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Economic resilience under COVID-19 in the CEMAC zone: Are procyclical adjustments of capital requirements necessary?

By Alim BELEK [a] Djimoudjiel DJEKONBE [b†] & Anatole Toinar MOGOTA [c]

Abstract. This paper analyzes the effects of procyclical regulatory capital adjustments on the ability of CEMAC economies to recover from the COVID-19. To achieve the objective, it uses quarterly data from 2005 to 2020 and Generalized Least Squares estimators as a technique. The results obtained show that the severity of the COVID-19 significantly impacted the economies of the sub-region and their ability to be resilient. Further, the results are robust regardless of the economic resilience indicator considered. Pro-cyclical capital adjustments in the pandemic context have a positive impact on resilience, thereby reducing exposure to economic vulnerabilities. It is advisable to promote countercyclical adjustments of regulatory capital to improve economic resilience. This is regardless the fact that under COVID-19, economic contractions may induce banks to adopt more pro-cyclical behavior in order to reduce the vulnerability of economies.
Keywords. Economic resilience; COVID 19; CEMAC; Capital requirements.
JEL. E51; G32; O11; C23; N20.

1. Introduction

The disruptions orchestrated by the COVID-19 pandemic in late 2019 plunged several economies into phases of unprecedented recessions. Declared in China, the leading economic partner of Sub-Saharan African (SSA) countries in terms of investment and trade, the pandemic has had a multidimensional global impact across economies worldwide. Appreciated as one of the least developed sub-regions in SSA, Economic Community of Central African States experienced a sharp contraction of its economy in the face of the pandemic. While the CEMAC economies recorded a positive variation in their average growth of 0.2% between 2018 and 2019 (largely supported by the favorable economic situations in Congo and Gabon with respective growth increases of 2.65% and 3.10% between), the forecast estimates during the pandemic are for an economic contraction of 1.6% by the end of 2020. Consisting mainly of oil exporting countries, the decline in

[a] Department of Economics, University of Bamenda, Cameroon.
. +16984760043 ✉. alim.belek@yahoo.fr
[b†] Higher Normal School of N'Djamena, Chad; CREDI (Center of Research in Economics and Inclusive Development), N'Djamena, Chad.
. +16984760043 ✉. djimoudjiel_djekonbe@yahoo.fr
[c] Department of Economics and Managment, University of Sarh, Chad.
. +16984760043 ✉. atmogota@gmail.com

growth in the CEMAC is explained primarily by the decline in demand for oil and the contraction of activity in the primary (-2%) and secondary (-0.1%) sectors. (BEAC, 2020). In order to build resilient economic capacity in the face of public debt, the IMF, in conjunction with the States, adopted internal resource mobilization programs that reduced the debt stock from 50.9% to 49% of GDP between 2019 and 2020.

The contraction of economic activities caused by the pandemic has led to the deterioration of the depth of the financial system[2] (on average equal to 2) and net equity (down 18% between mid-June 2019 and the end of 2020) of the banks, which were already weak in 2018. Theoretically, the erosion of capital can depend on the contraction of economic activity or even the resurgence of default risks during a recession (Hollander, 2015).

The crises of the 1980s led the Basel Committee on Banking Supervision (BCBS) to concede to banks the possibility of pro-cyclically adjusting their capital according to risks. In other words, it is a question of covering the risks of loans to customers (up to 8%) by the equity capital or regulatory capital. In reading the Basel I to III standards, the transitional empirical results that led to the various reforms, showed that phases of economic contraction (recession) are materialized by a strong procyclicality of banks' capital or regulatory capital (Pessarossi & Weill, 2015). Indeed, in periods of economic recession correlated with an upsurge in default risks, banks ration the supply of credit to supposedly riskier economic agents (Claessens *et al.*, 2009; Ouédraogo, 2014). In another sense, an inability of banks to be more resilient. However, banks are content to countercyclically release regulatory capital to meet credit demands from a profitability perspective in the expansion phase. In this way, the profitability perspective is in some ways reconciled with economic recovery or resilience in a global sense. In the same logic of guaranteeing long-term economic resilience, the contribution of the Basel standards consisted in promoting healthy banking competition, in short a financial and economic system less vulnerable to shocks. Apart from the etymological work of Holling (1973) on the notion of resilience oriented in the environmental domain, the current debate on resilience revolves around economic vulnerability, the index of resilience. Vulnerability is understood as adjustments in household incomes or economies to become less volatile in the face of exogenous shocks. Although Atkins *et. al.*, (2000) find that vulnerability does not allow for the conclusion of any resilience capacity of an entity. Indeed, vulnerability results from exposure to shocks that do not depend on the economy, whereas resilience is explained in terms of the capacity to withstand a shock. The work of Ngouhouo & Nchofoung (2021), inspired by the empirical reviews of Atkins *et al.*, (1998), has integrated into the consideration of economic resilience variants such as

[2] Depth of credit information index (0=low to 8=high). Depth of credit information index measures rules affecting the scope, accessibility, and quality of credit information available through public or private credit registries. The index ranges from 0 to 8, with higher values indicating the availability of more credit information, from either a public registry or a private bureau, to facilitate lending decisions.

macroeconomic stability, market efficiency and governance of sub-Saharan African countries.

In a context where economies have struggled to ensure their resilience in the face of the COVID-19 pandemic, the current question remains not only empirical in relation to target indicators but also to target economic and especially prudential policy instruments. While recent work by Angeon & Bates (2015) and Ngouhouo & Nchofoung (2021) introduces financial variants in the measurement of economic resilience, the prudential constraints of pro-cyclical adjustments to capital and provisions per se cannot be unaffected (Athanasoglou *et al.*, 2014; Huizinga & Laeven, 2019). In light of this, this article asks whether the procyclical adjustment standard for regulatory capital can still remain appropriate in terms of boosting economies during the pandemic period. In contrast to previous studies on economic resilience, this article makes two angular contributions. Complementing the work of Feindouno & Goujon (2016) and Ngouhouo & Nchofoung (2021), this paper integrates the prudential framework of regulatory capital adjustment into the composite index of economic resilience. On the other hand, it allows us to discuss the implications of banks' behaviors in promoting economic stability in a pandemic context explicated by COVID-19.

2. Eclectic review of literature

When the Basel accords were adopted in the 1980s, the issue of risk coverage by minimum capital requirements made it possible to reconcile the debate between the traditional models in industrial economics. Indeed, the controversy between the Structure Behaviour Performance (SBP) and Efficiency Structure (ES) models revolved around the behavior of banks in financing economies under a given market structure.

The proponents of the Structure-Behaviour-Performance model developed by Bain in 1953, start from the central hypothesis that the structure of the banking market dictates banking behavior, affecting to a certain extent the quality of banking services offered (loans and deposits) (VanHoose, 2017). Further, this hypothesis assumes a non-negligible effect of prudential regulation of regulatory capital to constrain the supply of credit and the welfare of consumers or customers. In the same dimension of the public choice theory, prudential regulation makes it possible to guarantee public welfare via the resilience of the banking system as a whole. Indeed, the capacity to absorb shocks constitutes a guarantee for the regulator and a signal of financial stability perceived by investors and shareholders. The empirical analysis justifying this hypothesis apprehends the structure of markets as banking concentration (Stern & Feldman, 2004; Ouedraogo, 2012) as a source of resilience seen by consumers and the regulator. The contribution of the ES model developed by Demsetz in 1973 showed that the structure of the banking market when it is concentrated can lead to a reduction in deposit rates and increase the level of bank profits for the sole case of those that are cost efficient. In other words, low bank

concentration does not support a direct improvement in consumer welfare via a situation of pure and perfect competition (Peltzman, 1977) . If the regulator's contribution is to promote low concentration so as to impact lending and borrowing rates, the sole consideration of the intrinsic cost management of banks may bias the regulator's objective. Bank cost adjustments in a situation of bank regulation based on recapitalization constraint can significantly affect the ability of some banks to being resilient and finance savings.

Economic resilience in the sense of Kim's work (2014) is based on an analysis of the capacity of financial institutions in general (via fiscal policy instruments, regulatory reserves, the key interest rate) to guarantee the stability of the economic system following a shock to the markets. At the level of microeconomic entities (such as banks), this resilience is similar to the constraints of adequate cyclical capitalization and the constitution of provisions for bad debt risks by banks (Saurina, 2011). Thus, on the one hand, we find the group of authors such as Mojon (1996), Couppey & Madiès (1997), Berenger & Teiletche (2003), Ayuso *et al.*, (2004) concluding that the most procyclical variant in the behavior of banks in the face of the financing of economies is regulatory capital or risk coverage capital. On the other hand, authors such as Huizinga & Laeven (2019) conclude given the current financial crises, the more procyclical nature of provisions to cover losses and bad debts. Whether it is provisions or capital, the macroeconomic framework of prudential regulation offers a guarantee of a resilient economic and financial system in times of crisis with pro-cyclical adjustment of banks' behavior. Indeed, banks may find themselves in a bind in meeting credit demands when they do not have the capital or capital adequacy to cover the risks. For the BCBS, the possibility of allowing banks to solidify their required capital with a surplus called the Tier 2 capital buffer can help to alleviate the financing constraints of economies. The issue of procyclicality received considerable attention in the G20 statements following the Lehman Brothers bankruptcy. The 2010 Basel Committee agreement (BCBS, 2010), known as Basel III, refers to the following four key objectives: to mitigate any cyclical overshooting of the minimum capital requirement, to promote more forward-looking provisions, to conserve capital to provide buffers that can be in a crisis, and to achieve the broader macro prudential objective of protecting the banking sector from periods of excessive credit growth. The third objective gave rise to the capital conservation buffer, and the fourth to the countercyclical capital buffer.

Although the capital conservation buffer is a reasonable proposal in the remedial provisions of the Federal Deposit Insurance Corporation Improvement Act of 1992 (FDCIA), Repullo & Saurina (2012) argue that the proposed capital conservation buffer could actually exacerbate the procyclical phenomenon. Regarding capital buffers, Marcucci & Quagliariello (2008) report that Italian banks reduced their loan supply during the period 1990-2004, due to the decline in their capital buffers, which had a negative impact on GDP, while the findings for UK banks are

similar (Francis & Osborne, 2009). Discussions about the pro-cyclical effects of bank capital requirements also figured prominently on the regulatory reform agenda after the financial crisis that began in 2007. The argument that these effects can occur is well known.

It is widely recognized that bank lending is cyclical, that is, banks respond to changes in economic activity. Specifically, during downturns, banks limit the supply of credit (Reza, 2011). At the same time, during these phases, the demand for new loans is low, because there are few alternative investment proposals with positive net present values. In other words, there is a simultaneous decline in the supply and demand for credit. In a severe crisis such as the one in 2007, the decline in loan supply, at least initially, is greater than the decline in credit demand. The perspectives proposed (Basel III) around 2010 after this subprime crisis have given rise to a new consideration of the concept of capital procyclicality: the capital buffer or capital cushion. Indeed, the capital buffer expresses the additional capital that is supposed to raise the level of capital in a countercyclical manner during a recession. Hollander (2015) concludes for the case of American banks that countercyclical capital adjustments make it possible to stabilize real shocks and limit financial instabilities.

3. Banking adjustments and economic dynamics in CEMAC: Stylized facts

While CEMAC countries were struggling to reconcile their growth trends with the financial depths of access to credit, the pandemic situation of COVID-19 has rather stalled the economic contraction due to restriction related to the confinement. Indeed, the drop in oil prices below $45 led to a decline in growth of 3% on average between 2015 and 2016. The recovery plans via the aid of the ADC (Development Assistance Committee) and IMF countries (an average of $236 million on average), which were more evident in Cameroon, Congo and Equatorial Guinea[3], helped to boost growth between 2017 and 2018. Thus, during this period, the average growth rate in CEMAC varied from 2.53% to reach a rate of -0.25% in 2018 against -2.29% in 2016. The contribution of banks in the process of economic recovery materialized by the adjustment of equity capital relative to the level of customer risks has experienced a real decline in late 2019. Under the auspices of the COVID-19 pandemic, the financial depth however below average (0 low and 8 high level) was maintained stable (score of 2.6) between 2019 and 2020 despite the drastic decline in equity capital in the CEMAC. Indeed, in conjunction with the decline in growth sustained by Equatorial Guinea and Gabon, which were more affected by the pandemic, equity fell by CFAF 1,181 million to CFAF 1,105 million in 2020 compared to CFAF 2,286 million in 2019.

The closure of trade barriers was one of the measures taken to reduce the spread of the pandemic, thereby reducing economic activities that

[3] Based on authors' calculations from WDI (2020) and IMF report. [Retrieved from].

led to recession. Due to their high dependence on international trade and the shocks suffered by their main partners, notably China and the European Union, CEMAC countries have also experienced a slowdown in their trade activities, especially in exports. The share of trade (exports + imports) in CEMAC has remained negatively stable despite the 0.5 point decline in the growth rate in 2019 against 2.4% in 2020 (UNDP, 2020). Equatorial Guinea and the Central African Republic are the two countries whose trade share fell by at least 2%.

4. Methodology

Despite the non-existence of a measure of resilience, it is conventionally granted under the assumption that the most resilient economies are the least vulnerable to economic shocks. Indeed, this validation came after Briguglio (2000) questioned the fact that, under certain constraints, small and supposedly fragile economies would be more resilient than large or developed economies. In reality, the resilience of small, but fragile, economies depend on the degree of control of external constraints on their examinations. Given this fact, studies such as Atkins *et al.*, (2000) have found it useful to distinguish resilience indicators from vulnerability indicators.

4.1. Resilience indices and resilience-vulnerability gaps for CEMAC countries

4.1.1. Selection of composite indicators of economic resilience/vulnerability

The economic literature does not actually discriminate in the choice of component indicators to calculate resilience/vulnerability indices. However, the basis for the choice of indicators is explained by the dimensions of my economic vulnerability. Indeed, Briguglio (2000) and Ngouhouo & Nchofoung (2021), retained five (5) and three (3) integral components of economic resilience respectively. These include *economic, social, environmental, governance and peripheral* components (Angeon & Bates, 2015)[4]. For the purposes of this study, we will retain four (4) components to move from the vulnerability index to the economic resilience index.

- *Economic components*

Unlike Atkins *et al.* (2000) who consider GDP volatility as a variant of economic resilience, most of the literature has confirmed the non-exhaustiveness of resilience components. In relation to the work of Angeon & Bates (2015), we will consider several categories of variables integral to the calculation of the economic component including public debt to GDP (Briguglio, 2016), the GDP deflator (inflation), the unemployment rate, oil rents to GDP, value added in the industrial, agricultural, manufacturing and service sectors as a percentage of GDP, and the degree of trade openness (Briguglio, 2000).

- *Institutional or political stability components*

[4] Voice and accountability, rule of law, political stability and absence of violence, government effectiveness, regulatory quality, and control of corruption.

Alesina *et al.*, (1989) combine political stability with institutional stability explained by unity in government and legislative support, using data from the International Country Risk Guide (ICRG) established by the PRS group. In the current context, the Country Policy and Institutional Assessment (CPIA) index is taken into account, whose values express the management of crime and impunity in a country as an institutional component. The index score varies between 1 and 6, expressing respectively a high and low level of the country's management quality on the socio-economic level.

- *Social components*

The literacy rate, education and health expenditure per capita, life expectancy and the Gini index constitute the group of social components of economic resilience. The choice of variables in this group is based on the availability of data on the one hand. On the other hand, they are chosen in order to remove ambiguity with respect to their conceptions in empirical interpretations (Angeon & Bates, 2015).

- *Peripheral components*

For the vast majority of works, we consider the existence of forces or variants supposedly exogenous such as transport costs, infrastructures, technology and the environment likely to have a significant impact on the resilient capacity of an economy. Thus, for the case of the peripheral components, we consider variables such as the number of internet users as a percentage of the population, CO2 emissions and renewable energy.

4.1.2. Economic resilience indices in terms of relative indicators

Based on the algorithm of Angeon & Bates (2015), Ngouhouo & Nchofoung (2021) constructed the economic resilience indices through the aggregated arithmetic means of the *j* components of resilience. On the other hand, the determination of the vulnerability index incorporates other types of components and indicators. The work of Angeon & Bates (2015) distinguished the categories of the integral components of resilience and vulnerability (see appendix for the selected indicators). The respective sub-indices of resilience (1) and vulnerability (2) are respectively given by the following relationships:

$$Ir_{ij,t} = \frac{1}{(\psi x^{r}{}_{ijk,t})} \sum_{j=1}^{n} x^{r}{}_{ijk,t} \quad (1)$$

and

$$Vul_{ij,t} = \frac{1}{(\psi x^{v}{}_{ijk,t})} \sum_{j=1}^{n} x^{v}{}_{ijk,t} \quad (2)$$

These indices are obtained upstream by the arithmetic mean of the observations of the *k* indicators belonging to the *j* components normalized by the differences between the maximums and the minimums at period *t*. Thus, the normalization is done by the formula:

$$X_{ik,t}^{r/v} = \frac{X_{ik,t} - X_k \min}{X_k \max - X_k \min} \quad (3)$$

With $X_{ik,t}^{r/v}$ the scale value of the vulnerability/resilience sub-index of country *i* by indicator *k*. X_k max *et* X_k min are respectively the maximum and minimum observations of the indicators of the *j* components of each country *i* considered at the period *t*.

From the above, the four (4) groups of components below will allow the determination of the vulnerability and economic resilience indices. From equations (1) and (2), the following relationships are derived:

$$Ir_{i,t} = \frac{1}{4}\sum_{j=1}^{4} Ir_{ij,t} \quad (4) \text{ et } Vul_{i,t} = \frac{1}{4}\sum_{j=1}^{4} Vul_{ij,t} \quad (5)$$

4.2. Resilience-vulnerability gaps

Apart from the consideration of GDP volatility by Atkins *et al.* (2000) as an indicator of economic vulnerability, the Commonwealth Vulnerability Index has established since 1992, its own indicators via some key variables. The work of Angeon & Bates (2015) helped explain the contribution of determination in the heterogeneity of exposure to exogenous shocks. Indeed, the latter have shown the conditions under which an economy can be resilient but vulnerable and vice versa. The equation highlighted is the following:

$$Ecart_{i,t} = Ir_{i,t} - Vul_{i,t} \quad (6)$$

4.3. Procyclical Regulatory Capital Adjustment Index

Hollander's (2015) approach considers from the work of Angelini *et al.* (2012), the taking of a macroprudential measure namely the leverage ratio given by the ratio of bank loans to capital[5]. The ratio allows banks to trade off cyclical readjustment of their capital to the economic situation (demand for loanable funds) and to be resilient following a given shock. Under Basel III, the procyclicality of capital is addressed by a countercyclical approach through the leverage ratio defined as follows:

$$\Omega_t = \overline{\Omega}^{(1-\rho_\Omega)} \Omega_{t-1}^{\rho_\Omega} \left(\frac{Y_t}{\overline{Y}}\right)^{-k_\Omega(1-\rho_\Omega)} e^{\alpha\Omega,t} \quad (7)$$

With $\alpha\Omega,t$ the targeted shock to the leverage ratio. Thus the conditions for bank capital procyclicality in the Hollander sense meet the following conditions:

[5] $\Omega_t = \frac{L_t}{CAP_t}$

$$\begin{cases} -k_{\Omega} < 0 \\ et \\ 1 < \rho_{\Omega} \leq 0 \end{cases} \quad (8)$$

Capital is only pro-cyclical in relation to a given indicator or variant. The sensitivity of the change in capital can have a significant effect on other aggregates or indicators and even on the business cycle (Saurina, 2011). This, in a way, influences economic growth (Duval & Vogel, 2008). In the dynamics of bank behaviour, the Basel accords conceive of the pro-cyclical adjustment of regulatory capital (or equity) as the proportion raised under the constraint of an increase in possible credit losses or risks. Several empirical works (Rabell *et al.*, 2005; Reza, 2011; De-Gregorio, 2012; Athanasoglou *et al.*, 2014) have shown the existence of high cyclicality of regulatory capital in economic expansion or recession phases. In a context of delayed transition from Basel I to III, an adjustment of regulatory capital coverage defined as follows emerges:

$$capr = \sigma\left[\frac{capital\_equity}{risk-weighted\ assets}\right] \quad (9) \quad (9)$$

4.4. Econometric model and estimation technique

It remains undeniable that variances in monetary (Rajan & Parulkar, 2008) and prudential or regulatory policy instruments of banks (Athanasoglou *et al.*, 2014; Huizinga & Laeven, 2019) influence the real sector of the economy (Wibowo, 2008). In light of this, this article asks whether the procyclical adjustment standard for regulatory capital can still remain appropriate in terms of boosting economies during the pandemic period. Given the existing dichotomy between resilience and economic vulnerability, it is important to analyse the effects on the intrinsic vulnerabilities of these economies. We will also take into account the gap approach in order to ensure the robustness of the effects of the dichotomy in the sense of Briguglio (2000). The general model can be specified as follows:

$$Y_{it} = X_{it} + Z_{it} + \varepsilon_{it} \quad (10) \quad (10)$$

With Y_{it} the group of economic resilience, vulnerability, and resilience-vulnerability gaps variable of country i at date t. The X_{it} variable of pro-cyclical adjustments of regulatory capital of banks in country i at date t. Zit is the group of control variables that can influence economic resilience. The ε_{it} is the error terms. Unlike the work of Atkins *et al.* (2000), which considered GDP volatility as an economic resilience variable, their study focused on a range of indicators that capture economic resilience through its vulnerability. Thus, the models to be estimated can be specified as follows:

$$Ir_{it} = \delta_0 + \delta_1 capr_{it} + \delta_2 covid_{it} + \delta_3 fdi_{it} + \delta_4 \text{cov}id * \text{lroe}_{it} + \delta_4 capr * \text{cov}id_{it} + \delta_5 Microfin * \text{cov}id_{it} + \delta_6 lMicrofin_{it} + \delta_7 lROA_{it} + \delta_8 lROE_{it} + \varepsilon_{1it} \quad (11)$$

$$Ecart_{it} = \lambda_0 + \lambda_1 capr_{it} + \lambda_2 covid_{it} + \lambda_3 fdi_{it} + \lambda_4 \text{cov}id * \text{lroe}_{it} + \lambda_4 capr * \text{cov}id_{it} + \lambda_5 Microfin * \text{cov}id_{it} + \lambda_6 lMicrofin_{it} + \lambda_7 lROA_{it} + \lambda_8 lROE_{it} + \varepsilon_{2it} \quad (12)$$

$Covid_t$ is a variable measuring the severity index of the COVID-19 pandemic in individual CEMAC countries. *FDI* and *Microfin* define respectively the proportion of foreign direct investment and the proportion of credit granted by microfinances in the GDP of each country in country *i* at the period *t* considered. *ROA* and *ROE* are respectively the levels of profitability of the assets and equity of the banks of the countries. In order to homogenize the data from the different databases, the variables were taken in logarithm.

The above theoretical conclusions have ruled out the non-exhaustiveness of the components of the economic resilience indicator. The range of elements used for this purpose suggests the possibility of the existence of endogeneity linked to the missing variables that can influence the resilience index and the vulnerability index. In addition, the dynamic process of economic resilience is likely to create unobservable heterogeneities. Thus, in order to estimate the above model, Generalized Least Squares (GLS) estimators will be used. This estimator will correct for autocorrelations of the residuals, which is a possible way of resolving the discussed endogeneity issues.

4.4. Data sources and descriptive statistics

This article uses a combination of several databases. Indeed, data on variables such as public debt, foreign direct investment, GDP, inflation, unemployment rate, and value added in the agricultural, industrial, manufacturing and service sectors, exports and imports, use of NICTs, CO2 emissions, consumption of renewable energies, education and health expenditure, life expectancy and the Gini index are taken from the WDI. In addition, the CPIA database was used to obtain data on the quality of governance of institutions. On the other hand, oil rents, equity, outstanding credits and credits to the economy are derived from the BEAC database. For COVID-19, Government Stringency Index (GSI) data measuring the monthly severity rate of the pandemic was used. Given the real time effects of the pandemic, the data used was quarterly from 2005 to 2020.

4.5. Descriptive statistics

The following table presents the descriptive statistics of the variables used in this study. On average the capital adequacy ratio is 2.67 points closer to the maximum value expressing the risk aversion of CEMAC banks. During the quarters in which the effect of the COVID-19 pandemic was observed, the average severity rate of the pandemic was 4 with a maximum of 4.5. The share of credit granted by microfinance institutions in GDP remains very low

with a negative logarithmic value of 5.6 points. This situation prevails for the other variables such as *FDI* and the resilience index whose averages are respectively around 3.11 and 0.99. The return on assets and equity have average estimated values of 0.65 and 2.82 points consecutively.

Table 1. *Descriptive statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
Capr	381	2.68716	0.562592	-0.310865	3.702312
Covid	20	3.971203	0.3906694	3.324316	4.46715
Credimin_Pib	337	-5.665695	1.542852	-11.1094	-3.480291
Fdi	365	-3.112375	1.419132	-7.891394	0.243285
Ir	384	-0.9920938	0.271213	-2.077917	-0.561657
Roa	372	0.6538836	0.573319	-2.13337	1.722822
Roe	372	2.823454	0.674816	-0.462035	4.032347

5. Results and interpretations

5.1. Main results

The Tables (2, 3 and 4) show the effects of the pro-cyclical capital adjustments and the severity of the COVID-19 pandemic on the economic resilience index. Given the weak direct linkages of the pandemic on the composite resilience indicator, the effects of the pandemic on transmission channels such as bank annuities (1), equity adjustments (2) and the share of microfinance credits in GDP were tested.

Figure 1 shows the correlation between capital adjustments in a context of rising bank risks and the economic resilience index. There is a negative correlation between the two variables. Procyclical increases in regulatory capital lead to a deterioration of the resilience index in CEMAC countries. However, it appears that the most resilient economies (Cameroon, Chad, Congo and Gabon) have countercyclical adjustments of their regulatory capital.

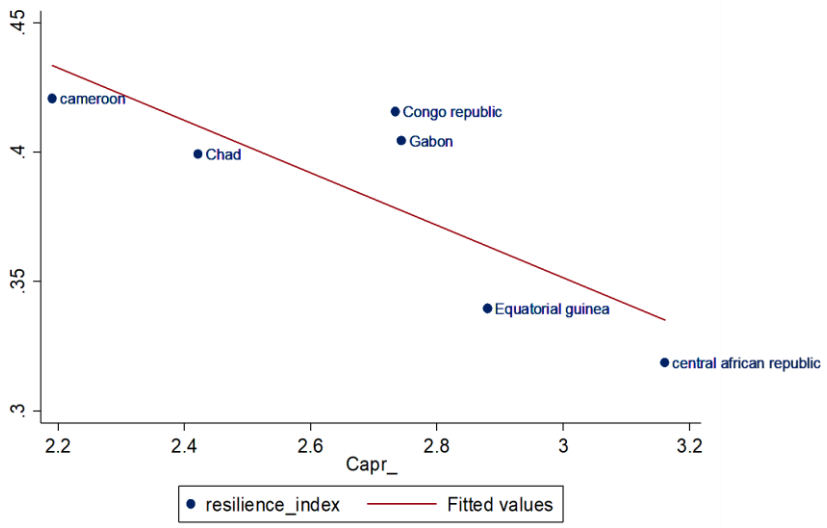

Figure 1. *Capital requirements and Resilience Index (see separated file)*

CEMAC countries, unlike other African countries or even sub-Saharan Africa, where the least affected until the end of 2020. The econometric results in the table below show that the pro-cyclical adjustments of equity capital constitute a loss of earnings for the economies. Indeed, despite the small (coefficient estimated at 0.009 points) effect of the increase in regulatory capital on the economic resilience index, the results remain significant at the 5% and 10% threshold. This state of affairs is explained by the excess liquidity of the CEMAC banking system, which in turn responds to the risk-averse behaviour of banks in the sub-region. The sign associated with the COVID-19 severity rate coefficient is not seem insignificant.

Table 2. *Effect of COVID-19 severity on the resilience index*

	Ir	Ir	Ir
Capr_	-0.0009	-0.0098**	-0.0090*
	(0.0044)	(0.0044)	(0.0042)
Covid	-0.0020**	-0.0027***	-0.0019**
	(0.0009)	(0.0007)	(0.0008)
Lcredimin_Pib	-0.0012	-0.0335**	0.0069
	(0.0144)	(0.0151)	(0.0295)
Lroa	0.0209	-0.0376	-0.0953
	(0.1392)	(0.1089)	(0.1094)
Lroe	-0.0973	-0.0150	0.0028
	(0.1280)	(0.1021)	(0.0972)
Covid*lroe	0.0002***	0.0001	0.0001*
	(0.0001)	(0.0001)	(0.0001)
Covid* capr_		0.0342***	0.0335***
		(0.0109)	(0.0103)
Covid*Microfin			-0.0857
			(0.0549)
Constant	0.4175	0.0118	0.1785
	(0.3888)	(0.3264)	(0.3264)
Quarterly	20	20	20
R-squared	0.7516	0.8637	0.8884

Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

For most countries, the pandemic has contributed to the slowdown of their economies. The CEMAC countries constitute the group of countries with low mortality rates due to COVID-19, which explains the low coefficient obtained. The 1 point increase in the pandemic severity rate contributed to reducing the resilience of CEMAC economies by at least 0.002 points on average. Regardless of the transmission channel considered, the effects remain significant at the 5% threshold at least. The economic contraction under the pandemic also affected the contribution of microfinance institutions to GDP. Indeed, the advent of the pandemic significantly altered the sources of funding for economies (IMF and World Bank Group loans and WHO grants). By extrapolating the conclusion of the UNDP report (2020) on the effects of the pandemic in Cameroon, the CEMAC economies were strongly exposed by the decline in export earnings.

For the same report, the containment strategy imposed by the different countries has affected the added values of the industrial (brewery) and

livestock sectors. According to the African Union report (2020), COVID-19 has affected the Moroccan and Egyptian economies through the revenues of the industrial sector and the transfer of migrants representing on average 6% to 4.4% of GDP.

Periods of economic recession are marked by strong pro-cyclical adjustments to capital given the assumed level of client risk. The effects of these adjustments on the financing of economies may also depend on the level of severity of the pandemic. The results table below shows that a high severity of COVID-19 leads to a positive effect on the resilience indicator via bank returns (0.0002 points) and pro-cyclical capital adjustments (0.034 points). Indeed, periods of economic contraction have stagnated bank profitability as a corollary to the excess liquidity of banks already observed in the sub-region. According to the IMF (2020), in order to limit the relative damage, it is important to ease monetary policy, provide adequate liquidity and meet the credit needs of SMEs.

Figure 2 below shows the relationship between the resilience/ vulnerability gap index and regulatory capital. Two cases explain the links between the resilience/vulnerability gap index and adjustments to capital or regulatory capital. High vulnerability or significant resilience supports the direction of the links between these variables. Despite this correlation, Table 3 shows the results of the more robust estimated empirical effects.

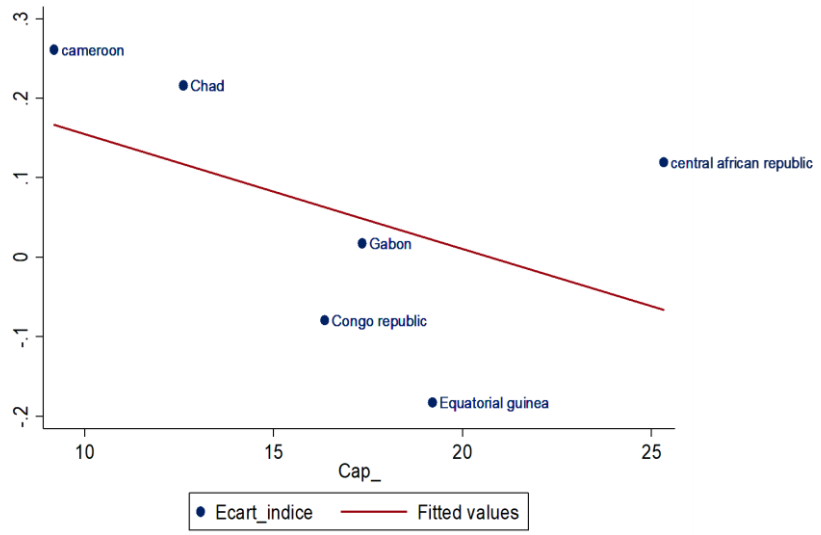

Figure 2. *Resilience/vulnerability index gap and regulatory capital (see separated file)*

In contrast to the previous result that pro-cyclical adjustments of regulatory capital (in the presence of non-negligible risks) negatively affect the resilience of economies, the case below shows opposite effects on the Gap index. This effect is significant at the 1% level regardless of the control of the effects under COVID-19. In addition to this variable, the results of the effects of pro-cyclical adjustments, bank yields and the share of microfinance credits

in the presence of an increasing variation in the severity of COVID-19 also show signs contrary to the previous case.

Overall, these opposite effects (and especially the negativity of the signs of the coefficients) are attributable to the strong economic vulnerability explained by their dependence on oil revenues and external demand of CEMAC countries. These countries are known to be vulnerable on average to external economic fluctuations and because of their institutional management (Ngouhouo & Nchofoung, 2021). Despite the aspect of economic vulnerability, the imposed containment has led to a stalemate in the situation (UNDP, 2020). Thus, a pro-cyclical increase in regulatory capital of 1 point positively affects the gap between the resilience and vulnerability of these economies by 0.24 points on average. In light of this result, and contrary to the conclusions of Ngouhouo & Nchofoung (2021), a pro-cyclical adjustment of regulatory capital can ensure a less vulnerable economy despite the constraints they mention.

Table 3. *Effect of COVID-19 severity on Resilience/vulnerability index gap*

	Ecart	Ecart	Ecart
Capr_	0.0224***	0.0273***	0.0275***
	(0.0031)	(0.0036)	(0.0037)
Covid	0.0013*	0.0017**	0.0019**
	(0.0006)	(0.0006)	(0.0007)
Lcredimin_Pib	-0.2624***	-0.2448***	-0.2322***
	(0.0102)’	(0.0123)	(0.0263)
Lroa	-1.1268***	-1.0947***	-1.1127***
	(0.0985)	(0.0888)	(0.0973)
Lroe	0.9221***	0.8770***	0.8826***
	(0.0906)	(0.0833)	(0.0864)
Covid*lroe	-0.0001*	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)
Covid* capr_		-0.0188*	-0.0190*
		(0.0089)	(0.0092)
Covid*Microfin			-0.0267
			(0.0488)
Constant	-3.1515***	-2.9291***	-2.8771***
	(0.2751)	(0.2662)	(0.2903)
Quarterly	20	20	20
R-squared	0.9944	0.9960	0.9961

Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5.2. Robustness of results

In order to test the robustness or sensitivity of the results of the effects of regulatory capital adjustments in the context of the severity of the COVID-19 pandemic, we used GDP as a measure of the resilience of economies in the sense of Atkins et al. The figure below confirms a priori the negative relationship between a procyclical variance of regulatory capital and GDP. The arbitrage of banks to ration credit constitutes a bottleneck to the financing of CEMAC economies.

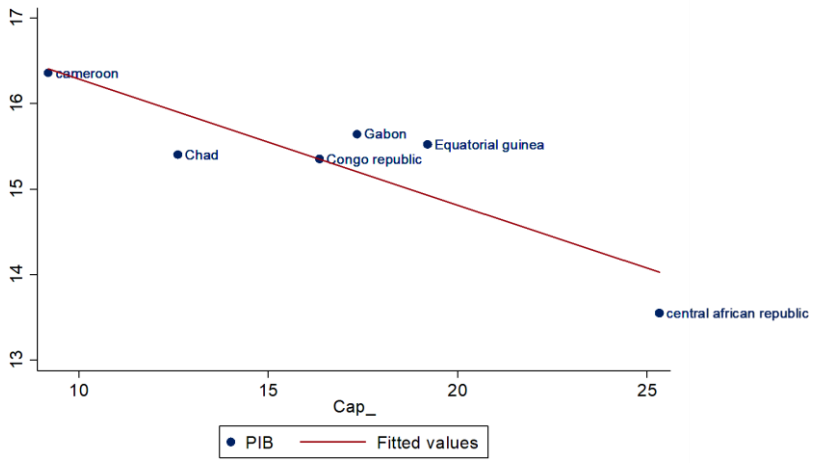

Figure 3. *Regulatory capital and GDP (see separated file)*

Three (3) cases of robust results are derived from the following analysis. These include the effects of bank regulatory capital, the effects of COVID-19 and its interaction with profitability and procyclical adjustments. Table 4 shows that despite the variable explaining economic resilience, pro-cyclical capital adjustments negatively affect the economy. The strong growth in bad debts, which explains the increase in equity capital to cover relative risks, is a loss of earnings for the financing of CEMAC economies. Worse, in a context of economic contraction manifested by the COVID-19 pandemic, the effects remain significant and more negative.

Table 4. *Effect of COVID-19 severity on GDP*

	(1)	(2)	(3)
Capr_	-0.1575***	-0.2065***	-0.2011***
	(0.0257)	(0.0288)	(0.0274)
Covid	-0.0085*	-0.0125***	-0.0073
	(0.0050)	(0.0046)	(0.0055)
Lcredimin_Pib	0.7487***	0.5708***	0.8287***
	(0.0841)	(0.0986)	(0.1931)
Lroa	2.1262***	1.8032**	1.4341**
	(0.8148)	(0.7110)	(0.7151)
Lroe	-2.3773***	-1.9232***	-1.8093***
	(0.7494)	(0.6666)	(0.6353)
Covid*lroe	0.0010***	0.0005	0.0006*
	(0.0003)	(0.0003)	(0.0003)
Covid*capr		0.1891***	0.1845***
		(0.0712)	(0.0674)
Covid*Microfin			-0.5476
			(0.3589)
Constant	26.3366***	24.0961***	25.1619***
	(2.2764)	(2.1311)	(2.1345)
Quarterly	20	20	20
Number of code	5	5	5

Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

A 1% increase in regulatory capital contracts the economy by at least 0.157 points; whereas this effect is less intense when considering the resilience index calculated earlier. Robust and significant results at the 1% threshold regardless of the control for the effects of interactions between COVID-19 and ROE and the procyclicality of regulatory capital. The effects of ROE and regulatory capital adjustment on GDP in the presence of COVID-19 severity are estimated at 0.0015 and 0.18 points respectively. Results robust to the 1% threshold and explained by the idleness of bank deposits due to the slowdown in financial activities or transactions and the structural excess liquidity of CEMAC banks (Mvondo, 2020). The difference in the magnitude of the effects of the COVID-19 pandemic on GDP and the economic resilience index when reading the coefficients obtained can be explained by the different variables involved in determining the index.

6. Conclusion

In the current era of the COVID-19 pandemic, the common language among economies revolves around their resiliencies and more specifically the identification of an adequate indicator based on relative criteria. In addition, there is no consensus on the integral variables in the determination of the resilience index since the work of the commonwealth. This paper analyses the effects of pro-cyclical adjustments of banks' regulatory capital in a pandemic context of COVID-19 on the resilience of CEMAC economies. The results are obtained on quarterly data from several sources. As a corollary to expectations, the results obtained indicated that the effect of the severity of the pandemic did indeed negatively affect the composite indicator of economic resilience. Given the vulnerability of the sub-region's economies and the risk posed to bank customers, the pro-cyclical increases ensure that the economy is just less vulnerable. These effects are robust when GDP is considered as the economic resilience variable. The results similarly showed that under the COVID-19 pandemic, bank profitability and equity instead increased as a result of lower credit demand due to the economic downturn.

Appendix

Components of the Economic Resilience Index

Components/indicators	Definition	Source	Type of indicator
Public debt	Level of public debt in relation to GDP or as %GDP	WDI	Resilience
Inflation	Change in consumer prices in % (GDP deflator)	WDI	Vulnerability
Foreign direct investment	Share of direct investment received from abroad (%GDP)	WDI	Resilience
Unemployment	Unemployment rate as % of labour force	WDI	Vulnerability
Oil rents	Oil rents as %GDP	BEAC/WDI	Resilience
Agricultural value added	Share of agricultural value added in %GDP	WDI	Resilience
Industrial value added	Share of industrial value added in %GDP	WDI	Resilience
Manufacturing value added	Share of manufacturing value added in %GDP	WDI	Resilience
Added value of services	Share of value added of the services sector in %GDP	WDI	Resilience
Degree of commercial openness	Degree of trade openness or trade flows	WDI	Resilience
Institutional quality	Average of the quality indices of the institutions	CPIA	Vulnerability
Literacy rate	Rate of access to education	WDI	Vulnerability
Education expenditure	Education expenditure as %GDP	WDI	Resilience
Health expenditures	Health expenditure as %GDP	WDI	Resilience
Life expectancy	Life expectancy at birth	WDI	Vulnerability
Gini index	Gini standard of living index	WDI	Vulnerability
NTIC	Internet users in %Population	WDI	Resilience
CO2	CO2 emission per capita	WDI	Vulnerability
Renewable energy	Renewable energy % energy used	WDI	Resilience

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