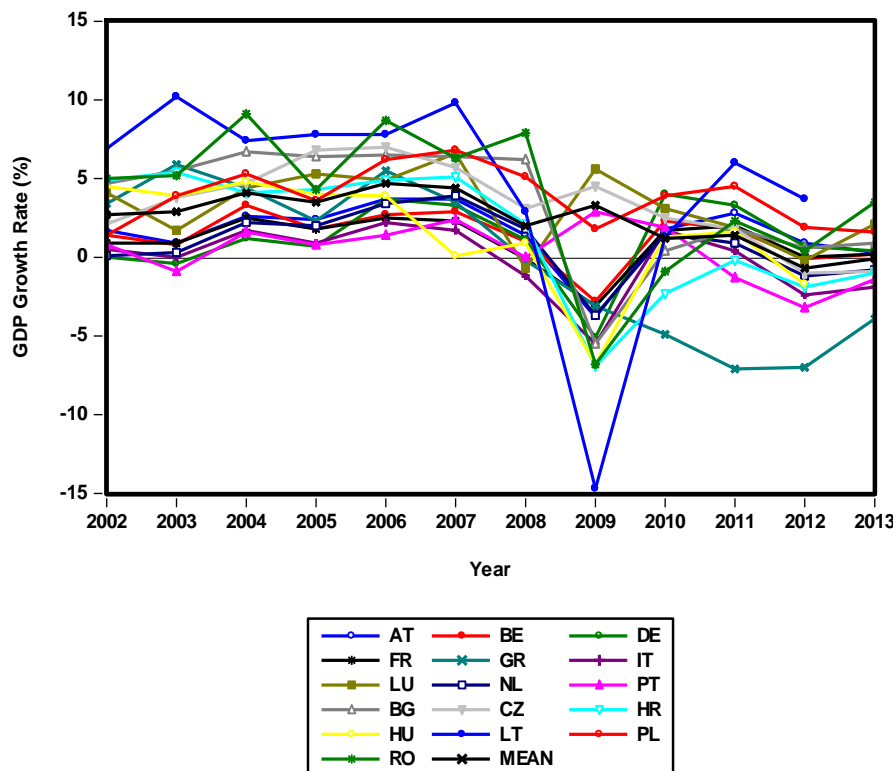
Source: Author's own calculation

For example, in 2005 Poland and Romania were seen running counter to the movement of the rest of the Euro Area and non-Euro Area countries. This broad co-movement among all 16 countries could be attributed to the fact that during the period under consideration the non-Euro Area countries were working assiduously to join the Euro. A closer look at figure 3.2 however shows that while all the Euro Area countries bunched up in their movement over the period, signifying a complete convergence, those of the non-Euro Area roughly trailed their path rather diverging from each other, which signifies a non-convergence to the Euro Area average.

Figure 3.3 below shows that while all the Euro Area countries with the exception of Greece appear to be co-moving together with the EU average although generally below the EU mean, and very close to each other signifying convergence to their regional mean, countries of the non-Euro Area while seem

to be somewhat co-moving are generally far apart each other and generally sit above the EU average.

**Figure 3.3. Convergence Analysis of Euro Area and Non-Euro Area GDP Growth Rates (GDPRGR).**



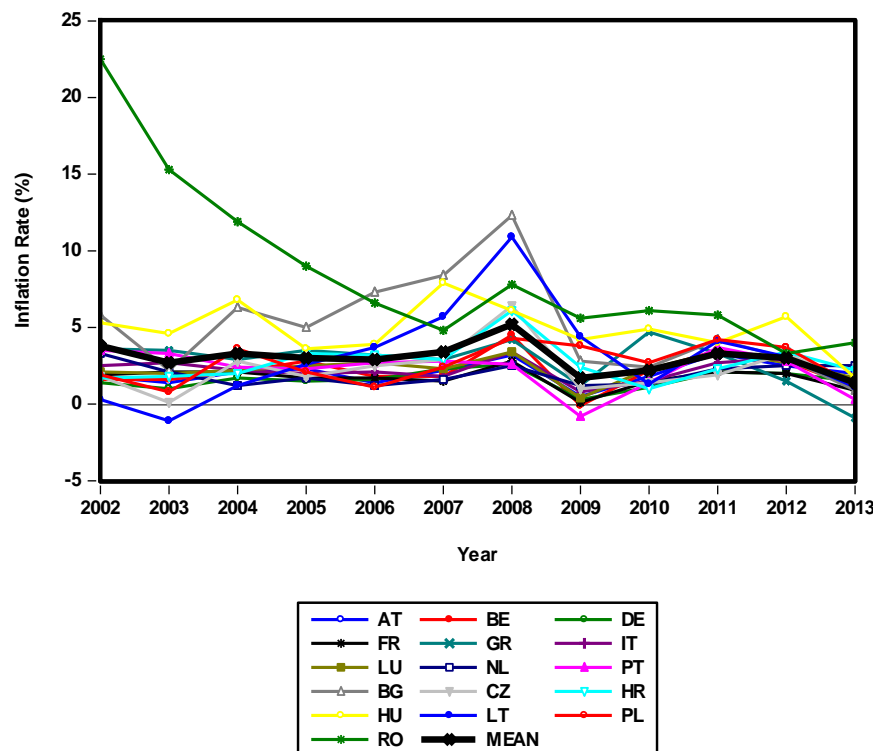
Source: Author's own calculation.

That the non-Euro Area countries' GDPRGR are generally sitting above their Euro Area counterparts' and the EU average seem to support the neo-classical theory of convergence which has it that "due to diminishing returns to reproducible capital, poor countries or regions with low capital/labour ratios have a higher marginal productivity of capital, and therefore will grow faster than richer ones, given the same level of saving and investment." (Soukiazis, 2000). It must however be noted that while all the Euro Area countries' GDP growth rate, apart from Luxembourg, Portugal and Greece, together with three of the non-Euro Area countries, namely Lithuania, Poland and Romania dipped in 2009 to negative digits, the rest of the non-Euro Area countries together with the EU mean went in the opposite, registering positive growth rates.

In figure 3.4 below we show the convergence of inflation rates. Clearly while all countries in both the Euro Area and the non-Euro Area seem to be co-moving with the EU mean all the Euro countries are bunched up below the EU

mean with the non-Euro Area countries diverging from each other above the EU average.

**Figure 3.4. Convergence Analysis of Euro Area and non-Euro Area Inflation Rates (INFRATE).**

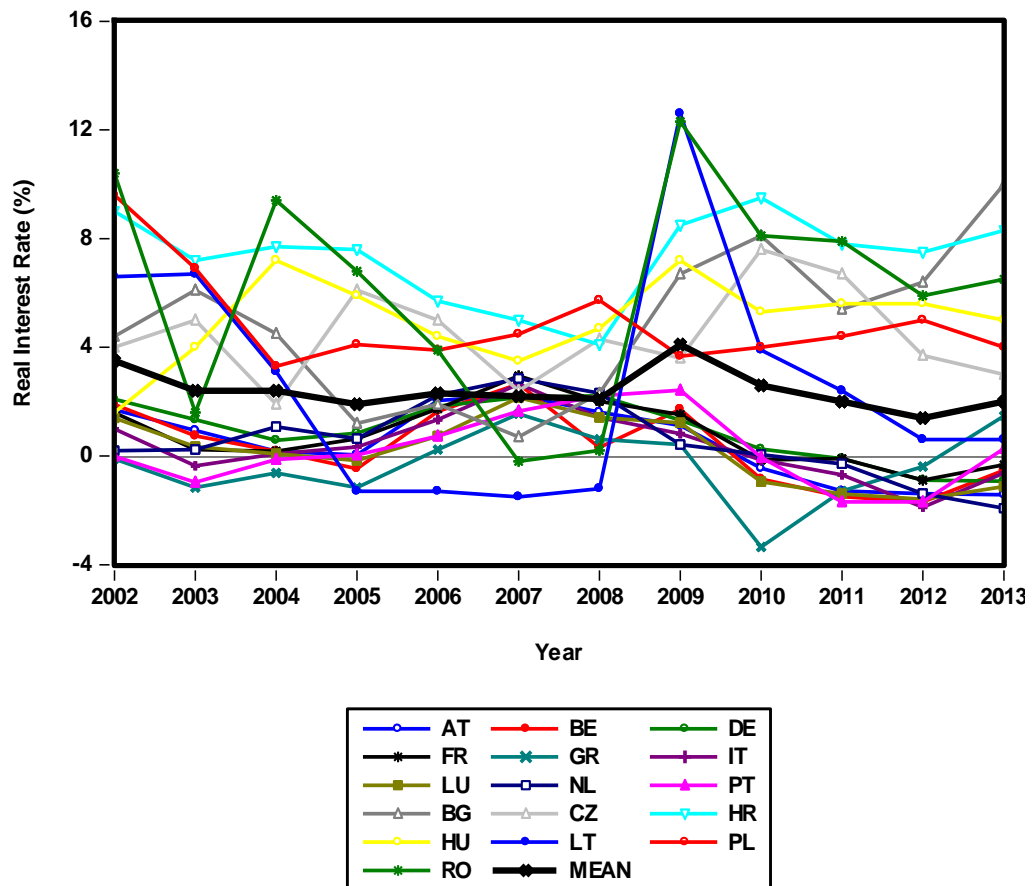


Source: Author's own calculation.

It must be noted however that between 2002 and 2007, Romania recorded astronomically high inflation rates, way above their counterparts in the non-Euro Area and the EU mean for that matter.

In figure 3.5 below we observe that while all the Euro Area economies' real interest rates (REALINT) are bunched up and co-moving with the EU mean, showing convergence, and indeed registering negative numbers from 2010 to 2013, the Euro Area economies are thrown in different directions, diverging from each other.

**Figure 3.5. Convergence Analysis of Euro Area and Non-Euro Area Real Interest Rates (REALINT).**



Source: Author's own calculation.

That the Euro Area countries registered negative real interest rates from 2010 to 2013 may be explained by the ECB's efforts to restore the Euro Area's economic growth by fostering more lending for real investment to kick-start economic recovery following the economic recession in 2008.

### 3.6.2 Pairwise Correlation Analysis

We next turn to a pairwise correlation analysis to see if our graphical analysis could be supported or not. In our analysis a high positive correlation coefficient and a low variance means macroeconomic convergence in the member countries, and consequently any external shock would impact them in the same direction, with the effect of reducing the risk of the instability of the macroeconomic environment. On the other hand, a high variance and a low correlation between countries denote macroeconomic divergence and hence high costs for the union.

Below table 3.1 display the correlations of percentage change in exchange rate between countries of the Euro and non-Euro Areas respectively

to elicit similarities or otherwise in their movements. Looking at the level of convergence between countries in both the Euro and non-Euro Areas in table 3.1 it could be seen that apart from Poland (PL) and a couple of cases in Romania<sup>14</sup>, which correlations with the other countries are generally low the remaining countries have correlation coefficients well above 0.50. between them. This ranges between 0.97 and 1 for the Euro Area countries, and 0.51 and 0.98 for the non-Euro Area countries. our findings from the foregoing correlation analysis support and reflect our findings of potential convergence in the Euro zone and a non-convergence in the non-Euro zone.

We can conclude by these results that while the Euro Area countries can be said to be relatively fully converged on exchange rate, clearly attributable to the Euro as a single currency, those of the non-Euro Area are still approaching full convergence. This is not surprising as during the studied period and even to date these countries, with the exception of Lithuania which adopted the Euro on January 1, 2015, have been making progress towards convergence in their bid to fulfil the conditions for adopting the Euro. Reflecting back on our earlier graphical analysis it would be said that these findings of full convergence in the Euro Area and a non-convergence in the non-Euro Area from our pairwise correlation analysis support those findings from the graphical analysis.

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<sup>14</sup> Romania's correlation with the Netherlands (NL) is 0.47, and 0.44 with Lithuania (LT).



**Table 3.1. Pairwise Correlation Matrix for the Euro Area and the Non-Euro Area Exchange Rates (EXRATEPC).**

Countries	AT	BE	DE	FR	GR	IT	LU	NL	PT	BG	CZ	HR	HU	LT	PL	RO	MEAN	STD DEV
AT	1.000																-2.7	6.8
BE	0.997	1.000															-2.8	6.8
DE	0.999	0.995	1.000														-2.3	6.8
FR	0.998	0.996	0.998	1.000													-2.4	7.0
GR	0.977	0.977	0.977	0.983	1.000												-3.4	7.1
IT	0.997	0.995	0.998	0.999	0.978	1.000											-2.8	6.9
LU	0.997	0.996	0.998	0.999	0.985	0.998	1.000										-2.8	6.8
NL	0.994	0.987	0.995	0.995	0.969	0.996	0.991	1.000									-2.6	6.9
PT	0.992	0.992	0.992	0.995	0.983	0.995	0.995	0.988	1.000								-2.9	7.3
BG	0.832	0.837	0.839	0.831	0.773	0.846	0.836	0.827	0.843	1.000							-5.4	8.1
CZ	0.730	0.760	0.728	0.739	0.752	0.731	0.755	0.712	0.757	0.738	1.000						-4.9	8.2
HR	0.803	0.815	0.806	0.804	0.734	0.820	0.807	0.796	0.819	0.973	0.739	1.000					-3.8	6.1
HU	0.662	0.668	0.662	0.669	0.669	0.672	0.675	0.658	0.688	0.672	0.781	0.743	1.000				-4.2	9.3
LT	0.818	0.822	0.823	0.811	0.744	0.830	0.812	0.818	0.818	0.982	0.686	0.953	0.637	1.000			-4.3	6.8
PL	0.383	0.421	0.378	0.380	0.383	0.364	0.403	0.332	0.397	0.373	0.742	0.467	0.666	0.301	1.000		-2.0	9.8
RO	0.508	0.519	0.505	0.499	0.503	0.502	0.516	0.470	0.552	0.539	0.553	0.598	0.616	0.440	0.711	1.000	-5.1	8.1

Notes: The table presents pairwise correlation coefficients of percentage change in real exchange rate (EXRATEPC) between 16 countries of the Euro and non-Euro Areas respectively, over the period 2002 – 2013, to elicit similarities or otherwise in their movements, and thereby infer the level of convergence. A higher coefficient means a higher level of convergence and vice-versa. The table also displays each country's mean and standard deviation. The sample countries are Austria (AT), Belgium (BE), Germany (DE), France (FR), Greece (GR), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT), Bulgaria (BG), Czech Republic (CZ), Croatia (HR), Hungary (HU), Lithuania (LT), Poland (PL), and Romania (RO).

**Table 3.2. Pairwise Correlation Matrix for the Euro Area and the Non-Euro Area GDP Growth Rates (GDPRGR).**

Countries	AT	BE	DE	FR	GR	IT	LU	NL	PT	BG	CZ	HR	HU	LT	PL	RO	MEAN	STDEV
AT	1.000																1.5	2.0
BE	0.943	1.000															1.3	1.7
DE	0.899	0.855	1.000														1.1	2.5
FR	0.957	0.969	0.861	1.000													1.0	1.6
GR	0.328	0.409	0.008	0.361	1.000												-0.1	4.9
IT	0.919	0.972	0.838	0.969	0.461	1.000											-0.2	2.2
LU	0.067	0.180	-0.069	0.175	0.438	0.235	1.000										3.2	2.3
NL	0.917	0.924	0.824	0.876	0.488	0.894	0.212	1.000									0.9	2.1
PT	-0.107	0.107	-0.108	-0.021	0.381	0.132	0.802	0.190	1.000								0.4	1.8
BG	0.804	0.785	0.529	0.748	0.717	0.761	0.033	0.835	-0.049	1.000							3.4	3.8
CZ	0.225	0.308	0.044	0.281	0.695	0.354	0.728	0.495	0.689	0.412	1.000						3.3	2.6
HR	0.742	0.717	0.427	0.713	0.812	0.741	0.159	0.741	-0.017	0.954	0.429	1.000					1.5	4.0
HU	0.752	0.792	0.537	0.807	0.593	0.837	0.010	0.667	-0.109	0.837	0.250	0.850	1.000				1.5	3.5
LT	0.883	0.810	0.676	0.860	0.493	0.821	-0.066	0.761	-0.316	0.879	0.132	0.889	0.848	1.000			4.5	6.9
PL	0.681	0.705	0.657	0.648	0.399	0.636	0.202	0.855	0.274	0.615	0.558	0.500	0.340	0.492	1.000		3.8	1.8
RO	0.782	0.771	0.529	0.714	0.686	0.717	-0.037	0.807	-0.061	0.963	0.352	0.899	0.797	0.816	0.656	1.000	3.8	4.5

Note: The table presents pairwise correlation coefficients of GDP growth rate (GDPRGR) between 16 countries of the Euro and non-Euro Areas respectively, over the period 2002 – 2013, to elicit similarities or otherwise in their movements, and thereby infer the level of convergence. A higher coefficient means a higher level of convergence and vice-versa. The table also displays each country's mean and standard deviation. The sample countries are Austria (AT), Belgium (BE), Germany (DE), France (FR), Greece (GR), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT), Bulgaria (BG), Czech Republic (CZ), Croatia (HR), Hungary (HU), Lithuania (LT), Poland (PL), and Romania (RO).

In table 3.2 above showing the correlation coefficients for GDP growth rate (GDPRGR) for both the Euro Area and the non-Euro Area we see the generally high correlation between the Euro Area economies and even with most of their counterparts in the non-Euro Area with a few exceptions like Portugal which has generally low correlations with the economies in both regions, indeed between -0.02 with France and 0.38 with Greece for the Euro Area, while having correlations ranging between -0.02 with Croatia and -0.05 with Bulgaria<sup>15</sup>. It must be said that the magnitude of the coefficients between the non-Euro Area economies and with their Euro Area counterparts are mixed, showing divergence and seems to support the graphical representation in figure 3.3.

Table 3.3 below shows the pairwise correlation matrix for the Euro Area and the non-Euro Area inflation rates (INFRATE). Apart from the Netherlands and Greece we observe a generally high correlation between the Euro Area economies than between the non-Euro Area economies where a generally low correlation between countries and a mixed picture obtain. This picture seems to reflect that shown by the graphical representation in figure 3.4 which points to a convergence in inflation rates in the Euro Area and a non-convergence in the non-Euro Area economies.

In table 3.4 below showing the pairwise correlation matrix for the Euro Area and the non-Euro Area real interest rates (REALINT) we observe a reasonably high correlation between the Euro Area economies ranging between 0.59 and 0.97. Within the non-Euro Area economies on the other hand a mixed picture of negative and generally low correlations between countries obtain. This picture seems to reflect the graphical representation in figure 3.5 which points to a convergence in real interest rates in the Euro Area and a non-convergence in the non-Euro Area economies.

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<sup>15</sup> It has a correlation of 0.68 with the Czech Republic though.

**Table 3.3. Pairwise Correlation Matrix for the Euro Area and the Non-Euro Area Inflation Rates (INFRATE).**

Countries	AT	BE	DE	FR	GR	IT	LU	NL	PT	BG	CZ	HR	HU	LT	PL	RO	MEAN	STDEV
AT	1																2	0.8
BE	0.906	1															2.1	1.2
DE	0.875	0.796	1														1.6	0.6
FR	0.718	0.848	0.707	1													1.7	0.7
GR	0.241	0.515	0.197	0.609	1												2.8	1.5
IT	0.671	0.794	0.658	0.931	0.462	1											2.2	0.8
LU	0.867	0.929	0.835	0.859	0.509	0.783	1										2.3	0.8
NL	0.432	0.297	0.327	0.370	-0.108	0.521	0.287	1									2	0.7
PT	0.558	0.604	0.591	0.837	0.582	0.813	0.756	0.394	1								2.3	1.3
BG	0.421	0.553	0.669	0.554	0.488	0.487	0.517	0.020	0.390	1							5.1	3.2
CZ	0.626	0.708	0.785	0.571	0.221	0.568	0.596	0.178	0.235	0.829	1						2.3	1.6
HR	0.482	0.613	0.623	0.426	0.087	0.515	0.472	0.166	0.126	0.734	0.858	1					2.7	1.3
HU	0.204	0.255	0.432	0.410	0.456	0.364	0.216	-0.110	0.399	0.593	0.480	0.202	1				5	1.6
LT	0.452	0.527	0.583	0.228	0.155	0.283	0.388	-0.021	-0.019	0.757	0.831	0.861	0.328	1			3.1	3.1
PL	0.456	0.447	0.315	0.170	0.119	0.250	0.229	-0.030	-0.050	0.302	0.538	0.371	0.393	0.592	1		2.7	1.3
RO	-0.172	-0.095	-0.207	0.310	0.393	0.282	-0.071	0.406	0.428	0.092	-0.209	-0.273	0.141	-0.439	-0.312	1	8.6	5.6

Note: The table presents pairwise correlation coefficients of inflation rate (INFRATE) between 16 countries of the Euro and non-Euro Areas respectively, over the period 2002 – 2013, to elicit similarities or otherwise in their movements, and thereby infer the level of convergence. A higher coefficient means a higher level of convergence and vice-versa. The table also displays each country's mean and standard deviation. The sample countries are Austria (AT), Belgium (BE), Germany (DE), France (FR), Greece (GR), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT), Bulgaria (BG), Czech Republic (CZ), Croatia (HR), Hungary (HU), Lithuania (LT), Poland (PL), Romania (RO).

**Table 3.4. Pairwise Correlation Matrix for the Euro Area and the Non-Euro Area Real Interest Rates (REALINT).**

	AT	BE	DE	FR	GR	IT	LU	NL	PT	BG	CZ	HR	HU	LT	PL	RO	MEAN	STDEV
AT	1																0.4	1.4
BE	0.938	1															0.3	1.4
DE	0.967	0.870	1														0.9	1.1
FR	0.914	0.867	0.913	1													0.8	1.2
GR	0.660	0.665	0.590	0.751	1												-0.3	1.4
IT	0.896	0.846	0.899	0.972	0.623	1											0.3	1.2
LU	0.956	0.932	0.946	0.940	0.733	0.909	1										0.2	1.2
NL	0.806	0.672	0.794	0.851	0.587	0.902	0.770	1									0.5	1.4
PT	0.744	0.683	0.735	0.823	0.573	0.817	0.812	0.728	1								0.2	1.4
BG	-0.566	-0.433	-0.582	-0.678	-0.618	-0.682	-0.548	-0.762	-0.395	1							4.3	2.5
CZ	-0.421	-0.516	-0.300	-0.392	-0.754	-0.332	-0.535	-0.338	-0.345	0.289	1						4.6	1.7
HR	-0.508	-0.300	-0.495	-0.581	-0.675	-0.525	-0.476	-0.754	-0.434	0.724	0.342	1					7.2	1.7
HU	-0.508	-0.451	-0.544	-0.429	-0.221	-0.379	-0.426	-0.211	0.019	0.280	-0.013	0.168	1				5	1.6
LT	-0.006	0.200	-0.007	-0.127	-0.152	-0.167	0.080	-0.421	0.081	0.687	-0.052	0.640	0.145	1			2.8	4.5
PL	0.284	0.253	0.368	0.144	0.102	0.048	0.280	-0.164	-0.150	0.038	-0.038	0.105	-0.818	0.220	1		5	1.8
RO	-0.372	-0.167	-0.367	-0.365	-0.347	-0.340	-0.295	-0.561	-0.148	0.527	0.086	0.844	0.374	0.637	-0.064	1	6	4.2

Note: The table presents pairwise correlation coefficients of real interest rate (REALINT) between 16 countries of the Euro and non-Euro Areas respectively, over the period 2002 – 2013, to elicit similarities or otherwise in their movements, and thereby infer the level of convergence. A higher coefficient means a higher level of convergence and vice-versa. The table also displays each country's mean and standard deviation. The sample countries are Austria (AT), Belgium (BE), Germany (DE), France (FR), Greece (GR), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT), Bulgaria (BG), Czech Republic (CZ), Croatia (HR), Hungary (HU), Lithuania (LT), Poland (PL), Romania (RO).

### 3.6.3 Sigma Convergence ( $\sigma$ )

We further explore the concept of sigma convergence to see if our observations from the above graphical and pairwise correlation analyses could be supported. The use of the concept of sigma convergence is to see if cross-country distribution of the individual macroeconomic variables declines over time. Standard deviation and the coefficient of variation are the two most frequently used summary measures of sigma convergence. Other sigma convergence methods used are the Gini coefficient, the Atkinson index, the Theil index, and the Mean Logarithmic Deviation (MLD). For our purposes however we elect to use the coefficient of variation and therefore do not intend to discuss the other methods beyond their mention. The coefficient of variation is a normalised measure of dispersion of a probability distribution. And it is defined as the ratio of the standard deviation to the mean, taking the following form:

$$cv = \frac{\sqrt{\sigma^2}}{\bar{y}}$$

where  $cv$  is the coefficient of variation,  $\sqrt{\sigma^2}$  is the standard deviation, and  $\bar{y}$  is the sample mean for the variable in question? For a particular macroeconomic variable in a particular region convergence is said to be taking place if the dispersion of the variable is decreasing. Conversely, it is said to be diverging if the dispersion is seen to be increasing over time. Simionescu (2014) assesses the degree of convergence of GDP per capita in 28 EU countries for the period 2000 – 2012 using the sigma convergence methodology and finds a reduction in the level of divergence between countries. Table 3.5 below shows the results of the calculation of sigma convergence for all four macroeconomic variables using the coefficient of variation method.

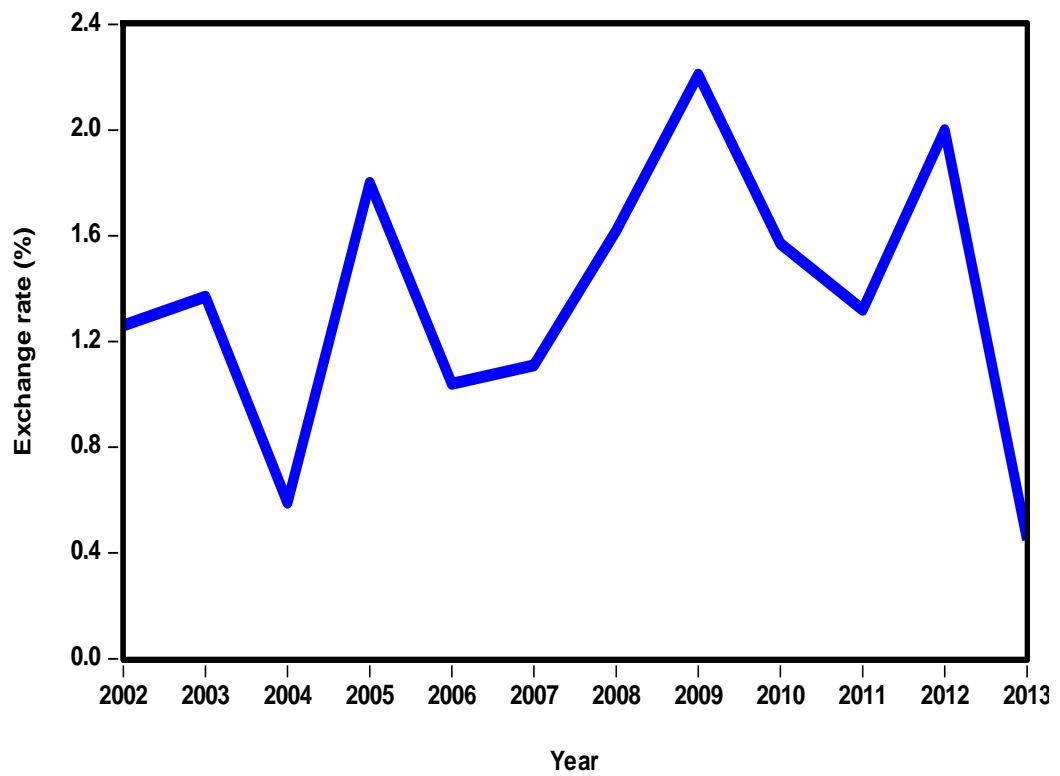
**Table 3.5. Coefficient of variation of all macroeconomic variables for the Euro and non-Euro Areas.**

YEAR	EXRATEPC	GDPRGR	INFRATE	REALINT
2002	1.26	1.36	2.24	2.93
2003	1.37	1.93	1.56	2.5
2004	0.59	1.42	1.2	2.64
2005	1.8	1.43	0.79	2.51
2006	1.04	1.35	0.78	1.18
2007	1.11	1.55	0.94	1.32
2008	1.62	1.63	1.28	1.5
2009	2.21	3.23	0.81	3.4
2010	1.57	1.45	0.66	3.36
2011	1.32	1.82	0.45	3.02
2012	2	1.53	0.4	2.92
2013	0.45	1.17	0.45	3.11

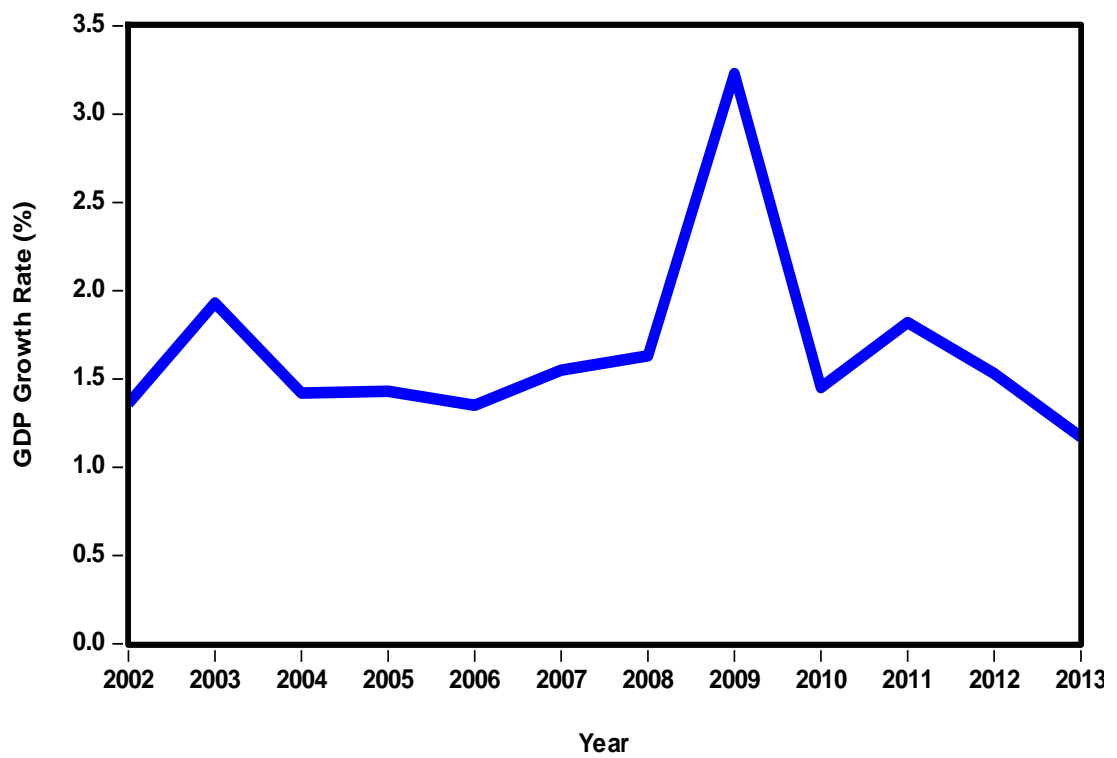
Source: Author's own calculation

To be able to better detect convergence or otherwise we plot our summary measures of sigma convergence based on the coefficient of variation for all our four macroeconomic variables consecutively below. In figure 3.6 below we find the evolution of the coefficient of variation calculated for 2002 to 2013 percentage change in exchange rate (EXRATEPC) for both the Euro Area and the non-Euro Area. Over the period no consistent and clear declining trend is observed. Rather the trend is one of peaks and troughs. For example, while we observe a dispersion between 2007 and 2009 as per the rise in the coefficient of variation from 1.11 in 2007 to 2.21 in 2009, similarly between 2009 and 2011 we observe a decline in the coefficient of variation from 2.21 in 2009 to 1.32 in 2011 signifying a convergence among the Euro Area and the non-Euro Area countries. While our sigma convergence analyses do not support our graphical and pairwise correlation analyses we intend to arrive at a more conclusive and robust results of ascertaining convergence or otherwise, with the use of the test of panel unit root, in section 3.5.4 below.

**Figure 3.6. Sigma Convergence of Percentage Change in Real Exchange Rate.**



**Figure 3.7. Sigma Convergence of GDP Growth Rate (GDPRGR).**



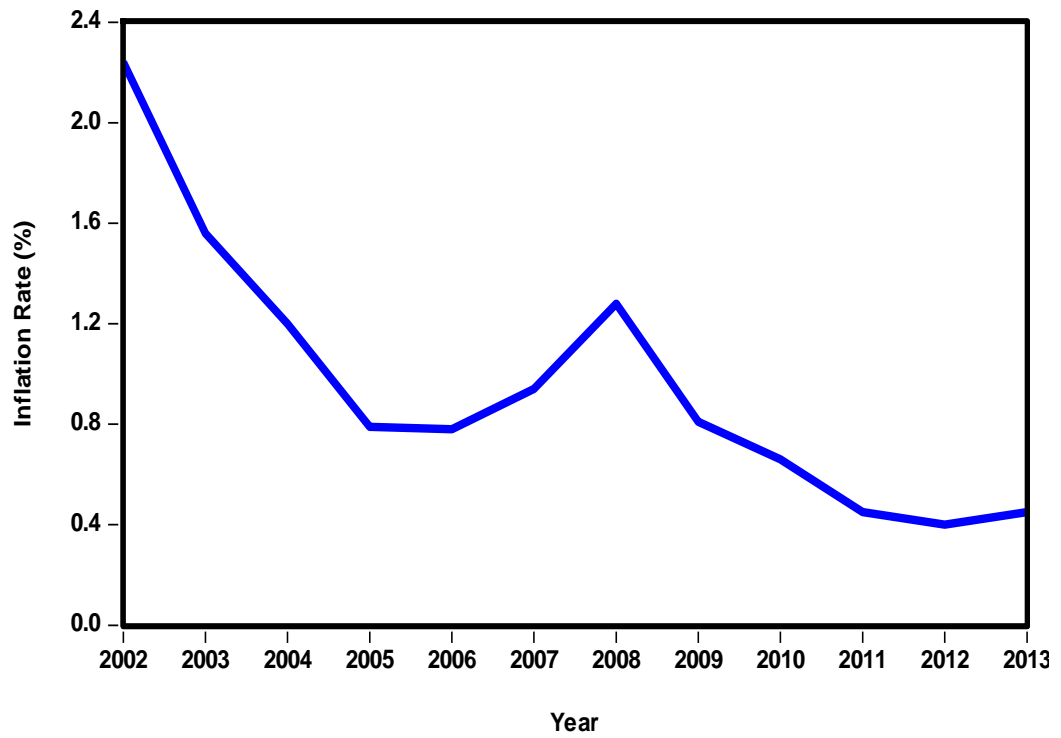


Similarly, in figure 3.7 above we observe an alternating trend of dispersion and convergence over the studied period, that is 2002 to 2013. For example, between 2008 and 2009 as per the rise in the coefficient of variation from 1.63 in 2008 to 3.23 in 2009, we observe a dispersion, while between 2009 and 2010 we observe a decline in the coefficient of variation from 3.23 in 2009 to 1.45 in 2010 signifying a convergence among the Euro Area and the non-Euro Area countries. Again, here as well, our sigma convergence analyses do not support our graphical and pairwise correlation analyses.

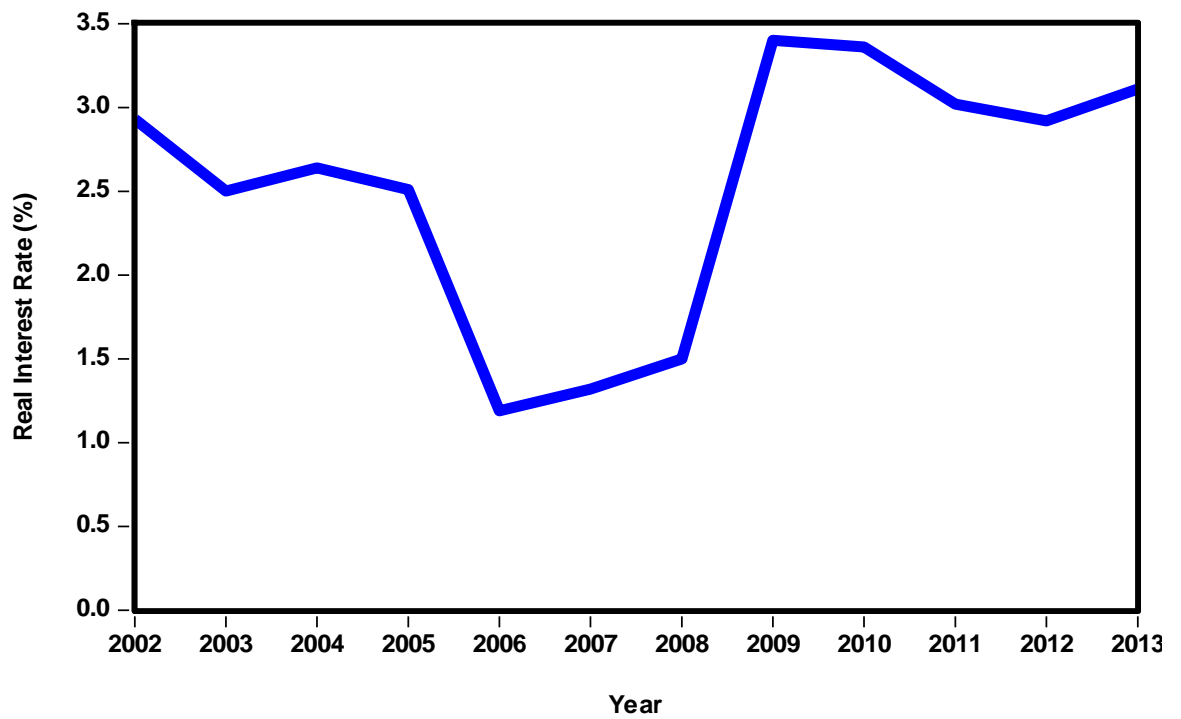
For inflation rate (INFRATE) we rather find two episodes of convergence over 2002 to 2006, and 2008 to 2013. For the first episode we observe a decline in the coefficient of variation from 2.24 in 2002 to 0.78 in 2006 depicting a convergence. Then between 2006 and 2008 the coefficient of variation rises up to 1.28, implying a dispersion or non-convergence. Nevertheless, from 2008 the coefficient drops again from 1.28 to 0.45 in 2013, implying another episode of convergence of inflation rate among the Euro Area and non-Euro Area countries. The picture here seems to support our graphical analysis which generally shows a co-movement between all countries within the two regions save a closer convergence in the Euro Area generally below the EU mean than the non-Euro Area where countries are further apart from each other and mostly above the EU mean over the years.

Figure 3.9 below shows the graphical representation of the sigma convergence of the real interest rate (REALINT) for both the Euro Area and non-Euro Area. Again looking at the alternating trend of dispersion and convergence over the studied period, that is 2002 to 2013, an absolute convergence between the EU economies cannot be confirmed. For instance, in 2005 to 2006 a convergence in real interest rate was observed when it dropped from 2.51 in 2005 to 1.19 in 2006. Then we see another rise to 3.40 in 2009 implying a divergence.

**Figure 3.8. Sigma Convergence of Inflation Rate (INFRATE).**



**Figure 3.9. Sigma Convergence of Real Interest Rate (REALINT).**



### 3.6.4 Panel Unit Root Literature

In using panel unit root the focus here is on long-run bivariate convergence between both the Euro and the non-Euro zone countries and their respective means. Baltagi (2005) notes that several unit root tests used in the time series literature have been extended to panel data. In the theoretical literature a number of issues which arise in this application to panel data arise which have been tackled by Im et al (2003), Maddala and Wu (1999), Choi (2001), Kao (1999), and Phillips and Moon (1999). For instance, Baltagi (2005) explains that the problem of spurious regression which obtains in the time series literature can be avoided when panel data is used as panel data regression estimates produce a consistent estimate of the true value of the parameter as both the cross-sectional and the time dimensions tend to  $\infty$ . This in his view is because the panel estimator averages across individuals and the information in the independent cross-section data in the panel leads to a stronger overall signal than obtains in a pure time series scenario. Lopez, C. and Papell, D. (2010) also in their empirical application of panel unit root test re-echoe the view shared by Baltagi (2005) and his fore-runners by noting that the extension of time series investigation of the convergence hypothesis, which often relies on unit root tests, to the panel framework has significantly influenced the literature on how to measure convergence of macroeconomic variables. According to them the rejection of the null hypothesis is commonly interpreted as evidence that the series have converged to their equilibrium state, since any shock that causes deviations from equilibrium eventually dies out. Holmes (2002) posits that panel data unit root testing offers a means of overcoming problems of low test power associated with the earlier applications of univariate ADF tests, and therefore uses the t-bar panel data unit root tests as advocated by Im et al. (1997) and Breuer et al. (1999) to identify strong convergence using either the US or Germany as the base country in his investigation of the international output convergence. Hall and Mairesse (2002) also note that in recent years the econometrics literature has proposed a number of tests for unit roots in panel data. One of such is the IPS (Im-Pesaran-Shin) test which is valid, as in our case, when the number  $T$  of time periods (years in our case) is small and the number  $N$  of individuals (countries in our case) is large, that is are consistent when  $T$  is fixed and  $N \rightarrow \infty$ . The IPS test

according to Hall and Mairesse (2002) views the panel data regression as a system of  $N$  individual regressions and is based on the combination of independent Dickey-Fuller tests for these  $N$  regressions. They further posit that aside allowing for heteroscedasticity, serial correlation, and non-normality, this test also allows for heterogeneity of trends and of the lag coefficient under the alternative hypothesis of no unit root.

While there have been quite a few possible procedures which have been proposed for testing unit roots in panel data (Levin and Lin (1992), Breitung and Mayer (1994), Quah (1992, 1994), Im, Pesaran and Shin (IPS) (1997)) the general structure used by most (though not all) panel unit root testing procedures follow a system of Augmented Dicker-Fuller regressions as follows (Lopez and Papell, 2010):

$$\Delta y_{it} = \rho_{it} y_{i,t-1} + \sum_{l=1}^{pi} \phi_{i,t} \Delta y_{i,t-1} + \alpha_i d_{i,t} + \varepsilon_{it} \quad (3.1)$$

where the  $d_{i,t}$  are the deterministic components. The null and alternative hypotheses tested are:  $\rho_i = 0$  means the  $y$  process has a unit root for individual  $i$ , while  $\rho_i < 0$  means that the process is stationary around the deterministic part. And  $\rho$  is the homogeneous rate of convergence. Stationarity in fact implies that the difference between a macroeconomic variable of interest of two countries at time  $(t)$  is less than the difference observed over a period  $(t-1)$ . Based on this definition, the test of convergence can be performed as a unit root test on the random variable of interest defined as the difference between the variable of interest of the two countries. If the null hypothesis that there is a unit root in the process can be rejected, then it is concluded that the variable in question of the two countries converges. In a scenario where multiple countries are being considered the unit root test can be performed on the difference between the variable of interest of a country  $k$  in the group and the average macroeconomic variable of interest of the entire group of countries. The rejection of the null hypothesis in this case means that country  $k$  converges towards the regional average.

Furthermore, following the empirical approach adopted by Ben-David (1993) in which he estimates the model below we aim to determine if the

differences between the individual Euro and non-Euro Areas countries for our selected macroeconomic variables and the regional means or averages are indeed diminishing over time and that individual country values tend to converge toward the regional mean over time. In other words, it may be expected that within the Euro and non-Euro Areas countries may be sharing a long-run equilibrium or persistent co-movement with respect to the selected macroeconomic variables, meaning they may wander from each other in the short run but then maintain a common path or equilibrium, and their deviation from this equilibrium has no tendency to grow steadily over time.

$$(y_{i,t} - \bar{y}_t) = \phi(y_{i,t-1} - \bar{y}_{t-1}) + \varepsilon_{i,t} \quad (3.2)$$

where  $y_{i,t}$  is the log of country  $i$ 's real per capita income at time  $t$  and  $\bar{y}_t$  is the average of the group's log per capita incomes at time  $t$ . A  $\phi < 1$  indicates the existence of income convergence within the group, while a  $\phi > 1$  indicates divergence.

According to Ben-David (1996) once  $\phi$  is estimated it gives an indication of the speed or rate of convergence within the given group of countries. A  $\phi$  can therefore be interpreted as a measurement of the strength of convergence toward the common mean. As a result, a more persistent differential, that is, higher value of  $\phi$  would correspond to weaker convergence as any shock would have a longer lasting impact, and a less persistent differential, that is, a lower value of  $\phi$  would correspond to stronger convergence. In contrast to the p-values, the rate of convergence remains the main attractiveness of his model and sits in its simplicity, its applicability to relatively small groups of countries, and its usefulness for conducting relatively quick and simple convergence comparisons across a multitude of groups that include different country compositions. According to Lopez and Papell (2010) the most common measure of persistence of an economic time series is the half-life, which is the amount of time it takes for a shock on a macroeconomic variable differential to dissipate by 50 percent. It is indeed the estimated length of time to eliminate half or 50 percent of the initial differential and how long it will take to close those gaps. The half-life is approximated by the ratio  $\ln(0.5)/\ln(\phi)$ .

### 3.6.4.1 Results of Panel Unit Root Tests for the Euro Area and the Non-Euro Area

In this section, we test for the macroeconomic convergence in the Euro and non-Euro Areas respectively, and present the results below.

**Table 3.6. Combined Euro Area and Non-Euro Area Test of Panel Unit Root Combined.**

	With Individual Intercept				Without Individual Intercept		
	ADF Test	IPS Test	PP Test	LLC Test	ADF Test	PP Test	LLC Test
EXRATEPC	68.193***	-4.28***	58.225***	-9.221***	122.93***	114.29***	-9.505***
GDPGR	51.739**	-2.54***	56.562***	-5.340***	83.863***	84.071***	-5.517***
INFRATE	103.952***	-6.99***	140.71***	-8.598***	61.835***	59.918***	-6.320***
REALINT	57.238***	-2.72***	72.567***	-4.506***	69.130***	64.157***	-4.298***

Note: Probability values are: \*\*\*1% \*\*5% \*10%. The table presents the coefficients of the results of the panel unit root tests of our selected macroeconomic variables: percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPGR), inflation rate (INFRATE), and real interest rate (REALINT) for all the 16 sample countries of the Euro and non-Euro Areas combined, for the period 2002 – 2013. The sample countries are Austria (AT), Belgium (BE), Germany (DE), France (FR), Greece (GR), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT), Bulgaria (BG), Czech Republic (CZ), Croatia (HR), Hungary (HU), Lithuania (LT), Poland (PL), Romania (RO). Time trend was not included in these computations. The four different tests for purposes of robustness are ADF - Fisher Chi-square, PP - Fisher Chi-square, Levin, Lin & Chu (LLC), and Im, Pesaran and Shin W-stat. Bandwidths in all the unit root tests are determined by the Newey-West statistic using the Barlett-Kernel.

**Table 3.7. Euro Area Test of Panel Unit Root in Level.**

	with Individual Intercept				Without Individual Intercept		
	ADF Test	IPS Test	PP Test	LLC Test	ADF Test	PP Test	LLC Test
EXRATEPC	33.764**	-2.753***	31.837**	-5.955***	67.401***	64.571***	-7.084***
GDPGR	35.970***	-2.756***	41.102***	-4.657***	53.754***	55.127***	-4.972***
INFRATE	65.982***	-5.920***	89.437***	-8.222***	26.189*	24.437	-3.148***
DINFRATE	74.888***	-6.523***	139.450***	-9.700***	128.55***	164.04***	-12.261***
REALINT	18.609	-0.415	12.540	-1.069	45.142***	41.708***	-4.651***
DREALINT	36.204***	-2.900***	36.584***	-3.927***	77.923***	77.566***	-7.817***

Note: Probability values are: \*\*\*1% \*\*5% \*10%; DINFRATE is differenced inflation rate; DREALINT is differenced real interest rate. Note: Probability values are: \*\*\*1% \*\*5% \*10%. The table presents the coefficients of the results of the panel unit root tests of our selected macroeconomic variables: percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPGR), inflation rate (INFRATE), and real interest rate (REALINT) for all the 9 sample countries of the Euro Area, for the period 2002 – 2013. The sample countries are Austria (AT), Belgium (BE), Germany (DE), France (FR), Greece (GR), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT), Time trend was not included in these computations. The four different tests for purposes of robustness are ADF - Fisher Chi-square, PP - Fisher Chi-square, Levin, Lin & Chu (LLC) and Im, Pesaran and Shin W-stat. Bandwidths in all the unit root tests are determined by the Newey-West statistic using the Barlett-Kernel.

**Table 3.8. Non-Euro Area Test of Panel Unit Root in Level.**

	With Individual Intercept				Without Individual Intercept		
	ADF Test	IPS Test	PP Test	LLC Test	ADF Test	PP Test	LLC Test
EXRATEPC	34.428***	-3.335***	26.388**	-6.851***	55.538***	49.721***	-6.345***
GDPGR	15.769	-0.710	15.460	-2.760***	30.109***	28.944**	-3.124***
DGDPGR	52.482***	-5.381***	80.350***	-8.439***	91.870***	104.25***	-10.164***
INFRATE	37.970***	-3.815***	51.281***	-6.348***	35.646***	35.487***	-5.569***
REALINT	38.629***	-3.652***	60.028***	-5.914***	23.988**	22.447*	-2.234**

Note: Probability values are: \*\*\*1% \*\*5% \*10%; DGDPGR is differenced GDP growth rate. The table presents the coefficients of the results of the panel unit root tests of our selected macroeconomic variables: percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPGR), inflation rate (INFRATE), and real interest rate (REALINT) for all the 7 sample countries of the non-Euro Area, for the period 2002 – 2013. The sample countries are Bulgaria (BG), Czech Republic (CZ), Croatia (HR), Hungary (HU), Lithuania (LT), Poland (PL), Romania (RO). Time trend was not included in these computations. The four different tests for purposes of robustness are ADF - Fisher Chi-square, PP - Fisher Chi-square, Levin, Lin & Chu (LLC) and Im, Pesaran and Shin W-sta. Bandwidths in all the unit root tests are determined by the Newey-West statistic using the Barlett-Kernel.

**Table 3.9. Euro Area Speed of Adjustment and Half-Life.**

	$\beta$ (Euro Area Average speed of adjustment)	Half-life
EXRATEPC	0.203***	0.43
GDPGR	0.194***	0.42
INFRATE	-0.024	undefined
REALINT	0.725***	2.15

Note: Probability values \*\*\*1% \*\*5% \*10%. The table presents the results of the Euro Area speed of adjustment and Half-life of our selected macroeconomic variables: percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPGR), inflation rate (INFRATE), and real interest rate (REALINT) for all the 9 sample countries of the Euro Area, for the period 2002 – 2013. The sample countries are Austria (AT), Belgium (BE), Germany (DE), France (FR), Greece (GR), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT). INFRATE is not statistically significant so we cannot compute the half-life.

**Table 3.10. Non-Euro Area Speed of Adjustment and Half-Life.**

	$\beta$ (Non-Euro Area speed of adjustment)	Half-life
EXRATEPC	0.173***	0.39
GDPGR	0.354***	0.67
INFRATE	0.588***	1.31
REALINT	0.611***	1.41

Note: Probability values \*\*\*1% \*\*5% \*10% The table presents the results of the Non-Euro Area speed of adjustment and Half-life of our selected macroeconomic variables: percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPGR), inflation rate (INFRATE), and real interest rate (REALINT) for all the 7 sample countries of the non-Euro Area, for the period 2002 – 2013. The sample countries are Bulgaria (BG), Czech Republic (CZ), Croatia (HR), Hungary (HU), Lithuania (LT), Poland (PL), Romania (RO). Time trend was not included in these computations.

Above in table 3.6 we present the results of the panel unit root test of all the macroeconomic variables indicating convergence of the national values of the sample countries of the Euro Area and the non-Euro Area combined to the European Union mean. Also in tables 3.7 and 3.8 are presented the results of the panel unit root test of all the macroeconomic variables to infer convergence of national values to the Euro and non-Euro Areas means respectively.

It is evident from tables 3.6, 3.7, and 3.8 that the results for all the macroeconomic variables, whether in the case of the combined Euro Area and the non-Euro Area or individual zonal analyses, are very consistent throughout with a unit root always rejected at mostly statistical significance of between 1 and 5 percent. The conclusion therefore is that there is convergence towards the sub-regional/zonal averages with respect to our chosen macroeconomic variables, among countries in the respective Euro Area and the non-Euro Area, as well as both zones combined. In terms of speed of convergence within both the Euro Area and the non-Euro Area, estimating Ben-David's (1993) model, the results of which appear in tables 3.9 and 3.10, the results are mixed. We find, for example, that while the speed of convergence for GDP growth rate (0.194) and inflation rate, (-0.024 (although not statistically significant)) within the Eurozone is faster than it obtains in the non-Eurozone (0.354 and 0.588 respectively) the reverse is for the percentage change in exchange rate and real interest rate variables. What all of this means is that while in the case of the non-Euro Area the average speed of convergence for percentage change in exchange rate (EXRATEPC) and real interest rate (REALINT) variables are closer to zero than in the Euro Area, on the other hand the average speed for the GDP growth rate (GDPRGR) and inflation rate (INFRATE) variables are closer to zero in the Euro Area than in the non-Euro Area. If the values are closer to one, it denotes a slow rate of convergence. Conversely if it is closer to zero then it denotes faster rate of convergence. The speed of convergence is calculated by estimating equation (3.2) above. Again, we calculate the half-life of the convergence process for both zones. As per our results in the last columns of tables 3.9 and 3.10 for both zones, for all variables, apart from the GDP growth rate variable (0.42 for the Euro Area and 0.67 for the non-Euro Area) it takes a shorter time for the gap between the non-Euro Area countries' values and the sub-regional average to be cut into half than the countries in the



Euro Area. This is not surprising as most of the European countries outside the Euro Area have been making efforts to join the Euro Area during the period under consideration, and would therefore be expected to be making efforts to meet the Euro Area convergence criteria as fast as possible. For example, while Romania, Bulgaria, Poland, Czech Republic, Hungary, and Sweden are on the enlargement agenda the following countries joined the Euro zone in the respective years in the parenthesis: Slovenia (2007), Cyprus (2008), Malta (2008), Slovakia (2009), Estonia (2011), Latvia (2014) and Lithuania (2015). The catching-up process of our sample non-Euro Area countries, all being CEEC (Central and Eastern European Countries), with the Euro Area countries, as appears in table 3.6 above reflects the CEEC integrative process into the Euro Area and the EU for that matter. This corroborates findings to the effect that the CEEC macroeconomic similarities to Western Europe have grown and have economic benefit implications (Ciobanu and Ciobanu, 2009). Ciobanu and Ciobanu (2009) note that the CEECs' catching-up reflects their achievement of market economy status, where they have open borders to trade and capital, a dwindled central planning regime and state intervention in production. They as well observe a generally low and stable inflation rates, and monetary and fiscal policies which were for most part transparent.

### **3.7 WAEMU and Non-Monetary Union SSA Panel Unit Root Results**

In this section, we test for the macroeconomic convergence in Sub-Saharan Africa. We however go straight to the use of the more robust of our chosen convergence test methods, that is, the test of unit root without first exploring the less robust preliminary methods as was done for our European analysis in the previous section. Below we present the results for the test of unit root, speed of convergence and their half-lives in tables 3.11 to 3.15, and discuss them.

**Table 3.11. Combined WAEMU and Non-Monetary Union Sub-Saharan Africa Test of Panel Unit Root Combined.**

	With Individual Intercept				Without Individual Intercept		
	ADF Test	IPS Test	PP Test	LLC Test	ADF Test	PP Test	LLC Test
EXRATEPC	175.936***	-8.959***	144.221***	-11.888***	283.632***	259.167***	-14.4402***
GDPGR	195.472***	-9.4390***	256.511***	-12.918***	74.275**	99.402***	-1.7456**
INFRATE	195.170***	-9.628***	251.452***	-9.807***	85.723***	113.787***	-3.909***
REALINT	213.896***	-10.954***	224.437***	-12.308***	160.052***	203.428***	-6.611***

Note: Probability values are: \*\*\*1% \*\*5% \*10%. The table presents the coefficients of the results of the panel unit root tests of our selected macroeconomic variables: percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPGR), inflation rate (INFRATE), and real interest rate (REALINT) for all the 27 sample countries of the WAEMU and the non-monetary union SSA combined, for the period 1999 – 2013. The sample countries are Burkina Faso (BF), Burundi (BI), Benin (BJ), Botswana (BW), Cote Ivoire (CI), Ethiopia (ET), Gambia (GM), Ghana (GH), Kenya (KE), Lesotho (LS), Madagascar (MG), Mali (ML), Mauritania (MR), Mauritius (MU), Malawi (MW), Mozambique (MZ), Namibia (NA), Niger (NE), Nigeria (NG), Rwanda (RW), Sierra Leone (SL), Senegal (SN), Swaziland (SW), Togo (TG), Tanzania (TZ), Uganda (UG), South Africa (ZA). Time trend was not included in these computations. The four different tests for purposes of robustness are ADF - Fisher Chi-square, PP - Fisher Chi-square, Levin, Lin & Chu (LLC) and Im, Pesaran and Shin W-stat. Bandwidths in all the unit root tests are determined by the Newey-West statistic using the Barlett-Kernel.

**Table 3.12. WAEMU Test of Panel Unit Root in Level.**

	with Individual Intercept				Without Individual Intercept		
	ADF Test	IPS Test	PP Test	LLC Test	ADF Test	PP Test	LLC Test
EXRATEPC	49.760***	-5.0489***	26.214**	-7.7632***	78.246***	55.583***	-8.609***
GDPGR	60.638***	-6.241***	54.199***	-6.964***	16.587	29.871***	-1.156
DGDPGR	103.301***	-11.245***	147.943***	-12.035***	131.700***	133.569***	-16.659***
INFRATE	71.809***	-7.309***	113.538***	-8.335***	28.975**	45.131***	-3.488***
REALINT	51.163***	-5.259***	53.353***	-6.921***	65.916***	71.643***	-6.541***

Note: Probability values are: \*\*\*1% \*\*5% \*10%; DGDPGR is differenced GDP growth rate Note: Probability values are: \*\*\*1% \*\*5% \*10%. The table presents the coefficients of the results of the panel unit root tests of our selected macroeconomic variables: percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPGR), inflation rate (INFRATE), and real interest rate (REALINT) for all the 7 sample countries of the Euro Area, for the period 1999 – 2013. The sample countries are Burkina Faso (BF), Benin (BJ), Cote Ivoire (CI), Mali (ML), Niger (NE), Senegal (SN), Togo (TG). Time trend was not included in these computations. The four different tests for purposes of robustness are ADF - Fisher Chi-square, PP - Fisher Chi-square, Levin, Lin & Chu (LLC), and Im, Pesaran and Shin W-stat. Bandwidths in all the unit root tests are determined by the Newey-West statistic using the Barlett-Kernel.

**Table 3.13. Non-Monetary Union Sub-Saharan Africa Test of Panel Unit Root in Level.**

	With Individual Intercept				Without Individual Intercept		
	ADF Test	IPS Test	PP Test	LLC Test	ADF Test	PP Test	LLC Test
EXRATEPC	126.176***	-7.424***	118.007***	-9.225***	205.385***	203.584***	-11.712***
GDPRGR	134.834***	-7.289***	202.312***	-10.959***	57.689**	69.531***	-1.439*
INFRATE	123.361***	-6.348***	137.915***	-7.129***	56.748**	68.656***	-3.056***
REALINT	162.733***	-9.6122***	171.084***	-10.147***	94.137***	131.786***	-5.0502***

Note: Probability values are: \*\*\*1% \*\*5% \*10%; The table presents the coefficients of the results of the panel unit root tests of our selected macroeconomic variables: percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPRGR), inflation rate (INFRATE), and real interest rate (REALINT) for all the 20 sample countries of the non-monetary union Sub-Saharan Africa, for the period 1999 – 2013. The sample countries are Burundi (BI), Botswana (BW), Ethiopia (ET), Gambia (GM), Ghana (GH), Kenya (KE), Lesotho (LS), Madagascar (MG), Mauritania (MR), Mauritius (MU), Malawi (MW), Mozambique (MZ), Namibia (NA), Nigeria (NG), Rwanda (RW), Sierra Leone (SL), Swaziland (SW), Tanzania (TZ), Uganda (UG), South Africa (ZA). Time trend was not included in these computations. The four different tests for purposes of robustness are ADF - Fisher Chi-square, PP - Fisher Chi-square, Levin, Lin & Chu (LLC), and Im, Pesaran and Shin W-stat. Bandwidths in all the unit root tests are determined by the Newey-West statistic using the Barlett-Kernel.

**Table 3.14. WAEMU Speed of Adjustment and Half-Life.**

	$\beta$ (WAEMU Average speed of adjustment)	Half-life
EXRATEPC	0.308***	0.59
GDPRGR	0.254***	0.51
INFRATE	-0.176***	0.45
REALINT	0.118***	0.32

Note: Probability values \*\*\*1% \*\*5% \*10%. The table presents the results of the WAEMU speed of adjustment and Half-life of our selected macroeconomic variables: percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPRGR), inflation rate (INFRATE), and real interest rate (REALINT) for all the 7 sample countries of the WAEMU, for the period 1999 – 2013. The sample countries are Burkina Faso (BF), Benin (BJ), Cote Ivoire (CI), Mali (ML), Niger (NE), Senegal (SN), Togo (TG).

**Table 3.15. Non-Monetary Union Sub-Saharan Africa Speed of Adjustment and Half-Life.**

	$\beta$ (Non-Monetary Union SSA speed of adjustment)	Half-life
EXRATEPC	0.265***	0.52
GDPRGR	0.313***	0.60
INFRATE	0.276***	0.54
REALINT	0.464***	0.90

Note: Probability values \*\*\*1% \*\*5% \*10% The table presents the results of the non-monetary union Sub-Saharan Africa speed of adjustment and Half-life of our selected macroeconomic variables: percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPRGR), inflation rate (INFRATE), and real interest rate (REALINT) for all the 20 sample countries of the non-monetary union Sub-Saharan Africa, for the period 1999 – 2013. The sample countries are Burundi (BI), Botswana (BW), Ethiopia (ET), Gambia (GM), Ghana (GH), Kenya (KE), Lesotho (LS), Madagascar (MG), Mauritania (MR), Mauritius (MU),

Malawi (MW), Mozambique (MZ), Namibia (NA), Nigeria (NG), Rwanda (RW), Sierra Leone (SL), Swaziland (SW), Tanzania (TZ), Uganda (UG), South Africa (ZA).

We present the results of the panel unit root test of all the macroeconomic variables indicating convergence of the national values of the sample countries of the WAEMU and the non-monetary union Sub-Saharan Africa combined to the Sub-Saharan African mean in table 3.11 above. Also in tables 3.12 and 3.13 are presented the results of the panel unit root test of all the macroeconomic variables to infer convergence of national values to the WAEMU and non-monetary union Sub-Saharan African means respectively. Clearly, from these three tables it could be seen that the results for all the macroeconomic variables, whether in the case of the combined WAEMU and the non-monetary union Sub-Saharan Africa or individual zonal analyses, are very consistent throughout with a unit root always rejected at mostly statistical significance of between 1 and 5 percent as in the European analyses preceding it. We can therefore conclude that there is convergence towards the sub-regional/zonal averages with respect to our chosen macroeconomic variables, among countries in the WAEMU and the non-monetary union Sub-Saharan Africa respectively, as well as both zones combined. Within the respective WAEMU and non-monetary union Sub-Saharan Africa regions the results also give an indication of the periphery economies catching up with the core. In regard to the speed of convergence within both the WAEMU and the non-monetary union Sub-Saharan Africa, estimating Ben-David's (1993) model, as was done in the European analyses, the results are also somewhat consistent. The speed of convergence is generally faster in the WAEMU than in the non-monetary union Sub-Saharan Africa, with all our macroeconomic variables apart from the percentage change in exchange rate (EXRATEPC) variable. This is a sharp deviation from the European analyses where the speed of convergence was broadly faster in the non-Euro Area than in the Euro Area. We find for example in tables 3.14 and 3.15 that the speed of convergence for GDP growth rate (0.254), and real interest rate (0.118) respectively within the WAEMU is faster than it obtains in the non-monetary union Sub-Saharan Africa (0.313, and 0.464 respectively). The converse is rather for the percentage change in exchange rate variable where the speed of adjustment is faster in the non-monetary union Sub-Saharan Africa than the WAEMU. What all of this means is that a generally faster speed of convergence obtains in the WAEMU than in the

non-monetary union Sub-Saharan Africa. We can thus locate a speedier catching up process with respect to the exchange rate variable in the non-monetary union Sub-Saharan Africa than in the WAEMU, most probably because of the regional integrative processes that have taken off all over the region. The West African Monetary zone (WAMZ) for example is working tirelessly towards adopting a common currency any time soon, which it keeps postponing, while the Republic of South Africa has been in a common monetary arrangement which provides a framework for exchange rate and monetary policies since 1986 with Lesotho and Swaziland, both of whom are among our sample of countries. The faster speed of convergence in the WAEMU for all the rest of our macroeconomic variables could be explained by the WAEMU's common objective of attaining improved competitiveness, economic convergence, common market, policy coordination, and law harmonization (Kireyev, 2016). Again, we calculate the half-life of the convergence process for both zones, which is the time span which is necessary for current disparities to be halved. As per our results in the last columns of tables 3.14 and 3.15 for both zones, for all variables, apart from the percentage change in exchange rate variable (0.59 for the WAEMU and 0.52 for the non-monetary union Sub-Saharan Africa) it takes a longer time for the gap between the non-monetary union Sub-Saharan Africa countries' values and the sub-regional average to be cut into half than the countries in the WAEMU.

### **3.8 CONCLUSION**

In this chapter we have looked at the historical background to the creation of the European single market, as a world war II desire for the restructuring of international financial relations which gave birth to the Bretton Woods agreements as a special purpose vehicle which laid down the rules and procedures governing the world economy in 1944. We have also looked at the Optimum currency areas theory (OCA) as propounded by Mundell (1961), McKinnon (1963), and Kenen (1969), and in the context of the European Economic and Monetary Union, whereby we find support for the OCA endogeneity hypothesis in the literature. The analysis is further extended to the WAEMU where we find that the region does not score highly on the OCA criteria. For purposes of establishing macroeconomic stability we as well ascertained the level of macroeconomic convergence as we believe that

macroeconomic convergence has risk implications for the determination of NIMs to the extent that the Euro and the non-Euro Areas' respective abilities to deal with economic shocks harmoniously will impact on the cost of financial intermediation. This is because significant differences in macroeconomic performance between countries have the tendency to elicit different reactions to shocks thereby necessitating country-specific responses which may harm an entire monetary zone and effectively raise the cost of financial intermediation (Oshikoya et al, 2010). To establish the level of macroeconomic convergence we employ a gamut of macroeconomic convergence methods starting with graphical analysis, through pairwise correlation analysis, sigma convergence and panel unit root test. Before then we explore the econometric literature on the use of panel unit root test in a rather fairly brief detail, where it is observed that the use of several unit root tests in the time series literature have been extended to panel data, thereby supporting our approach. Our findings are that while all four methods give mixed results we deem the results of the panel unit root a more robust one because of its robust theoretical underpinnings in the econometric literature. While we find both the Euro Area and non-Euro Area to be converging to their respective regional averages as well as their EU average on all the four macroeconomic variables we generally find the speed of convergence higher in the non-Euro Area than in the Euro Area. This is not strange as our sample non-Euro Area countries were vigorously pursuing accession agenda. In the final analysis we can establish that possible macroeconomic instability resulting from possible lack of convergence in the macroeconomic environment within either zone with dire consequences for cost of financial intermediation could not be supported.

The same analysis, however moving straight into the use of the most robust of all the methods, test of panel unit root, without any preliminary assessment with the use of the less robust methods, is again extended to the WAEMU and the non-monetary Sub-Saharan African region as comparator regions. The findings here are that there is convergence towards the sub-regional/zonal averages with respect to our chosen macroeconomic variables, among countries in the WAEMU and the non-monetary union Sub-Saharan Africa respectively, as well as both zones combined. And that within the respective WAEMU and non-monetary union Sub-Saharan Africa regions the results also give an indication of the periphery economies catching up with the

core. As well the speed of convergence is generally faster in the WAEMU than in the non-monetary union Sub-Saharan Africa, with all our macroeconomic variables, which is also indicative of the fact that their periphery is catching up faster with the core than it does in the non-monetary union Sub-Saharan African region. This finding and conclusion again are replicative of the finding for the Euro Area and the non-Euro Area convergence. Nevertheless, the findings in the WAEMU are in sharp contrast with the findings of Seck (2014) who finds no disparity reduction and speed at which the lagging countries were catching up with the leaders in the region.

# **CHAPTER FOUR**

## **THE USE OF BANK-LEVEL DATA TO STUDY THE DETERMINANTS OF BANK NET INTEREST MARGINS IN THE EURO AREA VERSUS THE NON-EURO AREA**

### **4.1 Introduction**

The banking industry in an economy is known to play a crucial role in providing support for economic growth, in that it allocates capital in an economy by channelling funds from lenders to borrowers. It is therefore important that this intermediation role is executed at the lowest possible cost for the realisation of greater social welfare, as the lower the intermediation margin, the lower the social costs of financial intermediation. This was echoed by Merton (1993) who stated that: "A well developed, smoothly functioning financial system facilitates the efficient life-cycle allocation of household consumption and the efficient allocation of physical capital to its most productive use in the business sector." It is this all-important role of the bank in an economy and the efficiency with which it is required to be discharged which links net interest margin (NIM) to the real economy, and therefore warrants our investigation, particularly in the context of the competition and efficiency effects of the European Economic and Monetary Union (EMU) on the European banking industry. This is further reinforced by the European Commission's (EC) principal objective, in its White Paper on Financial Services Policy (2005-2010) which presents the European Commission's financial services policy priorities up to 2010. The paper states that the commission's principal objectives included consolidating dynamically towards an integrated, open, inclusive, competitive, and economically efficient European Union financial market and to remove the remaining economically significant barriers so that financial services could be provided and capital can circulate freely throughout the EU at the lowest possible cost (EC's Financial Services Policy 2005-2010). Casu and Giradone (2011) also note that the



deregulation of financial services together with the establishment of the EMU was aimed at creating a level playing field in the provision of banking services across the EU, with the removal of entry barriers to foster competition and efficiency in the banking markets. This was because the expectation was that increased competition would incentivise bank managers to reduce costs, thereby fostering efficiency in turn to maximise social welfare.

It is not surprising that over a decade after the establishment of the European Economic and Monetary Union (EMU) one of its effects on the European banking industry that stands in relief is, competition, and the resulting efficiency. We noted that the establishment of the EMU spurred increased cross-border consolidation as banking firms sought to take advantage of scale economies afforded by the EMU, compete and to achieve efficiency gains. All of this is consistent with the literature in which competition is generally regarded as a positive force and often associated with the increase in efficiency both of which enhance consumer welfare. Note must however be made that the momentum of competition experienced in the crisis period tapered in the post-crisis period (Davis and Karim, 2014) It is in our bid to find empirical support for these developments that we look at the effects of the European Monetary and Economic Union (EMU) on bank net interest margin (NIM) and its determinants, testing the hypotheses outlined below in sub-section 4.1.1, with particular emphasis on competition and efficiency, which to the best of our knowledge, has never been studied. In this empirical study we contrast our findings in the Euro Area with the non-Euro Area. For our analysis we use a total sample of 361 banks, made up of 290 banks from the Euro Area, and 71 banks from the non-Eurozone, from across 9 countries of the Euro Area where we could obtain adequate data on individual banks, namely Austria, Belgium, Germany, France, Greece, Italy, Luxembourg, Netherlands, Portugal, but not for Spain; and 7 countries from the non-Euro Area namely, Bulgaria, The Czech Republic, Croatia, Hungary, Lithuania, Poland, and Romania over the period 2002 – 2013.

Overall we find all our tested hypotheses outlined in the next sub-section 4.1.1 supported by our empirical results. That is, we find reducing impact of our explanatory variables on NIMs in the Euro Area than in the Non-Euro Area reflecting, inter alia, a more competitive environment, greater scale and management efficiencies and a higher macroeconomic stability generated by the establishment of the Economic and Monetary Union (EMU).

The rest of the chapter is organised as follows: the next section, which is Section 4.2 reviews the empirical literature on banking competition in the European. Section 4.3 describes the methodology and data, followed by Section 4.4 which also discusses the empirical results. And lastly Section 4.5 concludes with policy implications and recommendations.

#### **4.1.1 Tested Hypotheses**

- **Hypothesis 1**

We hypothesize that the two efficient structure hypotheses, that is, the X-efficiency, referring to, management efficiency, and proxied by bank cost-to-income ratio, and abbreviated as (BMQCI) and S-efficiency, that is scale efficiency, also proxied by log of bank total assets and abbreviated as (BSIZE), both have a greater reducing effect on NIM in the Euro Area than in the non-Euro Area.

We recognise that the EMU has attracted and will continue to attract Foreign Direct Investment (FDI) from within and outside the union, particularly large ones that might only be viable above a certain size resulting in: a) economies of scale b) lower marginal cost, all with reducing effects on NIM in the Euro zone than in the non-Euro zone (Oshikoya et al, 2010)

- **Hypothesis 2**

The degree of banking competition, respectively using the Boone indicator, the Lerner index and the Herfindahl-Hirschman index (HHI), has a larger magnitude of reducing impact on NIM in the Euro Area than in the non-Euro Area, because of the effects of the EMU by way of the single market in combination with free capital movement, free open borders and the single banking licence affording market contestability.

As the generally accepted hypothesis goes a more competitive banking market is expected to drive down bank loan rates/increase deposit rates, adding to the welfare of households and enterprises (Van Leuvensteijn, 2009). Within the context of the Euro and the non-Euro Areas the reducing effect of the competition variable on NIM is so expected given the liberalised and harmonised financial regulation which allows free competitive market behaviour and cross-border operation within the single market, as well as

creating a level-playing field between banks from different member states (ECB, 1999). However, the magnitude of the reducing impact is expected to be higher in the Euro Area than in the non-Euro Area because of the effects of a monetary union.

- **Hypothesis 3**

We hypothesize that exchange rate has a larger reducing impact on NIM in the Euro Area than in the non-Euro Area. Exchange rate stability between countries within the Euro Area should enhance the effectiveness of the Single Market as a source of competitive pressure.

## **4.2 Empirical Literature on banking competition in the European Union**

In this section we examine the empirical Literature on banking competition in the European Union to see how it has evolved, and if indeed differences obtain in the levels of competition between the Euro Area and the non-Euro Area.

Competition in banking like other industries is generally considered to have welfare implications as it impacts the efficiency with which banks deliver services to the public, and the quality and prices of products and services they put on offer. It is not surprising that the establishment of the European Economic and Monetary Union (EMU), the introduction of the Euro and the extensive deregulation of financial services, all of which took place over two decades ago, were all aimed at fostering integration, eliminating entry barriers and promoting competition and efficiency in EU banking (Casu and Girardone, 2009; Weill, 2011). Our objective in this section therefore is to analyse the evolution of competition in the EU banking industry to ascertain whether the process of integration has indeed resulted in the expected results in terms of competition, efficiency in bank intermediation and ultimately welfare. It must however be noted that the nexus between competition, efficiency and financial stability has not been straightforward both in the theoretical and empirical literature<sup>16</sup>. For example, while Carletti and Hartmann (2002) find that the widely-accepted trade-off between competition and stability does not generally hold, Northcott (2004) note that there is no consensus in the literature as to

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<sup>16</sup> As the perceived benefits from competition have got to be juxtaposed with the risks of potential instability.

which competitive structure optimizes both efficiency and stability. That said, to the extent that the philosophy exists that competition is important for the dynamic efficiency of the banking industry bank market competition authorities within the EU like in other jurisdictions around the world have never relented in fostering competition among banks within the EU. In the EU the responsibility for competition policy and enforcement is the remit of the European Commission (EC), where the presence of a possible trade-off between competition and stability has always been central to policy formulation (Casu and Girardone, 2011).

In the dawning years of the EMU it was widely claimed that there had been phenomenal structural change in the European banking and financial services market, manifesting itself in the shape of trends towards consolidation; heightened disintermediation and increase in the level of actual and potential cross-border competition, with a downward pressure on bank profitability, particularly catalysed by the Economic and Monetary Union (EMU) (Goddard et al., 2001; Humphrey et al., 2006; De Bandt, and Davis, 1999). A few studies at the time however point to a reduced banking competition, thereby countering the generally accepted view of heightened competition (Fernandez de Guevara, Maudos and Perez, 2005; Weill, 2004 in Weill, 2011). Nonetheless Weill (2004) argues that most of the 1990s mergers and acquisitions were domestic in nature and therefore anti-competitive, but in the post EMU banking industry competition the major mergers and acquisitions are cross-border and are as a result competition-enhancing. Bikker and Bos (2008) also echo a similar perspective by noting that while cross-border competition increased across the EU within the confines of the individual EU countries' national borders some banks may occupy dominant positions. Indeed, with the advent of the EMU, which saw the consolidation of harmonised regulations, the absence of exchange rate risk for banks and the elimination of entry barriers; the European banking landscape can be said to be characterised by cross-border mergers and acquisitions, consolidation, and further intensification of banking competition and contestability. This is supported by Weill (2011) who finds greater banking competition and integration in the EU, post-EMU. This cross-border nature of competition in the EU is further given credence by Andries and Capraru (2012) who find evidence to conclude that competition in the EU is more the work of the internationalization process than deregulation. Figure 4.1

shows a consistent reduction in the number of credit institutions over the period 2002 to 2013 in the EU to confirm the consolidated nature of the banking industry through cross-border mergers and acquisitions as a result of competition, this trend is however not as marked in the non-Euro Area as in the Euro Area and the EU as a whole.

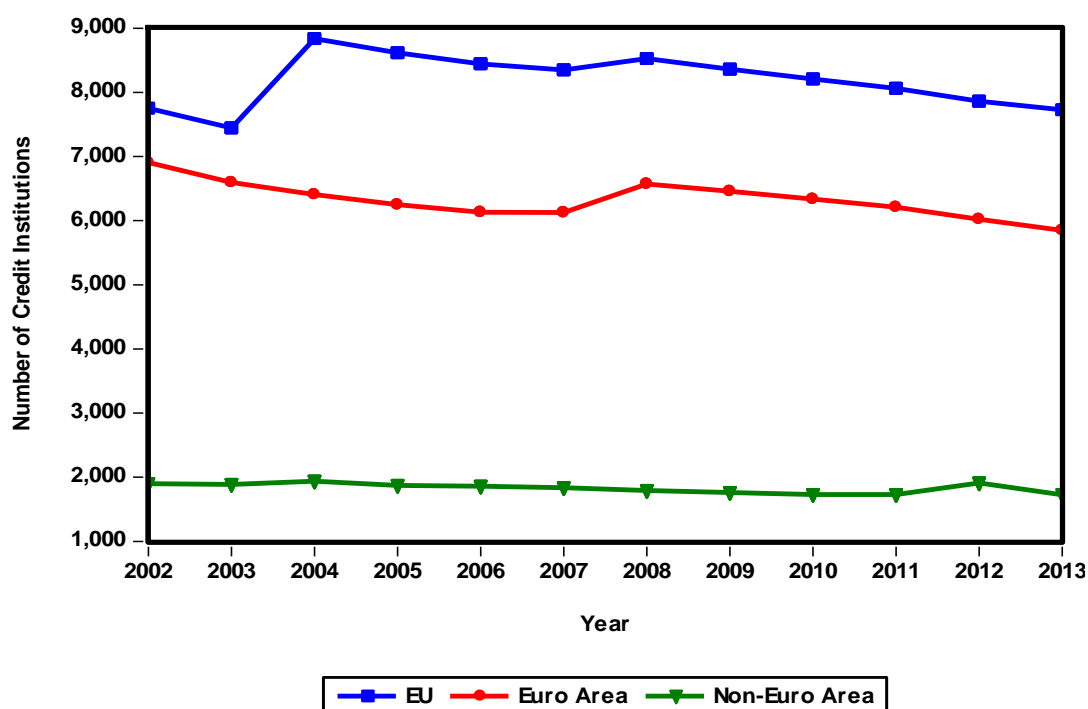
Bikker et al. (2006) however note that the increased concentration and the increased market shares of major banks may have impaired competition. This fear was re-echoed by Bikker and Spierdijk (2008) who also suggested that the blurring of the borders between sectors of the financial services industry may have weakened banking competition within the EU.

The theoretical relationship between competition and net interest margin is not difficult to find in the literature. And it is generally accepted that the level of net interest margins reflects competitive conditions and efficiency in a bank market, premised on the assumption that competition forces banking firms to be efficient and narrows bank interest margins. To that extent Bikker and Bos (2009) posit that in the decade following the introduction of the EMU net interest margins in most countries within the EU fell, implying heightened competition, although the steady decline in interest rates may also have been a contributing factor. Analysis of competition and efficiency in 27 EU banking systems by Andries and Capraru (2012) over the period 2001 to 2009 corroborate this inferring competition from the relationship between competition and efficiency, and concluded that an increase in the efficiency of banks fostered competition in the new EU member states, most of which belong to our sampled non-Euro zone countries. Liebscher (2005) also underscored the implications for bank net interest margins in the wake of intense competition within the EU and said higher competition may lead to a reduction in interest rate margins and that without a compensating rise in cost efficiency might adversely affect banks' profitability, particularly in the Euro zone. The consequence would then be for banks to be tempted to relax their credit policies and take on more risk in their bid to maintain profitability.

It could be seen from the forgoing empirical studies that within the broad European Union in the post EMU era the presence of intense banking competition is observed. It must however be noted that most of the sampled countries in these studies belong to the Euro zone. For example, of the 14 EU countries studied by Humphrey et al (2006) only Sweden and the United

Kingdom do not belong to the Euro Area, the remaining 12 are all Euro Area countries.

**Figure 4.1. Number of Credit Institutions in the EU, the Euro Area and the non-Euro Area, 2002 – 2013.**



Source: ECB and author's own calculation

Also in our sample of non-Euro Area countries all of which belong to the CEEC block evidence is rife that competition levels are approaching the levels which obtain in the Euro zone as they open their economies to the large EU banks that may be operating at relatively low margins and may wish to extend their cross-border operations into the CEEC (Yildirim and Philippatos, 2007). To be precise Yildirim and Philippatos (2007) find the level of competition in our sampled non-Euro zone countries as monopolistic competition. Andries and Capraru (2012) also find an increase in competition in our sampled non-Euro zone countries among other CEEC countries over the period under study, 2001 to 2009, and attributed it to deregulation and foreign banks' entry through acquisitions or 'greenfield' investments.

It could be concluded here that overall, across the Euro and non-Euro zones increases in cross-border banking competition have been observed, particularly after the creation of the EMU as opposed to within individual countries. The peculiarity of the nature of these observed increases in competition being the cross-border or international nature of it as opposed to being domestic.

## 4.3 Methodology and Data description

### 4.3.1 Model Specification

The application of the single-step, static approach which incorporates all the determinants of net interest margins in a single estimation is the norm in the literature (Agoraki, 2009). We would however argue that the static model cannot be justified for advanced countries as in emerging markets. This is because in advanced economies, unlike emerging economies where information opacity is rife, banks' assessment of net interest margins and its determinants is based on clear information that changes only slowly over time. Not all the relevant information can be updated based on new information each period, so that NIMs could be systematically related each period, which provides enough justification for a dynamic specification as opposed to a static, one for advanced economies. The existence of inertia may also reflect the inability to observe all determinants of the NIM, and some may evolve slowly over time. The need for a dynamic approach is a testable proposition, and if serial correlation exists in a static evaluation of NIMs it is almost certainly the case that a lagged dependent variable is the omitted variable that causes the serial correlation.

The static approach has been applied in several studies including McShane and Sharpe (1985), Angbazo (1997), Demirgüç-Kunt and Huizinga (1999), Maudos and Fernández de Guevara (2004), Claey's and Vander Venet (2008), and Valverde and Fernandez (2007). The basic framework for this model involves the estimation of the following linear equation which brings together all the determinants of NIMs in a single stage as follows:

$$\begin{aligned} y_{it} &= \alpha + \beta_{BS}X_{it}^{BS} + \beta_{BM}X_{it}^{BM} + \beta_M X_{it}^M + \varepsilon_{it} \\ \varepsilon_{it} &= \mu_i + \nu_{it} \end{aligned} \quad (4.1)$$

where  $y_{it}$  represents the bank net interest margin for bank  $i$ , at time  $t$ ,  $\alpha$  is a constant term,  $\beta_{BS}X_{it}^{BS}$  denotes the vector of bank-specific explanatory variables, where  $it$  indexes bank  $i$ , at time  $t$ ,  $\beta_{BM}X_{it}^{BM}$  is a vector of market/industry characteristics variables,  $\beta_M X_{it}^M$  is a vector of macroeconomic

control variables, and  $\varepsilon_{it}$  is the error term capturing all other omitted factors, with  $\mu_i$  being the unobserved bank-specific effect and  $\nu_{it}$  the idiosyncratic error. Such static models in the literature are commonly estimated using least squares methods on fixed effects (FE) or random effects (RE) models. However, in dynamic relationships as is the case in our study these methods produce biased and inconsistent estimates, particularly with a large  $N$  and smaller  $T$ , which does not augur well for the accurate estimation of  $N$ -invariant regressors, mostly macroeconomic regressors (Garcia-Herrero et al, 2009), in which case the Generalised Method of Moments (GMM) estimator may be employed.

The display of a dynamic model in this particular study is our anticipation that previous values of bank margins may affect current values of those margins as banks need to match the random deposit supply function and the random demand of lending and non-traditional activities across periods (Valverde and Fernandez, 2007). Indeed, Valverde and Fernandez (2007) posit that the maximization of bank wealth considers both initial and end-of-period information. Therefore, within the empirical literature NIMs are known to display a tendency to persist over time. In this regard, we state the following dynamic specification of our model, which includes a lagged dependent variable among the regressors.

$$\begin{aligned} y_{it} &= \alpha + \delta Y_{it-1} + \beta_{BS} X_{it}^{BS} + \beta_{BM} X_{it}^{BM} + \beta_M X_{it}^M + \varepsilon_{it} \quad (4.2) \\ \varepsilon_{it} &= \mu_i + \gamma_t + \nu_{it} \end{aligned}$$

The three vectors of variables represent the bank-specific ( $X_{it}^{BS}$ ), bank market-specific ( $X_{it}^{BM}$ ) and macroeconomic variables ( $X_{it}^M$ ), and  $y_{it}$  represents the net interest margin. Subscripts  $i$  and  $t$  are for  $i$ -th bank and  $t$ -th time period. The error term has an unobserved bank-specific ( $\mu_i$ ), and the idiosyncratic error ( $\nu_{it}$ ) components, however we anticipate a possibility that, given developments like the 2007/2008 global financial crisis that occurred in the European banking sector during the sample period, time effects are present in the error component of the model, for which  $\gamma_t$  is the unobserved time effects.  $Y_{it-1}$  is the one-period lagged NIM and  $\delta$  the speed of adjustment to



equilibrium. A value of  $\delta$  between 0 and 1 implies that NIMs persist, but they will eventually return to their normal (average) level after a temporary shock, that is, mean-reverting. A value close to 0 means that the industry is fairly rapidly competitive (high speed of adjustment), while a value of  $\delta$  close to 1 implies less immediate competitive structure (very slow adjustment).

In the econometric literature because the lagged dependent variable is correlated with the error term by construction using OLS with fixed effects in the presence of a lagged dependent variable among the regressors gives rise to dynamic panel bias and inconsistent estimates (Nickel, 1981; Roodman, 2006). The combination of this problem and the challenges of unobservable heterogeneity across banks, as well as the potential endogeneity with some of our regressors warrant that we move away from the methodology of OLS with fixed or random effects and employ the Generalized Method of Moments (GMM) estimator following Arellano and Bover (1995)/Blundell and Bond (1998).

We anticipate that the challenge of unobservable heterogeneity in this study could be reflected in for example differences in ownership structure across banks and jurisdictions, Management quality, and so on. With regards to potential endogeneity we consider that banks with higher NIM may be able to increase their equity more easily through profit retention<sup>17</sup>. Again they would also be able to afford more advertising to increase their market share and consequently their size, of which they might take advantage to increase their NIM. Such reverse causality is not difficult to find in banking operations, and the use of OLS for estimation yields biased and inconsistent results in the presence of such problems.

To overcome the problem of endogeneity the meticulous use of instrumental variables is suggested in the literature as they are assumed to be uncorrelated with the error term. Nevertheless, if the instruments are poorly correlated with the explanatory variables they are meant to replace they render the regression results biased and inconsistent. To eliminate the time-invariant bank-specific effects emanating from unobservable heterogeneity, as well as the problem of endogeneity Arellano and Bond (1991) initially suggest first-

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<sup>17</sup> Athanasoglou et al. (2008) suggest that capital ratio is better modelled as an endogenous determinant of bank profitability in econometrical models.

differencing the regression equation for a GMM estimator for panel data, and also instrumenting the endogenous explanatory variables with suitable lags of their own levels. Nonetheless, given that the Arellano and Bond (1991) GMM estimator was flawed to the extent that if the lagged levels to be used as instruments were weakly correlated with the differences of the explanatory variables because they may be highly persistent then the included supplementary instruments may not be useful and thus yield large sample bias. Arellano and Bover (1995) therefore propose an improved panel data GMM estimator. This GMM estimator proposed by Arellano and Bover (1995) and fully developed by Blundell and Bond (1998) is the system GMM. Their position is that lagged levels are often poor instruments for variables in first differences. Thus, the original equations in levels can be added to the system, whereby predetermined and endogenous variables are instrumented with their own lagged first-differences, in which case the system GMM estimator is proven to have dramatic efficiency gains over the basic first-difference GMM (Baltagi, 2001). To this effect, in this study, we treat all bank specific variables in section 4.3.2.1 as endogenous and instrument them with their orthogonal transformations. We also test whether the instruments, as a group, are exogenous and indeed valid by performing the Hansen J. specification test of over-identifying restrictions. The test examines the lack of correlation between the instruments and the error term. Serial correlation has to be tested carefully in this context, and as Roodman (2009) explains, we expect to see first order serial correlation and not second order given the techniques we are using. All our results do display first order serial correlation, and we only test for second order. We obtain the AR2 statistics which measure the presence of second-order serial correlation with the null hypothesis that there is no serial correlation in the residuals. So in all we deem the methodology followed, that is, the system GMM estimator capable of controlling for potential endogeneity, unobserved heterogeneity and the persistence of the dependent variable, to yield consistent unbiased estimators.

### 4.3.2 Variable Construction

Following the empirical literature in Chapter one, we implement model 4.2 in section 4.3.1 above by considering the following bank-specific, market/industry specific, as well as macroeconomic variables.

#### 4.3.2.1 Bank-specific variables

##### Dependent variable

- **Net Interest Margin (NIM)**

In the introduction chapter we defined net interest margin of banks. For completeness, however we repeat it here, and also do an accounting decomposition of it following Demirguc-Kunt and Huizinga (1999). NIM is an accounting ratio which reflects bank efficiency in its intermediation role<sup>18</sup>. It is defined as a bank's total interest income minus the total interest expense over its total earning assets, thus having the following accounting identity:

$$NIM = \frac{TOTAL\ INTEREST\ INCOME - TOTAL\ INTEREST\ EXPENSE}{TOTAL\ EARNING\ ASSETS}$$

The accounting decomposition of a bank's interest margin from a bank's accounting identity of profits was first developed by Hanson and Rocha (1986), and followed by Demirguc-Kunt and Huizinga (1999) and Beck and Fuchs (2004). The starting point is to establish what constitutes a bank's before-tax-profits-to-assets (BTP/TA). Before tax profits to assets (BTP/TA) equals after-tax profits to assets (ATP/TA) plus taxes to assets (TX/TA). Therefore, BTP/TA is decomposed as follows:

$$\frac{BTP}{TA} = \frac{ATP}{TA} + \frac{TX}{TA} + \frac{NI}{TA} + \frac{NII}{TA} - \frac{OV}{TA} - \frac{LLP}{TA} \quad 4.3)$$

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<sup>18</sup> While net interest margin can indicate bank efficiency or inefficiency, it is not always the case that a reduction in net interest margins means improved bank efficiency, as a reduction in net interest margins can, reflect a reduction in bank taxation or, alternatively, a higher loan default rate (Demirguc-Kunt and Huizinga, 1999).

where  $\frac{ATP}{TA}$  is after tax profits to total assets,  $\frac{TX}{TA}$  is taxes to total assets,  $\frac{NI}{TA}$  is net interest income to total assets,  $\frac{NII}{TA}$  is non-interest income to total assets,  $\frac{OV}{TA}$  is overheads to total assets, and  $\frac{LLP}{TA}$  is loan loss provisioning to total assets.

Permitted by the above accounting identities we decompose net interest margins ( $\frac{NI}{TA}$ ) into its constituent parts as follows:

$$\frac{NI}{TA} = \frac{ATP}{TA} + \frac{TX}{TA} - \frac{NII}{TA} + \frac{OV}{TA} + \frac{LLP}{TA} \quad (4.4)$$

Equation (4.3) above means NIM is derived as banks' before tax profits to assets ( $\frac{BTP}{TA}$ ) made up of ( $\frac{ATP}{TA} + \frac{TX}{TA}$ ) plus bank's operating costs ( $\frac{OV}{TA}$ ), plus provisions ( $\frac{LLP}{TA}$ ) netted for non-interest income to total assets ( $\frac{NII}{TA}$ ) (Demirguc-Kunt and Huizinga, 1999).

From the foregoing accounting decomposition, it is clear that NIM as a summary measure of banks' net interest return is also an important component of bank profits (Angbazo, 1997). Also according to Demirguc-Kunt et al. (2004) while NIM reflects the efficiency with which a bank intermediates, it is also an indicator of the competitive nature of the banking markets. This is supported by Bikker and Bos (2008) who note that while competition and efficiency describe two different things they are often seen as almost synonymous, in that heavy competition forces banks to improve efficiency. As a result, like profitability measures as return on equity (ROE) and return on assets (ROA) NIM is expected to be smaller, the heavier competition is, thereby establishing a negative relationship between NIM and competition.

## Independent variables

- **Bank Capital (BCAP)**

Our bank capital variable proxies for risk aversion and regulatory requirements which is the norm in the empirical literature investigating the determinants of net interest margins. To this effect we use the ratio of equity to assets, hereafter abbreviated as BCAP, to proxy the bank capital variable. By Bankscope's definition this ratio measures the amount of protection afforded to

the bank by the equity they invested in it, as equity is a cushion against asset malfunction. And that the higher this figure the more protection there is. Our choice of this ratio as a proxy for this variable is particularly motivated by McShane and Sharpe (1985), Maudos and Fernández de Guevara (2004), Claeys and Vennet (2008). According to the theoretical model, a positive relationship is expected between our bank capital variable and net interest margin, as banks that are most risk averse will require a higher margin to cover the higher costs of equity financing compared to external financing, *ceteris paribus*. As well because these banks are seen to have lower bankruptcy and funding costs they are more likely able to charge higher margins. In addition, increases in regulatory capital requirements will also increase the NIM as banks are forced to fund their loan book using more expensive capital rather than lower cost debt and deposits.

- **Bank Credit Quality (BCREDSK)**

Saad and El-Moussawi (2012) in Dumicic and Ridzak (2013) note that credit risk belongs to the group of factors with the highest impact on banks' interest margins. Nassreddine et al (2013) also assert that the impact of deterioration of the credit quality on the NIM seems positive as banks seek to increase their margins to compensate, on the one hand the risk of default, and on the other additional costs necessary to monitor these credits. Following Bankscope's categorisation of asset quality ratios our bank credit quality variable, abbreviated to BCREDSK hereafter, is the ratio of loan loss provision to net interest revenue<sup>19</sup>. It is the relationship between provisions in the profit and loss account and the interest income over the same period. While this ratio should ideally be as low as possible, in a well-managed bank if the lending book is fraught with a higher risk it should be reflected by higher margins. Also while this ratio may not provide a forward-looking measure of bank exposure to default and asset quality it is more predominant in the literature than the forward-looking proxies like loan-to-asset ratio. We would therefore, as it broadly obtains in the empirical literature expect its relationship with NIM to be positive.

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<sup>19</sup> Ideally, the credit quality should be proxied by the ratio of non-performing loans to gross loans as is predominant in the empirical literature. The Bankscope database however only has these variables for a limited number of banks in our sample

- **Bank liquidity (BLIQ)**

We follow Ahmad and Matemilola (2013); and Dumitic and Ridzak (2013) and proxy our bank liquidity variable as the ratio of net loans to customer deposit and short-term funding, which we abbreviate hereafter as BLIQ. The understanding is that to the extent that banks' relatively illiquid loans are largely funded by relatively stable customer deposits they must ensure they have sufficient liquidity resources to be able to pay depositors in the event that a large number of them and investors may wish to withdraw their savings, that is, the bank's funding at once, leaving the bank short of funds which may have inimical consequences for critical services banks contribute to the economy. In order to compensate for this risk, known as liquidity risk, a premium dependable on the level of risk, is charged to the interest income. A high liquidity ratio means that a bank has adequate liquid assets to be able to meet unexpected deposit withdrawals or to fund increased loan demands and vice versa. We would therefore expect that banks with high levels of liquid assets, either voluntarily or for prudential reasons or as a result of regulation, may receive lower interest income than banks with less liquid assets, in which case, and given that the market for deposits is reasonably competitive, the relationship with net interest margin is expected to be negative (Angbazo, 1997; Demirgüç-Kunt et al., 2004). Conversely, Martinez Peria and Mody (2004) state that the liquidity ratio may have a positive impact on interest margins to the extent that banks are able to transfer this opportunity cost to borrowers. Under conditions of high volatility of wholesale funding on which banks have increasingly become dependent, bank interest rates can significantly diverge from the central bank rates, because of difficulties in obtaining liquidity. For example, during the 2007/8 financial crisis spill-over of tensions in the US subprime mortgage markets to the banks' short-term wholesale funding market in the EU led to a rapid deterioration of liquidity conditions (van Rixtel and Gasperini, 2013)

- **Bank Size (BSIZE)**

The inclusion of the bank size variable accounts for possible scale economies, where average cost declines as bank output rises, resulting from spreading fixed costs over a greater volume of output. Whether or not this happens in reality, that is, if indeed just based on their size larger banks are

more efficient than small banks has spanned a lot of empirical literature. Allen and Liu (2007) note that broadly, most studies on economies of scale in financial institutions find only small economies of scale in a firm's cost structure. Also within the empirical literature there exists the general feeling that economies of scale rise up to a certain level with size, beyond which financial institutions become too complex to manage and diseconomies of scale sets in. We therefore anticipate that the effect of size could be nonlinear, meaning that NIM is likely to increase up to a certain level by achieving economies of scale and decline from a certain level at which banks become too complex to manage. As earlier noted because the possible collapse of some large and complex banks could generate negative externalities that could cascade into the real economy, for which reason governments and regulatory authorities endeavour to prevent always, S-efficiency could have a positive impact on NIM. This problem with large and complex financial institutions is what is often referred to in the banking literature as 'too-big-to-fail' (Dudley, 2012). We would thus use the logarithm of total asset to capture the potential non-linear effect of bank size on NIM and thus expect the sign of the coefficient of bank size to be ambiguous based on the literature. Athanasoglou et al (2008) use real assets in logs and their square to capture the possible non-linear relationship between bank size and profitability in their analysis of the determinants of bank profitability in Greece over the period 1985 – 2001.

- **Bank Management Quality (BMQCI)**

This variable controls for the X-efficiency as described in our hypothesis, and is proxied by the cost to income ratio, defined as operating expenses of a bank as a share of sum of net-interest revenue and other operating income. It effectively measures the operating cost incurred to generate one unit of gross income or revenue. It is included as an indicator of the management's contribution in interest margins, to the extent that management quality is reflected in the composition of a bank's portfolio through providing, inter alia, profitable composition of assets and low-cost liabilities. A variety of measures have been used to proxy for management quality in the empirical literature. Angbazo (1997) for example uses ratio of earning assets to total assets, while Maudos and Fernandez De Guevera (2004); Dumcic and Ridzak (2013) use cost-to-income ratio. Our choice of cost-to-income ratio is motivated by Maudos

and Fernandez De Guevera (2004) posit that an increase in this ratio implies a decrease in the efficiency or quality of management, which will translate into a lower interest margin. And thus a negative sign is expected. In this study we use this management quality proxy to test for the hypothesis of X-efficiency as delineated in section 4.1.1 above. The X-efficiency (X-ES) version of the efficient structure hypothesis (ESH) states that banks with superior management or production technologies have lower costs and subsequently can offer more competitive interest rates on loans and/or deposits, leading to a negative relationship between operational efficiency and interest margins (Claeys and Vennet, 2008).

#### **4.3.2.2 Industry-specific variables**

We capture the effect of the degree of banking market competition with three proxies for the robustness of competition:

- The use of the Lerner index which is common in the empirical literature
- The use of the Herfindhal-Hirschmann Index (HHI)
- The use of the Boone Indicator which is relatively novel in the literature.

And in the light of the earlier hypothesized competition and x-efficiency in both the Eurozone and the non-Euro zone we would expect all three competition measures to bear a negative sign. In what follows we look at the nature of our three competition measures.

#### **Competition measures**

- **The Lerner index**

Data for the Lerner index is taken from the World Bank's Global Financial Development Database. And is calculated from the underlying bank-by-bank data from the Bankscope by World Bank and Bankscope staff using annual data from 1996-2010. The estimations follow the methodology described in Demirgüç-Kunt and Martínez Pería (2010)<sup>20</sup>. The index is one of the non-structural measures of competition used in the banking competition literature to infer competitive behaviour of banks. It directly measures pricing power by

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<sup>20</sup> They also follow Fernandez de Guevera et al (2005, 2007) and Berger et al (2008)



examining the price markup over marginal cost<sup>21</sup>. It is the difference between the price and the marginal cost, divided by the price, which measures the capacity to set prices above the marginal cost, being an inverse function of the elasticity of demand and of the number of banks (Maudos and Fernandez de Guevera, 2004). Higher values of it indicate greater market power and lower levels of bank competition. Simply put the Lerner index is a level measure of the percentage that price exceeds marginal cost represented algebraically as follows:

$$lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \quad (4.5)$$

where  $P_{it}$  is the price charged by bank  $i$  at time  $t$  on their assets and  $MC_{it}$  is the marginal cost. The calculation of marginal costs is also based on the following specification of a trans logarithmic cost function, where the estimated coefficients of the cost function are then used to compute the marginal cost:

$$\begin{aligned} \ln C_i = & a_0 + \ln TA_i + \frac{1}{2} a_k (\ln TA_i)^2 + \sum_{j=1}^3 \beta_j \ln w_{ji} \\ & + \frac{1}{2} \sum_{j=1}^3 \sum_{k=1}^3 \beta_{jk} \ln w_{ji} \ln w_{ki} + \frac{1}{2} \sum_{j=1}^3 \gamma_j + \ln TA_i \ln w_{ji} \\ & + \mu_1 Trend + \mu_2 \frac{1}{2} Trend^2 + \mu_3 Trend \ln TA_i + \sum_{j=1}^3 \lambda_j + Trend \ln w_{ji} + \ln u_i \end{aligned} \quad (4.6)$$

Where  $C_i$  is the bank's total costs, including financial and operating costs; and total assets ( $TA_i$ ) proxies as a measure of bank output. Prices of the production factors are defined as follows:

W<sub>1</sub>. Price of labour, defined as the ratio of labour costs to total assets.

W<sub>2</sub>. Price of capital, which is the ratio of operating costs (excluding personnel costs) / Fixed assets.

W<sub>3</sub>. Price of deposits, defined as financial Costs / Customer and short-term funding

The costs function (and hence of the marginal costs) is estimated separately for each country. This allows the parameters of the cost function to vary from one country to another to reflect different technologies. Fixed effects, are as well incorporated, aimed at capturing the influence of variables specific to each

<sup>21</sup> That is, the extra cost of producing an additional unit of output.

bank. Also included is a trend (Trend) to reflect the effect of technical change, which translates into movements of the cost function over time. Empirical studies that have used the Lerner index include, Fernandez de Guevera et al (2005), Carbo et al (2009), and Maudos and Fernandez de Guevera (2004). Following Fernandez de Guevera et al (2005) we dissect the index into its constituent parts as follows, first, with the assumption that the production of goods and services by a bank is proportional to its total assets, and therefore their prices can be calculated by estimating the average price of bank production, proxied by total assets, as a quotient of total revenue and total assets. The total revenue includes both interest income and non-interest income.

- **The Boone Indicator of Competition**

The Boone indicator is a new approach to measuring competition recently introduced by Boone (2008). Data for the indicator is taken from the World Bank's Global Financial Development Database. And is calculated from the underlying bank-by-bank data from the Bankscope by World Bank and Bankscope staff using annual data from 1997-2010. The estimations follow the methodology described in Schaeck and Cihák (2010) with a modification to use marginal costs instead of average costs<sup>22</sup>. This new measure of competition is based on the notion that in a competitive market more efficient companies are likely to be rewarded in terms of profits than their less efficient counterparts. This notion was motivated by Demsetz's (1973) efficiency hypothesis which has it that more efficient firms achieve superior performance in the way of higher profits than their less efficient competitors. It is this reallocation effect from inefficient to efficient firms which the Boone indicator exploits. The Boone indicator is the profit elasticity estimating the percentage decrease in profits resulting from a 1 percent increase in the marginal cost as follows (Clerides et al, 2013):

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<sup>22</sup> Refer to Hay and Liu 1997; Boone 2001; Boone, Griffith, and Harrison 2005) for more information.

$$\text{Profit elasticity} = \frac{\partial \ln \pi_i}{\partial \ln mc_i}$$

The effect being intensified when the least efficient firms exit the market. Boone (2008) demonstrates that the reallocation effect increases in monotone with the degree of competition; with competition resulting from a decrease in entry costs or to goods becoming closer substitutes. By this Boone (2008) indicates the difference between profits will increase when the market is more competitive, as the more efficient market will severely punish the least efficient bank. So that

the profit elasticity establishes a link between firm performance with differences in efficiency, measured by marginal cost, leading to the following estimable regression-based empirical model:

$$\pi_{it}/\pi_{jt} = \alpha + \beta_t(mc_{it}/mc_{jt}) + \gamma \tau_i + \varepsilon_{it} \quad (4.7)$$

where  $\alpha$ ,  $\beta_t$  and  $\gamma$  are parameters and  $\pi_{it}$  denotes the profit of firm  $i$  in year  $t$ . Relative profits  $\pi_{it}/\pi_{jt}$  are defined for any pair of firms and depend, inter alia, on the relative marginal costs of the respective firms,  $mc_{it}/mc_{jt}$ . The variable  $\tau_i$  is a time trend and  $\varepsilon_{it}$  an error term. The parameter of interest is  $\beta_t$ . It is expected to have a negative sign, because relatively efficient firms make higher profits. For example, if  $\beta = -0.2$ , a 1% increase in the marginal cost, due to a decrease in the efficiency level) of bank I will decrease its profits by 0.2 %. If  $\beta = -0.5$ , a 1% increase in the marginal cost of bank will decrease its profits by 0.5 %. And the  $\beta_t$  is referred to as the Boone indicator. Boone shows that when profit differences are increasingly determined by marginal-cost differences, this indicates increased competition. As marginal cost  $mc_{it}$  cannot be observed directly, it is derived from a trans-logarithmic cost function similar to the estimable cost function for the Lerner index above and commonly used in the banking literature. Empirical application to banking of the Boone indicator is limited and can be found in studies including Schaeck and Cihák (2012) and Amidu and Wilson (2014). Given the much touted banking competition resulting from the single market and currency we would expect it to have a negative

relationship with NIM in both the Euro Area and the non-Euro Area, but of a higher magnitude in the Euro Area than the non-Euro Area.

- **The Herfindhal-Hirschman Index**

The Herfindhal-Hirschman Index (HHI) is the most widely treated summary measure of concentration in the theoretical literature and often serves as a benchmark for the evaluation of other concentration indices (Bikker and Haaf, 2002). In the United States, the HHI plays a significant role in the enforcement process of antitrust laws in banking. It is often called the full-information index because it captures features of the entire distribution of bank sizes, as it takes into account all banks and not only the largest ones, and also considers the inequality of market shares (Garcia-Herrero et al, 2009). It takes the form:

$$HHI = \sum_{i=1}^n s_i^2$$

That is the *HHI* is calculated by summing the squares of the individual market shares of all the firms in the market. The HHI gives proportionately greater weight to the market shares of the larger firms. The *HHI* index ranges between  $1/n$  and 1, reaching its lowest value, the reciprocal of the number of banks, when all banks in a market are of equal size, and reaching unity in the case of monopoly. Davies (1979) in Bikker and Haaf (2002) analyses the sensitivity of the HHI to its two constituent parts, that is, the number of banks in the market and the inequality in market shares among the different banks and finds that the index becomes less sensitive to changes in the number of banks the larger the number of banks in the industry. Bikker and Haaf (2002) note that just as the index is widely treated in the theoretical literature so is it also about the most widely applied banking competition/concentration measure in the empirical literature on banking competition. As with the aforementioned competition measures we would expect it to have a negative relationship with NIM in both the Eurozone and the non-Euro zone.

We would like to argue that of the three foregoing competition variables the Boone indicator might seem to better reflect the competitiveness emanating from the single market and the establishment of the European economic and monetary union (EMU). This is because firstly, the Boone indicator is

monotonically related to competition, and that with no activity restrictions and no entry barriers and costs in the EMU, which are the theoretical bases of the indicator these would be captured more appropriately by it. Secondly the Boone indicator, unlike the Herfindahl-Hirschman Index (HHI), is a non-structural competition measure reflecting individual bank behaviour and therefore can capture cross-country competition effects than the Herfindahl-Hirschman Index (HHI) which is a structural measure, making it country-specific and therefore not particularly appropriate for a cross-country study as ours where we expect effective cross border competition. Again to the extent that the index becomes less sensitive to changes in the number of banks the larger the number of banks in the industry, as posited by Davies (1979), it will not be as good a metric for a cross-country study like the EU as for a single country study. The Lerner index while it is a non-structural competition measure, not requiring the relevant market to be defined, unlike the Herfindahl-Hirschman Index (HHI), and would therefore also be appropriate for a cross-country study like this, is also bedevilled by some shortcomings. Leon (2015) note that although the Lerner index is a measure of pricing market power and not a proxy for competition an increase of average market power over time may reflect an increase in the intensity of competition<sup>23</sup>. So overall we argue here that while the Herfindahl-Hirschman Index (HHI) is country-specific, the Lerner index and the Boone indicator could reflect conditions across countries.

#### **4.3.2.3 Macroeconomic variables**

We consider that the macroeconomic environment may as well impact NIM through a variety of channels. For instance, credit risk is influenced by economic growth, inflation and the level of real interest rates to the extent that they affect the borrower's repayment ability and the value of collateral (Garcia-Herrero et al, 2009). Again as macroeconomic instability heightens the risk faced by commercial banks it may have consequences for social welfare through increased NIM. Following most studies in the empirical literature we capture various aspects of the macroeconomic environment using percentage

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<sup>23</sup> Leon (2015) makes reference to recent studies which show that there have been situations where in the presence of decreases in individual Lerner indices as a result of competition, the average degree of market power either increases or decrease or remain stable owing to the reallocation effect from inefficient firms to efficient ones (Boone, 2008).

change in real exchange rate (EXRATEPC), GDP growth rate (GDPRGR), inflation rate (INFRATE), and real interest rate (REALINT). Percentage change in real exchange rate is defined as the real exchange rates growth rates (EXRATEPC), that is, the percentage change in the Euro in the case of the Eurozone and the respective relevant national currencies in the case of the non-Euro zone to the US Dollar exchange rate adjusted by the CPIs from the USA Department of Agriculture website. While the effective exchange rates can be used, we follow what is predominant in the empirical literature and elect to use the real percentage change in the relevant currency to the dollar. Effective exchange rates reflect a weighted average of the movements in cross-exchange rates against a basket of other currencies, with weights reflecting the relative importance of the other currencies, as measured by trade flows between the relevant countries ([www.bankofengland.co.uk](http://www.bankofengland.co.uk)) Given the elimination of transaction costs through the single currency we would expect a reducing effect on NIM in the case of the Eurozone, and also in the non-Eurozone because of their participation in the ERM II in readiness of accession. GDP growth rate (GDPRGR) is measured as the annual percentage growth rate of GDP at market prices based on constant local currency and aggregates based on constant 2005 U.S. dollars. Evidence abound in the extant literature that a positive relationship exists between rapid economic growth, measured by GDP growth rate and NIM as demand for credit increase during periods of economic boom and thus widen NIM (Athanasoglou, 2008). Chortareas et al (2011) also used GDP growth as a control variable in their study of the determinants of NIM in Latin American banks and found a rather negative relationship with NIM. We would similarly expect the same result for real interest rates as shown in the empirical literature. The real interest rate variable is included to capture the stance of monetary policy. It is defined as the lending interest rate adjusted for inflation as measured by the GDP deflator (World Bank National Accounts data). Demirguc-Kunt and Huizinga (1999) used real interest rate as well as government short term securities in their study of commercial bank interest margins and profitability in 80 countries from 1988 to 1995 and arrived at a negative relationship between real interest rate and NIM. Finally, our inflation rate variable (INFRATE) is measured by the CPI percentage change (World Bank National Accounts data). In line with the literature we expect a positive relationship between inflation rate and NIM, especially as in a

developed environment like EU the relationship would incorporate inflation expectations. Gunter et al (2013) however believe with perfect foresight of inflation there should be no influence on NIM, at least in theory. They find that in Austria where inflation has been stable over a long period, that is, low inflation variance, it may have caused banks to refrain from pricing in inflation for NIM.

#### **4.3.3 Data sources**

For our analysis, we use a total sample of 361 banks, made up of 290 commercial banks from the Eurozone and 71 banks from the non-Eurozone, from across 16 countries of the Euro and non-Euro zones, namely Austria, Belgium, Germany, France, Greece, Italy, Luxembourg, Netherlands, Portugal, for the Eurozone; and Bulgaria, The Czech Republic, Croatia, Hungary, Lithuania, Poland, and Romania for the non-Eurozone, over the period 2002 – 2013. We intentionally took Spain from the analysis because of limited data. In selecting our non-Eurozone countries as a comparator group of countries we were mindful of the fact that it would have served our purposes better if we chose a group of countries whose special characteristics and features were similar, especially in terms of level of development, to those in the Eurozone. Nevertheless, the number of such EU countries outside the Euro Area like the UK and Sweden were very limited, hence our choice of the group of countries who, although, were predominantly of the CEEC block, were part of the EU over a greater part of the considered period.

As could be gleaned from the previous section our explanatory variables are divided into three groups being: bank specific variables, banking market-structure variables, and country-specific macroeconomic characteristics. Our bank-specific variables were extracted from the Bankscope database maintained by Fitch/IBCA/Bureau Van Dijk. The financial information therein is provided by Fitch Ratings and compiled predominantly from the filed balance sheet and income statement as well as notes from the audited annual reports. To ensure comparability across countries the Bankscope financial data is based on the standardized global accounting format, and for some purposes we also limit our analyses to commercial banks of all sizes which were active under the period of study. Also, to serve our purposes of focusing on financial intermediation we use only unconsolidated financial data so that our analysis is not distorted by information from other non-bank subsidiaries not engaged in

financial intermediation. Data on our country-specific macroeconomic variables, namely, inflation rate, GDP growth rate, and real interest rate were taken from the World Bank’s World Development Indicators; while our percentage change in exchange rate variable was compiled by Dr Matthew Shane and obtained from the United States Department of Agriculture website. For data on our market structure variables we extracted data for the Boone Indicator and the Lerner Index from the World Bank’s Global Financial Development Database compiled by Demirguc-Kunt et al. (2009), and subsequently updated in 2013, a country-level bank dataset, which underlying data is the Bankscope database; and the IMF’s International Financial Statistics. Data for the HHI was the author’s own computation using total assets data from the Bankscope.

#### 4.3.4 Summary Descriptive Statistics

In this section we look at the dynamics of net interest margins (NIM) and the independent variables in a monetary union vis-à-vis a non-monetary union. Specifically, we compare the behaviour of NIM and its determinants, respectively, within the Euro Area and the non-Euro Area.

**Table 4.1. Summary Descriptive Statistics of the Euro Area, Non-Euro Area and Overall European Union (EU)**

Variable	Euro Area (3480 obs.)		Non-Euro Area (852 obs.)		Overall EU (4332 obs.)	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
NIM	2.4	2.1	5.1	3.9	3.0	2.7
BCAP	12.2	14.0	14.0	8.1	12.5	13.1
BCREDSK	20.2	60.7	22.2	48.0	20.6	58.4
BLIQ	73.0	63.9	91.3	60.2	76.6	63.6
BMQCI	67.5	34.1	80.8	51.4	70.1	38.5
BSIZE	6800107	39086635	1288681.	2257631.	5716143.	35114426
BOONE	-0.03	0.02	-0.1	0.2	-0.05	0.1
LERNER	0.2	0.1	0.2	0.04	0.2	0.1
HHI	0.1	0.1	0.2	0.1	0.1	0.1
EXRATEPC	-2.6	6.6	-3.1	8.5	-2.7	7.0
GDPRGR	1.2	2.3	3.0	2.9	1.6	2.5
INFRATE	1.9	0.8	4.0	3.3	2.3	1.8
REALINT	0.6	1.2	3.8	3.1	1.2	2.2

Source: Author’s calculation from Eviews

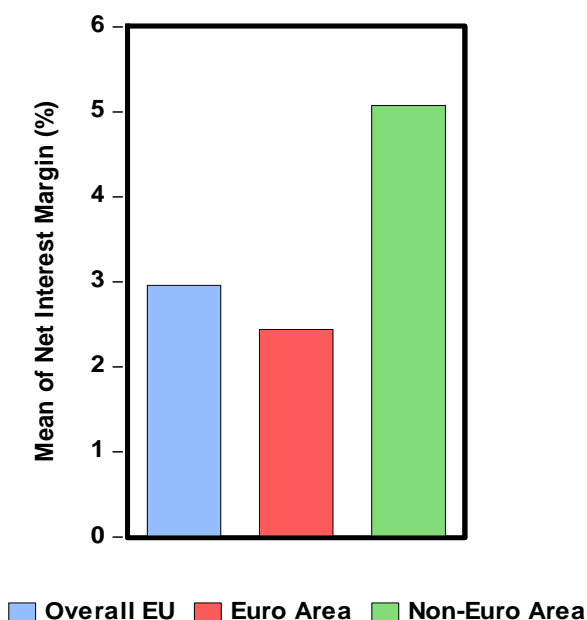
Notes: Variable names in first column are the acronyms for the various elected variables described in section 4.3.2 above.

In Table 4.1 we present the variables that are employed in the empirical analysis of the Euro and the non-Euro Areas, averaged by region/zone over the period 2002 - 2013. In figure 4.1 we also present a graph comparing the



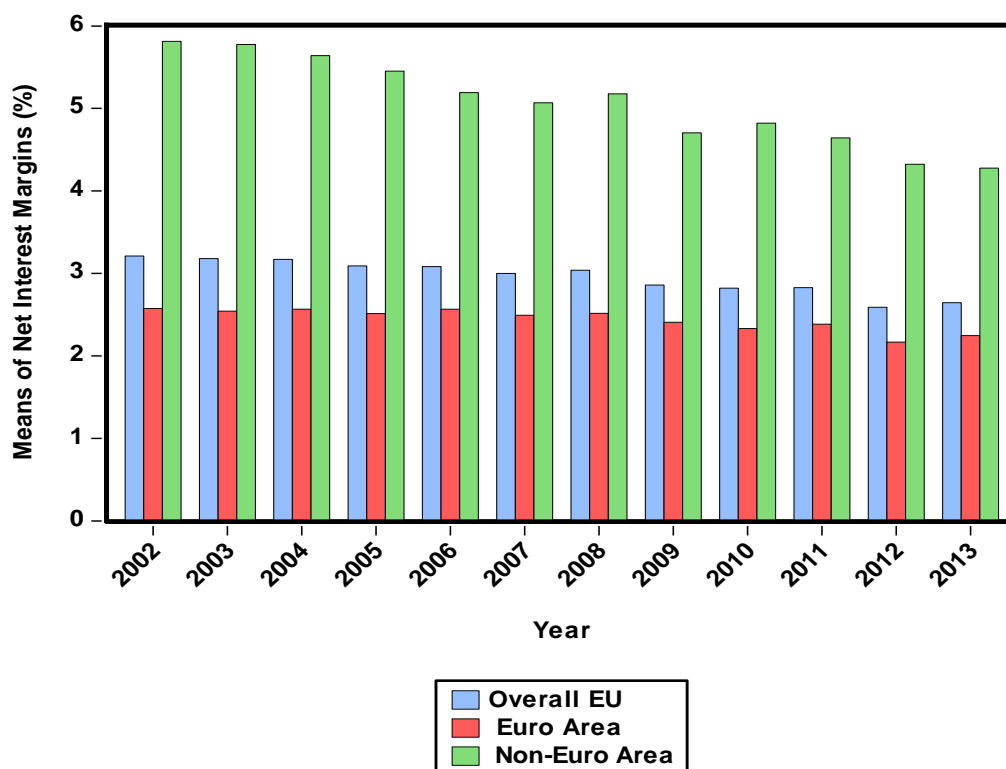
respective NIM means of the Euro Area and the non-Euro Area to those of the entire EU. From table 4.1 above the Euro Area has a lower mean NIM overall, 2.4 percent, than the non-Euro Area mean of 5.1 percent, and again lower than the entire EU mean of 3.0 percent. This is graphically represented in figure 4.2 below.

**Figure 4.2. Means of Net Interest Margins (NIM) for EU, Euro Area and Non-Euro Area.**



Source: Eviews and Author's own calculation

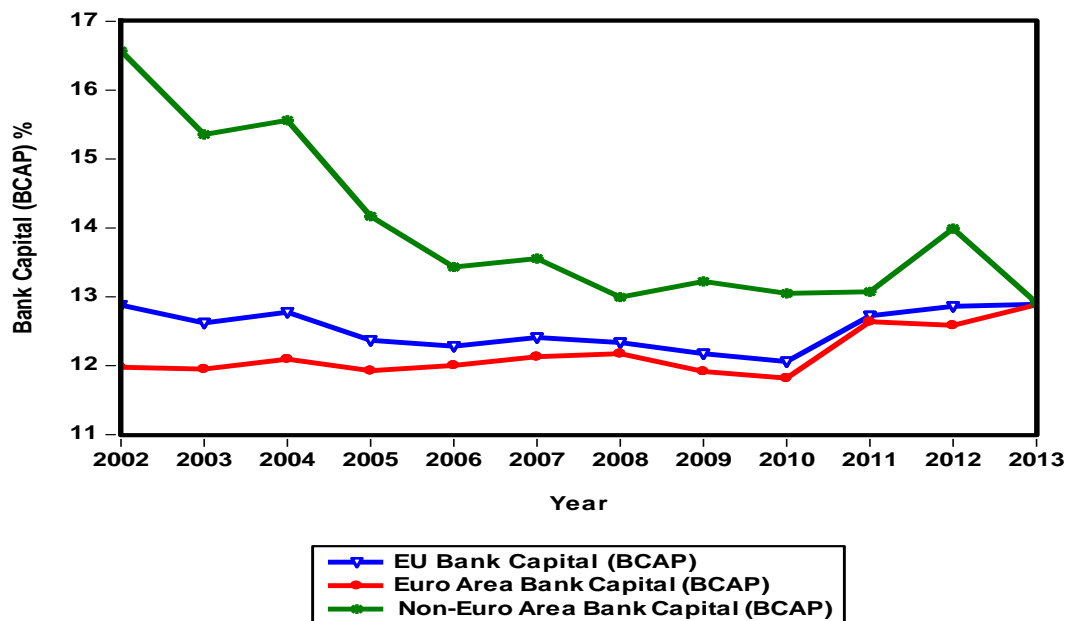
**Figure 4.3. Year-on Year Means of Net Interest Margins (NIM) for the EU, Euro Area and Non-Euro Area 2002-2013.**



Source: Eviews and Author's own calculation

Also in figure 4.3 above we observe that over the period under consideration, that is, from 2002 to 2013, NIM in the Euro Area has been consistently far lower than the non-Euro Area, as well as the EU mean as might be expected, even though the Non-Euro Area and the overall Europe means have also been falling consistently over the sample period. Again in table 4.1 the Euro Area has the least volatile NIM as per the standard deviation of 2.1 compared to 2.7 for the entire EU and 3.9 for the non-Euro zone. The most plausible explanation for this picture is that banks operating within the Euro zone can be said to be operating in an environment in which, first, there is no foreign exchange risk because of the elimination of transaction and accounting costs associated with bid-ask spreads and commissions on foreign exchange transactions; the effect of this being a reduction in systemic risk and the concomitant lowering of real interest rate, also naturally driving down NIMs within the Eurozone (Alkoholifey and Alreshan, 2010; De Grauwe, 2012).

**Figure 4.4. Trends in Mean Bank Capital (BCAP) for the EU, Euro Area and Non-Euro Area 2002-2013.**



Source: Eviews and Author's own calculation

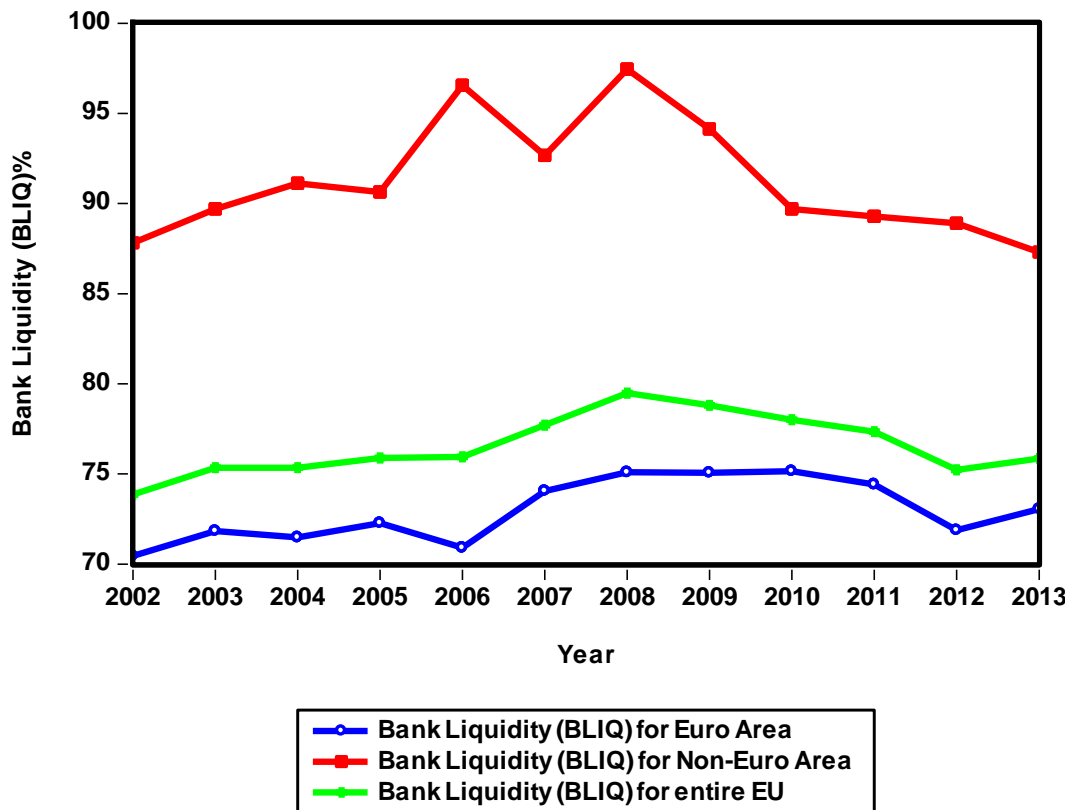
We also note that the mean equity-to-assets ratio (BCAP), our bank capital proxy, in the Euro Area, is 12.2 percent, which is lower than the non-Euro Area's mean of 14.8 percent, and the overall EU mean of 12.5 percent. While this may be due to the generally lower systemic risk which obtains in a monetary union, it may also be specifically due to the slow post-crisis recovery which made most Euro zone banks credit expansion averse. This proposition could further be supported by the lower mean bank credit risk ratio (BCREDSK) of 20.2 percent in the zone as compared to 22.2 and 20.6 percent for the non-Euro zone and the entire EU respectively, meaning Eurozone banks are keeping capital commensurate with their credit risk. Looking at trends in levels of bank capital over the period 2002 – 2013 as graphically represented in Figure 4.4 above, we see a consistent lowering in trend until 2010 when both the Euro Area and the EU together with the Non-Euro Area started rising to converge in 2013. This may be due to the implementation of financial support measures such as the European financial stability facility which facilitated capital flows to the Euro Area countries which needed financial bailout. And to the extent that most of the Euro Area sovereign debts were owned by the Euro Area banks this support invariably found its way to the banks. We could also point to the rising of bank capital in all Euro Area, non-Euro Area and EU in general to converge at the end of the sample period, as due to the imminent phasing-in of the Basel III capital requirement which sought to ensure banks' risk exposures are backed

by a high quality capital base following the financial crisis of 2007/8 (BIS, 2011). In terms of bank liquidity Euro Area banks appear to be holding less liquid assets than their counterparts in the non-Euro Area, with a mean of 73.0 percent as compared to the entire EU mean of 76.6 percent, and 91.3 for the non-Euro zone. While this may mean banks in the non-Euro Area are able to provide depositors with the reassurance that they will be able to meet their obligations when they fall due to forestall any possible runs than their counterparts in the Euro Area, it may as well signal the lower systemic risk which obtains in the Euro Area than in the non-Euro Area and that regulators may not place as high liquidity requirements as they would in the case of the non-Eurozone<sup>24</sup>. This is also reflected graphically in the trends over the period 2002 – 2013 in figure 4.5 below.

**Figure 4.5. Trends in Mean Bank Liquidity for the EU, Euro Area and Non-Euro Area.**

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<sup>24</sup> For the same prudential reasons which explains the relatively lower equity-to-assets ratio.

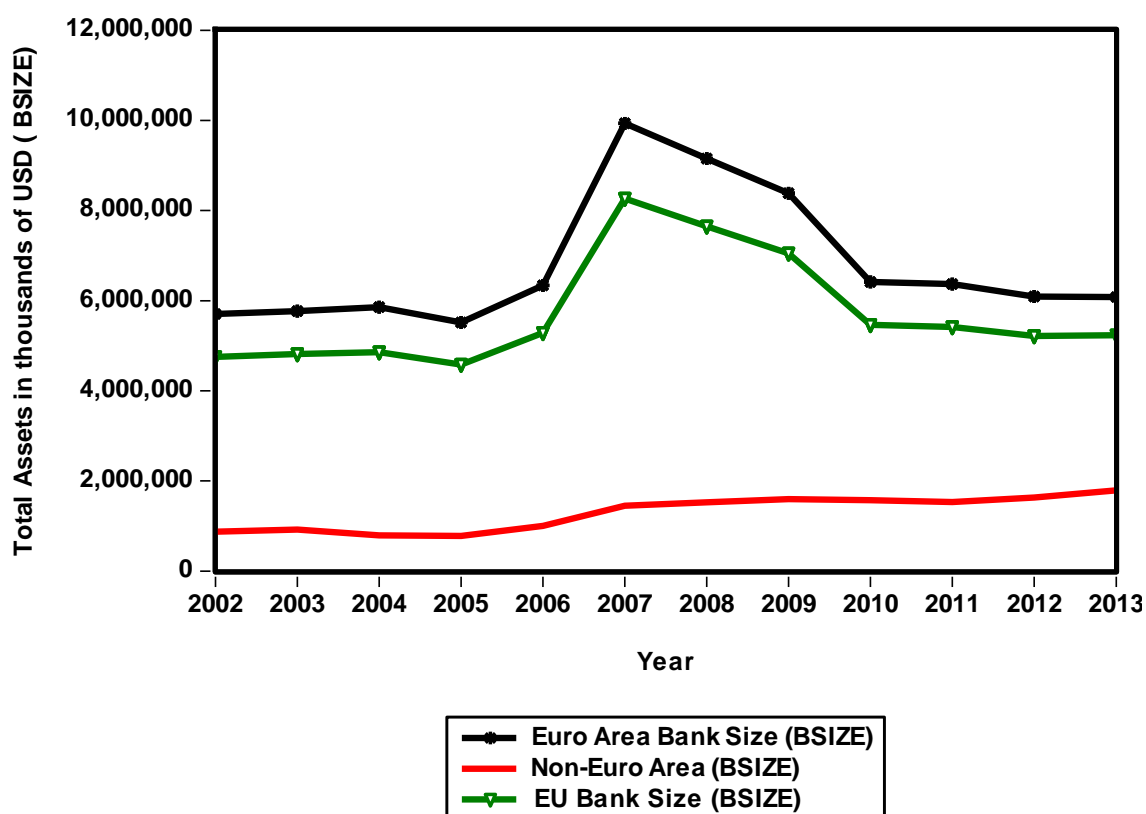


Source: Eviews and Author's own calculation

The Euro Area has a lower mean cost-to-income ratio (BMQCI), our X-efficiency proxy, of 67.5 percent compared to the non-Euro Area mean of 80.8 percent, and the EU mean of 70.1 percent. Again volatility of these mean values is lower in the Euro Area, with a standard deviation of 34.1 percent, than the EU average, with a standard deviation of 38.5 percent, and the non-Euro Area, with a standard deviation of 51.4 percent. What this implies is that banks in the Euro Area have a higher management/cost efficiency.

The mean for individual bank size (BSIZE) by total assets in the Euro Area in millions of US dollars (USD) is 6800107, larger than the non-Euro Area mean of 1288681 and 5716143 for the overall EU. That the Euro Area has a higher mean can be interpreted as a case of the monetary union affording the banks cross border opportunities to expand as compared to their counterparts in the non-Euro zone and the resulting characteristic consolidation. This is also reflected in the trends in bank size over the period 2002 – 2013 as appears in figure 4.6 below.

**Figure 4.6. Trends in Mean of Bank Size (BSIZE) in Total Assets (USD) for the EU, Euro Area and Non-Euro Area.**



Source: Eviews and Author's own calculation

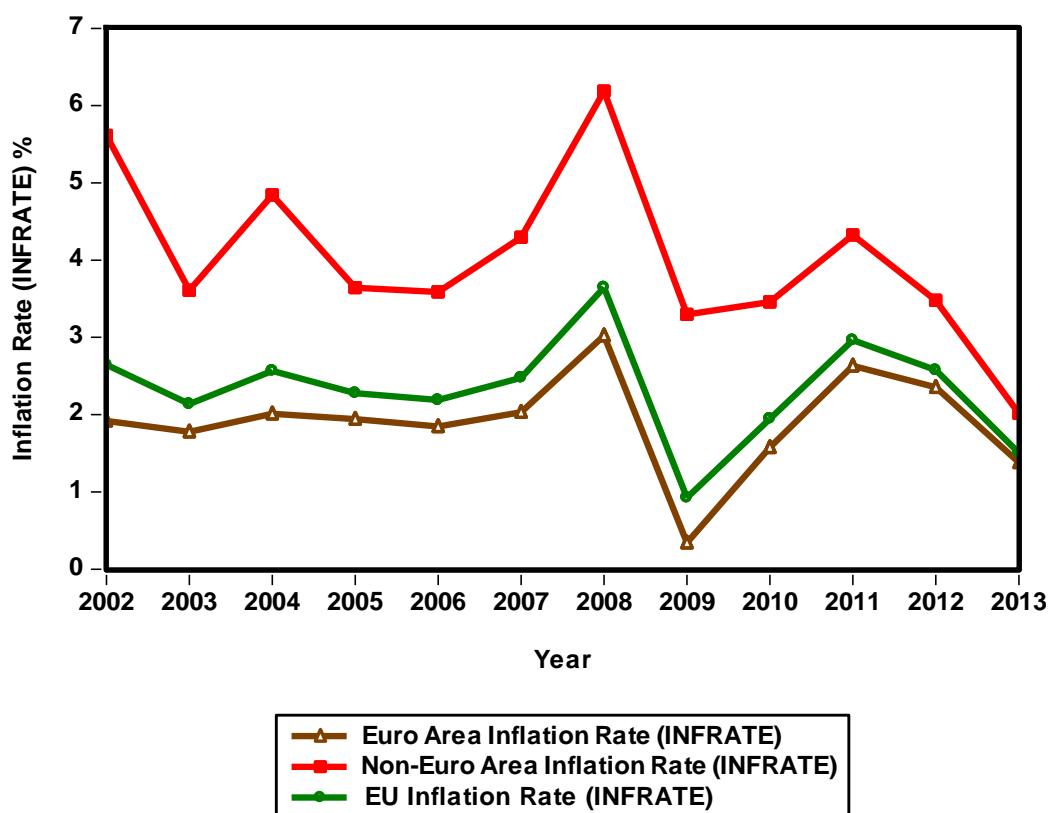
The mean bank concentration as measured by the Herfindhal-Hirschman Index (HHI) is 0.1 for the Euro Area, less than the non-Euro Area 0.2 but about the same as the mean for the EU mean of 0.1. This reflects a more competitive banking sector in the Euro Area than in the non-Euro Area. This is however not confirmed by the Boone indicator's mean of -0.03 for the Euro Area as against that for the non-Euro Area of -0.1, and -0.05 for the entire EU; the Lerner index places both the Euro Area and the non-Euro Area at par, that is, both zones have mean Lerner indices of 0.2 each, as well as the EU average.

In regards to our foreign exchange variable while both the Euro Area and the non-Euro Area means of the percentage change in foreign exchange rate (EXRATEPC), show an appreciation of the local currency against the US dollar as they carry the minus sign (-), this is higher in the Euro Area, with -2.6 percent, than -3.1 percent for the non-Euro Area, and again the overall EU mean of -2.7 percent over the sample period. In terms of volatility as measured by the standard deviation, the Euro Area as would be expected displays less volatility, 6.6 percent, than the non-Euro Area with a standard deviation of 8.5 percent, with the overall EU standard deviation at 7.0 percent. The reason for the relatively less volatility in the in the Euro Area being, as earlier mentioned in

this section, as a result of the elimination of foreign exchange risk through the elimination of transaction costs and accounting costs associated with bid-ask spreads and commissions on foreign exchange transactions within a monetary zone.

Interestingly GDP growth rate (GDPRGR) in the Euro zone has a lower mean of 1.2 percent. This comes behind the non-Euro zone mean of 3.0 percent and the EU mean figure of 1.6 percent. It seems however that this is a reflection of beta-convergence in the economic growth literature where the sampled countries of the non-Eurozone are all accession countries from the CEEC block and that their GDP growth rate would be expected to be faster as they seek to converge with the Eurozone. It must however be noted that the Eurozone GDP growth rate has been steadier, 2.3 percent, as measured by the standard deviation, than the non-Eurozone's 2.9 percent and the EU mean of 2.5 percent.

**Figure 4.7. Trends in Mean Inflation Rate (INFRATE) for the EU, Euro Area and Non-Euro Area 2002-2013.**



Source: Eviews and Author's own calculation

Coming to inflation rate (INFRATE) the Euro zone records a lower mean inflation rate of 1.9 percent, and a standard deviation of 0.8 percent, than the non-Euro zone with a mean of 4 percent, and a standard deviation of 3.3 percent, with the EU mean being 2.4 percent and volatility of 1.8 percent. The lower mean inflation rate in the Eurozone is not unexpected, as being a monetary zone the constituent countries adhere to strict price stability regime. These figures are supported by the trending over the period under consideration as represented in figure 4.7 above.

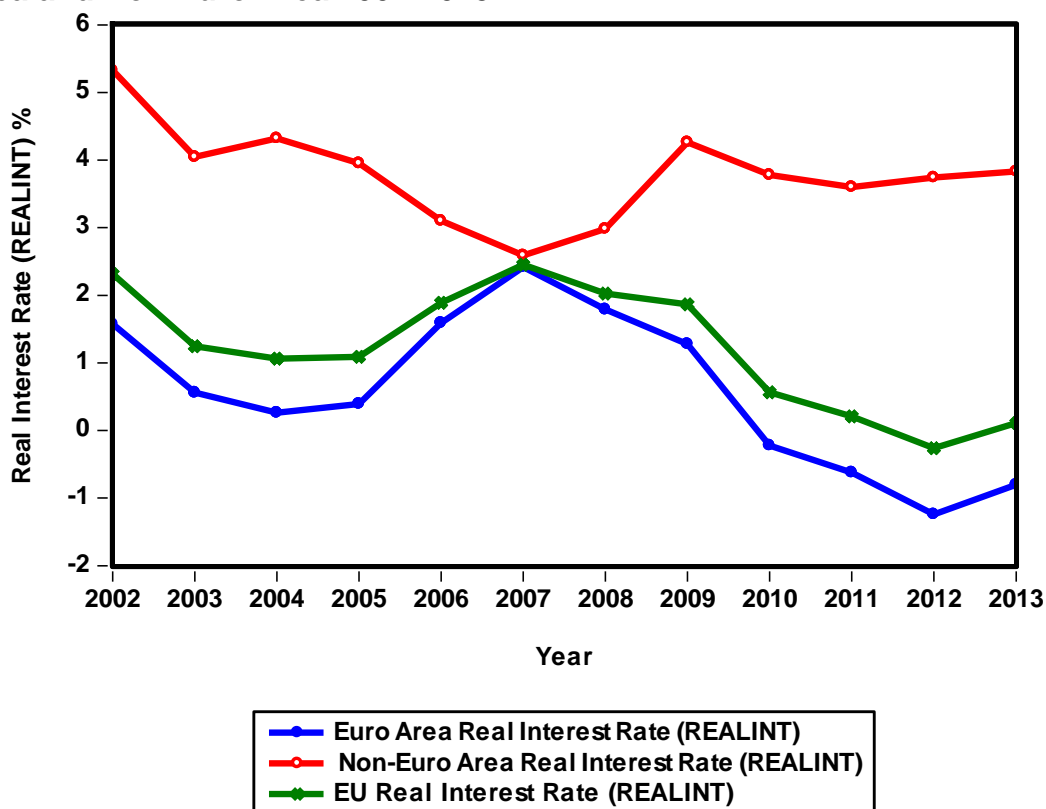
Again the lower mean real interest rate of 0.6 percent and a standard deviation of 1.2 percent, occurring in the Euro Area, as against the non-Euro Area's 3.8 percent and a standard deviation of 3.1 percent as well as the EU mean of 1.2 percent and a standard deviation of 2.2 percent is also as a result of the Euro Area being a monetary union. Even though the zone records lower mean for both inflation and real interest rates the mean real interest rate of 0.6 percent is lower than the mean inflation rate of 1.9 percent. This reflects the negative relationship that exists between inflation rate and interest rate in macroeconomic theory. The picture painted by the mean real interest rate values also seem to be reflected in the graphical representation of the trend over the period under discussion in figure 4.8 below, where consistently real interest rate in the Euro Area is below that of the non-Euro Area and the EU overall, except for 2007 where values for all three converge because interest rates in the Euro Area rose because of the financial crisis, pushing the EU overall to converge with the all-time high levels in the non-Euro Area.

#### **4.3.5 Pairwise Correlation Matrix**

In this section we use pairwise correlation coefficients as appear in tables 4.2 and 4.3 below to test the relationship between the key variables and also to test for the level of multicollinearity among the independent variables. It is evidently clear from tables 4.2 and 4.3, respectively depicting pairwise correlation matrices for the Euro Area and the non-Euro Area that all the variables show low pairwise correlation coefficients between them. This rules out the possibility of any considerable multicollinearity which warrants attention, meaning none of the independent variables is a perfect linear function of one or more independent variable



**Figure 4.8. Trends in Mean Real Interest Rate (REALINT) for the EU, Euro Area and Non-Euro Area 2002-2013.**



Source: Eviews and Author's own calculation

In terms of the relationships between NIM and the independent variables we see NIM positively related to bank capital (BCAP) in the correlation matrices for the two zones. This is consistent with the literature, and means well capitalized banks are less risky and are therefore able to pay less deposit rates and charge high loan rates, thereby making higher NIMs (Demirguc-Kunt et al, 2004).

We also observe the same positive relationship with bank credit risk (BCREDSK) in the case of the Euro Area which is consistent with much of the literature which signals better credit quality of loans warranting less provisioning and thus a reduction in provisioning costs, which in turn afford banks higher NIM. A negative relationship is on the other hand observed in the case of the non-Eurozone, which means banks make higher loan loss provisioning which reduces NIM when exposed to poor credit quality (Athanasoglou, 2008).

**Table 4.2. Euro Area Pairwise Correlation Matrix.**

	NIM	BCAP	BCREDSK	BLIQ	BMQCI	BSIZE	BOONE1	LERNER1	HHI1	EXRATEPC	GDPRGR	INFRATE	REALINT
NIM	1												
BCAP	0.286	1											
BCREDSK	0.068	0.047	1										
BLIQ	0.343	0.223	0.048	1									
BMQCI	-0.061	-0.017	-0.031	-0.029	1								
BSIZE	-0.248	-0.471	-0.071	-0.066	-0.141	1							
BOONE	-0.102	0.031	0.037	-0.079	-0.015	0.029	1						
LERNER	0.04	0.067	0.036	0.052	0.025	-0.063	0.226	1					
HHI	-0.058	0.031	0.067	-0.025	0.046	0.052	0.356	0.147	1				
EXRATEPC	-0.036	0.003	0.03	0.006	-0.014	0.043	0.084	0.04	0.029	1			
GDPRGR	-0.077	-0.021	-0.099	-0.116	-0.094	-0.008	-0.02	0.022	-0.016	-0.169	1		
INFRATE	-0.032	-0.012	-0.033	-0.024	-0.022	0.045	-0.004	-0.012	0.068	-0.244	0.28	1	
REALINT	0.068	-0.002	-0.022	0.015	-0.003	-0.063	-0.088	0.066	-0.096	-0.292	0.1	-0.247	1

Notes: No of observations is 3480. The table presents pairwise correlation coefficients of all our chosen variables: Net interest Margin (NIM), Bank Equity Capital (BCAP), Bank Credit risk (BCREDSK), Bank Liquidity (BLIQ), X-efficiency, proxied by Cost-to-Income Ratio (BMQCI), Bank Size (BSIZE), Boone Indicator, Lerner Index, Herfindhal-Hirschman Index (HHI), Percentage change in Exchange Rate (EXRATEPC), GDP growth rate (GDPRGR), Inflation Rate (INFRATE), and Real Interest Rate (REALINT) for 9 countries of the Euro Area, over the period 2002 – 2013, to test the relationship between the key variables and also to test for the level of multicollinearity among the independent variables. A higher coefficient means there is a linear correlation and vice-versa to infer multicollinearity or otherwise. The sample countries are Austria (AT), Belgium (BE), Germany (DE), France (FR), Greece (GR), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT).

**Table 4.3. Non-Euro Area Pairwise Correlation Matrix.**

	NIM	BCAP	BCREDSK	BLIQ	BMQCI	BSIZE	BOONE	LERNER	HHI	EXRATEPC	GDPRGR	INFRATE	REALINT
NIM	1												
BCAP	0.361	1											
BCREDSK	-0.065	-0.096	1										
BLIQ	0.114	0.289	-0.020	1									
BMQCI	-0.160	0.042	0.090	-0.240	1								
BSIZE	-0.271	-0.531	0.053	0.066	-0.352	1							
BOONE	0.056	0.081	-0.007	0.059	0.016	0.050	1						
LERNER	-0.109	-0.148	0.020	0.075	-0.119	0.261	-0.492	1					
HHI	0.141	0.029	-0.008	0.015	-0.040	0.026	-0.335	-0.028	1				
EXRATEPC	-0.073	-0.025	0.157	-0.001	0.000	0.059	0.188	0.088	-0.225	1			
GDPRGR	0.036	-0.022	-0.181	0.010	-0.034	0.007	-0.109	0.054	-0.107	-0.442	1		
INFRATE	0.215	0.064	-0.033	-0.114	0.031	-0.085	-0.187	0.051	0.222	-0.224	0.233	1	
REALINT	0.108	0.024	-0.036	0.037	-0.084	0.180	-0.216	0.269	0.413	-0.030	-0.186	0.167	1

Notes: No of observations is 852. The table presents pairwise correlation coefficients of all our chosen variables: Net interest Margin (NIM), Bank Equity Capital (BCAP), Bank Credit risk (BCREDSK), Bank Liquidity (BLIQ), X-efficiency, proxied by Cost-to-Income Ratio (BMQCI), Bank Size (BSIZE), Boone Indicator, Lerner Index, Herfindahl-Hirschman Index (HHI), Percentage change in Exchange Rate (EXRATEPC), GDP growth rate (GDPRGR), Inflation Rate (INFRATE), and Real Interest Rate (REALINT) for 7 countries of the Non-Euro Area, over the period 2002 – 2013, to test the relationship between the key variables and also to test for the level of multicollinearity among them. A higher coefficient means a there is a linear correlation and vice-versa to infer multicollinearity or otherwise. The sample countries are Bulgaria (BG), Czech Republic (CZ), Croatia (HR), Hungary (HU), Lithuania (LT), Poland (PL), and Romania (RO).

Bank liquidity (BLIQ) in the case of the two zones has a positive relationship with NIM, which is what is predominant in the literature. This means banks while banks with high levels of liquid assets, either voluntarily for prudential reasons or as a result of regulation, may receive lower interest income than banks with less liquid assets. They may however pass on the opportunity cost of the loss in interest income to customers, in which case a positive relationship with NIM may obtain (Martinez Peria and Mody, 2004)

For both zones we find bank size (BSIZE) and bank management efficiency (BMQCI) to be negatively related to NIM, which is consistent with the literature<sup>25</sup>. This means while quality management decisions may result in high NIM and a positive relationship, the relationship may conversely turn negative if the cost savings is passed on to customers. The same interpretation could be given in respect of BSIZE which accounts for the economies and diseconomies of scale of operations in the market for which empirical results have been mixed. The negative correlation in our case means banks in both zones are able to pass on their scale economies to the market as lower loan rates and higher deposit rates.

In the case of competition, the extant literature has it that in a competitive environment banks operate with lower margins, whereby a negative relationship obtains and vice versa. In the correlation matrix for the Eurozone we find that the Boone indicator and the HHI have a negative impact on NIM, while the Lerner index has a positive impact. On other hand, in the non-Eurozone, while we find a negative relationship for the Lerner index, a positive relationship is found with the Boone indicator and the HHI in the case of the non-Eurozone.

The relationship of percentage changes in exchange rate (EXRATEPC) with NIM is negative in both the Eurozone and the non-Eurozone. Since the relationship is ambiguous in the literature it remains to be seen what the result will be. For example, Fuentes and Basch (1998) note that while exchange rate affects bank margins its impact varies depending on the structure of the bank's assets and liabilities in foreign currency.

Similarly, for GDP growth rate (GDPRGR) and inflation rate (INFRATE) mixed relationships are found in the empirical literature. And this is reflected in the two zones. While the Euro Area shows a negative relationship for GDPRGR and INFRATE the non-Euro Area shows a rather positive impact of these

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<sup>25</sup> The literature makes an unambiguous prediction.

variables on NIM. This means in the case of the non-Euro Area while greater inflation increases the risk of default and thus banks will charge a higher lending rate that increases the interest rate spreads, within the Euro Area inflation may not be rising that much to occasion it being factored in interest rates. Lastly within the two zones we find a positive relationship with real interest rate (REALINT), which is consistent with the empirical literature. For example, Saunders and Schumacher (2000) note that greater market interest rate fluctuations increase interest rate margins

#### **4.4 EMPIRICAL RESULTS**

The objective of this chapter has been to investigate the dynamics of monetary union membership in the determination of net interest margins in the European Union, contrasting the Euro Area with the non-Euro Area. This was motivated by the creation, in our view, of the opportunities afforded by the single market and the common currency which generated higher competition and efficiency. In this context we recognise that these developments would have implications for the following determinants of net interest margins (NIM): The degree of banking competition (BOONE, LERNER and HHI), Exchange rate Risk (EXRATEPC) S-efficiency (BSIZE), that is scale efficiency, and X-efficiency (BMQCI) that is, management efficiency, which hypotheses we test and report results.

Below in tables in 4.4 for the Euro Area, 4.5 for non-Euro Area, and 4.6 for both, we present the regression results, with the different specifications reflecting the different empirical approaches to testing for banking competition (the Boone indicator, Lerner index and the Herfindahl-Hirschmann index), in the determination of net interest margins. We as well control for the effects of the 2007/8 financial crisis in the last three columns in 4.4 and 4.5, as well as 4.6.

**Table 4.4. Simultaneously Controlling for all Bank-Specific, Market Structure, Macroeconomic and Bank Capital in the Presence of the Financial Crisis Variables in the Euro Area.**

Variable	Column 1 BOONE	Column2 LERNER	Column 3 HHI	Column 4 BOONE	Column 5 LERNER	Column 6 HHI
NIM (-1)	0.111*** (0.007)	0.129*** (0.006)	0.079*** (0.008)	0.071*** (0.007)	0.255*** (0.008)	0.231*** (0.008)
BCAP	0.093 *** (0.012)	0.093*** (0.008)	0.107*** (0.014)	0.106*** (0.012)	0.073*** (0.011)	0.075*** (0.012)
BCREDSK	0.020*** (0.001)	0.013*** (0.001)	0.022*** (0.001)	0.0201*** (0.001)	0.003*** (0.0007)	0.004*** (0.001)
BLIQ	0.011*** (0.003)	-0.005** (0.002)	0.011*** (0.003)	0.011*** (0.003)	-0.006** (0.003)	-0.005* (0.003)
BMQCI	-0.011*** (0.004)	-0.023*** (0.003)	-0.131 *** (0.004)	-0.013*** (0.004)	-0.007*** (0.002)	-0.004* (0.002)
BSIZE	-0.855*** (0.128)	-0.755*** (0.093)	-0.871*** (0.148)	-0.816*** (0.137)	-0.363*** (0.078)	-0.302*** (0.102)
BOONE	-0.118*** (0.058)			-0.092*** (0.06002)		
LERNER		0.009** (0.004)			0.023 (0.007)	
HHI			-0.0501** (0.023)			-0.0002 (0.019)
BCAP_DAFTER2008				-0.009** (0.004)	-0.003 (0.003)	-0.011*** (0.003)
EXRATEPC	-0.0003 *** (0.003)	-0.004** (0.002)	-0.003 (0.002)	-0.001 (0.003)	-0.007*** (0.002)	-0.002 (0.002)
GDPRGR	0.019** (0.009)	0.009 (0.007)	0.019** (0.0098)	0.019** (0.009)	-0.007 (0.007)	0.011 (0.007)
INFRATE	0.057** (0.023)	0.078*** (0.021)	0.082*** (0.024)	0.026 (0.025)	0.077*** (0.026)	-0.013 (0.018)
REALINT	0.068*** (0.018)	0.041*** (0.015)	0.085*** (0.020)	0.043* (0.024)	0.016 (0.014)	0.015 (0.016)
J-Statistic	56.90	57.11	56.89	58.92	56.59	53.81
Prob(J-Statistic)	0.178	0.199	0.178	0.114	0.159	0.229
No. of Observations	2610	2900	2610	2610	2610	2610
AR (2) – P-Value	0.059	0.000	0.498	0.884	0.000	0.000
No. of Banks	290	290	290	290	290	290

Note: The table presents regression results of all our chosen variables: The dependent variable is Net Interest Margin (NIM). The independent variables are: Bank Equity Capital (BCAP), Bank Credit risk (BCREDSK), Bank Liquidity (BLIQ), X-efficiency, proxied by Cost-to-Income Ratio (BMQCI), Bank Size (BSIZE), Boone Indicator, Lerner Index, Herfindahl-Hirschman Index (HHI), Percentage change in Exchange Rate (EXRATEPC), GDP growth rate (GDPRGR), Inflation Rate (INFRATE), and Real Interest Rate (REALINT) and the interaction variable BCAP\_DAFTER2008 which controls for Bank Capital during the 2007/2008 Global Financial Crisis for 9 countries of the Euro Area, over the period 2002 – 2013. Columns 1 - 3 report the results of our baseline specifications simultaneously controlling for all our chosen variables. Columns 4 – 6 additionally control for the interaction variable BCAP\_DAFTER2008, depicting Bank Capital during the 2007/2008 Global Financial Crisis. The sample countries are Austria (AT), Belgium (BE), Germany (DE), France (FR), Greece (GR), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT). Probability values indicating statistical significance: \*\*\*1% \*\*5% \*10. Standard Errors are reported in parentheses. AR (2) is the test of second order serial correlation in the residuals, which null hypothesis is that there is no serial correlation. The J statistic is the Hansen test of over-identification restriction which null hypothesis is that the instruments are exogenous.

**Table 4.5. Simultaneously Controlling for all Bank-Specific, Market Structure, Macroeconomic, and Bank Capital in the Presence of the Financial Crisis Variables in the Non-Euro Area.**

Variable	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
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	BOONE	LERNER	HHI	BOONE	LERNER	HHI
NIM (-1)	0.340*** (0.017)	0.342*** (0.012)	0.363*** (0.017)	0.297*** (0.021)	0.285*** (0.017)	0.320*** (0.019)
BCAP	0.068*** (0.012)	0.051*** (0.011)	0.066*** (0.009)	0.082*** (0.019)	0.089*** (0.012)	0.075*** (0.013)
BCREDSK	-0.002* (0.001)	0.002** (0.001)	-0.0002 (0.001)	-0.003** (0.001)	-0.004*** (0.001)	-0.001 (0.001)
BLIQ	0.018*** (0.003)	0.018*** (0.003)	0.018*** (0.003)	0.016*** (0.005)	0.016*** (0.004)	0.019*** (0.004)
BMQCI	-0.001** (0.001)	-0.004*** (0.001)	-0.002*** (0.001)	0.002*** (0.001)	-0.004*** (0.001)	-0.003*** (0.001)
BSIZE	-0.383*** (0.107)	-0.506*** (0.755)	-0.276*** (0.087)	-0.479*** (0.142)	-0.585*** (0.102)	-0.408*** (0.090)
BOONE	-0.088** (0.039)			-0.055 (0.049)		
LERNER		-0.007 (0.007)			0.151*** (0.018)	
HHI			-0.060*** (0.011)			-0.062*** (0.012)
BCAP_DAFTER2008				-0.039*** (0.014)	-0.055*** (0.010)	-0.030*** (0.011)
EXRATEPC	0.027** (0.011)	-0.015*** (0.002)	-0.026*** (0.001)	0.030*** (0.011)	0.010 (0.008)	0.028*** (0.009)
GDPRGR	-0.014 (0.015)	0.027*** (0.006)	-0.023 (0.015)	-0.014 (0.018)	0.005 (0.013)	-0.025 (0.016)
INFRATE	0.257*** (0.025)	0.065*** (0.012)	0.281*** (0.019)	0.229*** (0.034)	0.174*** (0.027)	0.262*** (0.021)
REALINT	0.073*** (0.019)	0.121*** (0.012)	0.059*** (0.016)	0.077*** (0.021)	0.076*** (0.014)	0.068*** (0.017)
J-Statistic	46.69	55.14	48.83	46.35	54.05	51.72
Prob (J-Statistic)	0.567	0.254	0.48	0.541	0.254	0.331
No. of Observations	710	710	710	710	710	710
AR (2) P-value	0.773	0.269	0.219	0.000	0.000	0.000
No. of Banks	71	71	71	71	71	71

Note: The table presents regression results of all our chosen variables as described in table 4.4 for 7 countries of the Non-Euro Area, over the period 2002 – 2013. The sample countries are Bulgaria (BG), Czech Republic (CZ), Croatia (HR), Hungary (HU), Lithuania (LT), Poland (PL), Romania (RO). Columns 1 - 3 are the results for the baseline specification simultaneously controlling for all our chosen variables. Columns 4 – 6 additionally control for the interaction variable BCAP\_DAFTER2008, which controls for Bank Capital during the 2007/2008 Global Financial Crisis. Probability values indicating statistical significance: \*\*\*1% \*\*5% \*10. Standard Errors are reported in parentheses. AR (2) is the test of second order serial correlation in the residuals, which null hypothesis is that there is no serial correlation. The J statistic is the Hansen test of over-identification restriction which null hypothesis is that the instruments are exogenous.

**Table 4.6. Simultaneously Controlling for all Bank-Specific, Market Structure, Macroeconomic and Financial Crisis Variables in the Euro and Non-Euro Areas.**

	Euro Area	Non-Euro Area
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Variable	Column 1	Column2	Column 3	Column 4	Column 5	Column 6
	BOONE	LERNER	HHI	BOONE	LERNER	HHI
NIM (-1)	0.093*** (0.007)	0.073*** (0.008)	0.067*** (0.008)	0.320*** (0.014)	0.316*** (0.013)	0.8411*** (0.020)
BCAP	0.093 *** (0.012)	0.102*** (0.013)	0.104*** (0.014)	0.050*** (0.010)	0.053*** (0.012)	-0.069*** (0.008)
BCREDSK	0.021*** (0.001)	0.020*** (0.001)	0.022*** (0.001)	0.002** (0.001)	0.002** (0.001)	0.011*** (0.001)
BLIQ	0.014*** (0.003)	0.014*** (0.003)	0.014*** (0.003)	0.018*** (0.003)	0.017*** (0.004)	-0.004** (0.002)
BMQCI	-0.013*** (0.004)	-0.021*** (0.004)	-0.014*** (0.004)	-0.004*** (0.001)	-0.004*** (0.001)	-0.008*** (0.0004)
BSIZE	-0.778*** (0.146)	-0.882*** (0.147)	-0.793*** (0.163)	-0.515*** (0.082)	-0.521*** (0.077)	0.253*** (0.069)
BOONE	-0.069 (0.064)			0.054*** (0.016)		
LERNER		0.008 (0.007)			-0.002 (0.009)	
HHI			-0.035 (0.023)			-0.066*** (0.006)
DUMMY_AFTER2008	-0.142* (0.075)	-0.138* (0.075)	-0.143* (0.080)	-0.183*** (0.065)	-0.168** (0.081)	-0.248*** (0.061)
EXRATEPC	-0.001 (0.003)	-0.005 (0.003)	-0.004 (0.002)	-0.017*** (0.002)	-0.014*** (0.002)	-0.010*** (0.002)
GDPGR	0.020** (0.010)	0.012 (0.012)	0.020** (0.010)	0.013* (0.007)	0.003 (0.009)	0.002 (0.011)
INFRATE	0.033 (0.026)	0.070* (0.036)	0.046 (0.030)	0.044*** (0.013)	0.048*** (0.012)	-0.023* (0.013)
REALINT	0.034 (0.027)	0.028 (0.027)	0.045 (0.031)	0.136*** (0.018)	0.123*** (0.015)	0.038* (0.012)
J-Statistic	57.24	58.97	57.44	50.08	53.17	45.58
Prob(J-Statistic)	0.146	0.113	0.142	0.391	0.282	0.572
No. of Observations	2610	2610	2610	710	710	710
AR (2) – P-Value	0.000	0.000	0.000	0.000	0.000	0.000
No. of Banks	290	290	290	71	71	71

Note: The table presents regression results of all our chosen variables as described in table 4.4, and also controlling for the 2007/2008 Global Financial Crisis (DUMMY\_AFTER2008) for the 9 Euro Area and 7 Non-Euro Area countries, over the period 2002 – 2013. Columns 1 - 3 are the regression results for the Euro Area, and Columns 4 – 6 for the Non-Euro Area. Probability values indicating statistical significance: \*\*\*1% \*\*5% \*10. Standard Errors are reported in parentheses. AR (2) is the test of second order serial correlation in the residuals, which null hypothesis is that there is no serial correlation. The J statistic is the Hansen test of over-identification restriction which null hypothesis is that the instruments are exogenous.

In general, our econometric specifications look sound, and in all cases the lagged dependent variable is significant and correctly signed for a stable model. We report the serial correlation statistics in each case. Where this is acceptable, we can proceed on the assumption that the explanation is sound. If, as in the



case of the Euro Area with the Lerner Index we find that it is failed then we have to proceed with care. However, we have other reasons to be dubious about this indicator in banking studies as we discuss below. When we introduce intercept dummies or step dummies on capital to take account of the financial crisis we induce serial correlation in to the errors. This is not totally surprising in a short time series model, and we discuss these results only briefly below. As our baseline specification seems robust across indicators and regions we do not feel a need to re-specify them when we fail serial correlations tests, but rather accept that there is weak evidence supporting the underlying hypothesis being tested. In all other cases the errors on our relationships are acceptable and we can proceed to discuss our results, first bring out patterns of short run effects, following the common approach in the literature, and then we discuss the similarities differences between regions that emerge in the long run. The speed of response in our two regions differs, with the Euro Area responding more quickly to a change, and hence short-run difference may exist whilst long run similarities are present, as we discuss below with our bank capital variable. As differences remain for almost all variable that are maintained in both the short and the long run, the majority of our discussion focusses on the short run impacts.

## **HYPOTHESIS 1**

We hypothesize that the two efficient structure hypotheses, that is, the X-efficiency, proxied by bank cost-to-income ratio (BMQCI) and S-efficiency, also proxied by log of bank total assets (BSIZE), both have a greater reducing effect on NIM in the Euro Area than in the non-Euro Area.

We recognise that the EMU has attracted and will continue to attract Foreign Direct Investment (FDI) from within and outside the union, particularly large ones that might only be viable above a certain size resulting in: a) economies of scale b) lower marginal cost, all with reducing effects on NIM in the Euro zone than in the non-Euro zone (Oshikoya et al, 2010)

## **BMQCI**

BMQCI, our management efficiency variable which tests the X-efficiency hypothesis and proxied by cost-to-income ratio, is statistically negatively

significant at 1% across all specifications in both the Euro and non-Euro zones, as in the standard specifications in tables 4.4, 4.5, and 4.6 respectively. This lends support to the X-efficiency version of the Efficient-Structure-Hypothesis. This means within both zones banks have lower levels of operating cost per unit of gross income, implying efficient management where more profitable assets and low-cost liabilities are selected by management of banks. In both zones therefore banks are able to pass the lower costs on to their customers in the form of lower loan rates and/or higher deposit rates, thereby lowering the interest margin. This is consistent with the results in Vander Vennet (2002), who finds that higher efficiency reduces interest margins significantly for a sample of Western European countries. Maudos and Solis (2009) also find a significantly negative relationship between NIM and efficiency in bank management in their study of the determinants of net interest income in the Mexican banking system using an integrated model. The finding is further corroborated by those of Chortareas et al (2009) who investigated the determinants of interest rate margins in the Mexican banking industry focusing on their relationship with structural and non-structural measures of competition and non-parametric estimates of efficiency. The same authors also find a strong negative relationship between the X-efficiency and the net interest margins of the banking sectors of some Latin American countries. Notwithstanding the negative relationship between NIM and management efficiency (BMQCI) within both the Euro and non-Euro zones differences lie in the magnitude of the impact, where across our baseline specifications controlling for all three competition measure in tables 4.4 and 4.5 the magnitude of the reducing impact of Management efficiency (BMQCI) on NIM is higher in the Euro zone than in the non-Euro zone. For example, looking at our baseline specification in column 1 of table 4.4 in which the Boone indicator proxies for competition, while within the Euro Area the coefficient of BMQCI is -0.011, this is -0.001 in the case of the non-Euro Area. This level of differences in the reducing effects between the two zones, could be attributed to efficiency savings and industry competition which obtain more in a monetary union, and thus the Euro Area as a result of macroeconomic stability, than in a non-monetary union, and the non-Euro Area for that matter. It has for example been noted by Clarke and Daley (2010) that since the establishment of the Euro zone there is evidence of lower transaction costs for financial firms within the EMU. Another example is where

with the benefit of the TARGET2 (Trans-European Automated Real-Time Gross Settlement Express Transfer) and SEPA (Single Euro Payments Area) payments platforms the Euro system allows economies of scale to be exploited for lower fees and better cost efficiency to be achieved, indeed making the payments market within the Euro Area more dynamic and cost efficient (ECB, 2011). On the competition aspect, that a higher competition obtains in the Eurozone than in the non-Eurozone is evidenced by the mean values of our competition measures, for example. While the mean for the Boone indicator, for example is -0.03, that for the non-Eurozone is -0.1, indicating a higher competition in the Eurozone than in the non-Eurozone.

### **BSIZE**

Again with Bank size (BSIZE), measured by the log of total assets, a significantly negative relationship with NIM at 1% is observed across all our baseline specifications within both the Euro and the non-Euro Areas as appear in tables 4.4 and 4.5. The contrast however lies in the magnitude of the reducing impact of BSIZE on NIM within the two zones. For example, in our baseline regression in column 1 of table 4.4 while in the Euro Area the coefficient for bank size is -0.855, that for the non-Euro Area in column 1 of table 4.5 is -0.383, that is, of a higher magnitude in the Euro Area than in the non-Euro Area. The S-efficiency hypothesis predicts a negative relationship between interest margins and scale efficiency. That the sign of the BSIZE coefficient is negative within both zones supports the scale-efficiency hypothesis and captures the presence of economies of scale within the banking sector of both zones. The higher reducing impact within the Euro Area than in the non-Euro Area however are attributable to cost differences affording the Euro Area banks the ability to pass on part of their efficiency savings in the form of lower NIMs than the non-Euro Area banks, with all of this efficiency savings emanating from a more intense competition in the Euro Area than in the non-Eurozone, as alluded to earlier. The ECB (2014) for example in reporting on the market structure of the euro area banking system, that is, its capacity, consolidation and concentration over time asserts that in 2013 the euro area banking sector continued its consolidation process, driven by continued pressure to achieve cost containment, deleveraging and restructuring. Again, it

is our stated view that all of this is catalysed by heightened competition in the Euro Area than in the non-Euro Area.

Our findings of a negative relationship between NIM and BSIZE within the Euro and the non-Euro Areas are corroborated by the findings of Maudos and Fernando De Guevara (2004), and Angbazo (1997) who find that a negative association of bank size with net interest margins point to cost reduction resulting from economies of scale. A negative relationship is also reported by Gelos (2006) who show that higher net interest margins are associated with smaller bank size and larger overheads in the Latin American banking sector. Agoraki (2009) on the other hand find a rather positive relationship between NIM and bank size (BSIZE) in her analysis of NIMs in the South Eastern European countries where larger banks are earning higher margins. This positive relationship is confirmed by Peria and Mody (2004) who posit that such larger banks may be able to reap economies of scale while they do not choose to pass on some of these benefits to their customers in the form of lower spreads, which seems to be the case in the non-Euro zone.

With the foregoing results for both management efficiency (BMQCI) and bank size (BSIZE) the conclusion can then be drawn that the hypotheses of bank S-efficiency and X-efficiency respectively having reducing effects on NIM can be supported in both the Euro and the non-Euro Areas, although its incidence is higher in the Euro Area than in the non-Euro Area because of the effects of the monetary union.

## **HYPOTHESIS 2**

The degree of banking competition (BOONE, LERNER and HHI) has a larger reducing effect on NIM in the Euro Area than in the non-Euro Area because of the effects of the EMU. As we have discussed above, there are good theory based reasons for preferring the Boone indicator as it can apply to cross country competition, whilst the HHI cannot because it describes only local structure. As we note below there may be good reasons to be careful when using the Lerner index in studies of NIMs.

As the generally accepted hypothesis goes a more competitive banking market is expected to drive down bank loan rates/increase deposit rates, adding to the welfare of households and enterprises (Van Leuvensteijn, 2009). Within the context of the Euro and the non-Euro Areas the reducing impact of the

competition variables is so expected given the liberalised and harmonised financial regulation which allows free competitive market behaviour and cross-border operation within the single market, as well as creating a level-playing field between banks from different member states (ECB, 1999). Andres and Capraru (2014) find that competition in the EU generally increased after 2001 due to the adoption of the euro and the continuing European integration; and as well observe banking competition convergence among member states of the EU.

We note that since different competition measures belong to different measurement classifications they measure different things and do not provide the same inferences about competition our results seem mixed (Carbo-Valverde et al, 2009; Liu et al, 2013 in Leon, 2015). The choice of a particular competition measure in this context influences conclusions that can be drawn in regards to the implications of competition (Leon, 2015). For example, the HHI belong to the class of measures that infer competition from the structural characteristics of the bank market and specifically measures the level of market concentration, while the Lerner index which is based on bank behaviour measures the level of market power of a firm identified by the divergence between the firm's price and its marginal cost. The Boone indicator which is also another non-structural measure of competition and based on bank behaviour, infers the degree of competition from the effect of reallocation of market share or profits from inefficient firms to efficient ones. To support this finding we investigate the degree of consistency among our three competition measures using cross-country correlations a squared correlation coefficient,  $r^2$  in parenthesis. For this we use the mean values of our competition measures for the Euro Area and non-Euro Area respectively, averaged over the period 2002 – 2013 in tables 4.7 4.8 and 4.9 below.

In our baseline regression in the first columns of tables 4.4 and 4.5 respectively the Boone indicator has a reducing impact on NIM within both the Euro and the non-Euro Areas at 1% and 5% statistical significance respectively. However, the magnitude of the impact within the Euro Area is higher, -0.118, than in the non-Euro Area, -0.088. These results clearly support our hypothesis that the level of competition within the Euro Area has a higher reducing impact on NIM than in the case of the non-Euro Area.

While column 3 of tables 4.4 and 4.5 which controls for the HHI supports the finding of a reducing effect on NIM as could be seen with the Boone indicator in both zones in column 1 of same tables, this is not the case when the Lerner index is controlled in our baseline specification in column 2 of tables 4.4 and 4.5 respectively. We rather find that while the Lerner index was informative, that is, was able to pick up the competition effects, in the non-Euro Area and thus had a negative relationship with NIM, though not statistically significant, in the Euro Area it was not informative, and including it in the regression induces serial correlation in the errors which is absent with the other indicators. It has a positive sign, thereby suggesting a positive relationship with NIM, which may result from the close relationship between the net interest margin (which might be seen as price minus cost) and the ratio of price minus marginal cost to price.

We do not find these inconsistencies in the picking up of competition effects in the different jurisdictions, that is, the Euro Area versus the non-Euro Area, by our different competition measures strange, as Carbo-Valverde et al (2009) note that it is not possible to use one or two measures of banking competition that seem to be informative in one jurisdiction and necessarily expect the same two measures to be equally informative when applied to another jurisdiction. What is more important is that the Lerner index is known to suffer major theoretical and practical limitations, and indeed a measure of pricing power as opposed to being a proxy for competition (Leon, 2015). To that extent it may not have been able to properly pick up the level of competition in the Euro Area, and thus indicate the wrong impact on NIM. For instance, recent studies abound to the effect that there have been scenarios where increases in competition as signalled by decreases in individual Lerner indices have been recorded in the presence of either increases or decreases or even stable average degree of market power as a result of reallocation effect from inefficient to efficient banks (Leon, 2015; Boone, 2008).

Furthermore, Leon (2015) posits that efficient firms are known to have higher price-cost margin than their less efficient counterparts, in which case the weighted average Lerner index can increase even though there may be a decrease of the respective individual Lerner indices<sup>26</sup>. Since neither the HHI nor the Lerner index can pick up efficiency effects and possible contestability

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<sup>26</sup> He thus recommends partly eliminating the reallocation effect through the use of the unweighted Lerner index as a measure of competition

outcomes, reflecting competitive outcomes in a particular bank market in the presence of higher margins we would vouch for our results with the Boone indicator as the more robust one. And rightly so because the Boone indicator is the competition measure which can capture reallocation effects and contestability outcomes, even in the presence of higher margins. Indeed the Boone indicator is the only one of our three competition measures which has proved consistent and informative as far as the effects on NIM in both the Euro and non-Euro Areas are concerned, as well as much touted as superior to the Lerner index and the HHI in the banking competition literature (van Leuvensteijn, 2009)<sup>27</sup> Drawing our conclusions based on it; we find that the Boone indicator has a reducing effect on NIM within both the Euro and the non-Euro Areas at 1% and 5% statistical significance, and as expected, the magnitude of the impact is bigger in the Euro Area than in the non-Euro Area as appears in column 1 of tables 4.4 and 4.5 respectively. This supports our hypothesis that the level of competition within the Euro Area has a higher reducing impact on NIM in the Euro Area than the non-Euro Area as a consequence of the competitive force generated by the establishment of the Economic and Monetary Union (EMU).

**Table 4.7. Degree of Consistency among the Three Competition Measures Using their Mean Values for the Euro Area and non-Euro Area respectively, over the period 2002 – 2013**

	BOONE LERNER	BOONE HHI	LERNER HHI
Euro Area	0.23 (0.05)	0.36 (0.13)	0.15 (0.02)
Non-Euro Area	-0.49 (-0.98)	-0.33 (-0.66)	-0.03 (-0.06)

Notes: Values not in parenthesis are correlation coefficients (r), next to them are their squared values (r<sup>2</sup>). Source: Eviews and own calculation with annual data over 2002 – 2013.

As earlier mentioned we follow Carbo et al (2009) and investigate the degree of consistency among our three competition measures using cross-country correlations of the mean values of our competition measures averaged over the period 2002 – 2013, with a squared correlation coefficient, r<sup>2</sup> in parenthesis, for the Euro and the non-Euro Areas respectively. The results are as presented in table 4.7 above.

<sup>27</sup> Findings from studies in the Euro Area using the Boone indicator differ somewhat from recent empirical evidence from alternative measures of competition applied to the European banking sector, such as concentration and price-based measures.

As noted by Carbo-Valverde et al (2009) if any of the three pairwise correlation values equal 1.0, then it would be a perfect substitute for the other, that is, it would contain the same information and be perfectly consistent with each other. On the other hand, if the  $r^2$  value were to be equal to 0.50, then it would mean the variation in one competition measure can only be explained by 50% variation in the other, which suggests a lack of consistency between the two indicators. This means while there would be a degree of consistency between the paired competition measures if  $r^2 = 0.50$ , it would not be strong because some of the time one indicator could generate rather opposite results about the extent of banking competition. Lastly, if the pair-wise value is at or close to 0.0, then the paired competition indicators contain no similar information, are basically not correlated, and would only randomly generate similar information regarding competition. Using the foregoing criteria, it could be seen from table 4.7 that the relationships between the three competition measures respectively in the Euro and Non-Euro Areas are not strong. Within the Euro Area only 5% of the information in the Boone indicator is also contained in the Lerner index, and 13% in the HHI. For the Lerner index and HHI only 2% of the information in the Lerner index is also contained in the HHI. Since these values are close to 0 it could be concluded that these paired competition measures do not contain similar information, meaning they are basically not correlated and would only randomly give similar information about competition. Extending the same analysis to the Non-Euro Area we find that the relationship is negative across all the pairings of the competition measures which means there are no correlations at all between the three measures of competition. It is not surprising that we report mixed effects from our three competition measures in both the Euro and the Non-Euro Areas. Following on from the foregoing we extend our analysis to investigate the within country consistency for each of our studied country within the two zones namely, the Euro and the non-Euro Areas over our studied period, 2002 – 2013 in tables 4.8 and 4.9 respectively below. This time however we add NIM to the measures as the banking literature recognises it as a simple proxy of the level of market competition (Bikker and Bos, 2008). And it is expected to be smaller, the heavier competition is.



Furthermore, NIM is known to share the same base case with the Lerner index and other non-structural competition measures such as the H-statistic<sup>28</sup>, the manipulation of which yield all three competition measures (Carbo-Valverde et al, 2009):

$$\frac{(TR - TC)}{TA}$$

Where  $TR$  is total revenue,  $TC$  is total cost and  $TA$  total assets.

For example,  $NIM = (interest\ income - interest\ expense)/TA$

$= [(TR - non-interest\ revenue) - (TC - operating\ cost)]/TA$

$= (TR - TC)/TA - (non-interest\ revenue - operating\ cost)/TA$

For the Lerner index, it is  $= (PC - MC)/P$

$= (TR/TA - \partial TC / \partial TA) / (TR/TA)$ , holding input prices constant.

Under constant returns to scale  $\partial TC / \partial TA = TC/TA$ , we have

$= (TR - TC)/TA$  divided by  $TR/TA$ .

**Table 4.8. Within-country Consistency of Bank Market Competition Measures for the Euro Area.**

	BOONE LERNER	BOONE HHI	BOONE NIM	LERNER HHI	LERNER NIM	HHI NIM
Austria	-0.45	0.88	0.39	-0.41	-0.01	0.49
Belgium	0.32	-0.38	0.59	-0.21	0.38	0.11
Germany	0.19	0.23	-0.62	0.47	-0.31	-0.19
France	0.27	0.56	-0.29	0.17	-0.12	-0.09
Greece	0.15	-0.31	0.15	-0.02	0.20	0.18
Italy	-0.58	-0.64	-0.51	0.17	-0.16	0.47
Luxembourg	0.45	-0.15	0.18	-0.22	-0.55	-0.01
Netherlands	-0.21	0.77	-0.37	-0.21	0.43	-0.78
Portugal	-0.16	-0.27	-0.12	0.22	0.50	0.06
(+r value)/9	5/9	4/9	4/9	4/9	4/9	5/9

Notes: Only correlation coefficients (r) are shown here; Source: Own calculation and Eviews with annual data over 2002 – 2013.

In table 4.8 above where we compare the degree of consistency between our competition measures within individual Euro Area countries we find that they are still weak even within individual countries. Out of the six pairings only

<sup>28</sup> The H-statistic is a measure of the degree of competition in the banking market. It measures the elasticity of banks revenues relative to input prices. Under perfect competition, an increase in input prices raises both marginal costs and total revenues by the same amount, and hence the H-statistic equals 1. Under a monopoly, an increase in input prices results in a rise in marginal costs, a fall in output, and a decline in revenues, leading to an H-statistic less than or equal to 0. When H is between 0 and 1, the system operates under monopolistic competition. (Bankscope)

two of them show a positive relationship for a little over half of the countries, that is, Boone versus Lerner and HHI versus NIM. And even that, none of the countries with these pairings show a correlation coefficient above 50%. In Austria however we find a strong correlation between the Boone indicator and HHI, meaning 88% of the information in the Boone indicator is also contained in the HHI. Likewise, the Netherlands where the correlation coefficient is 77% and 56% in France for the same pairing. Also for the pairing between the Boone indicator and NIM we find a correlation coefficient of 59% for Belgium.

Within the non-Euro Area however we see a relatively higher consistency across the pairings. Out of the six pairings three have over half of the correlation coefficients to be positive. Of all six however the Boone indicator versus the Lerner index show positive correlation across all countries, of which apart from Poland (26%), Croatia (35%), and Bulgaria (47%) the remaining four non-Euro Area countries show correlation coefficients well over 50%.

**Table 4.9. Within-country Consistency of Bank Market Competition Measures for the Non-Euro Area.**

	BOONE LERNER	BOONE HHI	BOONE NIM	LERNER HHI	LERNER NIM	HHI NIM
Bulgaria	0.47	0.31	-0.24	0.34	-0.23	-0.39
Czech Republic	0.85	-0.54	-0.08	-0.32	0.29	0.14
Croatia	0.35	-0.07	0.38	-0.86	0.29	-0.07
Hungary	0.68	-0.52	-0.92	-0.46	-0.54	0.50
Lithuania	0.68	-0.52	0.23	-0.46	0.27	0.24
Poland	0.26	-0.05	-0.60	-0.75	-0.51	0.12
Romania	0.90	0.001	0.33	-0.001	0.43	-0.01
(+r value)/9	7/7	2/7	3/7	1/7	4/7	4/7

Notes: Only correlation coefficients (r) are shown here; Source: Own calculation and Eviews with annual data over 2002 – 2013

Overall, we can conclude that while the consistency between our competition measures do vary they also vary both between the Euro and the non-Euro Areas, and across countries, meaning per time information hardly do two of our competition measures carry the same information. This is consistent with the findings of Carbo Valverde et al. (2009), who find that consistency among competition measures across some selected 14 Euro Area and non-Euro Area over the period 1995 – 2001 is weak.

### HYPOTHESIS 3

We hypothesize that exchange rate has a more reducing effect on NIM in the Euro Area than in the Non-Euro Area.

Across all our Euro Area specifications EXRATEPC which is the percentage change in US Dollar exchange rate has a consistently negative relationship with NIM and statistically significant at 1% and 5%, apart from our standard specification in the Euro Area when HHI is controlled in column 3, which has the expected negative sign but not statistically significant. This suggests that an appreciation of the Euro in terms of percentage change in US dollar exchange rate has a reducing effect on NIM in the Euro Area. This means with the elimination of transaction costs afforded by a single currency banks are able to pass on the cost savings on to customers in the shape of reduced NIM. While we observe the same reducing effects in the Non-Euro Area, rather surprisingly the magnitude of the reducing effect is higher in the Non-Euro Area than in the Euro Area. This finding in the Non-Euro Area may be attributable to the accession agenda of the constituent countries whereby because of this agenda their exchange rates may be converging to the Euro Area levels, thereby minimising/eliminating exchange rate risk to the levels in the Euro Area and therefore engendering a reducing effect on NIM. We investigate this by estimating the respective speed of convergence and half-lives, the results of which are reported in Tables 3.9 and 3.10 of chapter 3. That in these tables, the non-Euro Area average speed is closer to zero than the Euro Area average means the percentage change in exchange rate (EXRATEPC) in the countries of the non-Euro Area are converging faster than those of the Euro Area. If the values are closer to one, it denotes a slow rate of convergence. Conversely if it is closer to zero then it denotes a faster rate of convergence. The speed of convergence is calculated by estimating equation 3.2 in chapter 3. Again we calculate the half-life of the convergence process for both zones by using the following formula: 
$$\frac{0.5 \ln}{\text{Speed of convergence} \ln}$$

As per our results for both zones in tables 3.9 and 3.10 while the Euro Area records a half-life of 0.43 the Non-Euro Area also records a half-life of 0.39. This means it takes a shorter time for the gap between the Non-Euro Area countries and the sub-regional average to be cut into half than the countries in the Euro Area, thereby eliminating any foreign exchange rate risk. As indicated

earlier this may not be surprising as most of the sampled Non-Euro Area countries have an accession agenda, and therefore have been consistently converging. The negative relationship between exchange rate and net interest margin is consistent with Chortareas et al (2011) who find an equally negative relationship with net interest margin in Chile but a rather positive relationship in Colombia and Paraguay.

### **CONTROL VARIABLES (Bank-specific)**

### **LAGGED DEPENDENT VARIABLE (NIM)**

The lagged NIM across all our specifications for both the Euro and Non-Euro Areas are significant at 1% confirming the dynamic nature of our model specification, and justifies the inclusion of lagged values of net interest margin to account for previous values of the NIM in the estimated regressions.

Again across all specifications our results show that there is a relatively higher persistence of net interest margin across time in the Non-Euro Area than in the Euro Area, as the coefficients with the lagged net interest margin is relatively higher and significant. For instance, in our standard regressions for both zones where the Boone indicator is included as the competition measure in column 1 of tables 4.4 and 4.5 while the coefficient for the Euro Area is 0.11 that for the Non-Euro Area is 0.34. This means within both zones although competitive forces are sufficiently powerful to ensure that no firm can persistently earn NIM above the norm these forces are more powerful in the Euro Area than in the Non-Euro Area. This confirms the liberalised and harmonised financial regulation within the Euro Area which makes entry and exit into markets sufficiently free to bring abnormal NIM quickly into line with the competitive norm than it does obtain in the Non-Euro Area.

Consistent with our results particularly with the Non-Euro Area are those obtained by Dumicic and Ridzak (2013) who find a relatively high persistence of NIM across time in their study of NIM in eleven Central and Eastern European Countries (CEEC) five of which are part of our sample countries for the non-Euro zone.<sup>29</sup> Also consistent with our results for the Euro Area are the results of Maudos and Fernandez de Guevara (2004) who study NIM in five banking sectors of the European Union (EU), three of which are part of our sample countries for the Euro Area, and find that factors which, in part, were driven by

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<sup>29</sup> The coefficient for the lagged NIM across the non-Euro zone being between 0.44 and 0.58 across all specifications and significant at 5%.

several years of a favourable economic situation, due to, inter alia, convergence in the economies of the Euro Area, propitiating an environment of macroeconomic stability in which financial markets have shown low volatility were responsible for reduction of NIM.

## **BCAP**

The bank capital variable is significant at 1% in both the Euro and non-Euro Areas across all our three baseline specifications in columns 1 – 3 of tables 4.4 and 4.5 respectively, in which all three respective competition measures have been independently controlled. While the relationship between our capital adequacy variable (BCAP) and NIM in both the Euro and non-Euro Areas are positive for all three specifications, and even across the rest of the specifications, we observe higher magnitude of short term impact picked up in the Euro Area than in the Non-Euro area. In column 1 of tables 4.4 and 4.5, for example, when we control for the Boone indicator, while the coefficient is 0.093 and statistically significant at 1% in the Euro Area, within the Non-Euro Area the coefficient is 0.068 and statistically significant at 1%.

In our second specification when we control for competition with the Lerner index (HHI), in the Euro Area, the reported coefficient is 0.093, and 0.107 when the HHI is used to control for competition. Similarly, in the Non-Euro Area the reported coefficients are 0.051 and 0.066 when the Lerner index and the HHI are respectively controlled and significant at 1%. The positive relationship between the equity capital and net interest margins in both zones is consistent with the hypothesis that while substituting equity for debt reduces the risk of insolvency, and therefore ought to have the effect of lowering the cost of borrowed funds, equity is a more expensive source of funding, and therefore an increase in equity capital by substituting equity for debt leads to higher required net interest margins (NIM) as these costs may be passed on to customers (Anbgazo, 1997).

In practical terms what this means is that banks in both zones are subject to high regulatory capital and would ask for higher rents to compensate for it (Saunders and Schumacher, 2000). Nevertheless, the higher effects in the Euro Area than in the Non-Euro Area may be explained by the free movement of

capital facilitated by the monetary union. This translates into free excess capital with which banks in the Euro Area may be motivated to increase their portfolio of risky assets (Claeys and Vennet, 2008) which accrue higher rents than in the Non-Euro Area. The issue of high regulatory capital within both zones is particularly evidenced by the post-financial crisis response by the European Commission initiatives to create a safer and sounder financial sector for the single market culminating into a single rulebook for all financial actors, including banks in the 28 Member States of the European Union which is the foundation for the Banking Union. The single rule book lays down capital requirements aimed at executing a comprehensive and risk-sensitive framework to promote enhanced risk management amongst banks and other financial institutions (<https://ec.europa.eu/>). To this effect subsequent to the original capital requirements directives there have been several upward revisions to date. However, we should note that in the long run the effects of capital on the NIM is the same in both regions, as we discuss below.

## **BCREDSK**

Extending the same analysis to our credit or default risk variable, the ratio of loan loss provision to net interest revenue (BCREDSK), we find that while credit risk is statistically significantly positive at 1% in the Euro Area across all our standard specifications, and consistent with the literature, in the Non-Euro Area it is only positive and significant at 5% when we control for the Lerner index leaving the other specifications in columns 1 and 3 of table 4.5 rather inversely related. Nevertheless, these are hardly significant, 10% when the Boone indicator is controlled for and not at all significant when the HHI is controlled for. The more prevalent explanation in the extant literature for the positive relationship in both zones is that banks with riskier loans select higher net interest margins (Angbazo, 1997). We as well find a higher magnitude of impact on NIM when BCREDSK increases in the Euro Area than in the Non-Euro Area. For example, in column 2 of tables 4.4 and 4.5 where the Lerner index is controlled for while we record a coefficient of 0.013 for the Eurozone 0.002 is reported. The explanation of a higher magnitude of the impact in the Euro Area than in the Non-Euro Area is that, in a monetary union macroeconomic instability is comparatively more contained than in a non-

monetary union leading to a comparatively lower default risk rates; and therefore proportionately low provisions for loan losses reflecting in higher NIMs. This is in contrast to the Non-Euro Area as a non-monetary union where the incidence of higher loan loss provisions than in the Euro Area will have the effect of reducing bank NIMs within the Area. Gunter et al (2013) show that increasing loan losses or nonperforming loans relative to earning assets causes banks to lose interest income generated from these loans and to move funds to lower-yielding assets that are less prone to default. Both effects tend to negatively influence the NIM in the short run, in other words deteriorations in credit quality tend to decrease the NIM. This is as well consistent with the hypothesis that increased exposure to credit risk is normally associated with decreased firm profitability and considering NIM as a profitability/performance measure, the negative relationship between NIM and our credit risk variable within the non-Euro zone is not surprising and consistent with the findings of Athanasoglou et al (2008). Also consistent with our results for the Euro Area is the ECB's (2013) claim in its financial stability report that the Euro area's large and complex banking groups (LCBGs) outperformed smaller significant banking groups (SBGs) in recent years and quarters, largely because of their lower credit risk costs.

## **BLIQ**

In respect of bank liquidity risk (BLIQ) our results largely indicate a positive relationship with NIM significant at 1% in both the Euro and Non-Euro Areas, across all our standard specifications, which is consistent with what obtains in the literature; meaning banks would charge higher rents as the cost of holding less profitable liquid assets in their bid to mitigate liquidity risk. The only exception is in the Eurozone where the sign turns negative once the Lerner index is controlled for. It must however be noted that the coefficients are consistently larger in the non-Euro Area than in the Euro Area. For example, in our baseline specification in column 1 of tables 4.4 and 4.5 respectively where the Boone indicator is used to control for competition while the coefficient is 0.011 in the Euro Area, within the Non-Euro Area the coefficient is 0.018. This means within the Euro Area liquidity risk is likely to reduce because of deeper and more liquid markets deriving from the free movement of capital afforded by the monetary union. As a result, banks factor in less liquidity risk premium in

their interest rates than banks in the non-Euro Area. Liquidity risk is again likely to reduce because as part of the banking union to reinforce the deeper economic and monetary union to support the single currency within the Euro Area, minimum liquidity requirements are set to ensure that banks hold a sufficient amount of liquid assets to withstand stress and to enhance short-term resilience of the liquidity risk profile of banks<sup>1</sup>. Our findings are consistent with the view of Athanasoglou et al (2008) who note that during periods of increased uncertainty, financial institutions may decide to diversify their portfolios and/or raise their liquid holdings in order to reduce their risk. They are as well consistent with Brock and Suarez (2000) who investigate the behaviour of bank spreads in Latin America using the ratio of short-term assets to total deposits as a proxy for liquidity ratio and find it positively correlated with the spread for all the Latin American countries under study, and statistically significant for Bolivia, Columbia and Peru.

## **MACROECONOMIC CONTROL VARIABLES**

Almarzoqui and Naceur (2015) note that generally, a stable macroeconomic environment, with low inflation, low interest rate, and low reserve requirement, will support lower net interest margins. We consider that while the other macroeconomic variables may have a positive relationship with NIM in both the Euro and non-Euro Areas the magnitude of the coefficients will be higher in the Non-Euro Area due to incidence of higher convergence in the Euro Area than in the Non-Euro zone.

### **GDP Growth Rate (GDPRGR)**

Across all specifications GDPRGR has a positive effect on NIM in the Euro Area and the Non-Euro Area, only where it is statistically significant, specifically in column 2 of table 4.5 where the Lerner index proxies as a competition measure. This means in both zones periods of high growth can result in higher net interest margins due to more intense credit activity and better loan quality. These findings are consistent with those of Dumčić and Ridzak (2013), and Claeys and Vennet (2008). According to Claeys and Vennet (2008) the positive association between the business cycle and bank margins is mainly a characteristic of the Western European bank markets. And this is what Demirgüç-Kunt and Huizinga (1999) and Demirgüç-Kunt et al. (2004) explain by



suggesting that GDP serves as a general indicator of economic development by reflecting differences in banking technology and the mix of banking opportunities. Therefore, it is only natural that an increase in GDP should be expected to increase bank's income as a result of more lending and lower default rates (Brock and Suarez, 2000; Claeys and Vennet, 2008). And that for these markets, higher economic growth is associated with higher margins, as a reflection of more lending and lower default rates. We however note a higher magnitude in impact in the Non-Euro Area than in the Euro Area. For instance, in column 2 of table 4.5 where the reported coefficient is 0.027 within the Euro Area this is 0.019 in column 1 of table 4.4. That the increases are lower in the Euro Area than in the non-Euro Area can be explained by the relatively higher macroeconomic stability in the Euro Area than in the Non-Euro Area reflected in for example, lower costs to financial firms integrating across the national boundaries (Clarke and Daley, 2010). The higher macroeconomic stability is further buttressed by the ability of the Euro Area as a monetary union to adopt a common approach to addressing shocks should they arise.

### **Inflation Rate (INFRATE)**

INFRATE has a largely significantly positive impact on NIM in both the Euro Area and the Non-Euro Area across all specifications. In both zones the positive and significant effects of inflation on intermediation margins is possibly due to the ability of banks to at least satisfactorily, forecast future inflation, which in turn implies that interest rates have been appropriately adjusted to achieve higher margins. This may also be viewed as the result of bank customers' failure (in comparison to bank managers) to fully anticipate inflation, implying that above normal margins could be gained from asymmetric information (Athanasoglou et al, 2008). That the magnitude of the effects is higher in the Euro Area than in the Non-Euro Area can be explained by the relatively better ability of banks within the Euro Area to possibly fully anticipate and forecast future inflation, which in turn implies that interest rates have been appropriately adjusted to achieve higher margins than in the Non-Euro Area. Our results of positive relationship of inflation rate with net interest margins in both zones is consistent with Brock and Suarez (2000) who find a positive relationship of inflation rate with bank spreads in Bolivia, Chile, Columbia and Peru.

## **REALINT**

As expected real interest rate has a positive impact on NIM in both the Euro Area and Non-Euro Area, as banks would account for this as a marginal cost of funds to them. We observe however that, across all our specifications in tables 4.4 and 4.5 the magnitude of the coefficients is higher in the Non-Euro Area than in the Euro Area. For example, in the Non-Euro Area, in table 4.5, where REALINT is statistically significant at 1% across all our three baseline specifications in columns 1 - 3, while the coefficient is 0.073 in column 1, in column 1 of table 4.4 a coefficient of 0.068 is reported. The reason for these differences in effects between the two zones can be found in the very primary objective of a monetary union to maintain price stability. For instance, in the Euro Area the ECB's monetary policy is to maintain price stability in the shape of keeping inflation rates of below, but close to, 2% over the medium term through the appropriate level of short-term interest rates. And to the extent that this ECB interest rate is an important factor for banks in the Euro Area when setting the interest rates that they charge when they lend money it is reflected in their NIM. For example, by raising or lowering interest rates the ECB can exercise indirect influence over the interest levels that the banks apply to interbank transactions, business loans, consumer loans, mortgages and savings accounts, amongst other things. Therefore, with this kind of monetary policy it would be expected that the Euro Area interest rate which is really the price that banks pay to borrow funds from the European Central Bank would be lower than what obtains in the Non-Euro Area, where price stability is not guaranteed because of the heterogeneity in monetary policy. Our finding of a positive relationship of real interest rate with net interest margin is also consistent with Brock and Suarez (2000) who find a positive relationship in some countries in Latin America

## **EFFECTS OF 2007/8 FINANCIAL CRISIS**

### **BCAP\_DAFTER2008**

We consider that with the banks within the EU having gone through an episode of financial crisis which started in the summer of 2007 and having reached its peak in 2008, there might be a structural break with a potential impact on the way our regulatory capital variable (BCAP) might impact NIM. Motivated by Dumovicic and Ridzak (2010) in Table 4.6 we test for the potential

structural break in this relationship by creating a crisis dummy `DUMMY_AFTER2008`, whereby years after 2008 take on the value of 1 and 0 otherwise. We also interact the aforementioned crisis dummy with our equity capital ratio (BCAP) in Tables 4.4 and 4.5. In so doing we get specific estimates for the partial relationship of BCAP with net interest margin in the 2008 financial crisis, which results we report across columns 4 – 6 of table 4.4 for the Euro Area, and columns 4 – 6 in table 4.5 for the Non-Euro Area. The results show that there is a structural change in the relationship between equity capital ratio and net interest margin. The relationship between the equity capital ratio and net interest margin is negative in the crisis period compared to normal times. In column 4 of tables 4.4 and 4.5 in which the Boone indicator proxies for competition in both the Euro Area and the Non-Euro Area the interaction coefficient (`BCAP_DAFTER2008`) is significantly negative for both zones. This runs counter to the general hypothesis in the literature, which is that while substituting equity for debt reduces the risk of insolvency, and therefore has the effect of lowering the cost of borrowed funds, equity is a more expensive source of funding, and therefore increasing equity capital by substituting equity for debt leads to higher required net interest margins (NIM) as banks may pass on these costs on to customers, rendering a positive relationship between bank capital and NIM (Anbgazo, 1997). However, we should note that these regressions display significant serial correlation and hence the results have to be treated with care.

Our findings are corroborated by Berger and Bouwman (2013) who note that the recent financial crisis has raised fundamental issues about the role of bank equity capital, and that various proposals have been put forward to the effect that banks should hold more capital. They further argue that the undergirding premise in all of these proposals is that there are externalities owing to the safety net offered banks and therefore for purposes of enhanced social efficiency banks must be seen to be operating with more capital, especially during financial crisis.

### **DUMMY\_AFTER2008**

This dummy variable captures the effect of the period in the run-up to the start of the financial crisis in up to its peak in 2008. The relationship between this variable and NIM is negative in both zones, only marginally significant at

10% in the Eurozone, and 1% in the Non-Euro Area with generally higher magnitude of the coefficients than in the Euro Area. These findings are consistent with those of Dumicic and Ridzak (2013) who find a reducing effect of the financial crisis on NIM in the CEEC. However, once again we have induced serial correlation in the errors with our step dummy and hence we have to treat our results with care.

### Long-run effects

Below in tables 4.10 and 4.11 we present our results of the long-run impacts for our bank-specific and competition variables and discussion. In section 4.3.1 where we specify our model to be estimated we anticipated the display of a dynamic model in that previous values of bank margins may affect current values of those margins as banks need to match the random deposit supply function and the random demand of lending and non-traditional activities across periods (Carbo-Valverde and Fernandez, 2007). This means observations in one period are linked to those in some other period. Therefore, if one of the driving variables has an initial positive impact on the NIM we anticipate that in period  $t + 1$  NIM will continue to increase, since past NIM has a positive effect. This cumulative effect will continue whilst the driving variable remains higher than its initial value. This specification relies on the assumption that the effect of all explanatory variables on NIM initially reflects the short-run effects, and thereby underestimate the long-run effects of the explanatory variables. Estimation of long-run effects requires a dynamic structure where the full effect of changes in the explanatory variables on NIM may only come about with a lag (Farahani et al, 2009). Therefore, to estimate the long-run effects we have used the following dynamic model.

$$\begin{aligned}
 y_{it} &= \alpha + \delta Y_{it-1} + \beta_{BS} X_{it-1}^{BS} + \beta_{BM} X_{it-1}^{BM} + \beta_M X_{it-1}^M \quad (4.8) \\
 &+ \varepsilon_{it} \\
 \varepsilon_{it} &= \mu_i + \gamma_t + \nu_{it}
 \end{aligned}$$

The long run effects can be seen as those that will be observed when  $y_{it} = Y_{it-1}$  so that in the long-run, an increase in an explanatory variable, say bank capital (BCAP) will raise NIM by:

$$\frac{\beta_{it}}{(1 - \delta)}$$

There are various ways to evaluate the significance of long run effects, as these may differ from the significance of the short run effect, and we use the relevant parameter restriction implied above to derive ‘t’ statistics which we report in tables 4.14 and 4.15 below.

## Results

As we would expect with positive and significant lagged dependent variables, long run impacts exceed short run ones, albeit by more in the non-Euro Area than in the Euro Area. In each case we report three regressions for each Area, and it is interesting to note that the long run effects of the Boone indicator are the same in the two regions, suggesting that the long run effects of the Single Market environment are the same, albeit with a slower impact outside the Euro Area than in it. The Lerner index is less appropriate for NIMs than elsewhere and in the Euro Area it induces serial correlation, and hence it is not surprising the effects differ noticeably. The HHI index has a small negative impact in both areas in the long run. The bank specific indicators outside of the influence of the regulators display smaller effects in the non-Euro Area than they do in the Euro Area, even given the slower speed of adjustment outside the Euro Area than in it, and hence all our comments on these indicators above continue to hold, with bank size having particularly noticeable long run effects in the Euro Area.

Perhaps the most interesting long run results come from the two variables influenced by regulators, liquidity and importantly bank capital. In the non-Euro Area extra liquidity has a greater effect on bank NIMs than in the Euro Area, reflecting the higher cost of liquid assets to banks outside the Euro Area. The long run impacts of bank capital on NIMs are similar both across specifications and across regions, and this is important for policy evaluation purposes. Our preferred Euro Area specification uses the Boone index, and there a one percentage point increase in bank capital will raise net interest margins by 0.105 in the long run, whilst in the non-Euro Area specification using the Boone indicator a similar increase in bank capital will raise NIMs by 0.104 in the long run. In the non-Euro Area specification using the HHI index margins would rise by 0.103 in the long run. There are many ways that banks may finance their loan books, but the two most obvious sources of funds are equity

raising and deposit taking. If a bank pays 5 percent on its deposits and has to pay an equity yield of 15 percent then an increase in equity finance of one percentage point, reflected in an increase in BCAP of one percent will mean that net interest margins must rise by 10 basis points to cover the increase in costs. This is exactly the long-run figure we find for both areas we study, although the impact takes longer to come through in the less competitive non-Euro Area. Hence if regulators wish to increase capital holding by banks they know that the impacts will be around the same in all European Union countries whether or not they are in the Euro Area. This is an important and interesting result.

**Table 4.10. Simultaneously Controlling for all Bank-Specific, Market Structure and Macroeconomic Variables for the Short-Run Effects, and for only Bank-Specific and Market Structure Variables for the Long-Run Effects in the Euro Area**

VARIABLE NAME	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6
	BOONE	LERNER	HHI	BOONE LONG-RUN	LERNER LONG-RUN	HHI LONG-RUN
NIM (-1)	0.111*** (0.007)	0.129*** (0.006)	0.079*** (0.008)			
BCAP	0.093*** (0.012)	0.093*** (0.008)	0.107*** (0.014)	0.105*** (7.859)	0.107*** (11.507)	0.117*** (7.737)
BCREDSK	0.020*** (0.001)	0.0133*** (0.001)	0.022*** (0.001)	0.023*** (-2.015)	0.015*** (14.667)	0.024*** (22.093)
BLIQ	0.011*** (0.003)	-0.005** (0.002)	0.011*** (0.003)	0.013*** (3.548)	-0.006** (-2.455)	0.011*** (3.092)
BMQCI	-0.011*** (0.004)	-0.023*** (0.003)	-0.131*** (0.004)	-0.012*** (-2.715)	-0.027*** (-6.843)	-0.014*** (-3.570)
BSIZE	-0.855*** (0.128)	-0.755*** (0.093)	-0.871*** (0.148)	-0.961*** (-6.679)	-0.867*** (-8.136)	-0.945*** (-5.879)
BOONE	-0.118*** (0.058)			-0.133*** (-2.015)		
LERNER		0.009** (0.004)			0.010** (2.230)	
HHI			-0.0500** (0.023)			-0.054** (-2.138)

EXRATEPC	-0.0003 *** (0.003)	-0.004** (0.002)	-0.003 (0.002)
GDPGR	0.019** (0.009)	0.009 (0.007)	0.019** (0.0098)
INFRATE	0.057** (0.023)	0.078*** (0.021)	0.082*** (0.024)
REALINT	0.068*** (0.018)	0.041*** (0.015)	0.085*** (0.020)
J-Statistic	56.90	57.11	56.89
Prob(J-Statistic)	0.178	0.199	0.178
No. of Observations	2610	2900	2610
AR (2) – P-Value	0.059	0.000	0.498
No. of Banks	290	290	290

Note: Probability values \*\*\*1% \*\*5% \*10; standard errors in parentheses in core regressions in columns 1 to 3, and t-statistic in parentheses beneath long- run coefficients in columns 4 to 6. List of sample countries, studied period and diagnostic tests are the same as in table 4.4 notes

**Table 4.11. Simultaneously Controlling for all Bank-Specific, Market Structure and Macroeconomic Variables for the Short-Run Effects, and for only Bank-Specific and Market Structure Variables for the Long-Run Effects in the Non-Euro Area.**

Variable name	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
	BOONE	LERNER	HHI	BOONE LONG-RUN	LERNER LONG-RUN	HHI LONG-RUN
NIM (-1)	0.340*** (0.017)	0.342*** (0.012)	0.363*** (0.017)			
BCAP	0.068*** (0.012)	0.051*** (0.011)	0.066*** (0.009)	0.104*** (5.681)	0.077*** (4.818)	0.103*** (6.674)
BCREDSK	-0.002* (0.001)	0.002** (0.001)	-0.0002 (0.001)	-0.003** (-1.976)	0.003** (2.321)	-0.0003 (-0.236)
BLIQ	0.018*** (0.003)	0.018*** (0.003)	0.018*** (0.003)	0.028*** (5.496)	0.027*** (5.377)	0.029*** (5.633)
BMQCI	-0.001** (0.001)	-0.004*** (0.001)	-0.002*** (0.001)	-0.002*** (-2.358)	-0.006*** (-8.125)	-0.003*** (-3.727)
BSIZE	-0.383*** (0.107)	-0.506*** (0.755)	-0.276*** (0.087)	-0.581*** (-3.560)	-0.769*** (-6.997)	-0.433*** (-3.174)
BOONE	-0.088** (0.039)			-0.133** (-2.298)		
LERNER		-0.007 (0.007)			-0.010 (-0.913)	
HHI			-0.060*** (0.011)			0.041*** (3.418)
EXRATEPC	0.027** (0.011)	-0.015*** (0.002)	-0.026*** (0.001)			
GDPGR	-0.014 (0.015)	0.027*** (0.006)	-0.023 (0.015)			
INFRATE	0.257*** (0.025)	0.065*** (0.012)	0.281*** (0.019)			

REALINT	0.073*** (0.019)	0.121*** (0.012)	0.059*** (0.016)
J-Statistic	46.69	55.14	48.83
Prob(J-Statistic)	0.567	0.254	0.48
No. of Observations	710	710	710
AR (2) – P-Value	0.773	0.269	0.219
No. of Banks	71	71	71

Note: probability values \*\*\*1% \*\*5% \*10; standard errors in parentheses in core regressions in columns 1 to 3, and t- statistic in parentheses beneath long- run coefficients in columns 4 to 6. List of sample countries, studied period and diagnostic tests remain the same as in table 4.5

#### 4.4 CONCLUSION

In this chapter we have attempted to analyse the effect of monetary union membership on bank net interest margins in the European Union for the period 2002 - 2013, using a total sample of 361 banks, made up of 290 banks from the Euro Area and 71 banks from the Non-Euro Area, from across 16 countries of the Euro Area and Non-Euro Area. The studied countries for the Euro Area are, Austria, Belgium, Germany, France, Greece, Italy, Luxembourg, Netherlands, Portugal, for the Euro Area. And for the Non-Euro Area we study Bulgaria, The Czech Republic, Croatia, Hungary, Lithuania, Poland, and Romania. We contrast our findings in the Euro Area with the those of the Non-Euro Area. Our objective has been to use our analysis for the European Union as a benchmark to extend the same level of analysis to evaluate the dynamics of the monetary union membership in the determination of net interest margins in Sub-Saharan Africa (SSA), and set out the policy implications and recommendations in the last chapter. Our choice of the EU was motivated by the fact that the EU has become the model of monetary union arrangements on which all SSA monetary union endeavours are modelled. We used the Arellano and Bover (1995) system GMM estimator which is robust to endogeneity problems and allows for the inclusion of a lagged dependent variable to control for unobserved heterogeneity between banks.



Given the deregulation of financial services in the European Union, and the development of information technology catalysed by the establishment of the Economic and Monetary Union (EMU), the advent of which set in motion a trend of internationalisation of the financial services market, intensified competition due in part to heightened disintermediation, and a trend of consolidation, all giving rise to a downward pressure on bank profitability within the Euro Area we consider that monetary union membership have implications for the following determinants of net interest margins (NIM): The degree of banking competition (BOONE, LERNER and HHI), Exchange rate Risk (EXRATEPC) Scale-efficiency (BSIZE) and X-efficiency (BMQCI), that is Management efficiency. We therefore test the following hypotheses:

1. Efficient Structure Hypothesis: We hypothesize the presence of X-Efficiency (BMQCI) and S-Efficiency (BSIZE)
2. The degree of banking competition (BOONE, LERNER and HHI) has a larger reducing impact on NIM in the Euro Area than in the Non-Euro Area because of the effects of the EMU.
3. We hypothesize that exchange rate has a more reducing impact on NIM in the Euro Area than in the Non-Euro Area.

We as well considered that the relatively lower interest NIM in the Euro Area as opposed to the Non-Euro Area were due to factors which, in part, were driven by several years of a favourable economic situation, due to convergence in the economies of the Euro Area, propitiating an environment of macroeconomic stability in which financial markets have shown low volatility (Maudos and Fernández de Guevara (2004). So we conduct tests of unit root on our four macroeconomic variables, viz, EXRATEPC, GDPRGR, INFRATE and REALINT to determine the level convergence between the Euro and the Non-Euro Areas. While our results show that the variables are broadly converged in both zones, their average speed of convergence as measured by  $\beta$  is higher in the Non-Euro Area than in the Euro Area, with the exception of GDPRGR which average speed is rather higher in the Euro Area than in the Non-Euro Area, and also takes a shorter time for the gap between the Euro Area countries and the sub-regional average to be cut into half than the countries in the Non-Euro Area. This shows how aggressive the European Union countries outside the Euro Area who have an accession agenda are in meeting the Euro Area convergence criteria as fast as possible.

Results for both management efficiency (BMQCI) and bank size (BSIZE) support the hypotheses of bank X-efficiency and S-efficiency respectively, with both variables having reducing impact on NIM in both the Euro Area and the Non-Euro Area, although this reducing impact is higher in the Euro Area than in the Non-Euro Area because of the effects of the monetary union. The policy implication therefore is for the relevant authorities to continue to promote efficiency savings via creating a congenial macroeconomic environment where banking firms could grow in sizes to be able to exploit economies of scale.

For our second hypothesis on the effects of banking competition we find that there is a strong case for preferring the Boone indicator of competition as it takes account of the impact of cross country competition. In addition, its long run effect is the same in our two regions. We should note inconsistencies in the picking up of competition effects in the different jurisdictions by our different competition measures as all three competition measures did not appear to be equally informative in the Euro Area and Non-Euro Area respectively. The Lerner index, a price minus cost index divided by price, may be a poor indicator of competition in banking as it is closely related to the NIM by definition. Hence we are not surprised that, like others, we find it has the wrong sign in the Euro Area regressions and that it induces serial correlation in the errors there. This notwithstanding our results support our hypothesis that the level of competition within the Euro Area has a higher reducing effect on NIM in the Euro Area than the Non-Euro Area as a result of the effects of the EMU. This calls for banking competition authorities in both zones to maintain competition at levels that will force banks to maintain efficiency levels that will positively impact social welfare through reduced NIM. The coupling of our first and second hypotheses are indeed consistent with the findings of Chortareas et al (2009) who find that the reducing effect of an interaction between their competition measure, the Herfindhal index, and their X-efficiency measure on NIM is consistent with the hypothesis that increasing banking efficiency, in addition to fostering competition, can reduce interest rate margins.

For our third and last hypothesis which is in reference to the effect of EXRATEPC on NIM in both zones we find that both the Euro Area and the Non-Euro Area show a reducing effect of EXRATEPC on NIM, but the coefficients for the Euro Area are larger. We therefore conclude by suggesting that because of the accession agenda of the constituent countries their rates are converging to

the Euro Area exchange rates, thereby minimising exchange rate risk and therefore engendering a reducing effect on NIM. It is our recommendation that these efforts within the Non-Euro Area should not be relented to expedite their accession agenda to join the Euro Area to be able to enjoy a sustainable exchange rate risk elimination.

In regard to the other macroeconomic variables we find the incidence of higher increases in NIM with an increase in GDPGR in the Non-Euro Area than in the Euro Area attributable to the relatively higher macroeconomic stability in the Euro Area than in the Non-Euro Area reflected in more lending and lower default rates. For the positive impact of INFRATE on NIM in both zones but relatively higher increases of NIM in the Euro Area than in the Non-Euro Area we extend the same argument as aforementioned. That is, the macroeconomic convergence in the economies of the Euro Area, propitiating an environment of macroeconomic stability in the form of price stability where banks within the Euro Area have a relatively better ability to possibly fully anticipate and forecast future inflation, which in turn implies that interest rates have been appropriately adjusted to achieve higher margins than in the Non-Euro Area. Again the higher magnitude of the coefficients of real interest rate (REALINT) in the Non-Euro Area than in the Euro Area seems to suggest a higher price stability in the Euro Area than in the Non-Euro Area where interest rates reflect higher and volatile inflation rates than in the Euro Area, and reflected in policy rates. It is our considered view that this gap will close up once the countries of the Non-Euro Area finally accede.

Overall we find reducing impact of our explanatory variables on NIMs in the Euro Area than in the Non-Euro Area reflecting, inter alia, a more competitive environment, greater scale and management efficiencies and a higher macroeconomic stability generated by the establishment of the Economic and Monetary Union (EMU). The implication for the managers of the economies within the two zones is to formulate and implement policies geared towards enhancing the convergence of their respective economic fundamentals to ensure macroeconomic stability. Again to extent that competition has a reducing effect on NIM in both zones policies must aim at ensuring the sustainability of competition in the banking sectors of both the Euro and the Non-Euro Areas as the European Commission has in its own wisdom already championed a lot of

regulatory changes aimed at fostering competition in the financial services market, and the banking sectors for that matter.

# **CHAPTER FIVE**

## **DETERMINANTS OF NET INTEREST MARGINS IN THE WEST AFRICAN ECONOMIC AND MONETARY UNION (WAEMU) VERSUS THE NON-MONETARY UNION SUB-SAHARAN AFRICA**

### **5.1 Introduction**

In this chapter we draw on our conclusions in the fourth chapter on the European Union (EU), that competition and efficiency are more important drivers of lower net interest margins in a monetary union than in a non-monetary union environment, and we extend the analysis to the Sub-Saharan African (SSA) region where we compare the banking sectors of the West African Economic and Monetary Union (WAEMU) and the non-monetary Union SSA. In chapter 4 we observe that the main drivers responsible for the generally lower net interest margins in the Euro Area than the Non-Euro Area were the prevalence of higher levels of banking competition and efficiency within the Euro Area as a dynamic of the Economic and Monetary Union (EMU) on the European banking industry. In this connection we extend our analysis in chapter 4, namely, competition and efficiency effects of economic and monetary union to the Sub-Saharan African banking industry, specifically, on the cost of intermediation. We do this by contrasting our findings in 20 non-monetary union Sub-Saharan African countries with 7 banking sectors out of the 8 WAEMU countries respectively. For the non-monetary union Sub-Saharan African countries, we study Botswana, Burundi, Ethiopia, Ghana, Gambia, Kenya, Lesotho, Madagascar, Mauritius, Mauritania, Malawi, Mozambique, Namibia, Nigeria, Rwanda, Sierra Leone, Swaziland, Tanzania, Uganda and South Africa. And also for the WAEMU the following countries are studied: Burkina Faso, Benin, Cote d'Ivoire, Mali, Niger, Senegal, and Togo.

The results show that in the context of Sub-Saharan African monetary union, specifically the WAEMU, the generally lower net interest margins observed, in the order of 5.4% mean for the WAEMU and 9.0% for the non-monetary union SSA, cannot be attributed to the competitive forces and Scale and management efficiencies, as well as a stable macroeconomic environment known to be generated in a monetary union environment. The empirical results show that the most important factor driving the relatively lower net interest margins in the WAEMU is the lower real interest rates that obtain in the region. And that the lack of competition has masked any gains that could have been made from the single currency and the relatively lower inflation.

Again as in our fourth chapter on Europe our focus here is on commercial banks which seem to dominate the financial systems of the sub-Saharan African region and are as a result the main channels for deposit mobilisation.

The rest of the chapter is organised as follows: the next section, which is Section 5.2 reviews the empirical literature on banking competition in the Sub-Saharan Africa. Section 5.3 describes the methodology and data, followed by Section 5.4 which also discusses the empirical results. And lastly Section 5.5 concludes with policy implications and recommendations.

We test the following hypotheses as was done in our studies on Europe being our benchmark region in this chapter.

### **5.1.1 Tested Hypotheses**

- **Hypothesis 1**

We hypothesize that the two efficient structure hypotheses, that is, the X-efficiency, proxied by bank cost-to-income ratio (BMQCI) and S-efficiency, also proxied by log of bank total assets (BSIZE), both have a greater reducing effect on NIM in the WAEMU than in the rest of Sub-Saharan Africa.

We recognise that since the mid-2000s the WAEMU has attracted new banks from Africa mainly the burgeoning multi-national banks from Nigeria and North Africa, far earlier than the rest of Sub-Saharan Africa in addition to the already existing Western European ones (Leon, 2014). These cross border banks come with a comparative advantage like economies of

scale and management expertise, and therefore lower marginal cost. And as a result we would expect them to have a greater reducing effects on NIM in the WAEMU than in the non-monetary union Sub-Saharan.

- **Hypothesis 2**

The degree of banking competition, respectively using the Boone indicator, the Lerner index and the Herfindahl-Hirschman index (HHI), has a larger magnitude of reducing impact on NIM in the WAEMU than in the non-monetary union Sub-Saharan Africa, because of the effects of the economic and monetary union in the way of the single market in combination with free capital movement, free open borders and the single banking licence supposedly affording market contestability.

- **Hypothesis 3**

We hypothesize that exchange rate has a more reducing effect on NIM in the WAEMU than in the non-monetary union Sub-Saharan Africa. Exchange rate stability between countries within the WAEMU should enhance the effectiveness of the Single Market as a source of competitive pressure.

### **5.1.2 Immediate Post-Independence Banking Industry in Sub-Saharan Africa**

Historically, the immediate post-independence banking industry in Sub-Saharan Africa was seen to be characterised by massive government interventions in the operations across the Sub-region. This took the form of directed credit allocation according to what governments thought to be the national development agenda as opposed lending according to commercial criteria; and nationalisation of previously foreign-owned banking institutions and the newly-established government-owned banks set-up from the scratch (Brownbridge and Harvey, 1998). Furthermore, this era in the sub-Saharan Africa's banking industry was characterised by negative consequences of unwarranted government interventions manifesting as low deposit levels, leading to low levels of lending, stifled competition, attended by poor service quality, accumulation of bad debts on a scale which resulted in the insolvency of most commercial banks, especially the state-owned ones. Also documented in the post-independence Sub-Saharan African banking history is the lack of

professionalism and commercial lending expertise on the part of commercial banks as well as inadequate prudential regulation and supervision capacity on the part of the central banks. Other interventions embarked on by the immediate post-independence Sub-Saharan African governments were the use of exchange controls to discourage investment in foreign assets in order to shore up savings in domestic assets. For the commercial banks this meant that it became easier for them to attract deposits, and at lower interest rates than would otherwise have been. Similarly, nominal interest rate controls were the order of the day in a bid to keep cost of borrowing low in order to encourage investment.

Nevertheless, all of the above scale of government intervention in the Sub-Saharan African banking industry with their negative consequences were to see an end in the early 1980s, not by design on the part of the governments but as a side effect in the search for solutions to the acute economic crisis, indeed a crisis similar to the Latin American debt crisis of the 1980s, which engulfed the region in the 1980s. The economic crisis deriving from combined adverse external shocks, and in the words of Brownbridge and Harvey (1998), anti-export and anti-agricultural biases in governments' policy formulation. Specifically, in the quest for solutions to their economic woes by Sub-Saharan African governments the only option that was left to them was to resort to international financial institutions like the World Bank and the International Monetary Fund (IMF). And as part of the conditions demanded by these international financial institutions African governments were to adopt structural adjustment programmes the main objective of which was to reduce the magnitude of state intervention in markets, including financial markets. These led to the implementation of a programme of financial sector liberalisation in the late 1980s and 1990s, according to Brownbridge and Harvey (1998). The objectives of the programme were inter alia:

- To remove government control of interest rates to allow the mechanism of market forces to eliminate the negative effects of negative real interest rates.
- To remove all government controls over bank lending to allow for efficiency in credit allocation.



- To lower entry barriers in the shape of licensing of new banks in to engender competition in order to reduce the cost of financial intermediation and also increase the available range of bank services.
- To strengthen prudential regulation and supervision
- To reduce state ownership of banks
- And to develop securities markets

It must be said however that the pursuit of a programme of financial liberalisation did not see much success for reasons bordering on the lack of commitment on the part of commercial banks to embrace change, as well as the lack of the political will on the part of governments to implement the programme to the letter. For example, due to the anticipated high cost impact on government budgets most African governments were reluctant to allow for the raising of nominal interest rates over and above the prevailing high inflation rates. Overall, it would be said that the anticipated growth of efficient financial intermediation and efficient allocation of credit on commercial lines did not materialise in much of Sub-Saharan Africa. Again to the extent that the reform implementation was being made in the midst of economic crisis and unstable macroeconomic environment where real sector borrowers had difficulty with their investments resulting in bad/non-performing loans, it made bank lending on strict commercial principles very difficult.

### **5.1.3 Current developments in Sub-Saharan African banking**

Two to three decades after the reform, the region can boast of a relatively stable macroeconomic and financial environment, with expected strong economic growth in many countries in the region, which augurs well for further development of the banking system (EIB, 2013). This notwithstanding, financial and banking systems of Sub-Saharan Africa remain underdeveloped. The banking systems in the region are highly concentrated and generally inefficient at financial intermediation; they are characterized by their small size and low intermediation, and despite little barriers to entry and exit, as evidenced by the dominant market share of foreign banks, competition is still limited (EIB, 2013; IMF, 2013; Beck and Hesse, 2009). The foregoing is also re-echoed by Mlachila et al (2013) who note that the scale of financial intermediation in Sub-Saharan Africa remains significantly lower than in other developing regions of

the world, while access to financial services is also relatively low, which is a reflection of a combination of low income levels, small absolute size, and infrastructural weaknesses. In this context, access to finance in sub-Saharan Africa is among the lowest in the world and presents one of the key obstacles to the activity and growth of enterprises. This in turn constrains the region from achieving its full growth potential. Talking about the generally inefficient financial intermediation in the region what readily stands in relief is the generally high net interest margins which obtain in the region. To this effect, Beck and Cull (2013) note that net interest margins as well as interest rate spreads are higher in Africa than in less developed countries outside Africa in the order of the median African country net interest margin standing at 5.9 per cent in 2011, and 4.7 per cent outside Africa; while the interest rate spread between lending and deposit rate stand at 10.3 per cent in Africa and 8.2 per cent outside. Beck and Cull (2013) blame the high net interest margins on the lack of competition in most Sub-Saharan African banking sectors. Again they note that the small size of many African economies constrains African banking firms from benefiting from economies of scale. Again the dispersion of population in most African countries means banking operations outside of urban centres are not effective. Amidu (2011) also note that in 2005, the average interest margin in low-income African banking sectors was three times that of higher-income banking sectors, 12.75% against 3.89%; a development he attributes to the absence of scale economies, high risks and political volatility. We also observe that the mean net interest margin over the period 1999 – 2013 for Sub-Saharan Africa region outside of a monetary union was 9.0% which is about twice as much that of the non-Euro Area over 2002 – 2013, 4.2%.

## **5.2 Review of empirical literature on banking competition in Sub-Saharan Africa**

While in the wider empirical literature on bank interest margins determinants the role played by the structure of the bank market in cross-country studies such as this are inconclusive (Leon, 2015) the generally high bank interest spreads and margins that obtain in Sub-Saharan Africa has been variously blamed among other factors on lack of competition in the various banking sectors of the region (for example, Beck and Cull, 2013 and Chirwa

and Mlachila, 2004). In view of this we find it appropriate to review the empirical literature on banking competition in SSA in this section in order to put further analyses of our data and findings in subsequent sections in a proper context, the scarcity of banking competition literature on Africa notwithstanding.

The literature on banking competition has it that foreign bank entry, especially through greenfield investments would normally spur competition because it increases the number of industry participants who come on board with comparative advantages in the form of better access to capital, skill and management expertise, scale economies and so on (Leon, 2015). In the post-reform Sub-Saharan African banking industry such has been the experience which is further enhanced by the influx of indigenous African banks, who also come on board armed with added competitive advantage in the form of local knowledge and services adapted to the African markets. Leon (2014), find an intensification of banking competition in countries outside of WAEMU over the second part of the 2000s. For the countries of the WAEMU however Leon (2015) find that while they have experienced a structural change with the entry of banks from other West African and North African countries, the industry is characterised by imperfect competition, and that bank concentration only eased up in the second half of the 2000s. Beck and Cull (2013) also describe African banking sectors as highly concentrated and characterised by low degree of competition. They for example find that while the share of the five largest bank was 81 percent in the median African country in 2011, it was 64 percent outside Africa during the same period.

For the review of empirical literature on the determinants of net interest margin in Africa we refer back to the literature review chapter which is the second chapter.

### **5.3 Methodology and Data description**

Our model specification, variable description, and data sources sections are virtually the same as in Chapter 4 on Europe, however, for completeness we repeat them here with the relevant modifications.

### 5.3.1 Model Specification

The application of the single-step, static approach which incorporates all the determinants of net interest margins in a single estimation is the norm in the literature (Agoraki, 2009). We would however argue that the static model cannot be justified either for advanced countries or as in emerging markets. This is because in emerging economies information opacity is rife, banks' assessment of net interest margins and its determinants is based on clear information that changes only slowly over time. Not all the relevant information can be updated based on new information each period, so that NIMs could be systematically related each period, which provides enough justification for a dynamic specification as opposed to a static, one for advanced economies. The existence of inertia may also reflect the inability to observe all determinants of the NIM, and some may evolve slowly over time. The need for a dynamic approach is a testable proposition, and if serial correlation exists in a static evaluation of NIMs it is almost certainly the case that a lagged dependent variable is the omitted variable that causes the serial correlation.

The static approach has been applied in several studies including McShane and Sharpe (1985), Angbazo (1997), Demirgüç-Kunt and Huizinga (1999), Maudos and Fernández de Guevara (2004), Claeys and Vander Vennet (2007), and Carbo-Valverde and Fernandez (2007). The basic framework for this model involves the estimation of the following linear equation which brings together all the determinants of NIMs in a single stage as follows:

$$\begin{aligned} y_{it} &= \alpha + \beta_{BS}X_{it}^{BS} + \beta_{BM}X_{it}^{BM} + \beta_M X_{it}^M + \varepsilon_{it} \\ \varepsilon_{it} &= \mu_i + \nu_{it} \end{aligned} \quad (5.1)$$

Where  $y_{it}$  represents the bank net interest margin for bank  $i$ , at time  $t$ ,  $\alpha$  is a constant term,  $\beta_{BS}X_{it}^{BS}$  denotes the effects of a the vector of bank-specific explanatory variables, where  $it$  indexes bank  $i$ , at time  $t$ ,  $\beta_{BM}X_{it}^{BM}$  is the effects of a vector of market/industry characteristics variables,  $\beta_M X_{it}^M$  is the effects of a vector of macroeconomic control variables, and  $\varepsilon_{it}$  is the error term capturing all other omitted factors, with  $\mu_i$  being the unobserved bank-specific effect and  $\nu_{it}$  the idiosyncratic error. Such static models in the literature are commonly estimated using least squares methods on fixed effects (FE) or random effects

(RE) models. However, in dynamic relationships as is the case in our study these methods produce biased and inconsistent estimates, particularly with a large  $N$  and smaller  $T$ , which does not augur well for the accurate estimation of  $N$ -invariant regressors, mostly macroeconomic regressors (Batalgi, 2001, Garcia-Herrero et al, 2007), in which case the Generalised Method of Moments (GMM) estimator may be employed.

The display of a dynamic model in this particular study is our anticipation that previous values of bank margins may affect current values of those margins as banks need to match the random deposit supply function and the random demand of lending and non-traditional activities across periods (Carbo-Valverde and Fernandez, 2007). Indeed, Carbo-Valverde and Fernandez (2007) posit that the maximization of bank wealth considers both initial and end-of-period information. Therefore, within the empirical literature NIMs are known to display a tendency to persist over time. In this regard, we state the following dynamic specification of our model, which includes a lagged dependent variable among the regressors.

$$\begin{aligned} y_{it} &= \alpha + \delta y_{it-1} + \beta_{BS} X_{it}^{BS} + \beta_{BM} X_{it}^{BM} + \beta_M X_{it}^M + \varepsilon_{it} \quad (5.2) \\ \varepsilon_{it} &= \mu_i + v_{it} \end{aligned}$$

The three vectors of variables represent the bank-specific ( $X_{it}^{BS}$ ), bank market-specific ( $X_{it}^{BM}$ ) and macroeconomic variables ( $X_{it}^M$ ), and  $y_{it}$  represents the net interest margin. Subscripts  $i$  and  $t$  are for  $i$ -th bank and  $t$ -th time period. The error term has an unobserved bank-specific ( $\mu_i$ ), and the idiosyncratic error ( $v_{it}$ ) components.  $y_{it-1}$  is the one-period lagged NIM and  $\delta$  the speed of adjustment to equilibrium. A value of  $\delta$  between 0 and 1 implies that NIMs persist, but they will eventually return to their normal (average) level after a temporary shock, that is, mean-reverting. A value close to 0 means that the industry is fairly rapidly competitive (high speed of adjustment), while a value of  $\delta$  close to 1 implies less immediate competitive structure (very slow adjustment).

In the econometric literature because the lagged dependent variable is correlated with the error term by construction using OLS with fixed effects in the presence of a lagged dependent variable among the regressors gives rise to dynamic panel bias and inconsistent estimates (Nickel, 1981; Roodman, 2006).

The combination of this problem and the challenges of unobservable heterogeneity across banks, as well as the potential endogeneity with some of our regressors warrant that we move away from the methodology of OLS with fixed or random effects and employ the Generalized Method of Moments (GMM) estimator following Arellano and Bover (1995)/Blundell and Bond (1998).

We anticipate that the challenge of unobservable heterogeneity in this study could be reflected in for example differences in ownership structure across banks and jurisdictions, Management quality, and so on. With regards to potential endogeneity we consider that banks with higher NIM may be able to increase their equity more easily through profit retention<sup>30</sup>. Again they would also be able to afford more advertising to increase their market share and consequently their size, of which they might take advantage to increase their NIM. Such reverse causality is not difficult to find in banking operations, and the use of OLS for estimation yields biased and inconsistent results in the presence of such problems.

To overcome the problem of endogeneity the meticulous use of instrumental variables is suggested in the literature as they are assumed to be uncorrelated with the error term. Nevertheless, if the instruments are poorly correlated with the explanatory variables they are meant to replace they render the regression results biased and inconsistent. To eliminate the time-invariant bank-specific effects emanating from unobservable heterogeneity, as well as the problem of endogeneity Arellano and Bond (1991) initially suggest first-differencing the regression equation for a GMM estimator for panel data, and also instrumenting the endogenous explanatory variables with suitable lags of their own levels. Nonetheless, given that the Arellano and Bond (1991) GMM estimator was flawed to the extent that if the lagged levels to be used as instruments were weakly correlated with the differences of the explanatory variables because they may be highly persistent then the included supplementary instruments may not be useful and thus yield large sample bias. Arellano and Bover (1995) therefore propose an improved panel data GMM estimator. This GMM estimator proposed by Arellano and Bover (1995) and fully developed by Blundell and Bond (1998) is the system GMM. Their position is

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<sup>30</sup> Athanasoglou et al. (2008) suggest that capital ratio is better modelled as an endogenous determinant of bank profitability in econometrical models.

that lagged levels are often poor instruments for variables in first differences. Thus, the original equations in levels can be added to the system, whereby predetermined and endogenous variables are instrumented with their own lagged first-differences, in which case the system GMM estimator is proven to have dramatic efficiency gains over the basic first-difference GMM (Batalgi, 2001). To this effect, in this study, we treat all bank-specific variables in section 5.3.2.1 as endogenous and instrument them with their orthogonal transformations. We also test whether the instruments, as a group, are exogenous and indeed valid by performing the Hansen J. specification test of over-identifying restrictions. The test examines the lack of correlation between the instruments and the error term. Serial correlation has to be tested carefully in this context, and as Roodman (2009) explains, we expect to see first order serial correlation and not second order given the techniques we are using. All our results do display first order serial correlation, and we only report our test for second order. We obtain the AR 2 statistics which measure the presence of second-order serial correlation with the null hypothesis that there is no serial correlation in the residuals. So in all we deem the methodology followed, that is, the system GMM estimator capable of controlling for potential endogeneity, unobserved heterogeneity and the persistence of the dependent variable, to yield consistent unbiased estimators.

### **5.3.2 Variable Construction**

Following the empirical literature in Chapter two we implement model 5.2 in section 5.3.1 above by considering the following bank-specific, market/industry specific, as well as macroeconomic variables

#### **5.3.2.1 Bank-specific variables**

##### **Dependent variable**

- **Net Interest Margin (NIM)**

We define NIM and decompose it into its constituent parts following Demirguc-Kunt and Huizinga (1998). NIM is an accounting ratio which reflects bank efficiency in its intermediation role<sup>31</sup>. It is defined as a bank's interest

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<sup>31</sup> While net interest margin can indicate bank efficiency or inefficiency, it is not always the case that a reduction in net interest margins means improved bank efficiency, as a reduction in net interest margins can, reflect a reduction in bank taxation or, alternatively, a lower loan default rate (Demirguc-Kunt and Huizinga, 1998)

income minus the total interest expense over its total earning assets, thus having the following accounting identity:

$$NIM = \frac{\text{Total Interest Income} - \text{Total Interest Expense}}{\text{Total Earning Assets}}$$

The accounting decomposition of a bank's interest margin from a bank's accounting identity of profits was first developed by Hanson and Rocha (1986), and followed by Demirguc-Kunt and Huizinga (1999) and Beck and Fuchs (2004). The starting point is to establish what constitutes a bank's before-tax-profits-t-assets (BTP/TA). Before tax profits to assets (BTP/TA) equals after-tax profits to assets (ATP/TA) plus taxes to assets (TX/TA). Therefore, BTP/TA is decomposed as follows:

$$\frac{BTP}{TA} = \frac{ATP}{TA} + \frac{TX}{TA} + \frac{NI}{TA} + \frac{NII}{TA} - \frac{OV}{TA} - \frac{LLP}{TA} \quad (5.3)$$

Where  $\frac{ATP}{TA}$  is after tax profits to total assets,  $\frac{TX}{TA}$  is taxes to total assets,  $\frac{NI}{TA}$  is net interest income to total assets,  $\frac{NII}{TA}$  is non-interest income to total assets,  $\frac{OV}{TA}$  is overheads to total assets, and  $\frac{LLP}{TA}$  is loan loss provisioning to total assets.

Permitted by the above accounting identities we decompose net interest margins  $\left(\frac{NI}{TA}\right)$  into its constituent parts as follows:

$$\frac{NI}{TA} = \frac{ATP}{TA} + \frac{TX}{TA} - \frac{NII}{TA} + \frac{OV}{TA} + \frac{LLP}{TA} \quad (5.4)$$

Equation (5.3) above means NIM is derived as banks' before tax profits to assets  $\left(\frac{BTP}{TA}\right)$  made up of  $\left(\frac{ATP}{TA} + \frac{TX}{TA}\right)$  plus bank's operating costs  $\left(\frac{OV}{TA}\right)$ , plus provisions  $\left(\frac{LLP}{TA}\right)$  netted for non-interest income to total assets  $\left(\frac{NII}{TA}\right)$  (Demirguc-Kunt and Huizinga, 1999).

From the foregoing accounting decomposition, it is clear that NIM as a summary measure of banks' net interest return is also an important component of bank profits (Angbazo,1997). Also according to Demirguc-Kunt et al. (2004) while NIM reflects the efficiency with which a bank intermediates, it is also an indicator of the competitive nature of the banking markets. This is supported by



Bikker and Bos (2008) who note that while competition and efficiency describe two different things they are often seen as almost synonymous, in that heavy competition forces banks to improve efficiency. As a result, like profitability measures as return on equity (ROE) and return on assets (ROA) NIM is expected to be smaller, the heavier competition is, thereby establishing a negative relationship between NIM and competition.

### **Independent variables**

- **Bank Capital**

Our bank capital variable proxies for risk aversion and regulatory requirements which is the norm in the empirical literature investigating the determinants of net interest margins. To this effect we use the ratio of equity to assets, hereafter abbreviated as BCAP, to proxy the bank capital variable. By Bankscope's definition this ratio measures the amount of protection afforded to the bank by the equity they invested in it, as equity is a cushion against asset malfunction. And that the higher this figure the more protection there is. Our choice of this ratio as a proxy for this variable is particularly motivated by McShane and Sharpe (1985), Maudos and Fernández de Guevara (2004), Claeys and Vennet (2008). According to the theoretical model, a positive relationship is expected between our bank capital variable and net interest margin, as banks that are most risk averse will require a higher margin to cover the higher costs of equity financing compared to external financing, *ceteris paribus*. As well because these banks are seen to have lower bankruptcy and funding costs they are more likely able to charge higher margins. In addition, increases in regulatory capital requirements will also increase the NIM as banks are forced to fund their loan book using more expensive capital rather than lower cost debt and deposits. Boutin-Dufresne et al (2013) in their study of banking sector efficiency across regional blocks of Sub-Saharan Africa also find a positive relationship between bank capital, proxied by equity-to-assets ratio, and NIM to be positive.

- **Bank Credit Quality**

Flamini et al (2009) claim that the main source of bank-specific risk in Sub-Saharan Africa is credit risk, and that the exposure of banks to high credit risk is due to poor enforcement of creditor rights, weak legal environment, and

insufficient information on borrowers. Schweiger and Liebeg (2009), Saad and El-Moussawi (2010) in Dumitic and Ridzak (2010) note that credit risk belongs to the group of factors with the highest impact on banks' interest margins. Nassreddine et al (2013) also assert that the impact of deterioration of the credit quality on the NIM seems positive as banks seek to increase their margins to compensate, on the one hand the risk of default, and on the other additional costs necessary to monitor these credits. Following Bankscope's categorisation of asset quality ratios our bank credit quality variable, abbreviated to BCREDSK hereafter, is the ratio of loan loss provision to net interest revenue<sup>32</sup>. It is the relationship between provisions in the profit and loss account and the interest income over the same period. While this ratio should ideally be as low as possible, in a well-managed bank if the lending book is fraught with a higher risk it should be reflected by higher margins. We would therefore, as it broadly obtains in the empirical literature expect its relationship with NIM to be positive. Ahokposi (2013) in his study of 41 countries across Sub-Saharan Africa find credit risk to be positively and significantly associated with net interest margins.

- **Bank liquidity (BLIQ)**

We follow Ahmad and Matemilola (2013); and Dumitic and Ridzak (2013) and proxy our bank liquidity variable as the ratio of net loans to customer deposit and short-term funding, which we abbreviate hereafter as BLIQ. The understanding is that to the extent that banks' relatively illiquid loans are largely funded by relatively stable customer deposits they must ensure they have sufficient liquidity resources to be able to pay depositors in the event that a large number of them and investors may wish to withdraw their savings, that is, the bank's funding at once, leaving the bank short of funds which may have inimical consequences for critical services banks contribute to the economy. In order to compensate for this risk, known as liquidity risk, a premium dependable on the level of risk, is charged to the interest income. A high liquidity ratio means that a bank has adequate liquid assets to be able to meet unexpected deposit withdrawals or to fund increased loan demands and vice versa. We would therefore expect that banks with high levels of liquid assets, either

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<sup>32</sup> Ideally, the credit quality should be proxied by the ratio of non-performing loans to gross loans as is predominant in the empirical literature. The Bankscope database however only has these variables for a limited number of banks in our sample

voluntarily or for prudential reasons or as a result of regulation, may receive lower interest income than banks with less liquid assets, in which case, and given that the market for deposits is reasonably competitive, the relationship with net interest margin is expected to be negative (Angbazo, 1997; Demirgüç-Kunt et al., 2004). Conversely, Martinez Peria and Mody (2004) state that the liquidity ratio may have a positive impact on interest margins to the extent that banks are able to transfer this opportunity cost to borrowers. In a cross-country study of 41 Sub-Saharan African countries Ahokpossi (2013) find that the liquidity ratio negatively and significantly affects interest margins,

- **Bank Size (BSIZE)**

The inclusion of the bank size variable accounts for possible scale economies, where average cost declines as bank output rises, resulting from spreading fixed costs over a greater volume of output. Whether or not this happens in reality, that is, if indeed just based on their size larger banks are more efficient than small banks has spanned a lot of empirical literature. Allen and Liu (2007) note that broadly, most studies on economies of scale in financial institutions find only small economies of scale in a firm's cost structure. Also within the empirical literature there exists the general feeling that economies of scale rise up to a certain level with size, beyond which financial institutions become too complex to manage and diseconomies of scale sets in. We therefore anticipate that the effect of size could be nonlinear, meaning that NIM is likely to increase up to a certain level by achieving economies of scale and decline from a certain level in which banks become too complex to manage. We would thus use the logarithm of total asset to capture the potential non-linear effect of bank size on NIM and thus expect the sign of the coefficient of bank size to be ambiguous based on the literature. Athanasoglou et al (2008) use real assets in logs and their square to capture the possible non-linear relationship between bank size and profitability in their analysis of the determinants of bank profitability in Greece over the period 1985 – 2001. Also, Flamini et al (2009) find a positive and significant coefficient of the size variable in its relationship with bank profitability in their study of commercial bank profitability in Sub-Saharan Africa, which supports the economies of scale market-power hypothesis.

- **Bank Management Quality (BMQCI)**

This variable is proxied by the cost to income ratio, defined as operating expenses of a bank as a share of sum of net-interest revenue and other operating income. It effectively measures the operating cost incurred to generate one unit of gross income or revenue. It is included as an indicator of the management's contribution in interest margins, to the extent that management quality is reflected in the composition of a bank's portfolio through providing, inter alia, profitable composition of assets and low-cost liabilities. A variety of measures have been used to proxy for management quality in the empirical literature. Angbazo (1997) for example uses ratio of earning assets to total assets, while Maudos and Fernandez De Guevera (2004); Dumicic and Ridzak (2013) use cost-to-income ratio. Our choice of cost-to-income ratio is motivated by Maudos and Fernandez De Guevera (2004) posit that an increase in this ratio implies a decrease in the efficiency or quality of management, which will translate into a lower interest margin. And thus a negative sign is expected. In this study we use this management quality proxy to test for the hypothesis of X-efficiency as delineated in section 5.1.1 above. The X-efficiency (X-ES) version of the efficient structure hypothesis (ESH) states that banks with superior management or production technologies have lower costs and subsequently can offer more competitive interest rates on loans and/or deposits, leading to a negative relationship between operational efficiency and interest margins (Claeys and Vennet, 2008).

### **5.3.2.2 Industry-specific variables**

We capture the effect of the degree of banking market competition with three proxies for the robustness of competition:

- The use of the Lerner index which is common in the empirical literature
- The use of the Herfindhal-Hirschmann Index (HHI)
- The use of the Boone Indicator which is relatively novel in the literature.

### **Competition measures**

- **The Lerner index**

Data for the Lerner index is taken from the World Bank's Global Financial Development Database. And is calculated from the underlying bank-by-bank data from the Bankscope by World Bank and Bankscope staff using annual data from 1996-2010. The estimations follow the methodology described in Demirgüç-Kunt and Martínez Pería (2010)<sup>33</sup>. The index is one of the non-structural measures of competition used in the banking competition literature to infer competitive behaviour of banks. It directly measures pricing power by examining the price markup over marginal cost<sup>34</sup>. It is the difference between the price and the marginal cost, divided by the price, which measures the capacity to set prices above the marginal cost, being an inverse function of the elasticity of demand and of the number of banks (Maudos and Fernandez de Guevera, 2004). Higher values of it indicate greater market power and lower levels of bank competition. Simply put the Lerner index is a level measure of the percentage that price exceeds marginal cost represented algebraically as follows:

$$lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \quad (5.5)$$

where  $P_{it}$  is the price charged by bank  $i$  at time  $t$  on their assets and  $MC_{it}$  is the marginal cost. The calculation of marginal costs is also based on the following specification of a trans logarithmic cost function, where the estimated coefficients of the cost function are then used to compute the marginal cost:

$$\begin{aligned} \ln C_i = & a_0 + \ln TA_i + \frac{1}{2} a_k (\ln TA_i)^2 + \sum_{j=1}^3 \beta_j \ln w_{ji} \quad (5.6) \\ & + \frac{1}{2} \sum_{j=1}^3 \sum_{k=1}^3 \beta_{jk} \ln w_{ji} \ln w_{ki} + \frac{1}{2} \sum_{j=1}^3 \gamma_j + \ln TA_i \ln w_{ji} \\ & + \mu_1 Trend + \mu_2 \frac{1}{2} Trend^2 + \mu_3 Trend \ln TA_i + \sum_{j=1}^3 \lambda_j \\ & + Trend \ln w_{ji} + \ln u_i \end{aligned}$$

<sup>33</sup> They also follow Fernandez de Guevera et al (2005, 2007) and Berger et al (2008).

<sup>34</sup> That is, the extra cost of producing an additional unit of output.

where  $C_i$  is the bank's total costs, including financial and operating costs; and total assets ( $TA_i$ ) proxies as a measure of bank output. Prices of the production factors are defined as follows:

$w_1$ . Price of labour, defined as the ratio of labour costs to total assets.

$w_2$ . Price of capital, which is the ratio of operating costs (excluding personnel costs) / Fixed assets.

$W_3$ . Price of deposits, defined as financial Costs / Customer and short-term funding

The costs function (and hence of the marginal costs) is estimated separately for each country. This allows the parameters of the cost function to vary from one country to another to reflect different technologies. Fixed effects, are as well incorporated, aimed at capturing the influence of variables specific to each bank. Also included is a trend (Trend) to reflect the effect of technical change, which translates into movements of the cost function over time. Empirical studies that have used the Lerner index include, Boutin-Dufresne et al (2013) in Sub-Saharan Africa, who find a significantly positive relationship of the Lerner index with NIM. Other studies include Fernandez de Guevera et al (2005), Carbo et al (2009), and Maudos and Fernandez de Guevera (2004). Following Fernandez de Guevera et al (2005) we dissect the index into its constituent parts as follows, first, with the assumption that the production of goods and services by a bank is proportional to its total assets, and therefore their prices can be calculated by estimating the average price of bank production, proxied by total assets, as a quotient of total revenue<sup>35</sup>.

- **The Boone Indicator of Competition**

The Boone indicator is a new approach to measuring competition recently introduced by Boone (2008). Data for the indicator is taken from the World Bank's Global Financial Development Database. And is calculated from the underlying bank-by-bank data from the Bankscope by World Bank and Bankscope staff using annual data from 1997-2010. The estimations follow the methodology described in Schaeck and Cihák (2010) with a modification to use marginal costs instead of average costs. This new measure of competition is based on the notion that in a competitive market more efficient companies are

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<sup>35</sup> Includes both interest income and non-interest income, and total assets.

likely to be rewarded in terms of profits than their less efficient counterparts. This notion was motivated by Demsetz's (1973) efficiency hypothesis which has it that more efficient firms achieve superior performance in the way of higher profits than their less efficient competitors. It is this reallocation effect from inefficient to efficient firms which the Boone indicator exploits. The Boone indicator is the profit elasticity estimating the percentage decrease in profits resulting from a 1 percent increase in the marginal cost as follows (Clerides et al, 2013):

$$Profit\ elasticity = \frac{\partial \ln \pi_i}{\partial \ln mc_i}$$

The effect being intensified when the least efficient firms exit the market. Boone (2008) demonstrates that the reallocation effect increases in monotone with the degree of competition; with competition resulting from a decrease in entry costs or to goods becoming closer substitutes. By this Boone (2008) indicates the difference between profits will increase when the market is more competitive, as the more efficient market will severely punish the least efficient bank. So that

the profit elasticity establishes a link between firm performance with differences in efficiency, measured by marginal cost, leading to the following estimable regression-based empirical model:

$$\pi_{it}/\pi_{jt} = \alpha + \beta_t(mc_{it}/mc_{jt}) + \gamma \tau_i + \varepsilon_{it} \quad (5.7)$$

where  $\alpha$ ,  $\beta_t$  and  $\gamma$  are parameters and  $\pi_{it}$  denotes the profit of firm  $i$  in year  $t$ . Relative profits  $\pi_{it}/\pi_{jt}$  are defined for any pair of firms and depend, inter alia, on the relative marginal costs of the respective firms,  $mc_{it}/mc_{jt}$ . The variable  $\tau_i$  is a time trend and  $\varepsilon_{it}$  an error term. The parameter of interest is  $\beta_t$ . It is expected to have a negative sign, because relatively efficient firms make higher profits. For example, if  $\beta = -0.2$ , a 1% increase in the marginal cost, due to a decrease in the efficiency level) of bank I will decrease its profits by 0.2 %. If  $\beta = -0.5$ , a 1% increase in the marginal cost of bank will decrease its profits by 0.5 %. And the  $\beta_t$  is referred to as the Boone indicator. Boone shows that when

profit differences are increasingly determined by marginal-cost differences, this indicates increased competition. As marginal cost  $mc_{it}$  cannot be observed directly, it is derived from a trans-logarithmic cost function similar to the estimable cost function for the Lerner index above and commonly used in the banking literature. Empirical application to banking of the Boone indicator is limited and can be found in studies including Schaeck and Cihák (2012) and Amidu and Wilson (2014). Given the much touted banking competition resulting from the single market and currency we would expect it to have a negative relationship with NIM in both the WAEMU and the non-monetary union Sub-Saharan Africa, but of a higher magnitude in the WAEMU than the non-monetary union Sub-Saharan Africa.

- **The Herfindahl-Hirschman Index**

The Herfindahl-Hirschman Index (HHI) is the most widely treated summary measure of concentration in the theoretical literature and often serves as a benchmark for the evaluation of other concentration indices (Bikker and Haaf, 2002). In the United States, the HHI plays a significant role in the enforcement process of antitrust laws in banking. It is often called the full-information index because it captures features of the entire distribution of bank sizes, as it takes into account all banks and not only the largest ones, and considers the inequality of market shares (Garcia-Herrero, 2009). It takes the form:

$$HHI = \sum_{i=1}^n s_i^2$$

That is the HHI is calculated by summing the squares of the individual market shares of all the firms in the market. The HHI gives proportionately greater weight to the market shares of the larger firms. The HHI index ranges between  $1/n$  and 1, reaching its lowest value, the reciprocal of the number of banks, when all banks in a market are of equal size, and reaching unity in the case of monopoly. Davies (1979) analyses the sensitivity of the HHI to its two constituent parts, that is, the number of banks in the market and the inequality in market shares among the different banks and finds that the index becomes less sensitive to changes in the number of banks the larger the number of banks in the industry. Bikker and Haaf (2002) note that just as the index is



widely treated in the theoretical literature so is it also about the most widely applied banking competition/concentration measure in the empirical literature on banking competition. As with the competition measures we would expect it to have a negative relationship with NIM in both the WAEMU and the non-monetary union Sub-Saharan Africa. Ahokposi (2013) in a cross-country study of 41 Sub-Saharan African countries, however, find that banks' market power, proxied by the HHI, explains the observed high interest margins.

We would like to argue that of the three foregoing competition variables the Boone indicator might seem to better reflect the competitiveness emanating from the single currency and market conditions in the WAEMU. This is because firstly, the Boone indicator is monotonically related to competition, and that with no activity restrictions and no entry barriers and costs in the WAEMU, which are the theoretical bases of the indicator these would be captured more appropriately by it. Secondly the Boone indicator, unlike the Herfindahl-Hirschman Index (HHI), is a non-structural competition measure reflecting individual bank behaviour and therefore can capture cross-country competition effects than the Herfindahl-Hirschman Index (HHI) which is a structural measure, making it country-specific and therefore not particularly appropriate for a cross-country study as ours where we expect effective cross border competition. The Lerner index while it is a non-structural competition measure, not requiring the relevant market to be defined, unlike the Herfindahl-Hirschman Index (HHI), and would therefore also be appropriate for a cross-country study like this, is also bedevilled by some shortcomings. Leon (2015) note that although the Lerner index is a measure of pricing market power and not a proxy for competition an increase of average market power over time may reflect an increase in the intensity of competition<sup>36</sup>. So overall, we argue here that while the Herfindahl-Hirschman Index (HHI) is country-specific, the Lerner index and the Boone indicator could reflect conditions across countries.

### **5.3.2.3 Macroeconomic variables**

We consider that the macroeconomic environment may as well impact NIM through a variety of channels. For instance, credit risk is influenced by

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<sup>36</sup> Leon (2015) makes reference to recent studies which show that there have been situations where in the presence of decreases in individual Lerner indices as a result of competition, the average degree of market power either increases or decrease or remain stable owing to the reallocation effect from inefficient firms to efficient ones (Boone, 2008).

economic growth, inflation and the level of real interest rates to the extent that they affect the borrower's repayment ability and the value of collateral (Garcia-Herrero et al, 2009). Again as macroeconomic instability heightens the risk faced by commercial banks it may have consequences for social welfare through increased NIM. Following most studies in the empirical literature we capture various aspects of the macroeconomic environment using percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPRGR), inflation rate (INFRATE), and real interest rate (REALINT). Percentage change in exchange rate is defined as the real exchange rates growth rates (EXRATEPC), that is, the percentage change in the CFA Franc in the case of the WAEMU and the respective relevant national currencies in the case of the non-monetary union SSA to the US Dollar exchange rate. Given the elimination of transaction costs through the single currency we would expect a reducing effect on NIM in the case of the WAEMU, and also in the non-monetary union SSA because of their respective preparatory work towards the formation of economic and monetary union. Today almost every Sub-Saharan African country belong to a regional economic block. WAMZ for example is another West African economic block made up of the Anglophone West African countries aiming at adopting a single currency, the Eco in the near future, with the eventual aim of merging with the WAEMU. GDP growth rate (GDPRGR) is measured as the annual percentage growth rate of GDP at market prices based on constant local currency and aggregates based on constant 2005 U.S. dollars. Evidence abound in the extant literature that a positive relationship exists between rapid economic growth, measured by GDP growth rate and NIM as demand for credit increase during periods of economic boom and thus widen NIM (Athanasoglou, 2008). Chortareas et al (2011) also used GDP growth as a control variable in their study of the determinants of NIM in Latin American banks and found a rather negative relationship with NIM. We would similarly expect the same result for real interest rates as shown in the empirical literature. The real interest rate variable is included to capture the stance of monetary policy. It is defined as the lending interest rate adjusted for inflation as measured by the GDP deflator (World Bank National Accounts data). Demirguc-Kunt and Huizinga (1999) used real interest rate as well as government short term securities in their study of commercial bank interest margins and profitability in 80 countries from 1988 to 1995 and arrived at a negative relationship between real interest rate and NIM.

Finally, our inflation rate variable (INFRATE) is measured by the CPI percentage change (World Bank National Accounts data). In line with the literature we expect a positive relationship between inflation rate and NIM. Beck and Hesse (2009) in their testing of the four sets of hypotheses for high margins in the Ugandan banking sector find that faster GDP growth and rising inflation were positively associated with interest spreads. Also Mlachila and Chirwa (2002) in their study of the financial reforms and interest rate spreads in the commercial banking system of Malawi find Price instability, proxied by inflation, positively related to interest spreads.

### **5.3.3 Data sources**

For our analysis we use a total sample of 185 banks, made up of 45 banks from the WAEMU and 140 commercial banks from the non-monetary union Sub-Saharan Africa, from across 27 countries of the WAEMU and non-monetary union Sub-Saharan Africa, namely Burkina Faso, Benin, Cote d'Ivoire, Mali, Niger, Senegal, and Togo, for the WAEMU; and Botswana, Burundi, Ethiopia, Ghana, Gambia, Kenya, Lesotho, Madagascar, Mauritius, Mauritania, Malawi, Mozambique, Namibia, Nigeria, Rwanda, Sierra Leone, Swaziland, Tanzania, Uganda and South Africa, for the non-monetary union Sub-Saharan Africa, over the period 1999 – 2013.

We did not include Guinea Bissau in the WAEMU countries for lack of data covering the whole period under consideration. Being a comparator region to the Euro Area in our analysis we made sure that the WAEMU was a region with a mix of core and periphery countries as obtains in the Euro Area. To this effect Kireyev, A. (2016) note that the WAEMU has a large core and a small periphery in regional trade. Similarly, we applied the same criteria in the selection for the non-monetary union Sub-Saharan African countries, ensuring a mix of core and periphery countries, and that none of the countries were necessarily in an economic and monetary union in the strictest sense.

As could be gleaned from the previous section our explanatory variables are divided into three groups being: bank specific variables, banking market-structure variables, and country-specific macroeconomic characteristics. Our bank-specific variables were extracted from the Bankscope database maintained by Fitch/IBCA/Bureau Van Dijk. The financial information therein is

provided by Fitch Ratings and compiled predominantly from the filed balance sheet and income statement as well as notes from the audited annual reports. To ensure comparability across countries the Bankscope financial data is based on the standardized global accounting format, and for some purposes we also limit our analyses to commercial banks of all sizes which were active under the period of study. Also to serve our purposes of focusing on financial intermediation we use only unconsolidated financial data so that our analysis is not distorted by information from other non-bank subsidiaries not engaged in financial intermediation. Data on our country-specific macroeconomic variables, namely, inflation rate, GDP growth rate, and real interest rate were taken from the World Bank's World Development Indicators; while our percentage change in exchange rate variable was compiled by Dr Matthew Shane and obtained from the United States Department of Agriculture website. For data on our market structure variables we extracted data for the Boone Indicator and the Lerner Index from the World Bank's Global Financial Development Database compiled by Demirguc-Kunt et al (2009), and subsequently updated in 2013, a country-level bank dataset, which underlying data is the Bankscope database; and the IMF's International Financial Statistics. Data for the HHI was the author's own computation using total assets data from the Bankscope.

#### **5.3.4 Summary Descriptive Statistics**

In this section we look at the dynamics of net interest margins (NIM) and the independent variables in a monetary union vis-à-vis a non-monetary union. Specifically, we compare the behaviour of NIM and its determinants, respectively, within the WAEMU and the non-monetary union Sub-Saharan Africa.

In Table 5.1 we present the variables that are employed in the empirical analysis of WAEMU and the non-monetary union SSA, averaged by region/zone over the period 1999 - 2013. In figure 5.1 below we also present a graph comparing the respective NIM means of the WAEMU and the non-monetary union SSA to that of the entire SSA. From table 5.1 above WAEMU has a lowest mean NIM overall, 5.4 percent, than the non-monetary union SSA mean of 9.0 percent, and again lower than the overall SSA mean of 8.1 percent.

The evolution of NIM in all three regions is graphically represented in figure 5.1 below.

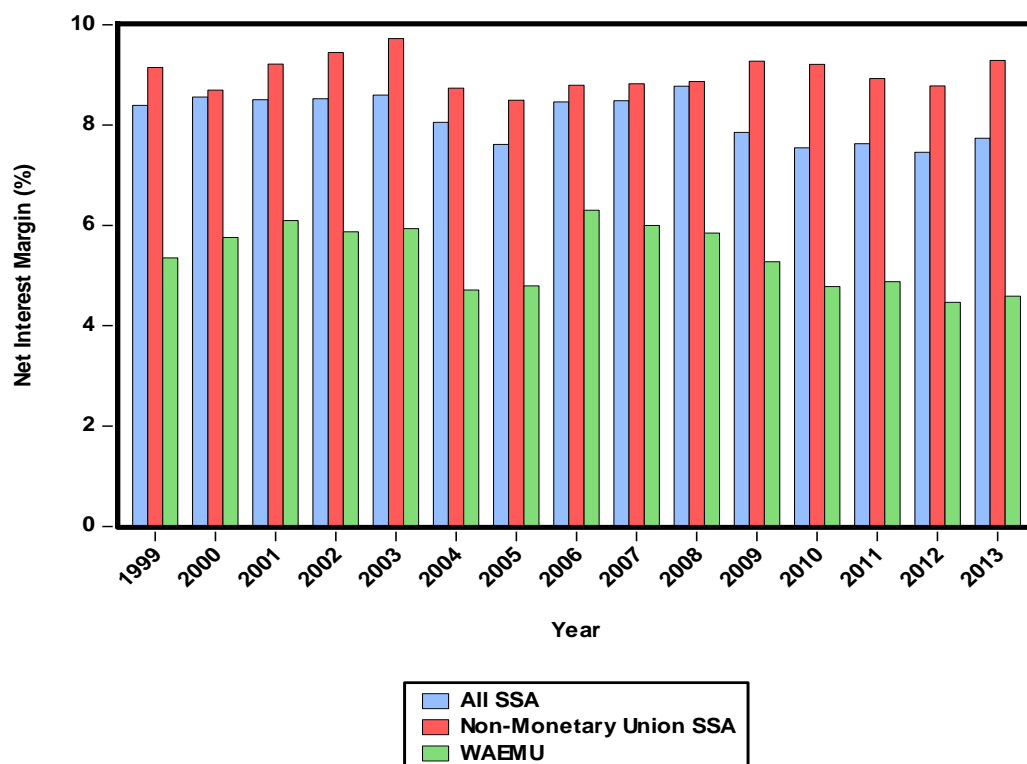
**Table 5.1. Summary Descriptive Statistics of the WAEMU, Non-Monetary Union SSA the Overall SSA.**

Variable	WAEMU (675 obs.)		Non-Monetary Union SSA (2100 obs.)		Overall SSA (2765 obs.)	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
NIM	5.4	4.5	9.0	7.9	8.1	7.4
BCAP	9.9	6.7	18.7	17.8	16.5	16.3
BCREDSK	18.8	63.2	20.8	57.6	20.4	59.1
BLIQ	54.6	79.6	62.5	88.9	54.6	79.6
BMQCI	79.1	53.3	64.7	38.1	68.5	43.3
Bsize	333244.7	304469.1	777480.5	4079194.	667665.0	3550473.
BOONE	-0.02	0.1	-0.06	0.07	-0.05	0.09
LERNER	0.2	0.1	0.2	0.2	0.2	0.1
HHI	0.3	0.1	0.4	0.2	0.3	0.2
EXRATEPC	-1.1	8.3	-0.7	9.3	-0.8	9.0
GDPGR	3.7	3.1	5.0	3.1	4.7	3.2
INFRATE	2.7	2.7	8.9	6.0	7.4	6.1
REALINT	1.8	2.8	9.7	8.5	7.7	8.3

Source: Author's calculation from Eviews.

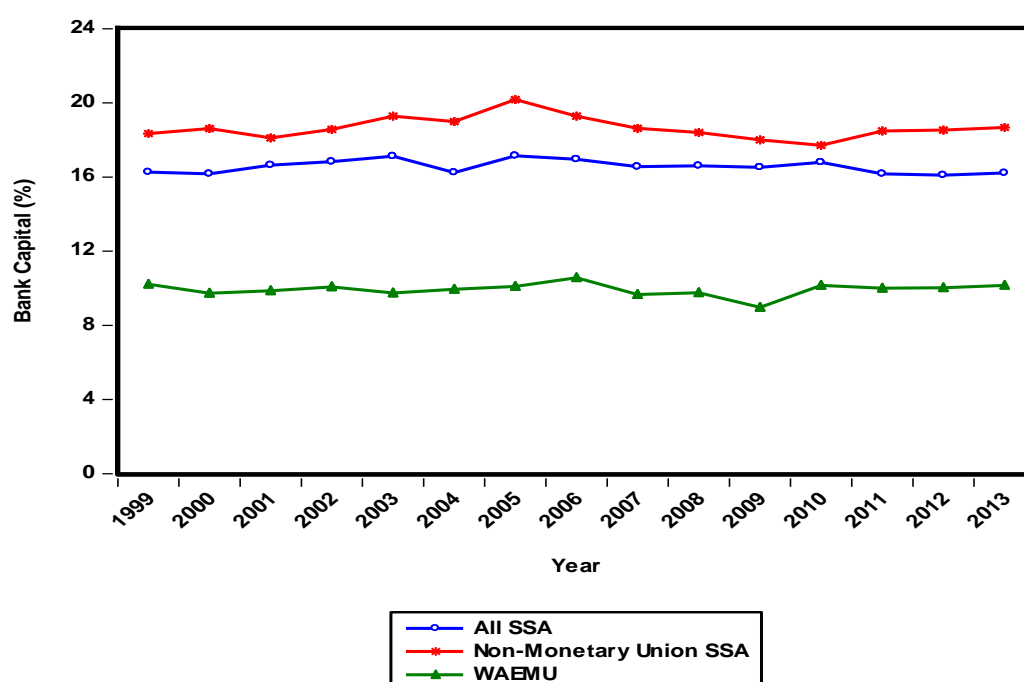
Notes: Variable names in first column are the acronyms for the various elected variables described in section 5.3.2 above.

**Figure 5.1. Year-on-Year Means of Net Interest Margins (NIM) of WAEMU, Non- Monetary Union SSA and overall SSA 1999 – 2013.**



In figure 5.1 above we observe that over the period under consideration, that is, from 1999 to 2013, NIM in WAEMU has been consistently far lower than the non-monetary union SSA, as well as the overall SSA mean as might be expected, even though all three means rise somewhat together up to 2003, fall briefly up to 2005 and then rise again from 2006. Interestingly after 2006 when the overall SSA NIM as well as the non-monetary union NIM begins to creep up that of WAEMU falls consistently 2013 when a slight rise is observed. Again in table 5.1 WAEMU has the least volatile NIM as per the standard deviation of 4.5 compared to 7.4 for the overall SSA and 7.9 for the non-monetary union SSA. The most likely explanation for this picture at this stage when we have not yet engaged in any econometric estimation is that banks operating within WAEMU can be said to be operating in a more stable macroeconomic environment in which, first, there is no foreign exchange risk because of the elimination of transaction and accounting costs associated with bid-ask spreads and commissions on foreign exchange transactions; the effect of this being a reduction in systemic risk and the concomitant lowering of real interest rate, evidenced by the means and standard deviations of the macroeconomic indicators in table 5.1 above (Alkholifey and Alreshan, 2010; De Grauwe, 2012). A similar picture was also observed in the case of the Euro Area and the non-Euro Area in Chapter 4 above.

**Figure 5.2. Trends in Maintenance of Bank Capital (%) for the WAEMU, Non-Monetary Union SSA and the overall SSA.**



We also observe in table 5.1 above that the mean equity-to-assets ratio (BCAP), our bank capital proxy, in WAEMU, is 9.9 percent, which is about half of what obtains in the non-monetary SSA, and SSA overall. While the generally lower systemic risk which obtains in a monetary union may readily lend itself in explaining this it appears the lower level of financial/capital market development is also a plausible explanation<sup>37</sup>. Another likely explanation may be that because of the comparative smallness of the WAEMU bank market indicated by the relatively lower GDP growth rate (GDPRGR) WAEMU banks tend to be credit expansion averse. This proposition could further be supported by the lower mean bank credit risk ratio (BCREDSK) of 18.8 percent in WAEMU as compared to 20.8 and 20.4 percent for the non-monetary union and the overall SSA respectively, meaning WAEMU banks maintain capital commensurate with their level of credit risk. Looking at trends in levels of bank capital over the period 1999 – 2013 as graphically represented in Figure 5.2 above we see a relatively less volatility in both WAEMU and non-monetary union SSA as we hardly observe significant peaks and troughs. In terms of bank liquidity WAEMU banks appear to be holding less liquid assets than their counterparts in the non-monetary union SSA, with a mean of 54.6 percent as compared to the 62.5

<sup>37</sup> The IMF notes that the WAEMU regional financial markets remain a marginal source of funding except for the governments. The regional stock market, based in Abidjan had 37 quoted companies as of end 2012 (Imam and Kolerus, 2013)

percent for the non-monetary union SSA. While this may mean banks in the non-monetary union SSA are able to provide depositors with the reassurance that they will be able to meet their obligations when they fall due to forestall any possible runs than their counterparts in WAEMU, it may also imply a lower systemic risk obtains in WAEMU than in the non-monetary union SSA and that regulators may not place as high liquidity requirements as they would in the case of the non-monetary union SSA<sup>38</sup>.

This is also reflected graphically in the trends over the period 1999 – 2013 in figure 5.3 below, where while the non-monetary union SSA liquidity trends seem to be displaying peaks and troughs those of WAEMU show a consistent fall towards end of the observed period, that is, 2013.

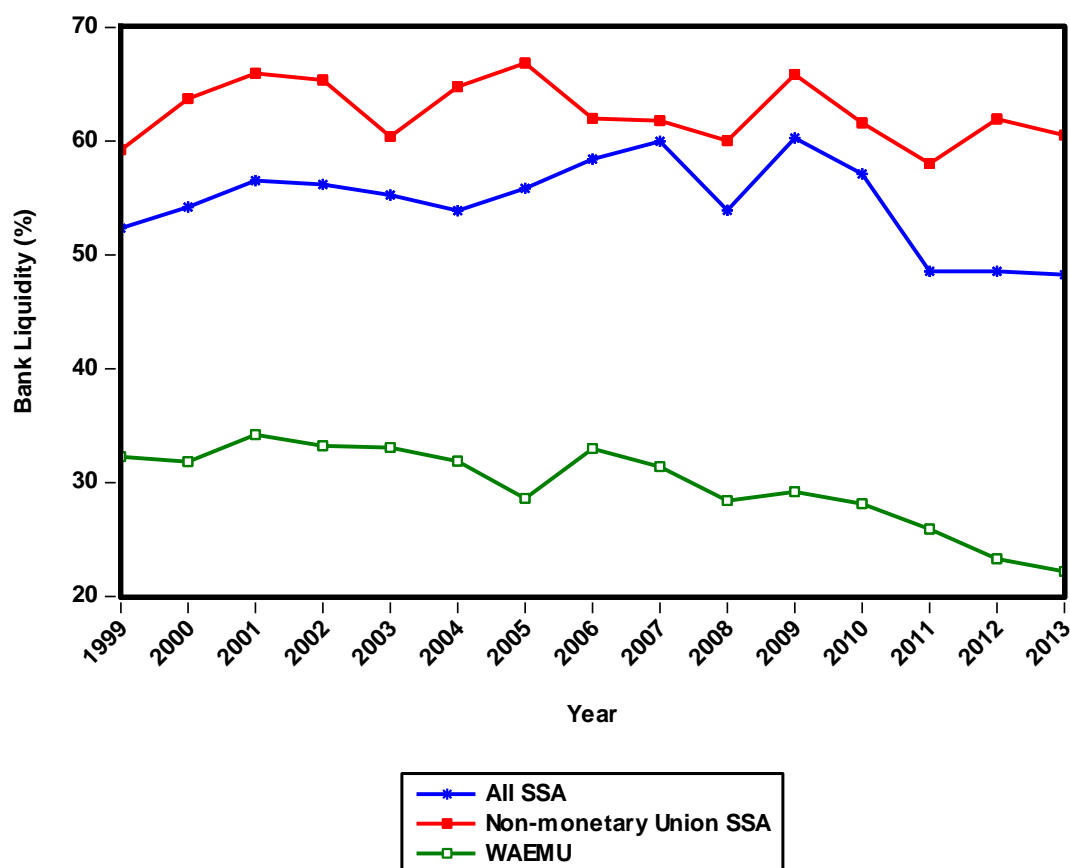
Rather contrary to our expectation and to what was observed in the Euro Area WAEMU has a higher mean cost-to-income ratio (BMQCI) of 79.1 percent compared to the non-monetary union SSA mean of 64.7 percent, and the overall SSA mean of 68.5 percent. In pretty much the same fashion the standard deviations of these mean values indicate a higher volatility in WAEMU, with a standard deviation of 53.3 percent, than the non-monetary union SSA standard deviation of 38.1 percent, and the overall SSA value of 43.3 percent. What this means is that banks in WAEMU have a higher management/cost efficiency. This may be down to lack of comparatively lower competition in the region as indicated by the means of our competition measures in table 5.1 above and as also alluded to in the brief review of the competition literature on the region in Section 5.1 above, as well as the smallness of the bank market which diminishes any advantage which could have been gained through scale economies.

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<sup>38</sup> For the same prudential reasons which explain the relatively lower equity-to-assets ratio

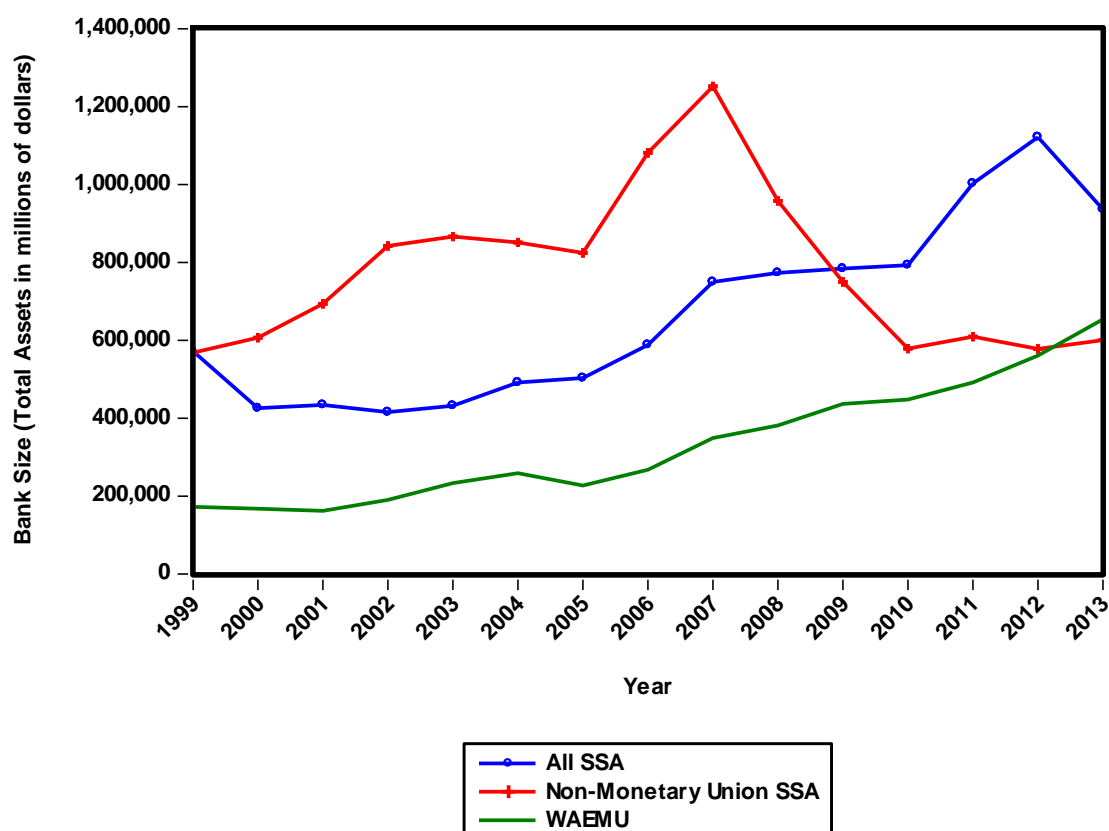


**Figure 5.3. Trends in the Maintenance of Bank Liquidity for the WAEMU, Non-Monetary Union SSA and the Overall SSA.**



The mean for individual bank size (BSIZE) by total assets in the WAEMU in thousands of US dollars (USD) is 333244.7, far lower than the non-monetary union SSA mean of 777480.5 and 667665.0 for the overall SSA. That the WAEMU has a far lower mean bank size can be interpreted as a case of the small bank market which cannot support large banks. Again the relatively high level of market concentration in the WAEMU, with the 3 largest banks taking up 60 percent of the market, and the five largest bank, 80 percent of assets (Leon, 2014), means the average bank size will diminish. This is at variance with what was observed in the Euro Area and what would have been expected in a monetary union for that matter. While this is also reflected in the year on year trends in bank size over the period 1999 – 2013 as appears in figure 5.4 below mean bank size consistently crept up over time to converge with the non-monetary union SSA mean and to even overtake it somewhat in 2012.

**Figure 5.4. Trends in Bank Size in Total Assets (BSIZE) for WAEMU, Non-Monetary Union SSA and Overall SSA 1999 – 2013.**



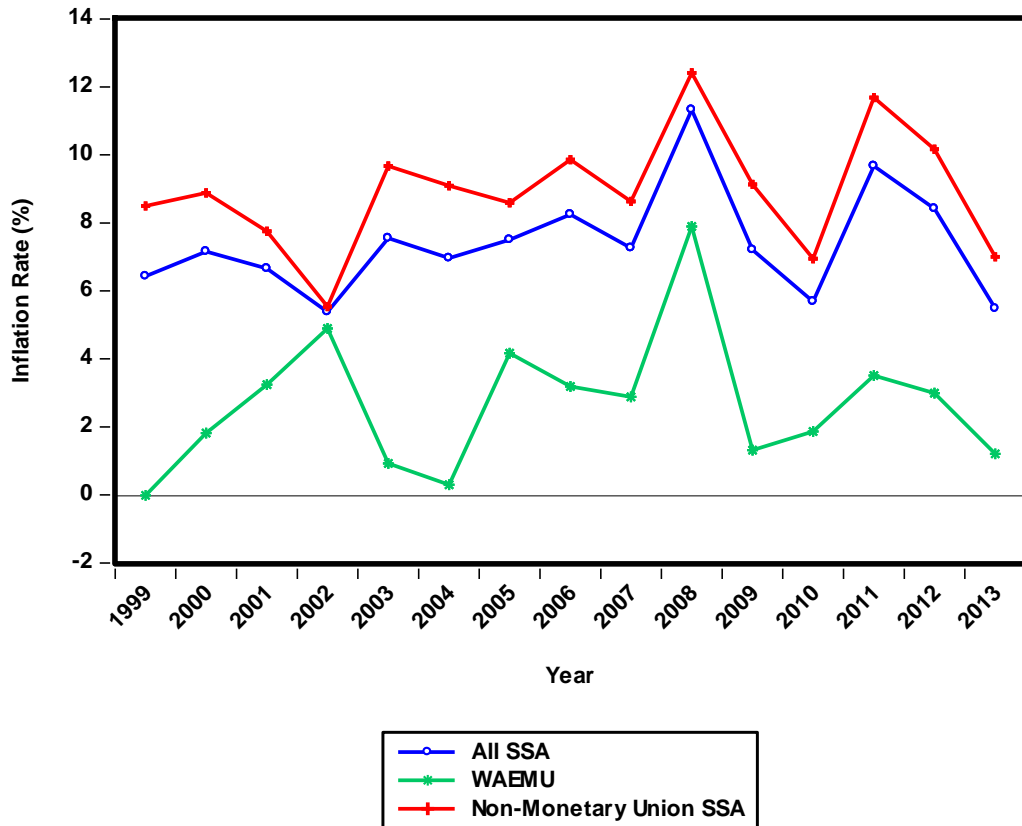
The mean bank concentration as measured by the Herfindhal-Hirschman Index (HHI) is 0.3 for the WAEMU, less than that of the non-monetary union SSA of 0.4 but about the same as the 0.3 mean for the overall SSA mean. While this reflects a slightly more competitive banking sector in the WAEMU than in the non-Euro Area, an inference which is at variance with the empirical findings noted in section 5.2 above that the WAEMU banking industry is characterised by imperfect competition and highly concentrated as compared to the non-monetary union SSA. The same evidence of putting competition in the WAEMU at par with its non-monetary union SSA counterpart is also given by the Lerner index mean of 0.2 across board. Evidence given by the means of the Boone indicator tend to be rather on the contrary; rather pointing to a higher competitive bank market in the non-monetary union SSA than the WAEMU which is in line with the empirical literature of banking competition in the SSA. Given the theoretical rigour of the Boone indicator as indicated in the variable description section above and in more elaborately in our discussion of empirical results in chapter 4 we would prefer to assume the means presented here as

giving a more credible picture than those indicated by the Lerner index and the HHI.

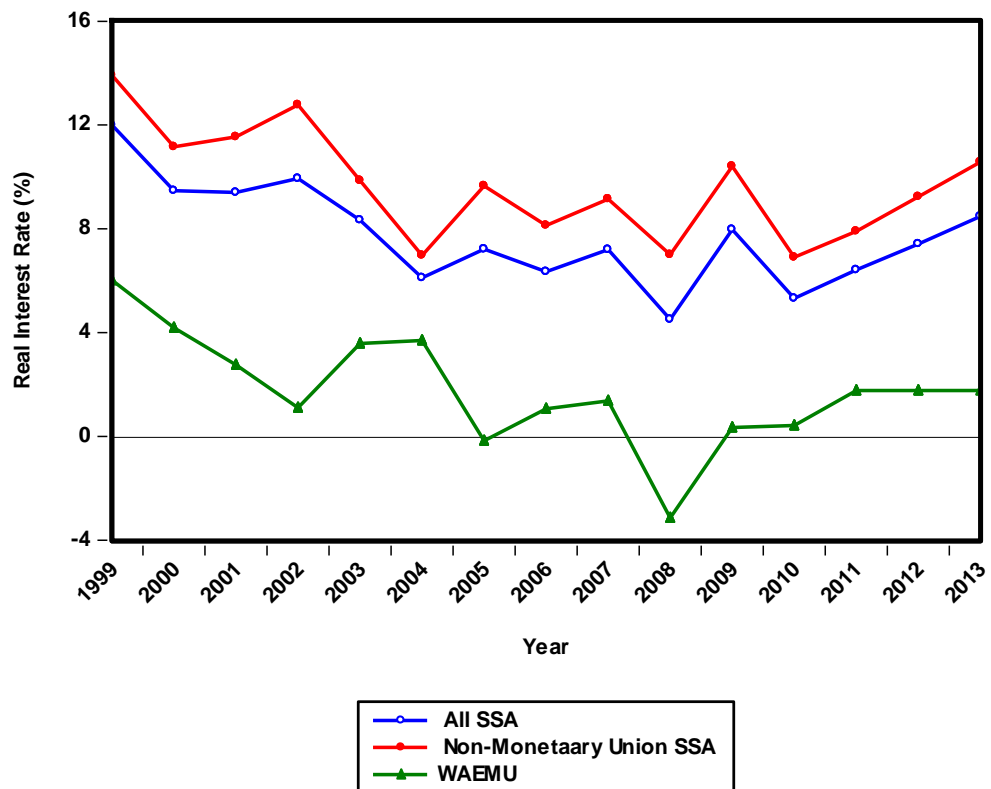
In regard to our macroeconomic variables table 5.1 indicates that while inflation and real interest rates in the WAEMU are lower than those of the non-monetary union SSA and the overall SSA mean values the GDP growth rate mean is lower for the WAEMU than for the rest of the non-monetary union SSA. That the inflation and real interest rates are lower in the WAEMU, with lower volatility as per the respective standard deviations, is because it is a monetary union. These trends in inflation and real interest rates are graphically represented below in tables 5.5 and 5.6 respectively. Similarly, per the respective standard deviations for the percentage change in exchange rate variable (EXRATEPC) we find more stability in the WAEMU than in the non-monetary union SSA because of the single currency, that is, the CFA Franc. And we would expect that in our discussion of our empirical results this will have a more negative impact on NIM in the WAEMU than in the non-monetary union SSA, as was observed between the Euro Area and the Non-Euro Area in chapter 4.

In figure 5.5 below while a strong volatility is observed in all three indicators mean of inflation rates is consistently lower in the WAEMU over the period considered. Below is a graph showing trends in real interest rates over the considered period. It shows a consistently lower real interest rate over the considered period in WAEMU than the rest of SSA and even dipping to the negative in 2008, apparently due to a considerably higher inflation in the same period.

**Figure 5.5. Inflation Rates (%) for all SSA, WAEMU and Non-Monetary Union SSA 1999 – 2013.**



**Figure 5.6. Real Interest Rate (%) for All SSA, WAEMU and Non-Monetary Union SSA 1999 – 2013.**



### 5.3.5 Pairwise Correlation Matrix

In this section we use pairwise correlation coefficients as appear in tables 5.2 and 5.3 below to test the relationship between our chosen variables and also to test for the level of multicollinearity among the independent variables in the WAEMU and the non-monetary union SSA respectively. It is evidently clear from these tables, that all the variables show low pairwise correlation coefficients between them. This rules out the possibility of any considerable multicollinearity which warrants attention, meaning none of the independent variables is a perfect linear function of one or more independent variable.

In terms of the relationships between NIM and the independent variables we see NIM we see the expected signs for all the variables for the WAEMU, with the exception of the GDP growth rate (GDPRGR) and the credit risk (BCREDSK) variables, both of which have negative signs. Similarly, for the non-monetary union Sub-Saharan Africa we observe all the variables are correctly signed with the exception, again, of the credit risk (BCREDSK) variable.

## 5.4 Empirical Results

The objective of this chapter has been to investigate the dynamic of monetary union membership in the determination of net interest margins in the Sub-Saharan Africa (SSA), contrasting our findings in the WAEMU with the rest of non-monetary union SSA, with the eventual aim of ascertaining whether the dynamics in the EU as a benchmark region are replicated in the SSA; and if not make recommendations as to how both the existing and the many prospective monetary unions in SSA can benefit from the positive impact of monetary union membership on net interest margins, that is *inter alia*, competition, x-efficiency and s-efficiency as it obtains in the Euro Area. In this section we report and discuss the results of the tested hypotheses delineated in section 5.1.1.

Below in tables 5.4, 5.5, and 5.6 are the regression results for the WAEMU and non-monetary SSA, with the different specifications reflecting the different empirical approaches to testing for banking competition (the Boone indicator, Lerner index and the Herfindhal-Hirschmann index), in the determination of net interest margins. We as well test for how GDP growth rate affects management efficiency proxied by cost-to-income ratio to impact on the variation in net interest margin by controlling for the interaction term `BMQCI_GDPRGR` in table 5.6.

We first look at a basic indicator, and then we compare estimators with each of the competition indicators in them. Only the Boone indicator passes a serial correlation test, and for this reason, amongst others we then use that indicator when looking for macro-economic indicators in the next table. Although as we can see from the correlation tables these variables are not strongly related we can only add them one at a time. The process will not be biased in this case. We also look at the role of Bank Management Efficiency and interact it with GDP growth to see if NIMs fall. In all cases we do not find WAEMU regression that do not display serial correlation, and hence our results have to be treated with care. We have also investigated long run results, derived from the long run steady state for our equations, as we discuss in chapter four above. The long run results are consistent and, unlike in chapter 4, there are no obvious commonalities with the short run ones so we discuss only those.

**Table 5.2 . Non-monetary SSA Pairwise Correlation Matrix**

	NIM	BCAP	BCREDSK	BLIQ	BMQCI	BSIZE1	BOONE1	LERNER1	HHI1	EXRATEPC	GDPGR	INFRATE	REALINT
NIM	1.000												
BCAP	0.331	1.000											
BCREDSK	-0.058	-0.044	1.000										
BLIQ	0.092	0.399	-0.023	1.000									
BMQCI	0.024	-0.132	0.302	-0.080	1.000								
BSIZE1	-0.272	-0.095	-0.069	0.161	-0.197	1.000							
BOONE1	-0.108	0.067	0.152	0.083	0.053	-0.006	1.000						
LERNER1	-0.105	-0.019	0.068	-0.032	-0.042	-0.032	-0.186	1.000					
HHI1	0.011	0.170	-0.062	0.260	-0.056	0.213	0.022	-0.106	1.000				
EXRATEPC	0.034	-0.018	0.048	-0.034	0.007	-0.071	0.009	-0.037	0.101	1.000			
GDPGR	0.046	-0.072	-0.044	-0.039	-0.010	0.053	-0.026	0.123	-0.077	-0.075	1.000		
INFRATE	0.090	-0.014	-0.015	0.010	0.015	-0.039	-0.148	0.087	0.029	-0.160	-0.053	1.000	
REALINT	0.036	-0.099	0.064	-0.040	0.072	-0.158	0.109	-0.201	-0.060	0.103	-0.056	-0.253	1.000

Notes: No of observations is 2100. The table presents pairwise correlation coefficients of all our chosen variables: Net interest Margin (NIM), Bank Equity Capital (BCAP), Bank Credit risk (BCREDSK), Bank Liquidity (BLIQ), X-efficiency, proxied by Cost-to-Income Ratio (BMQCI), Bank Size (BSIZE), Boone Indicator, Lerner Index, Herfindahl-Hirschman Index (HHI), Percentage change in Exchange Rate (EXRATEPC), GDP growth rate (GDPGR), Inflation Rate (INFRATE), and Real Interest Rate (REALINT) for 20 countries of the Non-monetary Union SSA, over the period 1999 – 2013, to test the relationship between the key variables and also to test for the level of multicollinearity among the independent variables. A higher coefficient means there is a linear correlation and vice-versa to infer multicollinearity or otherwise. The sample countries are Botswana (BW), Burundi (BI), Ethiopia (ET), Ghana (GH), Gambia (GM), Kenya (KE), Lesotho (LS), Madagascar (MG), Mauritius (MU), Mauritania (MR), Malawi (MW), Mozambique (MZ), Namibia (NA), Nigeria (NG), Rwanda (RW), Sierra Leone (SL), Swaziland (SW), Tanzania (TZ), Uganda (UG) and South Africa (ZA)

**Table 5.3. WAEMU Pairwise Correlation Matrix.**

	NIM	BCAP	BCREDSK	BLIQ	BMQCI	BSIZE1	BOONE1	LERNER1	HHI1	EXRATEPC	GDPRGR	INFRATE	REALINT
NIM	1.000												
BCAP	0.522	1.000											
BCREDSK	-0.013	-0.253	1.000										
BLIQ	0.629	0.562	-0.005	1.000									
BMQCI	-0.164	0.007	-0.246	0.048	1.000								
BSIZE1	-0.390	-0.436	0.071	-0.645	-0.203	1.000							
BOONE1	-0.030	0.050	0.072	0.086	-0.002	-0.100	1.000						
LERNER1	-0.001	-0.095	0.008	-0.105	0.011	0.153	-0.575	1.000					
HHI1	-0.052	0.065	0.023	0.080	0.019	-0.163	0.802	-0.607	1.000				
EXRATEPC	-0.016	0.004	0.021	-0.011	0.016	-0.078	0.075	0.051	0.136	1.000			
GDPRGR	-0.064	-0.067	0.029	-0.088	-0.119	0.054	-0.215	0.118	-0.134	-0.032	1.000		
INFRATE	0.013	0.016	-0.022	0.019	0.031	0.019	-0.028	-0.120	-0.014	-0.257	-0.070	1.000	
REALINT	0.012	-0.019	0.055	0.022	-0.019	-0.150	0.067	0.138	0.145	0.255	-0.027	-0.826	1.000

Notes: No of observations is 675. The table presents pairwise correlation coefficients of all our chosen variables: Net interest Margin (NIM), Bank Equity Capital (BCAP), Bank Credit risk (BCREDSK), Bank Liquidity (BLIQ), X-efficiency, proxied by Cost-to-Income Ratio (BMQCI), Bank Size (BSIZE), Boone Indicator, Lerner Index, Herfindahl-Hirschman Index (HHI), Percentage change in Exchange Rate (EXRATEPC), GDP growth rate (GDPRGR), Inflation Rate (INFRATE), and Real Interest Rate (REALINT) for 7 countries of the WAEMU, over the period 1999 – 2013, to test the relationship between the key variables and also to test for the level of multicollinearity among the independent variables. A higher coefficient means there is a linear correlation and vice-versa to infer multicollinearity or otherwise. The sample countries are Burkina Faso (BF), Benin (BJ), Cote d'Ivoire (CI), Mali (ML), Niger (NE), Senegal (SN), and Togo (TG)



**Table 5.4. Controlling for Bank-Specific Variables only and the Successive Inclusion of the Three Competition Measures in the Non-Monetary Union SSA and the WAEMU respectively**

VARIABLE	Non-Monetary Union SSA				WAEMU			
	COL 1	COL 2 (BOONE)	COL 3 (LERNER)	COL 4 (HHI)	COL 5	COL 6 (BOONE)	COL 7 (LERNER)	COL 8 (HHI)
NIM (-1)	0.299*** (0.004)	0.297*** (0.003)	0.297*** (0.004)	0.298*** (0.004)	0.460*** (0.002)	0.464*** (0.003)	0.459*** (0.003)	0.458*** (0.002)
BCAP	0.021*** (0.004)	0.029*** (0.005)	0.016*** (0.004)	0.021*** (0.004)	0.241*** (0.002)	0.223*** (0.025)	0.268*** (0.032)	0.221*** (0.021)
BCREDSK	0.024*** (0.001)	0.027*** (0.001)	0.025*** (0.002)	0.025*** (0.001)	0.007*** (0.002)	0.006*** (0.002)	0.003 (0.004)	0.006*** (0.002)
BLIQ	-0.002** (0.001)	-0.002* (0.001)	-0.0002 (0.001)	-0.002** (0.001)	0.219*** (0.005)	0.227*** (0.005)	0.215*** (0.006)	0.220*** (0.005)
BMQCI	-0.042*** (0.003)	-0.042*** (0.003)	-0.039*** (0.003)	-0.043*** (0.003)	-0.013*** (0.001)	-0.013*** (0.001)	-0.011*** (0.004)	-0.012 (0.001)
BSIZE	-0.934*** (0.061)	-0.864*** (0.059)	-0.986*** (0.060)	-0.951*** (0.062)	0.671*** (0.082)	0.722*** (0.128)	0.672*** (0.126)	0.700*** (0.104)
BOONE/LERNER/ HHI		-0.111*** (0.013)	0.121*** (0.007)	-0.010*** (0.003)		0.047*** (0.009)	0.030** (0.014)	0.046*** (0.010)
J-statistic	90.77	93.50	102.86	91.68	40.62	40.07	39.42	41.80
AR (2)	0.000	0.201	0.000	0.000	0.000	0.000	0.000	0.000
Probability (J-statistic)	0.457	0.351	0.150	0.402	0.399	0.379	0.406	0.309
No. of observations	1820	1820	1820	1820	585	585	585	585
No. of Banks	140	140	140	140	45	45	45	45

Note: The table presents regression results of all our chosen variables: The dependent variable is Net Interest Margin (NIM). The independent variables are: Bank Equity Capital (BCAP), Bank Credit risk (BCREDSK), Bank Liquidity (BLIQ), X-efficiency, proxied by Cost-to-Income Ratio (BMQCI), Bank Size (BSIZE), Boone Indicator, Lerner Index, Herfindahl-Hirschman Index (HHI), for 20 countries of the Non-Monetary Union SSA, and 7 countries of the WAEMU, over the period 1999 – 2013. Columns 1 - 4 report the results of for the Non-Monetary Union SSA. Columns 5 – 8 report the results of for the 7 WAEMU countries. Probability values indicating statistical significance: \*\*\*1% \*\*5% \*10. Standard Errors are reported in parentheses. AR (2) is the test of second order serial correlation in the residuals, which null hypothesis is that there is no serial correlation. The J statistic is the Hansen test of over-identification restriction which null hypothesis is that the instruments are exogenous.

**Table 5.5. Simultaneously Controlling for Bank-Specific Variables and the Boone Indicator with the Successive Inclusion of Macroeconomic Variables in Both the Non-Monetary Union SSA and the WAEMU.**

VARIABLE	Non-Monetary Union SSA				WAEMU			
	COL 1 (EXRATEPC)	COL 2 (GDPRGR)	COL 3 (INFRATE)	COL 4 (REALINT)	COL 5 (EXRATEPC)	COL 6 (GDPRGR)	COL 7 (INFRATE)	COL 8 (REALINT)
NIM (-1)	0.297*** (0.003)	0.303*** (0.004)	0.289*** (0.004)	0.297*** (0.004)	0.465*** (0.004)	0.465*** (0.003)	0.466*** (0.002)	0.469*** (0.003)
BCAP	0.029*** (0.005)	0.031*** (0.007)	0.012*** (0.005)	0.031*** (0.006)	0.209*** (0.026)	0.227*** (0.025)	0.209*** (0.030)	0.214*** (0.035)
BCREDSK	0.027*** (0.001)	0.028*** (0.001)	0.024*** (0.002)	0.028*** (0.001)	0.003*** (0.002)	0.006*** (0.002)	0.006* (0.003)	0.007*** (0.004)
BLIQ	-0.002** (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.002* (0.001)	0.230*** (0.005)	0.227*** (0.005)	0.229*** (0.007)	0.228*** (0.008)
BMQCI	-0.042*** (0.003)	-0.041*** (0.003)	-0.039*** (0.003)	-0.042*** (0.003)	-0.015*** (0.002)	-0.014*** (0.002)	-0.013*** (0.003)	-0.013*** (0.004)
BSIZE	-0.869*** (0.061)	-0.892*** (0.067)	-0.967*** (0.063)	-0.891*** (0.064)	0.671*** (0.082)	0.725*** (0.109)	0.795*** (0.114)	0.598*** (0.141)
BOONE	-0.112*** (0.013)	-0.116*** (0.013)	-0.040** (0.020)	-0.115*** (0.014)	0.017 (0.015)	0.055*** (0.018)	0.068*** (0.011)	0.089*** (0.014)
EXRATEPC/ GDPRGR/ INFRATE/ REALINT	-0.001 (0.003)	0.061*** (0.013)	0.110*** (0.007)	-0.021*** (0.006)	0.028*** (0.003)	0.015 (0.018)	0.211*** (0.007)	-0.229*** (0.010)
J-statistic	93.40	91.04	99.94	94.15	36.59	39.89	41.34	38.41
Probability (J-statistic)	0.327	0.391	0.181	0.308	0.488	0.343	0.287	0.405
AR (2)	0.237	0.544	0.000	0.119	0.000	0.000	0.000	0.000
No. of observations	1820	1820	1820	1820	585	585	585	585
No. of Banks	140	140	140	140	45	45	45	45

Note: The table presents regression results of all our chosen variables: The dependent variable is Net Interest Margin (NIM). The independent variables are: Bank Equity Capital (BCAP), Bank Credit risk (BCREDSK), Bank Liquidity (BLIQ), X-efficiency, proxied by Cost-to-Income Ratio (BMQCI), Bank Size (BSIZE), Boone Indicator, Percentage change in exchange rate (EXRATEPC), GDP growth rate (GDPRGR), Inflation Rate (INFRATE), and Real interest rate (REALINT) for 20 countries of the Non-Monetary Union SSA, and 7 countries of the WAEMU, over the period 1999 – 2013. Columns 1 - 4 report the results of for the Non-Monetary Union SSA. Columns 5 – 8 report the results of for the 7 WAEMU countries. Probability values indicating statistical significance: \*\*\*1% \*\*5% \*10. Standard Errors are reported in parentheses. AR (2) is the test of second order serial correlation in the residuals, which null hypothesis is that there is no serial correlation. The J statistic is the Hansen test of over-identification restriction which null hypothesis is that the instruments are exogenous

**Table 5.6. Controlling for the Interaction Between Bank Management Efficiency (BMQCI) and GDP Growth Rate (GDPRGR) respectively in the Non-Monetary Union SSA and the WAEMU.**

VARIABLE	Non-Monetary Union SSA			The WAEMU		
	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
NIM (-1)	0.294*** (0.004)	0.304*** (0.004)	0.295*** (0.004)	0.469*** (0.003)	0.459*** (0.005)	0.466*** (0.004)
BCAP	0.027*** (0.005)	0.031*** (0.005)	0.034*** (0.006)	0.204*** (0.031)	0.252*** (0.034)	0.311*** (0.030)
BCREDSK	0.025*** (0.001)	0.026*** (0.001)	0.036*** (0.002)	0.003 (0.003)	0.002 (0.004)	0.008*** (0.002)
BLIQ	-0.002* (0.001)	-0.001 (0.001)	-0.002** (0.001)	0.232*** (0.006)	0.218*** (0.007)	0.215*** (0.007)
BMQCI	-0.037*** (0.001)	-0.036*** (0.003)	-0.010*** (0.004)	-0.014*** (0.002)	-0.009*** (0.003)	-0.042*** (0.003)
BSIZE	-0.403*** (0.081)	-0.523*** (0.066)	-0.901*** (0.076)	0.457*** (0.127)	0.749*** (0.146)	0.533*** (0.135)
BOONE	-0.102*** (0.012)	-0.121*** (0.013)	-0.064*** (0.013)	0.056*** (0.011)	0.041* (0.023)	0.024 (0.029)
GDPRGR			0.521*** (0.033)			-0.837*** (0.217)
BMQCI_GDPRGR			-0.007*** (0.0004)			0.012*** (0.003)
J-statistic	90.06	92.71	98.00	35.61		37.30
Probability (J-statistic)	0.419	0.345	0.197	0.534		0.409
<b>AR (2)</b>	<b>0.637</b>	<b>0.415</b>	<b>0.778</b>	0.000	0.000	0.000
No. of observations	1820	1820	1840	585		585
No. of Banks	140	140	140	45		45

Note: The table presents regression results of all our chosen variables: The dependent variable is Net Interest Margin (NIM). The independent variables are: Bank Equity Capital (BCAP), Bank Credit risk (BCREDSK), Bank Liquidity (BLIQ), X-efficiency, proxied by Cost-to-Income Ratio (BMQCI), Bank Size (BSIZE), Boone Indicator, and the interaction term between x-efficiency (BMQCI) and GDP growth rate (GDPRGR), that is, BMQCI\_GDPRGR for 20 countries of the Non-Monetary Union SSA, and 7 countries of the WAEMU, over the period 1999 – 2013. Columns 1 - 4 report the results of for the Non-Monetary Union SSA. Columns 5 – 8 report the results of for the 7 WAEMU countries. Probability values indicating statistical significance: \*\*\*1% \*\*5% \*10. Standard Errors are reported in parentheses. AR (2) is the test of second order serial correlation in the residuals, which null hypothesis is that there is no serial correlation. The J statistic is the Hansen test of over-identification restriction which null hypothesis is that the instruments are exogenous

## **HYPOTHESIS 1**

In section 5.1.1 we outlined the hypothesis to be tested but for completeness we repeat them as we report the results here in this section.

We hypothesize that the two efficient structure hypotheses, that is, the X-efficiency, proxied by bank cost-to-income ratio (BMQCI) and S-efficiency, also proxied by bank total assets (BSIZE), both have a reducing effect on NIM in the WAEMU than in the non-monetary union SSA. Indeed, taking a cue from the EU we recognise that the WAEMU has attracted and will continue to attract large Pan-African banks from outside the union, particularly large ones from Nigeria that might only be viable above a certain size resulting in: a) economies of scale b) the lowering of marginal cost, all with reducing effects on NIM in the WAEMU than in the rest of the non-monetary union SSA

### **BMQCI**

BMQCI, our management efficiency variable which tests the X-efficiency hypothesis and proxied by cost-to-income ratio, is statistically negatively significant at 1% across all our specifications in both the West African CFA zone (WAEMU) and the non-monetary SSA, in tables 5.4, 5.5, and 5.6 respectively. This lends credence to the X-efficiency version of the Efficient-Structure-Hypothesis. The X-efficiency version states that banks with superior management or production technologies have lower costs and subsequently can offer more competitive interest rates on loans and/or deposits, leading to a negative relationship between operational efficiency and interest margins (Claeys and Vander Venet, 2008). It could thus be inferred from our results that, in both WAEMU and the non-monetary SSA, banks have lower levels of operating cost per unit of gross income, implying efficient management where more profitable assets and low-cost liabilities are selected by management of banks. In these two regions therefore banks are able to pass the lower costs on to their customers in the form of lower loan rates and/or higher deposit rates, thereby lowering the interest margin. Our results are consistent with those of Dumicic and Ridzak (2013) who find cost to income ratio as a proxy for management efficiency negatively correlated with net interest margin. It is again consistent with Maudos and Solis (2009) who find a significantly negative relationship between net interest margin and efficiency in bank management proxied by cost to gross income ratio. Also consistent with our results are

Sharma and Gounder (2012) who also used the ratio of operating expenses to gross income to proxy management quality in their study of the determinants of bank interest margins in Fiji and find a significantly negative relationship between Management quality and NIM.

Notwithstanding the negative relationship between NIM and management efficiency (BMQCI) within both WAEMU and the non-monetary union SSA differences lie in the magnitude of the effect, where for example across our standard specifications controlling for all three competition measures in columns 2, 3, 4, 6, 7, and 8 in table 5.4 the magnitude of the reducing impact of Management efficiency (BMQCI) on NIM is higher in the non-monetary union SSA than in WAEMU. For example, looking at our baseline specification in columns 2 and 6 of table 5.4 in which the Boone indicator proxies for competition, while within WAEMU the coefficient BMQCI is -0.013, this is -0.042 in the case of the non-monetary union SSA. This level of differences in the reducing effects is rather surprising as it would have been thought that the most savings in costs would come from a monetary union environment. And it is at variance with the results for the Euro Area and the Non-Euro Area, where possible efficiency savings, industry competition and macroeconomic stability resulting in a higher negative relationship was recorded for the Euro Area. We investigate this by looking at the means and volatility<sup>39</sup> of some of the factors that are likely to affect banks' costs of operations within the two regions in which case we elect to look at the average bank sizes by total assets, levels of competition, percentage change in exchange rates, the level of real interest rates and its volatility, and GDP growth rates. Using the Boone indicator while our summary statistics put the mean level of competition at -0.023 in WAEMU, this is -0.062 in the non-monetary SSA. This means the level of competition is higher in the non-monetary SSA than in the WAEMU and can naturally reduce management cost of operation in the non-monetary SSA than in WAEMU. However, in terms of the average bank size in the two respective regions while the figure is 333244.7, measured in millions of US dollars, for the WAEMU, this is 767091.5 in the non-monetary SSA, meaning economies of scale are more likely to be enjoyed by the banks in the non-monetary union SSA banks than their counterparts in the WAEMU. We also find that the volatility of exchange rate as per their standard deviations is higher in the non-monetary union SSA

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<sup>39</sup> We use standard deviation to infer the level of volatility

than the WAEMU, 9.2 and 8.3, meaning more foreign exchange transaction costs are likely to be incurred by banks in the non-monetary union SSA than in the WAEMU, soaring the total cost of operations. Similarly, while the mean real interest rate (REALINT) is 1.8% and a standard deviation of 2.8 obtain in the WAEMU, the figures in the non-monetary union SSA are 9.7% for the mean real interest rate and 8.6 standard deviation. In this case we would expect far higher costs in interest rates to be incurred in the non-monetary union SSA than in the WAEMU. This is even more so where we observe a mean inflation rate of 8.9% and a standard deviation of 6.1 in the non-monetary union SSA as against a modest mean inflation rate of 2.7% and a standard deviation of 2.7 in the WAEMU. Finally, while the mean GDP growth rate in the WAEMU is 3.7% and a standard deviation of 3.1, these are 4.9% and 3.1 in the non-monetary union SSA. This shows a generally higher growth and development in the non-monetary union SSA than the WAEMU affording the banks in the non-monetary union SSA a more vibrant business atmosphere to grow bigger than their counterparts in the WAEMU and enjoy economies of scale<sup>40</sup>. It is clear from the foregoing analysis that while real interest rates, inflation rates, percentage change in exchange rates appear to be more favourable in the WAEMU for the banks ought to have been able to contain costs of operations for it to have had a more reducing effect on net interest margins than in the non-monetary union SSA, our intuition is that the effect is neutralised by level of competition and GDP growth rate, which, as already stated has a better outlook in the non-monetary union SSA than the WAEMU. We test this by interacting GDP growth rate (GDPRGR) with the cost-to-income ratio, our management quality (BMQCI) proxy to see if it would be significant. The results are shown in columns 3 and 6 of table 5.6. As could be seen the coefficients in both regions are both statistically significant at 1%, however while in the non-monetary union SSA the interaction term has a reducing effect on NIM, it has an increasing effect on NIM in the WAEMU, thereby supporting our intuition. For the level of competition impacting on the X-efficiency proxy, cost-to-income, to have a higher magnitude

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<sup>40</sup> "The growth take-off in Africa has been one of the salient facts of the global economy in the last two decades. However, while per capita GDP has more than doubled in faster-growing Sub-Saharan economies during this period, it has increased only moderately on average in the WAEMU..... Political instability, challenging business and legal environments, a substantial infrastructure gap, and weak institutional and public investment management capacity have affected both the level of investment and even more its efficiency, and prevented most WAEMU countries from achieving sustainable high growth. Limited structural transformation also seems to have played a role" (IMF Country Report (2014) No.14/84 on WAEMU)

of negative impact on NIM in the non-monetary SSA than in the WAEMU we do not interact our competition measure with the X-efficiency proxy, cost-to-income as apart from the HHI, the Boone indicator and the Lerner index have marginal cost measures embedded in them therefore already imply cost efficiency.

## **BSIZE**

Again with Bank size (BSIZE) while we find a significantly positive relationship with NIM at 1% is observed across all our specifications within the WAEMU, a statistically significantly inverse relationship with NIM at 1% is observed in the non-monetary union SSA as appear in tables 5.4, 5.5, and 5.6. For example, in our baseline regression in column 5 of table 5.4 where we control for only bank-specific variables while in the WAEMU the coefficient for bank size is 0.671, that for the non-monetary union SSA in column 1 of table 5.4 is -0.934. That the coefficient of the bank size variable, BSIZE, is negatively signed in the non-monetary SSA supports the efficient structure hypotheses, specifically scale efficiency, as in the presence of positive scale effects, larger banks are expected to operate at and are associated with lower margins (De Haan and Poghosyan, 2012). This is presumably as a result of economies of scale and the ability to invest in technology that would enhance efficiency. Specifically, in the context of non-monetary union SSA this means in the non-monetary union SSA cost reduction resulting from scale economies afford the banks the ability to pass on part of their efficiency savings in the form of lower NIMs than their counterparts in the WAEMU. Gelos (2006) in his study of bank spreads in Latin America finds that in an imperfectly competitive environment, larger banks may be able to exploit economies of scale and lower interest margins. Also consistent with our results are the results of Chirwa and Mlachila (2002) who capture a negative relationship between bank size and spreads in their bid to test the efficient market hypothesis or existence of economies of scale and concluded that the negative relationship suggests economies of scale. However, their proxy for size differs from ours in that they used the market share of each commercial bank in the deposit market as an indicator of size. Also consistent with the WAEMU results is Flamini et al (2009) who study the determinants of commercial bank profitability in Sub-Saharan Africa, using the two-step General Method of Moments (GMM) approach, and find a significantly positive relationship of the bank size variable (BSIZE) with net

interest margin, and explain that it gives support to the economies of scale market-power hypothesis where larger banks make efficiency gains that can be captured as higher earnings due to the fact that they do not operate in very competitive markets. Also consistent are the results of Aboagye et al (2008) who find bank size to have a significantly positive impact on net interest margins in Ghana, which supports the relative market power (RMP) hypothesis. We can therefore conclude that larger banks in the WAEMU, unlike their counterparts in the non-monetary union SSA may not be passing on part of their efficiency gains to the customer due to the uncompetitive nature of the bank market in the WAEMU. Confirming our hunch of the imperfections in the banking sector competition in the WAEMU as opposed to the non-monetary union SSA, Leon (2015) note that the recent substantial structural changes in competition in the WAEMU precipitated by the entry and expansion of banks from West Africa and from North Africa notwithstanding banks operate under imperfectly competitive market in the WAEMU. And that while data exploration shows that concentration in the WAEMU's banking industry decreased over the second part of the 2000s the trend is less marked than in other African economies. For example, between 2000 and 2009 the three largest bank in the WAEMU took up 60.79% of the total market.

With the foregoing results for both management efficiency (BMQCI) and bank size (BSIZE) the conclusion can then be drawn that the hypothesis of bank X-efficiency having reducing effects on NIM, while it can be supported in both the WAEMU and the non-monetary union SSA, its incidence is higher in the non-monetary union SSA than in the WAEMU because of the better GDP growth rate outlook in the non-monetary union SSA than the WAEMU. In the case of S-efficiency while the hypothesis is supported in the non-monetary union SSA it is not supported in the WAEMU due to a relatively better competitive environment in the non-monetary union SSA than in the WAEMU.

## **HYPOTHESIS 2**

The degree of banking competition (BOONE, LERNER and HHI) has a larger reducing effect on NIM in the WAEMU than in the non-monetary union SSA because of the effects of the EMU.

As the generally accepted hypothesis goes a more competitive banking market is expected to drive down bank loan rates/increase deposit rates, adding



to the welfare of households and enterprises (Van Leuvensteijn, 2009). Within the context of the WAEMU and the non-monetary union SSA as is in the case the Euro Area and the non-Euro Area in chapter 4, a reducing effect of our three elected competition variables would have been expected given the continuous structural changes that the WAEMU and the non-monetary union SSA markets have undergone over the last decade or so (Leon, 2015). More so, it would have been thought that the WAEMU as a monetary union would have engendered a lot of cross-border operations, in particular when since 2007 the entry of new Pan-African banking groups spurred competition in WAEMU (Leon, 2015). Our results in columns 2, 3, 4, 6, 7, and 8 of table 5.4 however show that while two of our three competition measures, namely, the Boone indicator and the HHI are significantly negative at 1% in the non-monetary union SSA with the exception of the Lerner index which is significantly positive, all three measures are positively related with NIM at 1% for the Boone indicator and the HHI, and 5% for the Lerner index in the WAEMU. These results suggest the presence of market power in the WAEMU, giving banks the license to charge higher loan rates and paying lower deposit rates. This may be explained by the level of concentration present in the WAEMU as alluded to by Leon (2015). In the case of the non-monetary union SSA, Leon (2015) note that the recent entry and expansion of banks from the West and North Africa have decreased the hitherto concentration in the banking markets. It is therefore natural for these competitive trends in the non-monetary union SSA to be reflected in lower NIM compared to the WAEMU where the market is regarded as concentrated. Regarding the positive sign on the coefficient of the Lerner index for the non-monetary union SSA we refer to our detailed analysis in section 4.4 of chapter 4, under hypothesis 2 where we test the effects of competition in the Euro and the Non-Euro Areas. In this section, following Carbo et al (2009) we note that since different competition measures belong to different measurement classifications they measure different things and do not provide the same inferences about competition our results seem mixed (Carbo-Valverde et al, 2009; Liu et al, 2013 in Leon, 2015). The choice of a particular competition measure in this context influences conclusions regarding the implications of competition (Leon, 2015). For example, the HHI belong to the class of measures that infer competition from the structural characteristics of the bank market and specifically measures the level of market concentration, while the

Lerner index which is based on bank behaviour measures the level of market power of a firm identified by the divergence between the firm's price and its marginal cost. The Boone indicator which is also another non-structural measure of competition and based on bank behaviour, infers the degree of competition from the effect of reallocation of market share or profits from inefficient firms to efficient ones.

### **HYPOTHESIS 3**

We hypothesize that exchange rate has a more reducing effect on NIM in the WAEMU than in the non-monetary union SSA.

In our specification controlling for the Boone indicator in columns 1 and 5 of table 5.5 while our percentage change in exchange rate variable (EXRATEPC) is negatively related to NIM in the non-monetary union SSA, but not statistically significant, it is positively signed in WAEMU and significant at 1%. That EXRATEPC is significantly positive in the WAEMU may be because the majority of the banks operating in the WAEMU are foreign banks who, unlike the Euro Area, might be exposed to a significant currency induced credit risk emanating from the fact that their clients' assets and liabilities are usually not denominated in the same currency as the WAEMU. Therefore, should the domestic exchange rate depreciate significantly, the loan quality might deteriorate and banks might charge higher margins for the foreign exchange risk exposure. This is in stark contrast to the dynamics in the EU, where in the case of the Euro Area the relationship was found to be a negative one because of the elimination of foreign exchange risk deriving from the fact that most of the foreign banks engaged in cross-border operations were Euro Area banks whose domestic currency was the Euro and could have a reducing impact on net interest margins. Our results overall are similar to those of Chortareas et al (2011) who find exchange rate effect on net interest margins to be positive for Colombia and Paraguay but negative in Chile

### **CONTROL VARIABLES (Bank-specific)**

#### **LAGGED NIM**

The lagged NIM across all our specifications for both the WAEMU and the non-monetary union SSA are significantly positive at 1% confirming the dynamic nature of our model specification, and justifies the inclusion of lagged

values of net interest margin to account for previous values of the NIM in the estimated regressions. Again across all specifications our results show that there is a relatively higher persistence of net interest margin across time in the WAEMU than in the non-monetary union SSA, as the coefficients are relatively higher. For instance, for both regions where the Boone indicator is included as the competition measure in columns 2 and 6 of table 5.4 while the coefficient for the WAEMU is 0.464 that for the non-monetary SSA is 0.297. This means within both zones although competitive forces are sufficiently powerful to ensure that no firm can persistently earn NIM above the norm these forces are more powerful in the non-monetary union SSA than in the WAEMU. This confirms the higher competitive pressure, inferred from the means of our competition variables, as well as the magnitude and signs of their coefficients in the regression results in table 5.1, within the non-monetary union SSA are sufficient to bring abnormal NIM quickly into line with the competitive norm than it does obtain in the WAEMU. For example, while the mean of the Boone indicator for the WAEMU is -0.02, that for the non-monetary union SSA is -0.06. Consistent with our results for the WAEMU are those obtained by Dumicic and Ridzak (2013) who find a relatively high persistence of NIM across time in their study of NIM in eleven Central and Eastern European Countries (CEEC).

### **BCAP**

The bank capital variable is significant at 1% in both the WAEMU and non-monetary SSA across all specifications in tables 5.4, 5.5 and 5.6 respectively. While the relationship between our capital adequacy variable (BCAP) and NIM in both the WAEMU and the non-monetary SSA are significantly positive at 1% for all specifications, we observe higher magnitude of effects picked up in the WAEMU than in the non-monetary SSA. In columns 2 and 6 of table 5.4, for example, when we control for the Boone indicator, while the coefficient is 0.223 in the WAEMU, within the non-monetary SSA the coefficient is 0.029. In our second specification when we control for competition with the Lerner index, in the WAEMU, the reported coefficient is 0.268, and 0.221 when the HHI is used to control for competition. Similarly, in the non-monetary SSA the reported coefficients are 0.016 and 0.021 when the Lerner index and the HHI are respectively controlled and significant at 1%. The positive relationship between the equity capital and net interest margins in both regions

is consistent with the hypothesis that while substituting equity for debt reduces the risk of insolvency, and therefore ought to have the effect of lowering the cost of borrowed funds, equity is a more expensive source of funding, and therefore an increase in equity capital by substituting equity for debt leads to higher required net interest margins (NIM) as these costs may be passed on to customers (Anbgazo,1997). In practical terms what this means is that banks in both the WAEMU and the non-monetary SSA are subject to high regulatory capital and would ask for higher rents to compensate for it (Saunders and Schumacher, 2000). Nevertheless, the higher magnitude of the impact on NIM in the WAEMU than in the non-monetary SSA may be explained by looking at the lower mean equity capital to assets ratio (BCAP) of 9.9% in WAEMU against 18.7% in the non-monetary SSA which is a reflection of lower capital market development in the WAEMU compared to the non-monetary union SSA as explained in section 5.3. Judging from these numbers it appears banks in WAEMU are subject to more insolvency risk than banks in the non-monetary union SSA, and therefore may demand higher rents in the shape of higher NIM to compensate for it.

Our results of a positive relationship are consistent with those of Boutin-Dufresne et al (2013) who use pooled ordinary least squares, fixed effects and generalized method of moments (GMM) to obtain a statistically significant positive relationship, in their study of NIMs in SSA; Angbazo (1997); Saunders and Schumacher (2000); Maudos and Solis (2009) and Khediri and Khediri (2011), all find a positive and significant relationship between bank capital and NIM, in line with the theoretical and empirical literature. Sharma and Gounder (2012) also find a rather negative and not statistically significant relationship between bank capital and NIM across all model estimations using pooled ordinary least squares, fixed effects and random effects models, in their study of bank net interest margins in Fiji.

The fact must however be alluded to that the determinants of NIM and their influence vary across countries as well as regions of the world (Doliente, 2005; Hawtrey and Liang, 2008; Maudos and Solis, 2009, in Sharma and Gounder, 2012). For example, while bank capital and credit risk are found to be significantly and positively related to NIM in developed countries (e.g. Saunders and Schumacher, 2000 in Sharma and Gounder, 2012), the relationship has

been found to be significant but negative in some Latin American countries (Brock and Suarez, 2000 in Sharma and Gounder, 2012).

### **BCREDSK**

Extending the same analysis to our credit quality variable, the ratio of loan loss provision to net interest revenue (BCREDSK), we find that it is statistically significantly positive at 1% in both the WAEMU and non-monetary union SSA, across all the specifications in table 5.4 where we only control for the bank-specific variables, and where we subsequently control for all three competition measures in succession, except where we control for the Lerner index in the WAEMU, which is not statistically significant. The results of a positive sign are consistent with the extant literature which means that banks with riskier loans select higher net interest margins (Angbazo, 1997).

While the sign is positive in both regions we however find a higher magnitude of the impact on NIM in the non-monetary union SSA than in the WAEMU. For example, in columns 1 and 5 of table 5.4 where only the bank-specific variables are controlled for, while we record a coefficient of 0.007 for the WAEMU, 0.024 is reported for the non-monetary union SSA. The explanation of a higher magnitude of the effect in the non-monetary SSA than in the WAEMU may be summed up in the following statement of the IMF (2014), that “while economic performance has significantly improved in faster-growing Sub-Saharan Africa (SSA) countries over the last two decades, it has changed only modestly, on average in the WAEMU” (IMF, 2014). This may imply a comparatively lower default risk rates; and therefore proportionately low provisions for loan losses reflecting in higher NIMs in the non-monetary union SSA than in the WAEMU where a relatively poor economic performance may reflect a higher default risk rates and hence a proportionately higher provisions for loan losses reflecting in lower NIMs.

Gunter et al (2013) show that increasing loan losses or nonperforming loans relative to earning assets causes banks to lose interest income generated from these loans and to move funds to lower-yielding assets that are less prone to default. Both effects tend to negatively influence the NIM in the short run, in other words deteriorations in credit quality tend to decrease the NIM.

Our results of a positive sign are however consistent with those of Ahokpossi (2013) who find the importance of credit risk for the determination of

interest margins in SSA, because credit risk is positively and significantly associated with net interest margins. Also consistent with our results are those of Agoraki (2009), who find credit risk to significantly raise margins when she uses both static and dynamic models in her study of the Greek banking system.

Dumicic and Ridzak (2013) use reserves for impaired loans as a proxy<sup>3</sup> for asset quality in their study of net interest margins in the Central and Eastern European banking systems and find it significantly negatively correlated with net interest margin, and take the view that it most probably derives from the fact that the banks are not allowed to accrue interest on bad loans.

### **BLIQ**

In respect of bank liquidity risk (BLIQ) our results largely indicate a positive relationship with NIM significant at 1% in the WAEMU, while broadly significantly negative at 5% in the non-monetary union SSA. These are across all our specifications in table 5.4, where we only control for the bank-specific variables, and subsequently control for all three competition measures in succession, except where we control for the Lerner index in the non-monetary union SSA, which is not statistically significant. That the results are negative in the non-monetary union SSA means that within the non-monetary union SSA liquidity risk is likely to be relatively reduced because of deeper and more liquid markets deriving from the free movement of capital<sup>41</sup>. As a result, banks factor in less liquidity risk premium in their interest rates than banks in the non-monetary union SSA. Looking at the means of our liquidity risk variable, 62.5% for the non-monetary union SSA against 54.6% for the WAEMU, it is evident that banks in the non-monetary union SSA hold sufficient amount of liquid assets to withstand stress and to enhance short-term resilience of the liquidity risk profile of banks. On the other hand, it is clear from the results that banks in the WAEMU rather charge a premium for the liquidity risk they face, thereby increasing their net interest margins. Our results of a negative sign in the non-monetary union SSA is consistent with Doliente (2005) who finds a statistically significant negative relationship between net interest margins and liquid assets in Thailand and Malaysia in his study of South-East Asia. Also consistent are those of Sharma and Gounder (2012) who employ a cocktail of different

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<sup>41</sup> the IMF (2014) notes that investors in frontier markets in the UK and the US for example find the WAEMU domestic debt market as illiquid and unattractive compared to markets like Ghana and Nigeria, and therefore remain small, indeed constituting a meagre 8% of the WAEMU GDP.

methodologies including fixed and random effects models, random effects model with period clustered standard errors (PCSE) and pooled least squares, using the ratio of total liquid assets to total assets to denote liquidity risk and find a negative but a statistically not significant relationship in their study of NIMs in Fiji. Other studies include Ahokossi (2013) who also find that in Sub-Saharan Africa liquidity ratio negatively and significantly affects interest margins. Studies which also find a rather positive relationship include Chortareas et al (2011) also find a significantly positive relationship between liquidity risk and net interest margins in some Latin American countries, which result they deem consistent with the literature since banks tend to pass their liquidity risks to consumers through increasing interest rate margins.

## **MACROECONOMIC CONTROL VARIABLES**

Almarzoqui and Naceur (2015) note that generally, a stable macroeconomic environment, with low inflation, low interest rate, and low reserve requirement, will support lower net interest margins. This we consider will be in the interest of welfare and therefore now turn to look at the impact of the macroeconomic actors on NIM in both regions.

### **GDP Growth Rate (GDPRGR)**

GDP growth rate (GDPRGR) is our cyclical output proxy and captures the economic performance of the respective banking jurisdictions and the relationship is indeterminate in the literature since NIM is deemed to be procyclical. Athanasoglou et al (2008) for example posit that lending could decrease during periods of economic slowdown, since such periods are normally synonymous with increased risk. Similarly, loan loss provisions during such periods will be higher due to the deterioration of asset quality. Naturally during such periods banks would charge higher margins for higher default risk. Dietrich et al (2015) on the other hand assert that the risk premium can be lower in times of economic booms. Furthermore, Dietrich et al (2015) find that developing countries with higher GDP growth are likely to exhibit higher default probabilities compared to developed countries. Putting all the arguments together it is thus à priori unclear which effect will dominate.

In column 6 of table 5.5 the reported sign of the GDPRGR coefficient while positive with a magnitude of 0.015 in the WAEMU is not statistically

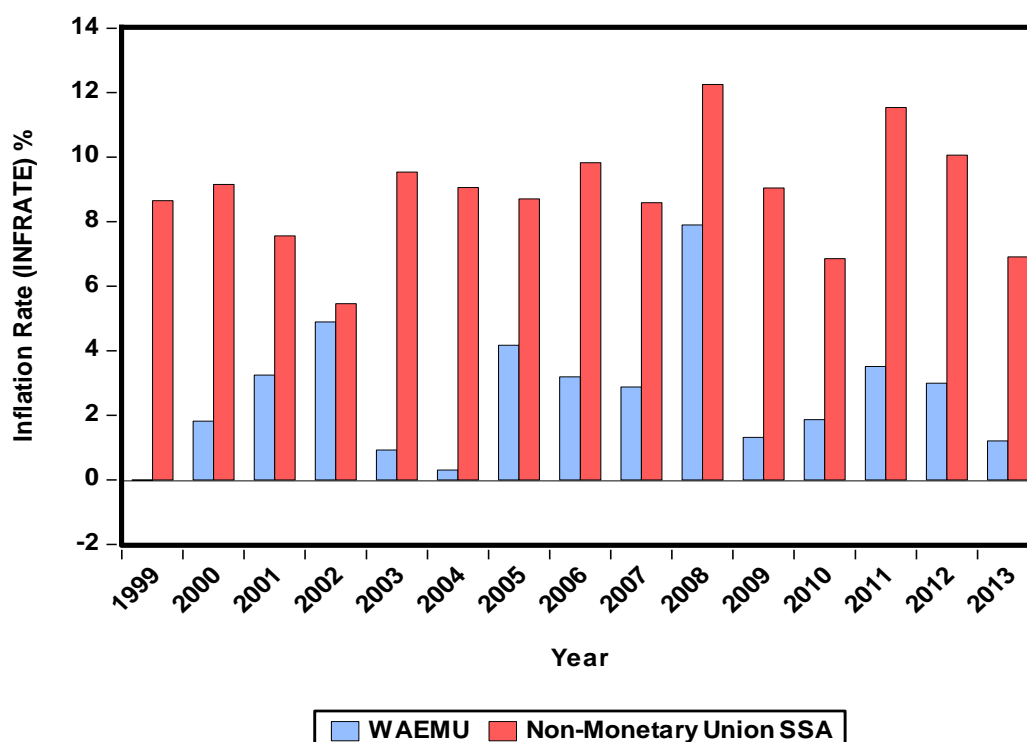
significant. This means in the WAEMU GDPRGR does not matter in the determination of net interest margins. It may be that due to the substantial economic volatility over the last two decades, as put by the IMF (2014), WAEMU banks have not been able to keep track of the cyclical output to be able to factor it into the determination of their net interest margins. The statistical non-significance of our results are consistent with Hovarth (2009) who also finds a rather positive but statistically not significant relationship for GDP growth in the Czech bank market. Demirguc-Kunt and Huizinga (1999) also find no statistically significant impact of GDP on NIM in their eighty-country study. They are also consistent with those of Beck and Hesse (2009) who find a negative relationship between GDP growth and interest spreads in Uganda but not statistically significant. Within the non-monetary union SSA nevertheless GDPRGR is significantly positively related to NIM at 1% in the specification in column 2 of table 5.5 with a coefficient of 0.061. This means in the non-monetary union SSA periods of high growth can result in higher net interest margins due to more intense credit activity and better loan quality. This explanation is corroborated by the assertion made by Brock and Suarez (2000); Claeys and Vennet (2008) to the effect that an increase in GDP per capita should be expected to increase bank's income as a result of more lending and lower default rates. And that for these markets, higher economic growth is associated with higher margins, as a reflection of more lending and lower default rates. Our results in the non-monetary union SSA are also consistent with those of Gunter et al (2013) who find GDP growth has a positive influence on NIM in the Austrian banking sector. Our results are however inconsistent with those of Chortareas et al (2011) for Argentina and Chile where GDP growth has a statistically significantly negative impact on NIM.

### **Inflation Rate (INFRATE)**

INFRATE has significantly positive impact at 1% on NIM in both the WAEMU and the non-monetary union SSA as appear in columns 3 and 7 of table 5.5 specifically. In both regions the significantly positive effect of inflation on intermediation margins is possibly due to the ability of banks to at least satisfactorily, forecast future inflation, which in turn implies that interest rates have been appropriately adjusted to achieve higher margins.



**Figure 5.7. Year-on-Year Comparison of Inflation Rates for the WAEMU and Non-Monetary Union SSA 1999 - 2013**



However, that the magnitude of the impact is lower in the non-monetary union SSA than in the WAEMU appears a paradox given that while the mean inflation rate over the period for the WAEMU is as low as 2.7%, this is 8.9% in the non-monetary union SSA; For example, in column 7 of table 5.5 while the coefficient for the WAEMU is 0.211, it is 0.110 in column 3 of table 5.5 for the non-monetary union SSA. Indeed, Figure 5.7 above shows that the mean inflation rate has been consistently higher in the non-monetary union SSA than in the WAEMU over the studied period. This finding is also supported by the IMF (2014) who project that inflation (percentage in the CPI) to 2018 will remain modest in the WAEMU than the rest of SSA.

The higher magnitude in impact on NIM in the WAEMU than in the non-monetary SSA can be explained by the probably relatively better ability of banks in the non-monetary union SSA to possibly fully anticipate and forecast future inflation correctly, which in turn implies that interest rates have been appropriately adjusted to achieve lower impact on margins than in the WAEMU. Athanasoglou et al (2008) also posit that the extent to which future inflation can be accurately forecasted so that banks can manage their operating costs depends on an economy's maturity. And therefore our results may also lie in the level of economic development between the WAEMU and the non-monetary

union SSA. Consistent with our findings is Flamini et al (2009) who find that inflation has a positive effect on bank profits, suggesting that banks in Sub-Saharan Africa forecast future changes in inflation correctly and promptly enough to adjust interest rates and margins. Also consistent with our results is Beck and Hesse (2009) who find that a higher rate of inflation is associated with higher margins and spreads in the Ugandan bank market. They are as well consistent with Brock and Suarez (2000) who find a positive relationship of inflation rate with bank spreads in Bolivia, Chile, Columbia and Peru. They are however inconsistent with Chortareas et al (2011) who find a negative relationship between inflation and NIM in Brazil, Chile, Colombia and Peru, but not statistically significant.

## **REALINT**

Unexpectedly real interest rate has a significantly negative impact on NIM in both the WAEMU and non-monetary union SSA. This suggests that banks in the WAEMU, as per the mean real interest rate (REALINT) of 1.8%, operate in a relatively low interest environment and are able to charge lower interest rates. For the non-monetary union SSA it may be that banks may not be pricing interest rate risks adequately, given that banks in the region operate in a relatively high real interest rate environment, as the mean real interest rate is 9.7%. Either way, we however observe that across all our specifications the magnitude of the negative impact as per the coefficients is higher in the WAEMU than the non-monetary union. For example, in column 8 of table 5.5 for the WAEMU while the coefficient for REALINT is -0.229 and significant at 1%, in column 4 of table 5.5 for the non-monetary union SSA this is -0.021 and significant at 1%. The higher magnitude of the reducing effect on NIM in the WAEMU than the non-monetary SSA is not surprising as the mean real interest rate is far lower in the WAEMU than it obtains in the non-monetary SSA, in the order of 1.8% in the WAEMU, and 9.7% in the non-monetary union SSA, clearly because of monetary union effects, where the monetary authorities' primary objective is to maintain price stability by keeping inflation low. Our finding of a negative relationship of real interest rate with net interest margin is consistent with Chortareas et al (2011) who find a negative relationship between average annual interest rate and interest rate margins in Argentina. Also contrary to our

findings are Brock and Suarez (2000) who find a positive relationship in some countries in Latin America.

## 5.5 Conclusion

In this chapter we have attempted to analyse the effect of monetary union membership on bank net interest margins in Sub-Saharan Africa for the period 1999 - 2013, using a total sample of 185 banks, made up of 45 banks from the WAEMU and 140 banks from the non-monetary union SSA, from across 7 countries of the WAEMU and 20 non-monetary union SSA. These are Burkina Faso, Benin, Cote D'Ivoire, Mali, Niger, Senegal, and Togo for the WAEMU; and Burundi, Botswana, Ethiopia, Gambia, Ghana, Kenya, Lesotho, Madagascar, Mauritania, Mauritius, Malawi, Mozambique, Namibia, Nigeria, Rwanda, Sierra Leone, Swaziland, Tanzania, Uganda, and South Africa for the non-monetary union SSA. Contrasting our findings in the WAEMU with those of the non-monetary SSA, our key objective has been to use our findings in the European Union as a benchmark against which to evaluate the dynamics of the monetary union membership in the determination of net interest margins in Sub-Saharan Africa (SSA), and set out the policy implications and recommendations in the last chapter. We used the Arellano and Bover (1995) system GMM estimator which is robust to endogeneity problems and to control for unobserved heterogeneity between banks, as well as allowing for the inclusion of a lagged dependent variable

The following hypotheses were tested as was done in Chapter 4 for our benchmark European Union analysis:

4. Efficient Structure Hypothesis: We hypothesize the presence of X-Efficiency (BMQCI) and S-Efficiency (BSIZE)
5. The degree of banking competition (BOONE, LERNER and HHI) has a larger reducing effect on NIM in the Euro zone than in the non-Euro zone because of the effects of the EMU.
6. We hypothesize that exchange rate has a more reducing effect on NIM in the Euro zone than in the non-Euro zone.

We find that while lower net interest margins generally obtain in the WAEMU than in the non-monetary union SSA, with a mean of 5.4 for the WAEMU and 9.0 for the non-monetary union SSA, this cannot be attributed to the level of competition and the relatively more stable macroeconomic

landscape, depicted by first and foremost the pegging of its currency to the Euro, the lower inflation rate, in the order of 2.7% mean as opposed to the non-monetary union SSA's mean of 8.9%, and lower real interest rate, also in the order of 1.8% for the WAEMU, and 9.7% for the non-monetary union SSA, as in the case of the Euro Area in Chapter four and would be expected in a typical monetary union for that matter.

While in the non-monetary union Sub-Saharan Africa our results for both management efficiency (BMQCI) and bank size (BSIZE) variables support the hypotheses of bank X-efficiency and S-efficiency respectively, with both variables having reducing effects on NIM, within the WAEMU only the X-efficiency is supported. Nevertheless, for the X-efficiency the reducing effect is higher in the non-monetary union SSA than in the WAEMU. We attribute this to the higher levels of competition and GDP growth rate in the non-monetary union SSA than in the WAEMU. This means in the non-monetary union Sub-Saharan Africa banks are afforded a faster growing economic and a more competitive environment to be able to compete, operate efficiently, and gain the critical mass in size to be able to realise scale economies to be able to reduce cost of financial intermediation. These findings therefore have policy implications for both regions. For the WAEMU it requires the relevant authorities to continue create a congenial macroeconomic environment to foster economic growth where banking firms in the WAEMU could grow in sizes to be able to exploit economies of scale, while also promoting policies aimed at enhancing competition, with the effect of reducing intermediation cost and enhancing social welfare. This will also have the effect of enabling the bank market to flourish and expand to economically viable sizes. This is especially where WAEMU is known to have a relatively small and underdeveloped financial market. For the non-monetary union SSA pursuing these same policies would further enhance the already noted positive effects.

For our second hypothesis on the effects of banking competition we find the presence of market power in the WAEMU, giving banks the license to charge higher loan rates and paying lower deposit rates; while in the non-monetary union SSA the presence of reducing impact of our competition proxies on NIM is evident. These findings are corroborated by the findings of Leon (2014) which establish the presence of concentration in the WAEMU, while in the case of the non-monetary union SSA, he notes that the recent entry and

expansion of banks from the West and North Africa have decreased the hitherto concentration in the banking markets. It is therefore natural for these competitive trends in the non-monetary union SSA to be reflected in lower NIM compared to the WAEMU where the market is regarded as concentrated. These findings are at variance with what is generally assumed, that competition in a monetary union drives down NIM than in a non-monetary union, as was seen in the case of the Eurozone versus the non-Eurozone in chapter four. So in terms of policy interventions it behoves the relevant financial services competition authorities to set an agenda geared to setting in motion competitive pressures within the WAEMU for the region to be able to enjoy the theoretically and empirically proven effects of competition on the efficiency with which banks intermediate in the region.

For our third and last hypothesis which is in reference to the effect of EXRATEPC on NIM in both zones while we find a significantly positive impact in the WAEMU, the opposite is the case in the non-monetary union SSA. We considered that this may be because the majority of the banks operating in the WAEMU are foreign banks who, unlike the Eurozone, might be exposed to a significant currency induced credit risk emanating from the fact that their clients' assets and liabilities are usually not denominated in the same currency. Therefore, should the domestic exchange rate depreciate significantly, the loan quality might deteriorate and banks might charge higher margins for the foreign exchange risk exposure. This we find in stark contrast to the dynamics in the EU, where in the case of the Eurozone the relationship was found to be a negative one because of the elimination of foreign exchange risk deriving from the fact that most of the foreign banks engaged in cross-border operations were Eurozone banks whose domestic currency was the Euro and could have a reducing impact on net interest margins. We may therefore find it prudent to recommend that WAEMU formulates policies that will foster the establishment of regional banks whose assets and liabilities will be significantly denominated in the CFA Franc in order to reduce their transaction costs with the eventual reducing effect on bank intermediation efficiency.

Across the gamut of the macroeconomic variables the following conclusions are made. While GDP growth rate is positively related with NIM in both regions, it is not significant in the WAEMU, but significant in the non-monetary union SSA. This means in the non-monetary union SSA periods of

high growth can result in higher net interest margins due to more intense credit activity and better loan quality. This explanation is corroborated by the assertion made by Brock and Suarez (2000); Claeys and Vennet (2007) to the effect that an increase in GDP per capita should be expected to increase bank's income as a result of more lending and lower default rates. And that for these markets, higher economic growth is associated with higher margins, as a reflection of more lending and lower default rates.

For the positive impact of INFRATE on NIM in both regions but of a higher magnitude in the WAEMU than in the non-monetary zone we find a relatively better ability of banks in the non-monetary union SSA to possibly fully anticipate and forecast future inflation correctly, which in turn implies that interest rates have been appropriately adjusted to achieve lower impact on margins than in the WAEMU. Again drawing on Athanasoglou et al (2008) assertion that the extent to which future inflation can be accurately forecasted so that banks can manage their operating costs depends on an economy's maturity we may conclude that our results may also lie in the dichotomy of the level of economic development between the WAEMU and the non-monetary union SSA, which calls for the WAEMU to develop strategies to enhance the region's economic development to catch up with the rest of Sub-Saharan Africa. extend the same argument of macroeconomic convergence in the economies of the Euro zone, propitiating an environment of macroeconomic stability in the shape of price stability where banks within the Euro zone have a relatively better ability to possibly fully anticipate and forecast future inflation, which in turn implies that interest rates have been appropriately adjusted to achieve higher margins than in the non-Eurozone. %. For the effect of real interest rate (REALINT), we however observe that the magnitude of the negative impact as per the coefficients is higher in the WAEMU than the non-monetary union. We find this higher magnitude of the reducing effect on NIM in the WAEMU than in the non-monetary SSA not surprising as the mean real interest rate is far lower in the WAEMU than it obtains in the non-monetary SSA, in the order of 1.77% in the WAEMU, and 9.68% in the non-monetary union SSA. This is clearly attributable to the monetary union effects where the primary objective of the WAEMU monetary authorities is to maintain price stability by keeping inflation low. In this regard while we will encourage the WAEMU monetary authorities to be rigorous with their approach to continually maintaining price stability, for the

non-monetary union SSA it is our recommendation that the region expedite their various monetary union agenda to be able to collectively and rigorously pursue price stability across the region.

Overall, rather unexpectedly we find higher magnitude of impact, both in increasing and reducing effects, of our explanatory variables on net interest margins in the non-monetary union SSA than in the WAEMU, which is puzzling and begs the question what then might be responsible for the generally lower NIM in the WAEMU than the non-monetary union SSA. To this we note that lower real interest rates in the WAEMU is the single most important factor driving the generally lower NIM in the WAEMU than it obtains elsewhere in the SSA. On this basis we can then conclude that in a monetary union while competition may immensely contribute to maintaining comparatively lower interest margins, as in the case of the Euro Area, the union's ability to pursue vigorously its primary objective of maintaining price stability by maintaining lower interest rates is key. As could be gleaned from chapter four on Europe, in a typical monetary union, competition is the major force that ignites efficiency of the two forms, that is scale and management efficiencies, for the achievement of lower cost of financial intermediation and social welfare in turn. It is therefore important that bank regulatory authorities in the WAEMU and the non-monetary union SSA at large consciously formulate policies geared to enhancing competitive bank behaviour, while the respective governments also ensure a sound macroeconomic environment within which banks operate in the regions.

Nonetheless referring back to the sub-optimality of the Euro Area in chapter three it is important to note here that if the Euro Area like the WAEMU scores low on the criteria for a monetary union and that it is a currency union rather than a fully-fledged monetary union (Mullineux, 2014), then the source of the competitive pressures within the Euro Area which impacts net interest margins negatively may be attributable to the presence of a well-developed single market rather than it being a monetary union. This is even further given credence by Andor (2014) who assert that the European economic and monetary union was an incomplete one. On that note we can then conclude that the lack of a well-developed single market in the WAEMU may well explain the puzzle of why competition did not have the same effect in the WAEMU as in the Euro Area.

# CHAPTER SIX

## CONCLUSION

In this thesis we note that the efficiency with which banks discharge their primary function of intermediating between savers and borrowers has consumer welfare implications; for which reason it has generated a lot of studies investigating the factors that are likely to impact the efficiency outcomes of this primary function of a bank, specifically the net interest margin. Among the key of such factors being the role played by a bank market structure. Within a monetary union we anticipate that the dynamics of these impacting factors, particularly the role played by a bank market structure, may be different from a non-monetary union jurisdiction. We therefore set out to contribute to the banking literature by looking at whether membership of a monetary union does matter in explaining the variation in net interest margin (NIM).

In this final and concluding chapter we highlight the main findings of each chapter, their limitations, offer public policy implications and recommendations and sign-post areas for likely future research.

Chapter one sets the tone by introducing our main motivation and contribution to knowledge. In chapter two we set out to review the theoretical literature on the two theoretical models which underpin most of the empirical studies into the determinants of net interest margins, namely, the Klein-Monti (1972) model, and the Ho and Saunders (1980) dealer model. We also review the main empirical studies using the Ho and Saunders (1980) dealer model, both on the African continent and the rest of the world where both individual country and cross-country studies are identified. We note that while studies on both advanced and other emerging economies abound those on Africa are scanty. Overall, we find that findings in different jurisdictions with respect to the various determinants of net interest margin are mixed.

In chapter three we recognise that since our contribution to knowledge borders on the contribution of monetary union membership towards the determination of bank net interest margins we look at the theory of the Optimum



Currency Area (OCA) as the relevant theory in any discourse on monetary union formation, and find support for the OCA endogeneity hypothesis in the literature. We as well in the same chapter look at the historical background to the formation of the European Economic and monetary union. This is intended to give context to our discussion in Chapter four, which looks at whether monetary union membership matter in the determination of net interest margin. Lastly in chapter three, recognising that the level of macroeconomic convergence in a monetary zone has risk implications for the determination of NIMs we also endeavour to establish the level of macroeconomic convergence and therefore the level of macroeconomic stability within the Euro and non-Euro Areas respectively. For example, we believe that the Euro and the non-Euro Areas' respective abilities to deal with economic shocks harmoniously will impact on the cost of financial intermediation. Therefore using the tools of graphical analysis, pairwise correlation analysis, sigma convergence analysis and finally tests of panel unit root we find that while both the Euro Area and non-Euro Area may be converging to their respective regional averages as well as their EU average on all our four macroeconomic variables, that is, percentage change in exchange rate, GDP growth rate, inflation rate and real interest rate, we generally find the speed of convergence higher in the non-Euro Area than in the Euro Area. Similar findings are also recorded for the WAEMU versus the non-monetary union Sub-Saharan Africa.

Motivated by the fact that the EU has become the model of monetary union arrangements on which all SSA monetary union endeavours are modelled, we use bank-level data to study the determinants of net interest margins in the European union in chapter four, contrasting our findings in the Euro Area with those of the non-Euro Area. Overall, we find higher reducing impact of our scale and X-efficiency variables on NIMs in the Euro Area than in the non-Euro Area reflecting inter alia a stronger competition and a higher macroeconomic stability in the Euro zone than in the non-Euro Area. The implication for the managers of the economies within the two zones is to develop policies geared towards enhancing the convergence of their respective economic fundamentals to ensure macroeconomic stability. Again, to extent that competition has a reducing effect on NIM in both zones policies must aim at ensuring the sustainability of competition in the banking sectors of both the Euro and the non-Euro Areas as the European Commission has in its own wisdom

already championed a lot of regulatory changes aimed at fostering competition in the financial services market.

We however consciously attempt to locate the source of the competition and efficiency in the Euro Area so that we could extend it to our comparator region in Sub-Saharan Africa. We find that the competition and efficiency effects that reduce net interest margins in the Euro Area derive from there being a well-developed single market with a strong socio-economic cohesion underpinning rather than the economic and monetary union which was found to be incomplete, because it lacked a fiscal and a political union, and therefore contributed to the European sovereign debt crisis. Our conclusion therefore is that it is rather the presence of a well-developed single market that engenders competition and efficiency to reduce bank net interest margins and not membership of a monetary union per se.

In our last main chapter which is chapter five we extend our analysis of the Euro versus the non-Euro Areas to Sub-Saharan Africa (SSA) where we contrast our findings in the West African Economic and Monetary Union (WAEMU) with some selected non-monetary union Sub-Saharan African (SSA) countries. Our findings here in this chapter reveal some interesting insights. Overall, rather unexpectedly we find higher magnitude of effects, both increasing and reducing, of our explanatory variables on NIMs in the non-monetary union SSA than in the WAEMU. This is puzzling and begs the question what then might be responsible for the generally lower NIM which obtains in the WAEMU than the non-monetary union SSA; the presence of market power in the WAEMU, which gives banks the license to charge higher loan rates and paying lower deposit rates; while on the other hand there is the presence of reducing effects of our competition proxies on NIM within the non-monetary union SSA. To this we note that lower real interest rates in the WAEMU is the single most important factor driving the generally lower NIM in the WAEMU than it obtains elsewhere in the SSA.

Comparing our European and Sub-Saharan African results we can conclude that it is the presence of a well-developed single market which generates the level of competition and efficiency which has the effect of lowering bank net interest margin in the Euro Area rather than it being a monetary union. And that by extension it is the absence of a well-developed

single market in the WAEMU which explains the unexpected effect of competition and efficiency on net interest margins in the region.

Therefore, in the final analysis the conclusion is that it is rather the presence of a well-developed single market that engenders competition and efficiency effects to reduce bank net interest margins rather than membership of a monetary union per se.

Given these findings, in terms of policy interventions it behoves the relevant authorities in the WAEMU to speedily complete the single market programme which has not yet been fully functional, although it constitutes a priority objective under the WAEMU Treaty (Claeys and Sindzingre, 2003).

### **Limitations of Thesis**

While we are convinced that the thesis presents robust results about the impact of monetary union membership on variations in the mean of net interest margins, and as well offers very insightful implications and useful recommendations likely to benefit regulatory authorities, monetary union agencies responsible for financial integration and the establishment of central banks for prospective monetary unions, policy makers, governments, bank owners and managers, investors, and the general public at large it is not without a few limitations which we highlight here.

Firstly, for our European analysis in chapter four, due to limited data for a good number of banks we left Spain out of the discussion. Our intuition is that we would have had improved results if we had included Spain since it is one of the largest Euro Area countries with a good number of banks. Again, in choosing a comparator group of countries to complete our European analysis we thought it would have served our purposes better if we chose a group of countries whose special characteristics and features are similar to those in the Euro Area. However, the number of such EU countries outside the Euro Area like the UK and Sweden were very limited.

Similarly, for purposes of comparative analysis of the role played by monetary union membership in the determination of net interest margins while we could have arrived at more robust findings by including other monetary union unions in Africa like the CEMAC we were again constrained by limited bank-level data and thus limited ourselves to the WAEMU. And even in the WAEMU Guinea Bissau was left out for the same reason of data constraint.

Our results for both Europe and Africa in chapters four and five respectively failed to elicit the expected impact of competition on net interest margin, particularly for the Euro Area, in the specifications where the Lerner index is used. The reason may be found in the literature on methods of banking competition measurement where the Lerner index is fraught with a number of limitations. For example, Oliver et al (2006) posit that the Lerner index could overestimate market power in banks where their risk-taking is not accounted for. This is because banks which spend relatively more of their resources granting loans reap higher rents in terms of margins. Furthermore, Leon (2014) point out that the Lerner index cannot distinguish between bank markets with high margins owing to inelastic demand and those with high margins because they are less competitive or collusive. To deal with this shortcoming he recommends the use of the conjectural-variation method developed by Iwata (1974), Bresnahan (1982), and Lau (1982), which we intend to employ in future.

### **Areas for Future Research**

Having introduced the role of monetary union membership into the debate and academic discourse on the determinants of net interest margin it is refreshing to sign post a few areas that can stimulate further research. In terms of methodology while the nature of our data set warranted a dynamic model and therefore elected to use the Arellano and Bover (1985) GMM we would recommend the inclusion of the difference GMM by Arellano and Bond (1991) for robustness in future research, its underscored weakness in the literature notwithstanding. We similarly for the same purposes of robustness recommend the addition of Fixed and Random effects methodologies for future research.

Also to the extent that there is a growing importance of bank fee income as a complement to net interest income we could have fully completed our analysis by bringing it into the discussion. For example, Hanweck and Ryu (2005) note that aggregate industry statistics point to an increasing prominence of noninterest income as a source of bank earnings. They make reference to the FDIC Quarterly Banking Profile which shows that noninterest income rose from 31 percent of quarterly net operating revenue in first quarter 1995 to 41 percent in second quarter 2003. We would therefore like to note its impact as an area future research could investigate.

Lastly, for future research, we would recommend going beyond the shores of Africa to include the Eastern Caribbean Currency Union (ECCU) and the CEMAC for purposes of comparative analysis. Again, future research could also use the United States of America, being the oldest monetary union, instead of the European Economic and Monetary Union as the benchmark monetary union.

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