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MARKET POWER AND BANKING FAILURE IN WAEMU ZONE: AN EMPIRICAL STUDY THROUGH GMM ESTIMATOR

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Abstract

This paper examines the relationship between market power and default risk for WAEMU banks. We use a dataset of 72 WAEMU banks from 2013 to 2020. The econometric results, after applying the system GMM estimator of Blundell and Bond (1998), indicate that bank concentration increases bank default risk. However, the test of non-linearity, through the introduction of the quadratic term of the concentration measure into the model, shows that above the 83% concentration threshold, an increase in market power could be favorable to banking stability. This study, therefore, recommends that monetary authorities exercise caution in their efforts to promote competition.

Keywords: Market power, Default risk, GMM, WAEMU.

JEL Classification: D43, G28, G33.

1. Introduction

The early 1980s were marked by an economic and financial crisis in most African countries. This crisis was reflected in the rapid deterioration of bank portfolios and the inefficiency of the banking sector in allocating funds to the economy (Caprio and Klingebiel, 1996). In response to this crisis, the monetary authorities, with the support of the international community, embarked on a policy of bank restructuring. With this in mind, the WAEMU Banking Commission was set up to supervise the activities of credit institutions and ensure compliance with banking regulations. These reforms were marked by financial liberalization, with the removal of interest rate ceilings, the reduction of reserve requirements, and the abolition of directed credit programs. In 2010, these measures led to the creation of a Financial Stability Committee (FSC), whose aim is to promote banking competition by reducing state intervention in the operation of the banking system. These reforms have also led to the entry of foreign banks and the development of cross-border banking groups. In theory, this increase in the number of banks should encourage competition.

Theoretically, the question of the link between banking competition and stability has crystallized around two distinct paradigms with opposed conclusions: "competition-fragility" and "competition-stability". The former, long considered dominant, attributes to competition a destabilizing effect on banking stability, and the latter a stabilizing effect. From a "competition-fragility" perspective, increased bank competition erodes market power, reduces bank margins, and, consequently, the bank's franchise value (Berger *et al*., 2009). Such a situation encourages banks to take more risks in pursuit of profits, leading to instability in the banking system (Allen and Gale, 2004; Keeley, 1990; Marcus, 1984). In Rajan's (1994) model, bank competition stimulates an excessive supply of credit and risk-taking, because as marginal loan applicants receive financing, the quality of the loan portfolio deteriorates, leading to bank fragility. Hellmann *et al* (2000) also show that bank competition for deposits can affect banks' prudential behavior, reducing bank profitability and fuelling incentives for excessive risk-taking. According to Edwards and Mishkin (1995), a banking system composed of a few large institutions is more stable than a competitive banking system, because, in the former scenario, banks can generate more profits, diversify their activities and control their operations, making them more resilient to external shocks. Numerous empirical studies also confirm the "competition-fragility" hypothesis (Khattak *et al*., 2022; Fu *et al*., 2014; Beck *et al*., 2013; Tabak *et al*., 2012).

On the other hand, lack of competition not only leads to inefficiencies but can also lead to high lending rates, forcing non-financial companies to take excessive risks. Stiglitz and Weiss (1981) provide theoretical underpinnings for "competition-stability" by showing that higher interest rates, resulting from a lack of competition, can increase the risk of loan portfolios due to adverse selection problems. Similarly, Boyd and De Nicolò (2005) show that in a competitive banking system, banks offer low lending rates to their customers, thereby helping to reduce the level of credit risk. These results suggest that competition reduces the risk of borrower default and therefore balconies losses, promoting financial system stability (Perotti and Suarez, 2002; Inderst, 2013). Amidu and Wolfe (2013) find that competition increases stability as the diversification of bank activities increases. In the same vein, Schaeck *et al* (2009) suggest that policies promoting bank competition have the potential to improve banking system stability. Schaeck and Cihák (2014) find that banking competition improves banking stability, and that the effect of competition on stability is greater for healthy banks than for fragile ones.

In the WAEMU zone, where the banking sector is highly oligopolistic, financial stability has traditionally been preserved through the supervision of individual institutions, using a microprudential approach to assess risks and their evolution. Even if the zone's banks were more or less spared by the 2007 financial crisis, it should be remembered that the banking crisis suffered by this zone in the 1980s was essentially caused by the poor management of credit institutions and the deterioration of the

economic environment, all of which were not taken into account by microprudential regulation (Dannon and Lobez, 2014). Of the seven countries in the WAEMU, six were deeply affected. Apart from macroeconomic causes, the main factors at the root of this banking crisis were banking regulations and the accounting framework, which had multiple flaws (Powo, 2000). In the end, the crisis of the 1980s necessitated reforms aimed at liberalizing and restructuring the banking sector, in particular, to strengthen the competitiveness of member states' economic and financial activities within the framework of an open, competitive market and a rationalized, harmonized legal environment.

According to the annual report of the WAMU Banking Commission (2022), the union's banking system had 133 banks in operation at the end of December 2022. This compares with 122 in 2018. The easing of financial conditions since 2004 has encouraged foreign banks to enter the banking market. International banks dominate the market, with 49.3% of the Union's banking assets. They concentrate 34.9% of the branch network, have 43.9% of ATMs, hold 54.3% of bank accounts, and employ 49.1% of the workforce. Sub-regional banks have a 49.0% market share. This category includes 37.4% of branches, 56.1% of ATMs, 45.7% of customer accounts, and 44.6% of employees. The zone's banking sector is therefore concentrated. From 2013 to 2016, the Herfindahl-Hirschmann concentration index (HHI) in the WAEMU zone fell from 1.332.558 to 1.246.566. At the same time, the banking stability index (Z-score) fell from 20.708 to 16.021. Over this period, one might assume that banking concentration is not conducive to banking stability. However, looking at the same variables between 2017 and 2019, we note that the HHI concentration index has maintained its downward trend, rising from 1230.328 to 1223.017. Over the same period, the banking stability index increased from 16.238 to 18.341. In light of these observations, one might be forgiven for thinking that banking concentration is conducive to banking stability. Given these contrasting trends, the effect of banking market structure on banking stability in the WAEMU appears ambiguous.

Thus, the main question that emerges from our reflections is the following: What is the effect of banking market structure on banking stability in the WAEMU? From this central concern arise several questions that may help to shed light on the main question: (i) what is the influence of banking market concentration on banking risk? (ii) is there a long-term relationship between banking market concentration and banking risk?

Thus, the general objective of this study is to analyze the effect of banking market structure on banking stability in the WAEMU. This general objective is broken down into three specific objectives, namely: (i) to examine the effect of banking concentration on banking risk; (ii) to show that there is a threshold beyond which the effect of banking market concentration on risk is reversed.

In this research, we start from the general hypothesis that market structure has no influence on banking stability in the WAEMU zone. To our specific objectives, we associate the following secondary hypotheses: (i) banking market concentration has a positive effect on banking risk in the WAEMU zone; (ii) there is a threshold beyond which increasing concentration reduces banking risk in the WAEMU zone.

This study is both interesting and challenging. As the banking system is at the heart of a country's economic, political, and social life, it is vital to ensure its stability. Methodologically, the study is based on dynamic panel models with the GMM estimator Blundell and Bond (1998). On the one hand, the system GMM estimator proves to be more efficient than the prime difference GMM estimator, as the latter gives biased results in finite echntillons when the instruments are weak. This estimation technique is ideal when the number of periods (T) is small for a large number of individuals (N). On the other hand, it has been specifically developed for estimating dynamic panel data equations with persistent dependent variables and potentially endogenous independent variables. In addition, the GMM system estimator allows for both unobserved heterogeneity and the potential endogeneity bias of the banking concentration variable. The application of the Blundell and Bond (1998) GMM estimator is perfectly suited to this study, as the data cover the period from 2013 to 2020 with a sample of 72 banks from the BCEAO bank balance sheet.

The rest of the article is structured as follows. Section 2 is devoted to a review of the literature on the relationship between market power and bank default risk. Section 3 presents the study methodology. Section 4 presents the data source and variable descriptions. Section 5 will discuss the empirical results, particularly the econometric analysis of the relationship between market power and default risk. Section 6 concludes the study.

2. Banking competition: stability or fragility?

This point will be analyzed in two sections. In the first section, the theoretical literature on the link between market power and bank default risk will be reviewed. In the second section, the empirical literature on the relationship between market power and bank default risk will be reviewed.

2.1. Theoretical review of the link between banking competition and stability

The theoretical question of the link between market structure and stability is currently crystallizing around two distinct paradigms with opposed conclusions: "competition-fragility" and "competition-stability". Competition-fragility assumes that competition favors the risk of bank failure. This paradigm has its roots in the work of Marcus (1984) and Keeley (1990), according to which greater competition reduces the value of bank accreditation, then increases banks' appetite for risk. Corbae and Levine

(2019) confirm this finding, pointing out that increased competition increases the efficiency and fragility of banks in the United States. Theorists defending this thesis, therefore, advocate restricting competition within the banking industry, thereby recognizing a "special" status for banks (Carletti and Hartmann, 2002).

In Rajan's (1994) model, bank competition stimulates excessive credit supply and risk-taking, because as marginal loan applicants receive financing, the quality of the loan portfolio deteriorates, leading to bank fragility. Hellmann et al (2000) also show that increased bank competition for deposits can affect banks' prudential behavior, reducing bank profitability and fuelling incentives for excessive risk-taking. The authors point out that controls on lending rates counteract the "market theft" effect and encourage banks to behave very cautiously. Similarly, restrictions on competition for deposits are more effective than higher capital requirements in curbing "bet for resurrection" behavior on the part of banks. Edwards and Mishkin (1995) believe that the excessive risk-taking observed in the USA in the 1980s stemmed from the deterioration in profits due to competition in the financial markets. According to these authors, a banking system composed of a few large institutions is more stable than a competitive banking system, because, in the former scenario, banks can generate more profits, diversify their activities and control their operations. In the latter, banks are more resilient to external shocks. Authors such as Srairi (2013) and Sullivan and Spong (2007) confirm that banking market concentration reduces banks' risk-taking, as they benefit from a higher franchise value.

By contrast, other models predict an inverse relationship between bank competition and risk-taking. A competition deficit not only leads to inefficiencies but can also result in high lending rates for non-financial companies. Stiglitz and Weiss (1981) provide theoretical underpinnings for "competition-stability" by showing that higher interest rates, resulting from a lack of competition, can increase the risk of loan portfolios due to adverse selection and moral hazard problems. Similarly, Boyd and De Nicolò (2005) show that in a competitive banking system, banks offer low lending rates to their customers, helping to reduce the level of credit risk. These results suggest that competition reduces the risk of borrower default and hence bank losses, thereby promoting financial system stability. Indeed, when banking competition intensifies, it is optimal to be cautious in acquiring market power, especially when competitors take excessive risks and fail (Perotti and Suarez, 2002; Inderst, 2013). Amidu and Wolfe (2013) find that competition increases stability as the diversification of banks' activities increases, but a relatively less efficient bank will be more heavily punished in a competitive market (Demsetz, 1973).

In the same vein, Schaeck et al (2009) suggest that policies favoring bank competition have the potential to improve banking system stability. Schaeck and Cihák (2014) find that banking competition improves banking stability and that the effect of competition on stability is greater for healthy banks than for fragile ones. This

observation is corroborated by Demsetz *et al* (1996) and Leuvensteijn *et al* (2011), who confirm that US banks with the highest capital ratios are also those with high market power. Dick (2007) confirms the scope of this work for the second phase of deregulation of the US banking market, however, it appears that financial liberalization has enabled the most efficient and effective banks to expand and put less efficient entities into competition. As a result, the efficiency and overall performance of banks in the market improved; leading to greater stability in the US banking system (Jayaratne and Strahan, 1998). The study by Berger *et al* (2009) is particularly interesting. It seems to be able to reconcile the two strands of the literature and in particular the franchise value and risk-shifting paradigms, by concluding that there is a non-linear relationship between concentration and stability. Specifically, the authors show that an increase in market power leads to an increase in the risk of bank portfolios, which could confirm the risk-shifting paradigm and the competition-stability thesis. However, Berger *et al* (2009) observe that the overall risk of failure borne by a bank does decrease with increasing market power. This is because banks would hold a larger share of capital, thereby increasing their capacity to absorb losses. Tabak *et al* (2012) indicate that competition affects risk-taking behavior in a non-linear way, as both high and low levels of competition enhance financial stability, while the effect is reversed for medium levels of competition.

Bank size and capitalization were found to be key factors in explaining this relationship. Beck *et al* (2013) approach fragility through the probability of enduring a systemic banking crisis and find that concentration and competition would be two quite distinct notions with different implications. A concentrated system would be more stable because it would be made up of larger, better-diversified banks, but not necessarily less competitive. Yeyati and Micco (2007) also confirm the divergence between the concepts of concentration and competition in Latin American countries, which may explain the above results. They observe that the entry of foreign banks, via mergers and consolidations, has strengthened competition in the banking market.

2.2. Review of the empirical literature on the link between banking competition and stability

At the empirical level, Moyo *et al* (2014) consider a sample of 16 sub-Saharan African countries over the period 1995-2010. Using the H-statistic developed by Panzar and Rosse (1987) as a measure of banking competition, the results indicate that the entry of foreign banks has increased competition in the banking markets of the countries in the sample. They also indicate that banks are more stable in countries with competitive banking systems. However, this study suffers from several limitations. The sample selected is heterogeneous since it includes countries at different levels of development. Furthermore, there is no guarantee that the relationship between competition and stability is common to all sub-Saharan African countries.

Turning to the UK, De-Ramon *et al*. (2019) use three separate measures of competition (the Boone indicator, the Lerner index, and the Herfihndahl-Hirschmann index) to examine the effects of banking market structure on bank stability as measured by the Z-score. The results show that, on average, competition reduces bank stability, but that this effect varies from bank to bank, depending on their financial health. For these authors, competition relatively encourages weaker banks to reduce costs as well as portfolio risk and increase capital ratios, thereby strengthening their stability, while reducing the incentives of relatively stronger banks to increase their capital ratios, thereby weakening their stability. Amidu and Wolfe (2013) analyzed the effect of competition on banking stability in 55 emerging countries over the period 2000-2007 and find a positive and significant link between competition and stability. Based on a sample of 14 countries, over the period 2003-2010, Fu *et al.* (2014) show that increasing concentration favors banking system fragility, due to the higher level of risk. Similar conclusions appear in the work of Leroy and Lucotte (2017), who find that competition improves financial stability by reducing systemic risk.

Similarly, Gonzalez *et al* (2017) test the relationship between competition and bank stability for 356 banks operating in the Middle East and North Africa (MENA) countries, over the period 2005-2012. The results show that for the entire sample, the relationship between competition and bank risk-taking is U-shaped for MENA banks. The negative linear relationship between the Z-score and the H-statistic in the Gulf countries shows that an increase in competition leads to a reduction in the level of financial stability. In the case of other countries, increased competition in non-competitive markets can lead to an increase in stability. The results confirm the importance of market structure as an explanatory factor for financial stability, but concentration is not associated with uncompetitive markets.

On a large set of Asian commercial banks, over the period 1994-2009, the study by Soedarmono *et al.* (2013) indicates that a high degree of market power in the banking market is associated with a higher capital ratio, high-income volatility, and high bank insolvency risk. Although banks in less competitive markets hold more capital, the level of capitalization is not high enough to offset the impact of excessive risk-taking on default risk. These authors, therefore, support the competition-stability hypothesis. Using three competition indicators (the Boone indicator, the Lerner index, and the Herfindahl-Hirschman index), Shijaku (2017) analyzes the relationship between competition and stability in Albanian banks over the period 2008-2015. The results indicate that competition is a factor in the stability of the banking system. Over the period 2000-2012, Kabir and Worthington (2017) examine the relationship between competition and banking system stability, based on Islamic and conventional banks. The results support the competition-fragility hypothesis concerning Islamic and conventional banks.

The results of Albaity *et al.* (2019) on a sample of 276 banks from eighteen MENA countries over the period from 2006 to 2015 indicate that increased competition is associated with low banking stability and profitability, as well as a high risk of insolvency. For these authors, the market power of banks with high profits is eroded in a highly competitive market, prompting them to take on more risk to compensate for lost profits, making them more fragile. As a result, the most stable banks in MENA countries are those in less competitive markets. Schaeck et al (2009) look at the US banking sector over the period 1980-2003 and find that more competitive banking systems have a lower probability of default, and are therefore more stable than monopoly banking systems.

On a sample of 2,529 cooperative banks from five European Union countries (Austria, France, Germany, Italy, and Spain) between 1998-2009, Fiordelisi and Mare (2014) find that competition measured by two indicators (Lerner index, Herfindahl-Hirschman index) has a stabilizing effect over both the short and long term and that the crisis of 2008 did not influence the relationship between competition and stability. De Nicolò et al (2006), using the Z-score for stability and the HHI for market structure, conclude that there is a positive relationship between bank concentration and bank risk-taking, confirming the "competition-stability" thesis of Boyd and De Nicolò (2005).

In addition, a few works have assessed the non-linearity in the relationship between banking stability and competition. Using the Lerner index as an indicator of competition, Liu *et al* (2013) find that there is an inverted U-shaped relationship between bank competition and European bank stability. Regional economic conditions also play an important role in determining bank stability. However, the result is not robust to the different competition measures chosen, with non-linearity only appearing when using concentration measures. In a sample of 221 banks from 33 sub-Saharan African countries, over the period 2000-2015, Brei *et al.* (2020) test the non-linearity between bank stability and competition. These authors find that at high and low levels of competition measured by the Boone indicator, competition increases stability. However, at medium levels, fragility is observed, confirming a non-linear relationship between bank competition and credit risk. Non-linearity is also observed by Jiménez *et al* (2013), for Spanish banks. On a set of Southeast Asian countries, Noman *et al.* (2017) discover a non-linear relationship between banking competition and stability by incorporating a quadratic competition term into their model.

The effects of banking competition on financial stability can be positive or negative, but history shows that many financial crises follow episodes of financial liberalization. The financial reforms adopted in most countries in response to the crises share a fundamental idea that, to preserve the stability of the banking and financial sector, competition must be limited.

3. Methodology

In this section, we review the empirical model used to study the effect of bank market power on bank stability. We then explain the measures of bank stability and bank market power, as well as the other variables used in the analysis.

3.1. Empirical Model Specification

The objective of the model to be estimated described in this section is to capture the effects of competition and region-specific economic conditions on bank stability. We also include a series of bank-specific covariates that have been used in previous empirical studies examining the determinants of bank stability. The model is specified as follows:

$$ZS_{i,t} = \beta_0 + \lambda ZS_{i,t-1} + \beta_1 MP_{i,t} + \beta_2 MP_{i,t}^2 + \beta_3 BV_{i,t} + \beta_4 MV_{j,t} + \beta_5 PS_{j,t} + \beta_6 ORIG_{i,t} + \mu_i + \nu_{i,t} \quad (1)$$

where indices *i*, *j* and t denote bank i, country j and year t. $ZS_{i,t}$ is the bank stability measure and $ZS_{i,t-1}$ is the one-period lagged stability measure. The bank stability measure included in our analysis is ZSCORE (defined below). λ represents the rate at which bank risk converges to a long-term level. $MP_{i,t}$ is the measure of market power, which is discussed below. $MP_{i,t}^2$ is the quadratic term of the market power measure that captures any non-linear relationship between market power and stability. $BV_{i,t}$ is a vector of bank-specific variables and $MV_{j,t}$ is a vector of variables specific to the country in which the bank is located. We also control for institutional factors specific to the countries in which the banks operate. For this last category of variables, we follow the work of Saidane *et al.* (2021), and retain political stability (PS) and a dummy variable $ORIG_{i,t}$ which is 1 when the bank's headquarters are outside the WAEMU, 0 otherwise. μ_i is a fixed effect and $\nu_{i,t}$ is a random disturbance.

3.2. Description of Variables

In this subsection, we present all the variables in the model, as well as the data sources.

- Measuring bank stability

We measure bank stability using the ZSCORE index. This index combines a measure of bank performance (return on assets, ROA), bank risk (standard deviation of ROA) and an indicator of safety and soundness (the bank's equity/assets ratio). The resulting ZSCORE index reflects the extent to which banks have a (capital) cushion to absorb losses. Consequently, higher values indicate lower risk and greater stability. The ZSCORE index has been widely used in previous empirical literature concerning the measurement and determinants of the safety and soundness of financial institutions

(De-Ramon *et al*., 2019; Gonzalez *et al*., 2017; Kabir and Worthington, 2017; De Nicolò *et al*., 2006; Iannotta *et al*., 2007; Beck *et al*., 2006). The ZSCORE index is calculated as follows:

$$ZSCORE = \frac{ROA + E/A}{\sigma(ROA)}$$

ROA is the bank's return on assets, E/A represents the equity/total assets ratio and σ (ROA) is the standard deviation of the return on assets. Since the ZSCORE index is highly asymmetric, we use the natural logarithm of the ZSCORE index, which is normally distributed (Laeven and Levine, 2009). We also include a lagged dependent variable $ZSCORE_{i,t-1}$ indicating the persistence of banking stability, as shown by Jiménez *et al*. (2013) and Garcia-Marco and Robles-Fernández (2008). Since ZSCORE and default risk move in opposite directions, we will use the inverse of ZSCORE to capture the influence of exogenous variables on bank default risk.

- Measuring market power

The simplest way to measure banking market power is to use structural measures such as concentration ratios. The CR3 concentration ratio is obtained by adding together the market shares of the three largest banks in terms of total assets. Many studies assessing the link between market power and stability use concentration indices as a measure of competition (Berger *et al*., 2009; De Ramon *et al*., 2019). It is calculated as follows:

$$CR3 = \sum_{i=1}^{3} MS_i \ ,$$

where MS_i represents the market share of bank *i* from the three largest banks in the sector.

Although CR3 is commonly used for ease of understanding, it has nevertheless been criticized for its narrow focus on a few large companies (Ye *et al*., 2009). The Herfindahl-Hirschman Index (HHI) is a commonly used measure of market concentration. It is defined as the sum of the squared market shares of each bank.

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

where s_i^2 represents the bank i's market share squared and n is the total number of banks in the sector. The HHI index can range from close to zero to 10,000.

- Bank-specific variables

We include a series of bank-specific variables in our model, in line with previous literature. We include the natural logarithm of total bank assets (SIZE) to control for bank size effects. Bank size may be positively related to banking stability due to efficiency gains through economies of scale. However, managers of large banks may tend to take more risks in anticipation of implicit "too big to fail" subsidies and the government safety net designed to bail out troubled institutions (O'Hara and Shaw, 1990; Stern and Feldman, 2004; Brown and Dinç, 2011). The relationship between bank size and stability is therefore not established. We perform a time adjustment by calculating the average logarithm of all banks' total assets for each period, then subtracting it from the logarithm of each bank's total assets for each period. We do this to avoid a spurious correlation between total assets and capital ratios that could result from the non-stationarity of total assets. Previous studies have found evidence to support this effect (Francis and Osborne, 2012; de-Ramon *et al*., 2022).

We also include the bank liquidity ratio. Liquidity is measured by liquid assets to total assets (LIQ). Holding this category of assets enables the bank to meet its short-term requirements, thereby limiting its exposure to liquidity risk. However, holding liquid assets generates a significant opportunity cost, which is likely to hurt banks' profitability and increase the risk of bankruptcy. The relationship between liquidity and stability is therefore not established.

The lending behavior of banks, represented by the ratio of loans to total assets (LOANS), should be negatively linked to banking stability, as credit is one of the riskiest areas of banking activity. The greater the bank's loan exposure, the higher the risk of default and, consequently, the weaker banking stability. This ratio is also an indicator of the bank's degree of diversification. A high ratio corresponds to a low degree of diversification.

Provisions as a proportion of total assets (PROVTA) are used to cover losses. Every bank must be prepared for potential losses on the loans it grants. To offset this credit risk, banks estimate expected future losses on their outstanding loans and book a provision accordingly. When a bank records a provision, it recognizes a loss on the loan in advance. The relationship between provisions and stability is therefore negative.

- Macroeconomic variables

The gross domestic product (GDP) growth rate is an economic indicator used to measure macroeconomic conditions in each country. On the one hand, favorable macroeconomic conditions enable banks to achieve good results; on the other hand, in periods of growth, banks may choose riskier assets and thus be exposed to a higher

risk of default. This is why the effect of the gross domestic product growth rate on stability is ambiguous.

We also introduce the inflation rate (INF) into the model. Indeed, price stability is generally one of the objectives sought by many central banks, including that of the WAEMU. While we are aware of the harmful effects of high inflation, the effects of moderate inflation are mixed (Cordeiro, 2003; Athanasoglou *et al*., 2008; Kamgna *et al*., 2009). Thus, the impact of the inflation rate on banking stability depends on the level of inflation.

- Institutional variables

Political stability and absence of violence/terrorism (PS) measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. This index ranges from -2.5 to +2.5. A score closer to -2.5 corresponds to more political instability in the country, while a score closer to +2.5 corresponds to less political instability. Theoretically, political stability induces banking stability. To test for the existence of an export channel of risk-taking, we include a dummy variable $ORIG_{i,t}$ which is worth one when the bank's headquarters are outside the WAEMU, zero otherwise. μ_i is a fixed effect, and $\nu_{i,t}$ is a random disturbance.

3.3. Estimation Method

Equation (1) takes the form of a dynamic panel regression model. Such models include one or more lags of the dependent variable as covariates and contain unobserved individual effects (fixed or random). By construction, the individual effects are correlated with the lagged dependent variable, making standard estimators of fixed or random effects inconsistent. Arellano and Bond (1991) use a generalized method of moments (GMM) estimator for such models, known as difference GMM. The values (levels) of the lagged exogenous variables are legitimate instruments for the lagged dependent variable in the first difference. However, these lagged variables may provide little information about the first differences (Arellano and Bover, 1995; Blundell and Bond, 1998).

Building on the work of Arellano and Bover (1995), Blundell and Bond (1998) developed a system estimator that exploits additional moment conditions on both first differences and levels, with the lagged first differences of the series used as instruments in the levels equation. The GMM system estimator reduces the potential bias in finite samples as well as the asymptotic imprecision associated with the difference estimator (Blundell and Bond, 1998).

The consistency of the GMM estimator in a system depends both on the assumptions that the error term is not autocorrelated and that the instruments used are valid. Two specification tests are presented. The first is Hansen's over-identification

test, which tests the validity of lagged variables as instruments. Hansen's test statistic is the minimized value of the objective function. Under the null hypothesis, this statistic asymptotically follows the Chi2 distribution with (J-K) degrees of freedom, where *J* is the number of instruments and *K* is the number of explanatory variables. The second test examines the hypothesis of the absence of autocorrelation in the error term. The presence of first-order autocorrelation in the differentiated residuals does not imply that the estimates are inconsistent. On the other hand, the presence of second-order autocorrelation implies that the estimates are inconsistent. For this reason, we apply the two tests defined by Arellano and Bond (1991) to verify the validity of the null hypothesis of first-order autocorrelation in the residuals (AR1) and the absence of second-order autocorrelation in the errors of the first-difference equation (AR2).

Equation (1) is therefore estimated using the two-stage GMM estimator with Windmeijer-corrected standard errors, including both lagged differences and levels of explanatory variables as instruments.

4. Data and Descriptive Statistics

This section successively presents the data sources and descriptive statistics for the model variables.

4.1. Data Sources

The initial sample is made up of 128 commercial banks in the WAEMU. Some banks were withdrawn for reasons of license withdrawal, series continuity or mergers & acquisitions, reducing the sample to 72 banks over the period 2013-2020, i.e. a panel of 576 observations. The data comes from the annual financial statements published by these banks on the official BCEAO website (2013-2020). Macroeconomic and institutional data are respectively extracted from the World Bank database (WDI, 2022) and (WGI, 2022). Table 1 describes the variables.

Table 1. Summary of variables, expected signs, and data sources

Variables	**Description**	**Sources**	**Expected signs**
Stability index (ZS)	$ZSCORE = \frac{(ROA + E/A)}{\sigma(ROA)}$	BCEAO	+
Banking concentration ratio ($CR3$)	$CR3 = \sum_{i=1}^{3} s_i$	BCEAO	+/-
The Herfindahl-Hirschman index(IHH)	$IHH = \sum_{i=1}^{n} s_i^2$	BCEAO	+ /-
Bank size ($SIZE$)	$SIZE = Ln(Total\ bank\ assets)$	BCEAO	+/-
Liquidity ratio (LIQ)	$LIQ = \frac{Cash + current\ deposit}{Total\ assets} * 100$	BCEAO	+
Bank loans ($LOANS$)	$LOANS = \frac{Customer\ receivables}{Total\ Assets} * 100$	BCEAO	+/-
Provisions ($PROVTA$)	$PROVTA = \frac{Provisions}{Total\ Assets} * 100$	BCEAO	-
GDP growth rate (TCPIB)	Relative percentage change in real GDP	WDI	+/-
Inflation rate ($INFL$)	Relative percentage change in the consumer price index.	WDI	+/-
Political stability (PS)	It ranges from around -2.5 (low) to 2.5 (high) governance performance.	WGI	+
Origin of the bank (ETR)	The value is 1 if the bank's head office is outside the WAEMU, and 0 otherwise.		-

Source: Authors, based on economic literature review

4.2. Descriptive Statistics

Descriptive statistics for all variables are given in Table 2. The value of the ZSCORE index ranges from 1 to 117.881, with a mean value of 27.984. The substantial variation in the ZSCORE index indicates that bank stability varies significantly across the sample of WAEMU countries. The bank concentration ratio stands at 60.935%. The Herfindahl-Hirschman index (between 1,000 and 2,000) indicates a moderately concentrated banking sector.

Table 2. Descriptive statistics for variables

Variables	**Obs.**	**Mean**	**Median**	**Q25**	**Q75**	**Standard deviation**	**Min**	**Max**
ZSCORE	576	27.984	22.023	8.706	41.845	23.546	1	117.881
CR3	576	60.935	56.047	49.356	72.766	16.281	41.943	100
IHH	576	1542.954	1246.603	1121.978	1614.930	803.209	957.652	5967.468
SIZE	576	-0.340	-0.291	-0.997	0.412	0.886	-2.704	1.493
LIQ	576	8.746	6.455	4.300	10.083	8.089	1.047	58.384
LOANS	576	54.256	55.134	46.215	63.313	12.927	16.352	91.243
PROVTA	576	0.610	0.382	0.135	0.736	0.793	0	8.718
TCPIB	64	5.456	5.941	4.392	6.865	2.273	-2.400	10.760
INFL	64	0.700	0.710	0.135	1.758	1.348	-3.233	3.022
PS	64	-0.867	-0.907	-1.265	-0.218	0.633	-2.201	0.301
ORIGINE	576	0.715	1	0	1	0.451	0	1

Source: Authors, based on data from BCEAO (2013- 2020), WDI (2022) and WGI (2022).

The logarithm of total bank assets averages -0.340, although the median value of the logarithm of total assets is -0.291, indicating a negatively skewed distribution. The banks in the sample hold an average of 8.746% cash about their banking assets, although the standard deviation value is 8.089, indicating that our sample contains very low-liquidity banks. Average loans were 54.256, indicating that lending is the main activity of WAEMU banks. The average provisioning of 0.610 is very low, meaning that WAEMU banks do not make many provisions. The real GDP growth rate varies from -2.400 to 10.760, indicating diversity in the level of economic development of the region's countries. The low inflation rate (0.700%) is explained by the price stability policy consistently pursued by the BCEAO. In addition, the political stability index has an average of -0.867, meaning that WAEMU countries are regularly confronted with socio-political crises. The dummy variable ORIGIN indicates that around two-thirds of our sample banks are foreign-owned.

Table 3. Person's correlation matrix between variables

	CR3	IHH	SIZE	LIQ	LOANS	PROVTA	TCPIB	INFL	PS
CR3	1.000								
IHH	0.630*	1.000							
SIZE	-0.184*	-0.319*	1.000						
LIQ	-0.105*	0.166*	-0.181*	1.000					
LOANS	-0.129*	-0.191*	-0.013	-0.273*	1.000				
PROVTA	0.047	0.053	-0.064	0.090*	0.105	1.000			
TCPIB	-0.159*	-0.233*	0.069*	0.053	0.037	0.025	1.000		
INFL	-0.022	0.023	-0.052	0.011	-0.031	0.024	-0.030	1.000	
PS	0.033	0.203*	0.036	0.001	-0.079*	-0.076*	0.077*	0.108*	1.000

Note: The * sign represents the correlation between variables at the 10% threshold.
Source: Authors, based on data from BCEAO (2013- 2019), WDI (2022) and WGI (2022).

The results of the correlation matrix, presented in Table 3, indicate a low correlation between the explanatory variables. Of all these explanatory variables, the pair concentration ratio (CR3) and Herfindahl-Hirschman index (HHI) present the highest correlation coefficient (0.335). Consequently, the impact of multicollinearity is not significant, and all the explanatory variables in the model can be retained for analysis.

5. Empirical Results

The results in Table 4 show that the lagged value of the inverse of ZSCORE has a significant effect at the 1% threshold, indicating that banking risk seems to persist, to some extent, over time. On the other hand, the coefficient of the CR3 variable is positive for the linear term but negative for the quadratic term. Both coefficients are statistically significant. The inflection point of the quadratic function is 83%. This implies a significant non-linear inverted-U relationship between banking market concentration and risk. This result is particularly interesting in that it reconciles the two strands of the literature and in particular the franchise value and risk-shifting

paradigms (Berger et al., 2009; Martinez-Miera and Repullo, 2010). The authors show that an increase in market power leads to an increase in the risk of bank portfolios, which could confirm the risk-shifting paradigm and the competition-stability thesis. However, the overall risk of failure borne by a bank does decrease with increasing market power. In this case, banks would hold a larger share of capital, increasing their capacity to absorb losses.

Table 4. Results of the effect of bank concentration ratios on banking risk in the WAEMU zone

ZS	CR3	$CR3^2$	IHH	IHH^2
ZS_{t-1}	0.203*** (0.009)	0.206*** (0.010)	0.209*** (0.011)	0.199*** (0.010)
CR3	0.027*** (0.006)	0.159** (0.064)	-	-
$CR3^2$	-	-0.096** (0.047)	-	-
IHH	-	-	0.128 (0.128)	0.809** (0.394)
IHH^2	-	-	-	-0.757** (0.372)
SIZE	0.152*** (0.012)	0.151*** (0.012)	0.150*** (0.012)	0.142*** (0.014)
LIQ	-0,003*** ($2{,}2\times10^{-4}$)	-0.003*** (2.3×10^{-4})	-0.003*** (2.2×10^{-4})	-0.003*** (2.5×10^{-4})
LOANS	-0,002*** ($1{,}0\times10^{-4}$)	-0.002*** (1.0×10^{-4})	-0.002*** (1.4×10^{-4})	-0.002*** (1.3×10^{-4})
PROVTA	-0,014** (0,001)	-0.014*** (0.001)	-0.014*** (0.001)	-0.014*** (0.002)
TCPIB	-0,007*** ($6{,}7\times10^{-4}$)	-0.007 (6.7×10^{-4})	-0.006*** (6.2×10^{-4})	-0.007*** (7.0×10^{-4})
INFL	-0,001** ($4{,}9\times10^{-4}$)	-0.001** (4.6×10^{-4})	-0.001*** (4.4×10^{-4})	-0.001** (5.6×10^{-4})
PS	0,020*** (0,006)	0.021*** (0.006)	0.024*** (0.006)	0.030*** (0.006)
ETR	-0,528*** (0,070)	-0.509*** (0.068)	0.538*** (0.074)	-0.604*** (0.076)
Const.	0,983*** (0,050)	0.992*** (0.053)	0.971*** (0.051)	0.961*** (0.074)
Observations	504	504	504	504
Number of banks	72	72	72	72
Test de Sargan-Hansen p-value	1.000	1.000	1.000	1.000
Arelanno-Bond AR[1] p-value	0.017	0.017	0.015	0.017
Arelanno-Bond AR[2] p-value	0.842	0.836	0.825	0.851

Note: Numbers in brackets are standard errors. *** (** and *) indicate coefficient significance at 99% confidence level (95% and 90%).
Source: Authors, based on estimation results. Data from balance sheets and income statements of WAEMU banks and financial institutions, 2013 to 2020.

In terms of control variables, bank size is associated with higher risk. Large banks may be engaged in riskier activities if they believe they are "too big to fail" and would be bailed out by the government when they fall into crisis (Afonso *et al*., 2014).

This result is consistent with that of Anginer and Demirgüc-Kunt (2014), who find that concentrated sectors containing a few large banks impose considerable

systemic risk. Unsurprisingly, a high level of liquidity reduces banking risk. The 2007-2008 financial crisis proved that financial institutions are generally very sensitive to liquidity risk. This result is in line with Aglietta (1998), who shows that doubts about liquidity destroy the confidence on which the structure of financial commitments is based, and lead to contagion. As with liquidity, the negative impact of lending on bank risk is hardly surprising. This is because, as a result of banking intermediation, lending is the activity most closely controlled by the bank. This expertise enables them to minimize the risk of moral hazard and adverse selection, which are the main causes of the rise in non-performing loans. In addition, loan diversification enables the bank to manage risk more effectively. Specifically, banks in the WAEMU zone are very cautious, to the extent that they lend to creditworthy, low-risk customers. This result is in line with that of Dannon and Lobez (2014).

Provisions for risks have a significant negative impact on banking risk. This can be explained by the fact that banks use provisions for bad debts to be able to cover losses arising from the default of their borrowers, or the inability of borrowers to repay principal and/or interest. In this case, the probability of future loss is measurable. As a result, it is in the interest of supervisory authorities to develop accounting methods that provide better protection against the risks incurred, notably by setting aside provisions before they arise.

Economic growth and inflation are both negatively associated with bank risk. In line with Saidane *et al* (2021), these results indicate that the characteristics of the country in which banks operate play a role in their risk of failure. The negative effect of economic growth on bank risk indicates not only that banks choose the least risky assets during periods of economic growth, but also that improved incomes increase the ability of economic agents to honor their commitments (Jokipii and Milne, 2011; Houston *et al*. 2010). Based on the fixed exchange rate system, BCEAO's monetary policy is designed to control inflation, which reflects macroeconomic instability and increases the accumulation of risks. But low inflation means that the economy is stagnant and wages can fall, making banks more cautious about granting credit.

The political stability measure admits a positive and significant coefficient. This result, although counter-intuitive, is in line with the work of Saidane *et al* (2021), who believe that political stability associated with an increase in credit activity can lead to an increase in the level of default risk. Here, the authors put forward the "paradox of tranquility" to justify their result (Minsky, 1986). Finally, we control the foreign status of banks. The dummy variable "ORIGIN" takes the value 1 if the bank's head office is outside the WAEMU and 0 otherwise. The results indicate that foreign banks take less risk than local banks. This may be explained by the fact that foreign banks tend to follow long-term strategies and thus contribute to the stabilization of the sector. They are less sensitive to economic conditions in the host country than local banks. What's more, they benefit from the support of their parent company, and thus maintain their

business in times of crisis in the host country (de Haas and Van Lelyveld, 2006). What's more, they have access to better banking technology (Haselmann, 2006), making them more effective at managing and controlling risk than their local counterparts.

6. Concluding Remarks

The objective of this article was to analyze the effects of banking market power on risk in the WAEMU space. We use a dataset of 72 WAEMU banks from 2013 to 2020. Methodologically, the study is based on Blundell and Bond's (1998) system GMM estimator. This estimator has the advantage of combining first-difference equations with level equations, in which the variables are instrumented by their first differences. Two major lessons can be drawn from these results. The first is that there is a "U-inverted" relationship between market power and bank risk. This means that bank market power initially increases bank risk, but this relationship reverses after a certain threshold (83%). Most African banks have been restructured in recent years. Bank restructuring has generally been justified by the gradual opening up of the sector to competition and the need to control production costs in the face of the prospect of free banking services and stiffer competition. The restructuring that has led to bank concentration has thus favored the economic stability of African banks. Monetary authorities would do well to encourage mergers and acquisitions and bank concentration to maintain a stable banking system. Three types of possible savings can be put forward: economies of scale linked to the enlargement of the market size, economies of variety induced by the diversity of the range of products offered and, finally, lower costs linked to improved productive efficiency (Jeffers and Oheix, 2003).

The second finding is that bank size is associated with higher risk. With such a result, the argument of the existence of economies of scale in transaction costs introduced by Diamond (1984) or Ramakrishnan and Thakor (1986), is not valid. The existence of financial intermediaries would be justified by the savings achieved in resolving informational asymmetries by delegating borrower control to a financial intermediary. In this study, the positive link between size and risk is not incompatible with the existence of size-related benefits but stems from the banks' institutional environment. Excessive risk-taking is the result of explicit or implicit public protection mechanisms linked to deposit insurance and the "too big to fail" doctrine. Monetary authorities need to keep a close eye on the activities of large banks, as they can expose the banking system to dangerous risks in the event of a crisis.

Overall, our results are of interest to government agencies charged with regulating and overseeing competition and stability in the WAEMU banking sector. Given the evidence of a non-linear relationship between banking competition (concentration) and stability (instability), policies must be implemented to achieve an appropriate level of competition, as "too little" or "too much" competition can lead to greater banking instability.

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