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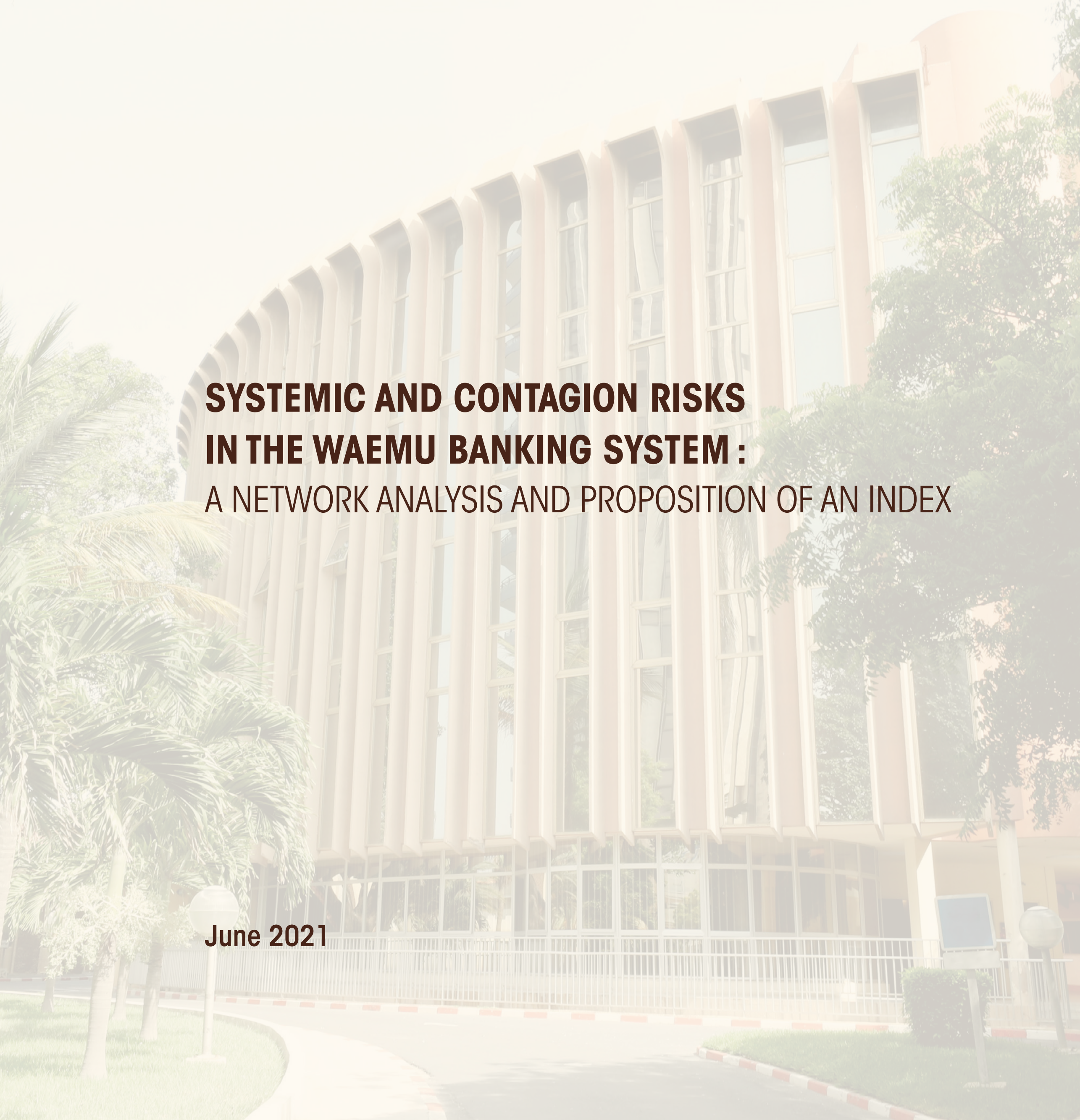

# SYSTEMIC AND CONTAGION RISKS IN THE WAEMU BANKING SYSTEM : A NETWORK ANALYSIS AND PROPOSITION OF AN INDEX

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## Preamble

The West African Center for Banking Studies and Training (COFEB) is a structure of the Central Bank of West African States (BCEAO) in charge of capacity building activities, economic and financial research. Since November 2019, the highest authorities of the Central Bank have decided to transform the regional Center and expand its missions by structuring it around three (3) Departments, namely the Department in charge of Education and Training Programs, the Research and Partnerships Department and the Department in charge of Administrative Administrative Affairs and Communication, all under the responsibility of a General Manager.

The vision of the BCEAO authorities, through this institutional transformation, is to make COFEB a center of excellence of international dimension in the field of training and research. Like all central banks, BCEAO must play a leading role in the process of generating knowledge and disseminating it to the general public and policy makers.This contributes to the transparency process recommended by international standards. In addition, as an economic and financial advisor of the West African Economic and Monetary Union (WAEMU) member States, it must inform and provide useful information to the national Authorities on the new challenges.

In this context, several technical studies, based on quantitative methods, are published each year on various topics of great interest to the economies of WAEMU. To disseminate and to share the main contents and lessons of these technical studies, we have deemed useful to create a new publication called «*COFEB ABrégés*».

In this series, the results of the research work are synthesized and translated into a language accessible to all. Finally, «Les ABrégés du COFEB» is intended to contribute to the sharing of the results of studies and research conducted within the BCEAO, with a view to reaching the widest audience and to enlighten political decision-makers on certain economic and financial issues.

**Ousmane SAMBA MAMADOU**,
Director General of COFEB

## About the theme of the study

*This first issue of the series «COFEB ABrégés» refers to the Study and Research Document (DER) N°COFEB /DER/2020/01, written by Vigninou GAMMADIGBE, in December 2020, on the theme « **Systemic and Contagion Risks in the WAEMU Banking System : A Network Analysis and Proposition of an Index** ».*

Financial stability is one of the major concerns of the Authorities of WAEMU. To address this issue, the BCEAO established a macroprudential supervision framework based on Financial Soundness Indicators (FSI), on stress tests (STs), and the identification and monitoring of Systemically Important Banking Institutions (SIBs). The research initiated by Mr. GAMMADIGBE completes this toolbox with two other instruments allowing to evaluate the fragility, contagiousness and vulnerability of credit institutions in the Economic Union. The methodology is based on a network analysis model of the Systemic Risk and Contagion (SRC) and a Systemic Risk and Contagion Index (SRCI).

The study seeks to identify the interconnection mechanisms between banks within the system and, on this basis, to simulate the contagion effects that could occur in the event of the failure of one of the banks.

The results shows that the size of a bank (market share) is less important than its interconnections in assessing its systemic character. They also highlight the importance of capital and bank liquidity in the liquidity in the resilience mechanism of banks to systemic risk.

**Ndèye Amy NGOM SECK**,
Director of Research and Partnerships

## Introduction

The study entitled "Systemic and Contagion Risks in the WAEMU Banking System: A Network Analysis and Proposition of an Index" (Risque systémique et de contagion dans le système bancaire de l'UEMOA : analyse en réseau et proposition d'un indice)[1] was conducted in December 2020, to help address the issue of financial stability, which is a key concern for the Authorities of WAEMU. It consolidates BCEAO's toolbox with the addition of two new instruments: a network analysis model of risk and contagion in the Union, and a systemic risk and contagion index (SRCI) that measures the fragility, contagiousness and vulnerability of credit institutions.

The results of the study, on a sample covering the period from 2007 to 2019, highlighted the heterogeneity of the banking ecosystem in terms of its soundness, due to the presence of vulnerable entities that pose a serious risk of generalized crisis in the Union. The study suggests an enhancement of the supervision of these institutions, urging the supervisory authority to adopt a series of macroprudential measures to that end.

## Interest and importance of the study for WAMU

The interest of this study is threefold:

First, the study relates to the phenomenon of contagious crises observed in recent years. This phenomenon revealed the fact that a solvency issue affecting a single banking entity can spread to other similar structures located either in the same geographic area or in a more distant environment. Indeed, the nature of the banking system is such that the failure of one bank can lead to the failure of others due to the domino effect caused by interlinking mutual relationships between the banks. This was the phenomenon underlying the subprime crisis that took place in 2008, following the collapse of the Lehman Brothers investment bank in the United States. During the banking system crisis in WAMU, which lasted from 1980 to 1995, contagion led to the failure of nearly 40% of the banks in the Union. The degree of interdependence depends both on the number of banks and on the volume or importance of their transactions, taken individually or across the banking system as a whole.

Second, the focus is on the existence of a banking union within WAEMU: this situation means that systemic risk must be considered from a regional perspective with a banking sector involving eight (8) countries. In addition, the number of entities in the banking system increased by 31.9%, from 97 to 128 banks between 2007 and 2019. Furthermore, the Union's banking landscape is changing, with a growing number of cross-border banks having strategic positions in the distribution of resources on the interbank market. However, the growing integration of the Union's banking market could also mean an increased risk of contagion in the banking system, if the institutions in the network are not sufficiently robust. As at December 31, 2007, interbank exposures ranged between 0.025 billion and 10 billion CFA francs. These figures rose to 0.3 billion and 33 billion CFA francs as at December 31, 2019.

Third, previous studies on this topic have focused on the situation in developed countries. Studies focusing on the case of WAMU countries have been limited to the design of early warning, bank stress-test and systemic risk indices using a probabilistic approach, which fails to take into account the vulnerability induced by the interconnection of banks, contagion effects and common exposures. Thus, the present study fills the gap in the empirical studies on WAMU banking system.

1 - Research Study/Document No. COFEB/DER/2020/01, by Mr. Vigninou Gammadigbe, Researcher at the Department of Research and Partnerships

Of the above, conducting a study on systemic risk and contagion risk in WAMU is of the utmost importance. The approach used by this study sheds more light on these types of risks and on how they can be effectively controlled.

### Contributions of the study

This study differs from previous studies on similar topics due to its methodological approach.

Taking advantage of recent advances in data analysis, including network analysis, the present study attempts to grasp the phenomenon of systemic risk contagion by considering the network and vulnerability characteristics of each bank. In other words, it assesses the interdependency and the potential systemic impacts in the event that one entity in the network runs into difficulties. Then, It is possible to derive relevant indicators and a systemic risk and contagion index from the matrix of bilateral banking exposures computed for WAMU.

Finally, the findings of this research allows, on the one hand, to assess the degree of systemic risk and contagion within the Union and, on the other hand, to implement "firewall" type measures, with a view to containing the spread of shocks in the event of a crisis in the banking system.

The methodology used is comprised of two distinct parts. The first part is based on a cross-sectional approach to the analysis of systemic risk and contagion. The second part deals with the construction of the index.

The first part proposes a network model of the interconnections between banks, in an attempt to estimate the impact of the failure of a single bank in the Union on the stability of the banking system of the Union, the number of banks that would be affected by the difficulties of a single bank occupying a strategic position within the banking network, and the costs in terms of capital for the banking system of the Union if a single bank were to fail, in light of the bilateral interbank exposures. In order to study the propagation of shocks within the banking sector through interbank exposures, two types of shocks were simulated: (i) a credit shock and (ii) a credit and liquidity shock on the balance sheet of a single bank.

The second part constructs a synthetic index to capture systemic risk and contagion risk for each periodic simulation, using a cross-sectional approach. This index is the Systemic Risk and Contagion Index (SRCI). It provides a dynamic risk analysis, specifying its systemic impact for each banking institution and its ultimate influence on the fragility of the banking system. For this purpose, the "systemicity" consists of three processes: contagiousness, vulnerability, and fragility.

A bank's contagiousness represents the average loss experienced by other entities in the system when it has trouble. Conversely, the vulnerability index shows the average loss, in terms of assets, suffered by an individual bank in the system when other banks experience adverse crises. As for the fragility of a banking institution, it takes into account the solvency, liquidity, profitability and portfolio quality of the bank in the absence of any shock.

### Key findings of the study and lessons learned

A graph illustrating the ratio of total equity to total assets, at the macroeconomic and microeconomic levels, shows a significant gap in terms of the soundness of the banks in the Union.

At the macroeconomic level, Niger, Senegal and Burkina Faso were the most highly capitalized banking centers as of December 31, 2019, while Togo was the least capitalized as of the same date. It should be recalled that Togo was on par with the former group roughly 15 years earlier. Over the same period, the Guinea-Bissau banking center deteriorated significantly, dropping from a level of capitalization in 2007 that was higher than that of the most capitalized banking centers on December 31, 2019, to a level of capitalization that was just slightly higher than Togo's on that date.

The microeconomic heterogeneity of bank capitalization highlights the presence of both strong and very weak banks in the network, which carry contagion risks. In addition, the graphs suggest an increase in the number of banks with negative capital and an increase in the divergence of bank capitalization at the individual level.

Interconnections play a significant role in bank failures. The analysis of the Systemic Risk and Contagion Index (SRCI) shows that, as the average number of interconnections per bank rise, so does their systemic risk. This finding is amplified when liquidity problems are taken into account in the model, thus confirming the observations made during the crises, when issues of confidence led some banks to cut off financing to others.

Furthermore, the findings of the network analysis and the calculation of the index show that the Union's banking system is not homogeneous in terms of the vulnerability and contagiousness of its banking centers. The analysis identifies banks that are likely to trigger financial instability through a phenomenon of contagion.

Four banks operating in four different countries could experience difficulties following the failure of a specific bank in the network  and consequently create a banking panic and a run on deposits in the four banking centres affected. The most vulnerable links in the system are the undercapitalized banks, particularly those with negative capital.

The study also reveals that the number of interconnections a bank has in the network is more significant in assessing its systemicity than its size. Thus, cross-border banks play a non-negligible role in the propagation of shocks from one banking center to another.

Finally, using a dynamic approach, the study identifies the banking institutions in the zone whose collapse could trigger a chain of bank failures in the Union and impact several banking centers. It also shows which banks are the most vulnerable, in addition to the systemically important banking institutions (SIBs) identified during the implementation of the new prudential framework under the Basel II and III standards in WAMU.

### The main recommendations of the study

To contain the risk of liquidity default, the intervention of the monetary authorities could consist of facilitating bailouts of suspicious banks by encouraging their orientation towards other sources of refinancing that are less costly in terms of capital. It could also involve injections of liquidity, or lowering of key interest rates. The aim is to direct weak banks to the Central Bank's windows, thereby preventing them from calling on other banks and helping reduce interconnections with such banks, thereby minimizing factors that could increase risk.

With regard to the situation of undercapitalized banks or banks with negative capital, which form the weak link in the Union's banking system in terms of vulnerability and contagiousness, the study suggests focusing specifically on their levels of liquidity, their interbank exposures and their significant commitments to the sectors most exposed to exogenous shocks. The study also recommends implementing a medium-term strategy to restore those banks' levels of capitalization in order to contain the risk of financial instability in the region.

Given the importance of the density of relationships between banks in assessing systemicity, interconnections should be taken into account in the definition of systemically important banking institutions (SIBs) in the WAEMU. Thus, the average number of interconnections of a bank over an annual period, calculated over sub-annual periods, could serve as a criterion for identification. In addition, higher weights should be given to the criteria of interconnection and cross-border activity than to bank size. On this basis, the results of the study can be used to supplement the methodology for identifying SIBs.

Finally, as a preventive measure, SIBs could be required to develop recovery plans outlining their strategies for dealing with different adverse shock scenarios and the actions they would take in the event of a failure of significant counterparts, such as large banks and companies that are major consumers of credit.

In conclusion, this study highlights the risks that could lead the WAEMU zone into a major and widespread banking crisis, given the rapid growth in the number of banking institutions and their interrelationships.

These risks can be controlled through prevention based on tools and actions taken with respect to credit institutions whose fragility, vulnerability and contagiousness have been identified..

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