Does the development of the financial system influence the level of inflation? A critical survey

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Abstract

Purpose: The objective of this paper is to examine the impact of financial development on inflation in the Economic and Monetary Community of Central Africa.

Method: We use a system GMM as an empirical strategy, using data from the BEAC and WDI databases over the period 1996–2022.

Results: The main results of this study show that despite the low level of inflation observed in the Economic and Monetary Community of Central Africa, the credit risk associated with the provision of credit increases inflation. This increase in inflation reduces the performance of the financial sector.

Originality: The originality of this article lies in the fact that the central bank must consider financial development as a tool of prudential analysis, which makes it possible to increase the effectiveness of the fight against inflation while improving the performance of the financial sector. This study also shows that financial development is a determinant of inflation.

Keywords: Financial system, inflation, GMM system, performance, spillovers.

Codes JEL: E31, E37, E43, E44, E47

Le développement du système financier influence-t-il le niveau de l'inflation ? Une étude critique

Résumé

Objectif : L'objectif de cet article est d'examiner l'effet du développement financier sur l'inflation dans la Communauté Economique et Monétaire de l'Afrique centrale.

Méthodologie : Nous faisons recours à un GMM en système comme stratégie empirique, en se servant des données extraites des bases de la BEAC et de la WDI sur la période 1996-2022.

Résultats : Les principaux résultats de cette étude montrent que malgré le faible niveau d'inflation observé dans la Communauté Economique et Monétaire de l'Afrique centrale, le risque de crédit associé à l'activité d'offre de crédit augmente l'inflation. Cette augmentation de l'inflation réduit la performance du secteur financier. Cette étude montre également que le développement financier est un déterminant de l'inflation.

Originalité de l'article : L'originalité de cet article tient au fait que la banque centrale doit appréhender le développement financier comme un outil d'analyse prudentielle permettant d'accroître l'efficacité dans la lutte contre l'inflation tout en améliorant les performances du secteur financier.

Mots clés : Système financier, inflation, GMM en système, performance, effets de débordement.

Classification JEL : E31, E37, E43, E44, E47

1. **Introduction**

Recent experience with financial crises, beyond their intensity, has shown that the relationship between financial sector development and inflation is not obvious. The role of the financial sector highlighted the key role of financial sector development in the macroeconomic instability observed during the crisis period. As well, the echoes of a new concern about the relationship between financial sector development and inflation exposed the failure to anticipate the risk. Similarly, the crisis exposed the inability of central banks to anticipate the risk associated with the improvement in financial sector activity. Financial sector developments cannot mitigate unintended effects, despite the central banks' low inflation target as collective insurance against risk. Although the real question is whether inflation targeting can really counteract the perverse effects of financial sector development, economic theory has not really tested this part of the analysis. It does, however, point out that the need to develop the financial sector stems from an imbalance in the accounts of economic agents (Antonin et al., 2019). The persistence of this condition has allowed the financial intermediary to play a central role in economic activity, linking agents with financing capacity to those with financing needs. The ability of the financial intermediary to convert maturities has consolidated its central position. The peculiarity of this activity is that financial intermediaries have the capacity to dispose of short-term deposits and transform them into medium- and long-term loans.

In addition to this ability to convert maturities, the combination of intermediation and payment services gives financial intermediaries a clear advantage over other actors in the financial sector. Moreover, for Batayneh et al. (2021), this ability to connect actors with resources for financing needs has led to the development of financial intermediation activity as the hub of stimulating economic activity. While access to resources has been the main basis for authors to support this development of intermediation activity, the effect of the behaviour of financial intermediaries towards liquidity has attracted another group of authors to this literature. The interest in this area in the literature describing the impact of the development of the financial sector is that the growth of liquidity is essential for economic activity, but the problem that arises is that it is not easy to know whether this liquidity is not a source of instability (Foglia, 2022). Consequently, ensuring stability has become imperative for this part of the literature (Noumba & Enguene, 2022).

The question arises whether monetary stability, which is one of the main objectives of central banks (Scialom, 2010), is also an indicator of economic performance and is able to control the behaviour of financial intermediaries in terms of liquidity. This article proposes to advance the existing literature by conducting an empirical study considering the way inflation is affected by financial sector development, especially in the Economic and Monetary Community of Central Africa (EMCCA) countries, and also investigating whether inflation targeting can contain the unintended effects of financial sector development.

The EMCCA sub-region receives special attention for the following reason: being among the group of sub-Saharan African countries with the least developed financial system compared to others, it may be interesting to examine the nature of the relationship between this level of financial sector development and inflation targeting. Furthermore, looking for monetary convergence among member states, countries agree to share the same currency and have a central bank that follows a low inflation target. Therefore, it may be interesting to find out whether these factors play a role in the relationship between financial sector development and inflation. To carry out the empirical analysis, we work over the period 1996–2022 and use two panel methods: the fixed effects method and the generalized method of moments. The paper reviews stylized facts and literature, presents the research methodology, framework, results estimation, and interpretation, and concludes with a conclusion.

2. Stylized facts presented

ECCMA member countries have experienced a sharp rise in household final consumption prices since Q4 2021, intensified by the Russian-Ukrainian crisis. The BEAC tightened its monetary policy to contain the increase and anchor expectations of a decline. EMCCA countries took measures to contain the inflationary crisis, costing them nearly $1,048 billion to maintain prices, financed by oil subsidies. Cameroon, for example, has implemented measures to address inflationary pressures since 2021, including stabilizing petroleum product prices, combating speculation, easing taxes and customs duties, suspending port charges, reducing freight costs, suspending withholding tax, and removing illegal roadblocks to reduce transport costs for agricultural products.

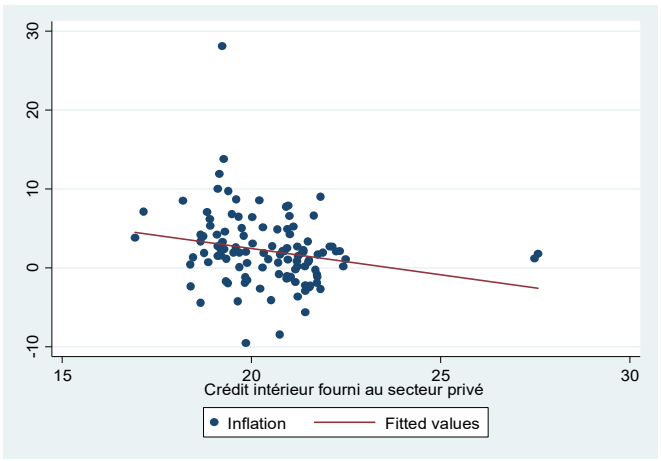
Table 1: Estimation of Fuel Subsidy Fiscal Cost 2022-2025 Based on Current Oil Price Projection

Country	2022		2023		2024		2025	
	Percent of GDP	CFAF billion	Percent of GDP	CFAF billion	Percent of GDP	CFAF billion	Percent of GDP	CFAF billion
Cameroon	1.8	480	2.4	298	0.9	271	0.7	253
CAR	0.8	12	0.7	12	0.6	10	0.5	9
Chad	1.1	86	1.1	85	1.0	84	1	83
Congo	2.8	251	1.4	125	0.8	71	0.9	84
Equatorial Guinea	0.7	69	0.7	59	0.6	46	0.5	42
Gabon	1.1	150	0.7	100	0.2	30	1	15
EMCCA	1.5	1048	1	679	0.7	512	0.6	486

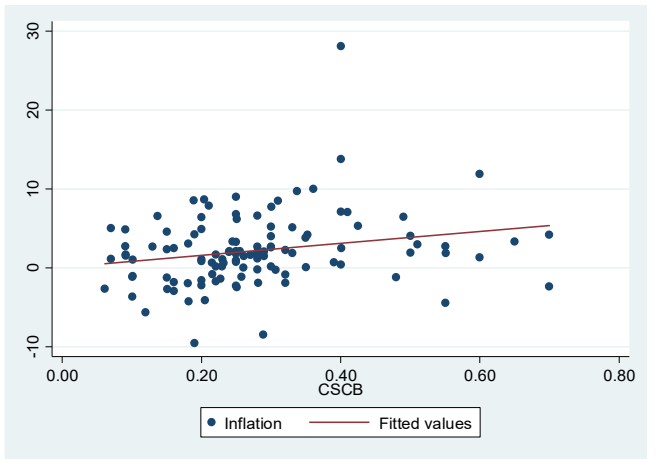
Source: IMF Staff calculations

The ECCMA financial market has experienced full expansion since 2019, with strong growth in the money market and public securities market. Interbank transactions reached 288 billion CFA francs in August 2021, an 88% increase from 153 billion in 2020. ECCMA treasury securities reached CFAF 5,820 billion, a 482% increase in three years. Recourse to the market increased from 2.1% of GDP in 2018 to 8% in March 2022.

Graph 1: Scatter plot between inflation and Credit EMCCA



Graph 2: Scatter plot between inflation and credit risk in EMCCA



Source: Authors

The degree of inflation, on the other hand, has increased with time, raising the question of whether these occurrences are connected. The graphs 1 and 2 below illustrate the deteriorating trend in the correlation between inflation and credit risk and credit to the economy, respectively.

However, a visual examination of graphs 1 and 2 suggest that conducting such a study is relevant for these EMCCA countries. First, there is a negative relationship between inflation and financial sector development, and graph 2 shows that an increase in credit risk increases the inflation rate. The scatter plot shows that the correlation between these variables is not so strong but is less dispersed. The scatter plot between the inflation variable and credit risks, used as the second interest rate variable, highlights the potential risk of instability and long-term price variability.

3. Theory and empirical approaches

The economic literature analyses various factors that explain the level of inflation in developed and developing economies. Indeed, some studies focus on some determinants such as economic growth, financial integration, poverty, and financial instability. The aim of this study, without being exhaustive, is to highlight, in addition to the above-mentioned determinants that financial development can also stand as an explanatory factor for inflation.

Recent economic analysis shows that inflation is also explained by factors such as the ecological footprint, bitcoin, foreign exchange transactions, and oil prices. The study of the Ecological Footprint remains at the centre of debates among policy analysts. Even if this is not the aim of the paper, the fact that Khan et al. (2022) state that some crucial determinants of the Ecological Footprint and its impact on macroeconomic variables have not been sufficiently addressed in the literature leads to its consideration as a potential determinant. The study by Khan et al. (2022) uses public expenditure, inflation dynamics, and economic growth as the main variables influencing inflation. Over the period 1971–2016, using fully modified dynamic least squares and robust canonical cointegration regressions. Khan et al. (2022) results show that inflation is negatively affected by government spending and economic growth. The main conclusion of the authors is that policymakers have to eliminate subsidies for domestic production of cost-effective environmental policies and price environmental resources. Khan et al. (2022) invite policymakers to create a trade-off between stabilising inflation and stabilising fluctuations through sustainable development.

As another factor explaining the level of inflation, the development of new finance with Bitcoins is mentioned. For example, during the recent COVID-19 pandemic, many commonalities shared by Bitcoin and gold raised the question of whether Bitcoin could hedge inflation or provide a safe haven as gold often does. Choi and Shin (2022) estimate a VAR model for this purpose. The authors provide systematic evidence of the relationship between inflation, uncertainty, Bitcoin prices, and gold. Indeed, Bitcoin appreciates in the face of inflation shocks (or inflation expectations), confirming the inflation hedging property claimed by investors. However, unlike gold, Bitcoin prices fall in response to shocks of financial uncertainty, reflecting the safe-haven quality of the currency. Interestingly, Bitcoin prices do not decline after shocks of political uncertainty, partly in line with the notion of Bitcoin's independence from government authorities. The monetary sector has also been pointed out as an important determinant of inflation.

Indeed, Ridwan (2022) argues that inflation occurs at any time, from any place, and cannot be controlled. However, there is a way to try to minimise it for Ridwan (2022) by controlling a number of economic instruments, such as the monetary sector. The author explains the need to manage how the financial aspects can be organised, both the money circulating in the community, the money of import and export transactions, and the money of savings. On this basis, this study is interested in disclosing several monetary factors that explain and influence inflation.

Hence, according to Ridwan (2022), inflation occurs slowly over a long period of time. Financial and economic factors become one of the instruments that have an impact on inflation. Following the author, it should not be surprising that with changes in the economic environment, both in the real and financial sectors, inflation will always follow. In addition to those statements, Kobou and Mbanga

(2022) insist on the fact that an increase in inflation reduces the performance of the financial sector and delays the central banker's actions. The result presented by Korinek and Sandri (2014) implies that, despite the rules defined in a monetary union, the relationship between financial sector development and inflation creates a complex environment where, regardless of the rules defined in a monetary union, the central banker's actions can be changed.

In other words, despite the prescribed inflation target in a monetary union, an inverse relationship between financial sector development and inflation is not ruled out. It is useful to frame this relationship for EMCCA. In this perspective, Creel et al. (2016) work on a sample of European Union countries (27 countries) over the period 1998–2011 and use the generalised method of moments. Creel et al. (2016) find that the policy space of the central bank expands in the presence of prudential policy instruments. However, the introduction of prudential policy tools into the relationship does not allow the authors to conclude whether an inverse relationship between financial sector development and inflation is ruled out.

The question of the impact of financial sector development on inflation has received only vague attention in the literature. To answer this question, only a few papers have attempted to determine the nature of the relationship between financial sector development and inflation. Unfortunately, a negative relationship between financial sector development and inflation has been found. While Boyd et al. (2000) use the loanable funds theory and credit market frictions to provide a theoretical basis for the existence of a negative relationship between financial sector development and inflation, Rousseau & Wachtel (2002) find that liquidity variability has a negative impact on inflation. The latter two authors, Rousseau and Wachtel (2002), explain that as the financial system deepens, high price variability is observed. This high price variability is associated with high inflation rates, which reduces the efficiency of this financial sector. To control for their assumption, Rousseau & Wachtel (2002) conducted causality tests from financial sector development to inflation and from inflation to financial sector development.

The first sets of papers, apart from the difference in the econometric technique used, were similar in terms of sample size and questions addressed. Batayneh et al. (2021) and Abbey (2012) are noteworthy in this respect. These different authors examined the impact of inflation on financial sector development in the case of a single economy. Batayneh et al. (2021) study Jordan; Abbey (2012) examines the Nigerian and Ghanaian economies in Africa. Apart from the specificity of the econometric techniques used, one of the striking points is that all these authors consider inflation an obstacle to financial sector development. Batayneh et al. (2021) examine this relationship for the period 1993–2018 in Jordan. For both countries, these two groups of authors find a negative and significant impact between financial sector development and inflation in the short and long run. As for Abbey (2012), the focus of the study remains the same. However, the author uses three different econometric techniques that allow him to show that the relationship between financial sector development and inflation is unidirectional. This relationship is positive but insignificant in the short run and becomes negative and significant in the long run.

A third group of contributions enhanced these lines of analysis and contributions to the subject. This core group of studies focused their analysis on the case of the monetary union context. The contributions of Keho (2009) and Creel et al. (2016) analysed the relationship between financial system development and inflation for countries structured in a monetary union. Minegishi & Cournède (2010) and Creel et al. (2016) did not construct an inflation equation. In fact, extending this empirical discussion to the case of countries organised in a monetary union allows them to show that the development of the financial sector is likely to affect common policies. The econometric technique, the problem addressed, and even the sample and time period of Keho (2009) differ from Creel et al. (2016). Keho (2009) conducts his analysis on the economies of the West African Economic and Monetary Union (WAEMU) over the period 1990–2005, uses different time series data techniques, and is interested in examining the causality between inflation and financial sector development in the long run.

According to Liu and Sharma (2022), oil price volatility remains one of the factors explaining the level of inflation. In their study, these authors examine the relationship between oil price volatility and the inflation rate between oil-producing and oil-exporting countries. Indeed, oil prices play an important role in energy markets and stimulate economic growth throughout the economy. According to these authors, oil price volatility has a large negative and measurable impact on the financial development of oil-importing and exporting countries. In addition, oil-exporting countries are affected by the vulnerability of oil costs.

Kim Lin and Suen (2010) cover a panel of 87 countries for the period from 1960 to 2005 and use the ARDL method to find that the long-run relationship between inflation and the financial sector is negative and significant, and in the short run it becomes positive but insignificant. Kim Lin and Suen's (2010) result aligns with Abbey's (2012). This similarity may mean that the sample size may affect the result. Effiong et al. (2020) restrict their analysis to African countries and work on a reduced panel of 39 African countries for the period from 1990 to 2015. The authors use GMM to show a negative inflation-financial sector relationship. Effiong et al. (2020) used Finance et al.'s (1999) model to construct an inflation equation and test the relationship between inflation and financial sector development. The negative sign confirmed Rousseau & Wachtel's (2002) hypothesis that inflation and financial sector development are inversely related.

4. Data and methodological approach

4.1. Data description

This paper uses unbalanced panel data for six (06) EMCCA countries over the period 1996–2022. The periodicity studied and the sample size are chosen according to data availability constraints. A description of the variables studied is given below. Data on the macroeconomic environment are taken from the World Development Indicators (WDI) database. The following variables are included: inflation rate, growth rate, oil price, and fiscal balance. Data on the development of the financial sector is taken from the Bank of Central African States (BEAC). The variables shelled are: credit to the non-financial private sector, interest rate of the central bank, TIAO, and non-performing loans.

Criteria selection is limited by data availability, with the most relevant data reflecting the phenomenon best. The study is based on annual data from 1996 to 2022. For the incidence of central bank action in the relationship, the interest rate is used (TIAO). The variables used are those that provide information on the macroeconomic environment, gross domestic product growth (GDP rate), oil price, and fiscal balance. Table 2 below defines each of the variables used.

The inflation variable indicates the central bank's stable price strategy. Keho (2009) counts the variable as independent, Effiong et al. (2020) as dependent. In this study, inflation is the only dependent variable. The variables remain to provide material on the development of the activity of financial actors. Credit extended to the non-financial private sector, called credit in this paper, measures the level of domestic credit supply. The non-performing loans variable measures the level of risk associated with the supply of credit. The literature supports using the first variable, which measures credit supply risk, while other variables consider central bank actions and the macroeconomic environment.

Table 2: Description of variables

Variables	Definition	Source	Expected signs
inflation	The inflation rate measures the rise in prices, often expressed as a percentage; it shows how a unit of currency effectively buys less than it did in previous periods. The rate of inflation reveals the extent to which a currency is depreciating and, as a result, the general level of prices for goods and services is rising.	WDI database	-
Credit	Measured by the level of loans to the non-financial private sector, it reports on the total amount of money made available by a financial institution to a borrower (individual or company).	BEAC report	+
Credit risk	Measured by non-performing loans, this is the potential loss resulting from a borrower defaulting.	BEAC report	-
TIAO	The central bank interest rate refers to the key policy rate. This rate is nothing more than the interest rate set by the central bank of a country or group of countries. This short-term interest rate set by the central bank of the monetary union allows it to regulate economic activity, and it uses this rate mainly to steer monetary policy and, consequently, to control the money supply and regulate the economic activity of the countries.	BEAC report	-
GDP rate	The Gross Domestic Product (GDP) rate is a broad measure of total domestic output; it acts as a comprehensive scorecard of a country's economic health.	WDI database	+
oil price	The oil price measures the evolution of the oil price as revealed by the behavior of the oil market. It is made up of a series of prices set by oil market operators, mainly in terms of their own value but also their speculated value under different conditions.	WDI database	-
budget balance	The budget balance is the difference between government revenue and expenditure. There are two opposing concepts in government accounting: budget deficit and budget surplus. The first term is used when the government budget is in deficit: government revenue is less than government expenditure, resulting in a negative budget balance. The second expression is used when the government budget is in surplus: government revenue is higher than government expenditure, resulting in a positive budget balance.	WDI database	-

Source: Authors

4.2. Empirical model

Research examines efficiency frontier model in EMCCA sub-region.

$$\boldsymbol{P_t = E[\lambda(\pi_t - \pi_t^*)^2 + (1-\lambda)(y_t - y_t^*)^2]} \qquad (1)$$

Where, $\boldsymbol{\pi_t}$ and $\boldsymbol{y_t}$ refer to the inflation rate and growth rate respectively and parameters $\boldsymbol{\pi_t^*}$ and $\boldsymbol{y_t^*}$ refer to the target. The parameters λ and 1-λ measure, respectively, the degree of responsiveness of monetary policy to the variation in the inflation rate and the degree of responsiveness of this policy to the variation in the growth rate. Using Finance and al.'s (1999) model, exact inflation and output variability estimates are not accurate. An optimal analysis should focus on a single target to understand financial sector development's impact on inflation and output. As the paper wants to investigate the impact of financial sector development on inflation, it is better to consider the incidence on inflation while using this efficiency frontier model. Furthermore, two dynamic panel data analysis techniques, the fixed effects model and the generalised method of moment in system (GMM system) are applied.

However the policy implication discussion is focused on result obtain from the GMM system method. Effiong et al. (2020) examine the relationship between monetary policy rule (r) and financial development using standard macroeconomic panel data models, combining both approaches to analyze inflation impact.

$$\boldsymbol{\pi_t = (1-a)\pi_t^* - \omega y_t - i^* + \vartheta_1 m + (\delta - a)\varepsilon^d - b\varepsilon^s} \qquad (2)$$

Here, $\boldsymbol{\pi_t}$ the inflation rate (dependent variable), explained by $\boldsymbol{\pi_t^*}$ which is the lagged value of inflation. This variable provides information on the rate of inflation achieved. $\boldsymbol{y_t}$, the growth rate of gross domestic product, $\boldsymbol{i^*}$ the interest rate of the central banker, $\boldsymbol{m}$ rank effects cause by financial changes as for example increase of money supply or even credit supply, ε^s and ε^d measure aggregate supply and demand shocks that cause inflation to move in the opposite direction. The model provide in this research methodology will allow us to test empirically whether the inflation rate is affected by changes in financial sector.

The paper examines the effect of financial sector development on inflation, aiming to determine if an inverse relationship is true in EMCCA. The specification, rewritten as equation 2, is similar to previous literature and econometric models.

$$\boldsymbol{\pi_{i,t} = \beta_0 + \partial\pi_{i,t-1} + \beta_1 Dsf_{i,t} + \beta_2 Risk_{i,t} + \beta_3 X_{i,t} + \mu_i + \lambda_t + \epsilon_{i,t}} \qquad (3)$$

Here, i and t terms refer to country and time respectively; $\boldsymbol{\mu_i}$ captures country effects and $\boldsymbol{\lambda_t}$ time effects, $\boldsymbol{\epsilon_{i,t}}$ takes into account all errors related to omissions. The $\boldsymbol{Dsf_{i,t}}$ variable rank financial sector development (is the rate of credit supply), $\boldsymbol{Risk_{i,t}}$ let know about the risk of credit caused by non-performing loan; the $\boldsymbol{X_{i,t}}$ term is the vector of control variables.

Table 2 provides a synoptic description of the variables in this model. Two econometric methods are used to estimate the relationship: the ordinary least squares method with fixed effects and the generalized method of moments in systems. Estimation with fixed effects controls for country heterogeneity and stable structural variables. The Fisher test and Hausman test are associated with this method. The Blundell & Bond (1998) estimator method offers a double advantage over GMMs as it simplifies estimating dynamic equations with lagged dependent variables. This econometric approach addresses statistical inference in regressions and handles instrument choice delicately. The estimator combines a first difference equation with a level equation, ensuring convergence even with finite observation numbers.

$$\begin{pmatrix} \boldsymbol{Y_{it}} \\ \boldsymbol{\Delta Y_{i,t}} \end{pmatrix} = \boldsymbol{\partial} \begin{pmatrix} \boldsymbol{Y_{i,t-1}} \\ \boldsymbol{\Delta Y_{i,t-1}} \end{pmatrix} + \begin{pmatrix} \boldsymbol{X_{i,t}} \\ \boldsymbol{\Delta X_{i,t}} \end{pmatrix} \boldsymbol{\beta} + \begin{pmatrix} \boldsymbol{\varepsilon_{i,t}} \\ \boldsymbol{\Delta\varepsilon_{i,t}} \end{pmatrix} \qquad (4)$$

Blondell & Bond (1998) systems introduce additional conditions to the level equation, focusing on the moment conditions, as there is no correlation between differentiated variables and specific effects. These conditions are relevant for understanding system dynamics.

$$E[X_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-s-1}).(\eta_i + \varepsilon_{i,t})] = 0 \; pour \; s = 1; \;\; t = 2, \dots, T. \qquad (i)$$

$$E[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-s-1}).(\eta_i + \varepsilon_{i,t})\,] = 0 \; pour \; s = 1; \; t = 2, \dots, T. \qquad (ii)$$

$$E[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})\,] = 0 \; pour \; s \geq 2; t = 2, \dots, T \qquad (iii)$$

$$E[X_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \; pour \; s \geq 2; t = 2, \dots, T \qquad (iv)$$

4.3. Methodological approach

The identification of the solution set by the GMM technique depends on the validity of the following assumptions: the error terms are not self-correlated; the instrumental variables used are valid. To ensure that these assumptions are met, Blundell & Bond (1998) have introduced two other tests: the Sargan/Hansen tests (to check for over-identification and the validity of the instruments used

in the estimation) and the test for the absence of autocorrelation of the error terms (this test implies that the estimator of the instrumental variables, i.e., the number of instruments (p), is greater than the number of explanatory variables (k) included in the model).

To validate the model, a robustness check of the model specification is required. Baltagi (2005) suggests that some tests are required. According to this author, the presence of a lagged value of both endogenous and exogenous explanatory variables, which is the main characteristic of dynamic models, requires stationary tests in addition to the Sargent and Hansen test. The series is mostly non-stationary.

Baltagi (2005) suggests that cointegrated variables allow indefinite mean and variance growth over time. Shin et al. (2003)'s test is suitable for studying the order of integration of variables in GMM panel methods, following Geoffroy & Nyanda (2021). Geoffroy & Nyanda (2021) use stationarity tests, Sargan/Hansen tests, and the absence of autocorrelation of error terms to verify the integrated order of variables and accuracy of estimated equation specifications. The second-order Wald autocorrelation test and the Sargan over-identification test are checked with a P-value > α. The significance level is controlled at 5%. The H0 hypothesis implies the absence of second-order autocorrelation of the first-difference residuals and gives a P-value of Prob > Z. This test is performed at a 5% explicit P-value > α.

The H0 hypothesis of the over-identification test implies the validity of the lagged variables used as instruments and gives a p-value of Prob > chi2. This test is explicitly performed at a 5% P-value > α. For both tests, the H0 hypothesis is verified (the results are presented in the table showing the estimation result). In addition, we can test for the cross-sectional dependence of variables. The impact of cross-sectional dependence on the estimation depends, of course, on a number of factors, such as the magnitude of the correlation between the cross-sections and the nature of the cross-section itself. If we assume that cross-sectional dependence is caused by the presence of common factors that are unobserved (and the effect of these components is therefore felt through the disturbance term) but uncorrelated with the included regressors, then standard fixed-effects and random-effects estimators are consistent, although not efficient, and the estimated standard errors are biased.

Moreover, if there is cross-sectional dependence in the disturbances, all estimation procedures based on instrumental variables (IV) and the generalized method of moments (GMM), such as those of Blundell and Bond (1998), are inconsistent as N (the cross-sectional dimension) becomes large for fixed T (the time dimension of the panel).

5. Empirical results

Descriptive analysis of data before discussing estimation results.

5.1. Baseline results

Table 3 shows oil price and GDP rate are the most dispersed series, with low standard deviations. Other variables have minimal variances, making logarithmic transformations unsuitable for normalizing the series.

The correlation table reveals a significant negative correlation between inflation and credit to the private sector, oil prices, and fiscal balance. However, financial development variables show a different sign, with credit risk negatively correlated with inflation and credit to the private sector positively correlated.

Table 3: Descriptive statistics

Variable	Obs.	Mean	Standard-deviation	Min	Max
Inflation	162	2.39	4.58	-9.45	28.11

Table 4: IPS stationary test

Level z-stat	prob.	In difference z-stat	prob.
-5.091	0.000	-8.284	0.0000

Credit	162	16.43	3.51	9.92	27.58	2.162	0. 450	-6.052	0.0000
Credit risk	162	29.5	12.71	16.00	70.01	-2.807	0.039	-7.221	0.0000
TIAO	162	4.79	1.47	2.5	7.82	2.663	0.996	-3.846	0.0001
GDP rate	162	1.33	7.71	-36.56	56.79	2.928	0.098	-6.068	0.000
Oil price	162	40.90	35.68	0.05	112.92	-1.798	0.192	-5.888	0.000
Budget balance	162	-16.03	16.94	-37,09	4.09	-5.016	0.094	-4.305	0.000
Note: Within-panel statistics are calculated on demeaned data. In the Levin-Lin-Chu Test, H0: non-stationarity in all panels; in addition, cross-sectional averages are subtracted from time series to mitigate the impact of cross-sectional dependence (Levin et al., 2002).									

Source: Authors' calculation using BEAC and WDI data

Table 5: Correlation among variables

Variable	inflation	credit	Credit risk	TIAO	GDP rate	Oil price	Budget balance
Inflation	1						
Credit	-0.078	1					
Credit risk	0.053	-0.034	1				
TIAO	0.113	-0.575	0.130	1			
GDP rate	0.079	-0.339	-0.039	0.262	1		
Oil price	-0.107	0.367	-0.512	-0.242	-0.084	1	
Budget balance	-0.140	0.219	-0.395	0.086	0.081	0.531	1

Source: Authors' calculation using BEAC and WDI data

EMCCA countries offer a lower volume of credit (around 16.43% of GDP) than other African countries (around 35% of GDP). This observation confirms the analysis proposed by the descriptive statistics and the correlation tables. The cross-dependence test (Table 6) shows whether the sum of the correlations between panel units is zero. The result of this test for the EMCCA countries provides a strong indication that the oil trend, fiscal balance, domestic credit, and interest rate are correlated across individuals. This main diagnostic found in heterogeneous panels provides a best-seen investigation of the mean correlation between panel units and helps to offer an appropriate decision on the unit root test to be performed before panel data analysis. However, as longitudinal data, panel data contain observations on different cross sections over time and model both the joint and individual behaviour of groups.

Table 6 shows that the cross-dependencies between these variables are weak. As the observations have been collected at a regular frequency, this may better explain why the collection of individuals is somehow correlated.

Table 6: Cross-sectional dependence test

Variable	CD-test	p-value	average joint	mean ρ	mean abs(ρ)
Inflation	2.228	0.026	27.00	0.11	0.32
Credit	15.977	0.000	27.00	0.79	0.79
Credit risk	16.203	0.000	27.00	0.81	0.81

TIAO	2.647	0.080	27.00	0.13	0.26
GDP rate	0 .925	0.355	27.00	0.05	0.18
Oil price	10.434	0.000	27.00	0.52	0.55
Budget balance	4.008	0.000	27.00	0.20	0.25
Notes: Under the null hypothesis of cross-section independence, CD ~ N(0,1), P-values close to zero indicate data are correlated across panel groups.					

Source: Authors' calculation using BEAC and WDI data

Niklas (2021) suggests Im Pesaran and Shin for weak cross-dependence unit root tests. The Im Pesaran and Shin (IPS) test compares the null hypothesis (H0) with the alternative hypothesis (H1), comparing all individual series with unit roots and at least one stationary series in the panel. The IPS test's decision rule is to accept H0 if the p-value is less than 10%, indicating a long-term relationship between variables except inflation, as shown in Table 3.

5.2. Estimation result and interpretation

5.2.1. Impact of financial development on inflation in EMCCA: baseline results

The results obtained using different econometric techniques (fixed effects model and system GMM) confirm the hypothesis of the existence of an inverse relationship between inflation and financial sector development. The deepening of the financial sector in EMCCA is achieved through the expansion of the supply of credit provided by the banking sector. However, the risk associated with the increase in this credit supply is likely to lead to high price variability and, hence, high inflation rates. This finding suggests that credit risk is not being contained by central bank action. The instability associated with non-performing loans, which represent a counterparty risk, tends to increase the inflation rate by a large amount. In fact, the positive sign associated with credit risk shows that the better access to financial services resulting from the development of financial intermediation activity rather increases the effect of counterparty risk, further acting as an amplifier of price variability and causing high inflation rates in EMCCA. Therefore, central bank action is reduced, and inflation targeting becomes inconsistent in the face of financial changes.

Table 7 above shows us two types of estimation. On the one hand, we have as a dependent variable inflation with a lagged endogenous variable and, on the other hand, the regression of a dependent variable without a lagged endogenous variable. The aim of such an approach is to measure the weight of the past on the explanatory power of the evolution of inflation. Thus, our results indicate that past information has had a negative impact on the current level of inflation. Regressions (1), (2), (3), and (4) allow us to confirm this statement.

Turning to the analysis of the impact of financial sector development on the level of inflation, the results found in Table 6 according to the fixed effects model confirm the hypothesis. Financial sector development, as measured by the ratio of loans to the non-financial private sector, is negatively correlated with inflation. The weight of this inverse relationship is greater in the absence of central bank intervention. This result tends to support the hypothesis that the central bank's action, through its policy rate, acts as an absorber of negative effects.

The instability is related to non-performing loans, which increase counterparty risk and the inflation rate. Specifically, the level of credit to the private sector has a negative and significant effect on the level of inflation in the Central African Economic and Monetary Community. Yet, the regressions (1), (2), (3), and (4) allow us to verify this assertion. At this level, we can conclude that the level of credit reduces the level of inflation. Still, the level of non-performing loans seems to explain the level of inflation in the EMCCA. The effect is also positive and significant. Credit risk affects the level of inflation in the EMCCA sub-region.

Table 7: Impact of financial development on inflation in EMCCA: baseline results

Dependent variable: Fixed effect model with lag value of inflation					Dependent variable Fixed effect model without lag value of inflation		
Inflation	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lag Inflation	-0.1628944 (0.0799472)	-0.1714737 (0.079326)	-0.1758985 (0.079313)	-0.1622431 (0.079612)	---	---	---
Credit	-0.072902* (0.1411376)	-0.103793* (0.128981)	0.124948** (0.189506)	-0.11443* (0.129603)	-0.052879* (0.141635)	-0.032028 (0.141445)	0.1578855 (0.192661)
Lag credit	---	---	---	---	---	---	---
Credit Risk	1.57609** (5.799193)	1.72295** (5.583581)	-0.4762559 (5.957447)	1.54076** (5.616302)	1.265168** (5.899769)	1.40479** (5.86838)	0.993355** 6.07898
Lag credit risk	---	---	---	---	---	---	---
TIAO	---	---	0.8100705 (0.591769)	---	---	---	0.866768 (0.599603)
GDP rate	0.074429** (0.075835)	---	0.091836** (0.075684)	---	0.062039** (0.0773958)	0.077837** (0.077579)	0.077627** (0.077313)
Oil trend	0.083672** (0.025648)	---	0.080574** (0.027261)	---	0.092858** (0.025759)	0.100114** (0. 256232)	0.047031** (0.027485)
Budget balance	---	-7.712786 (4.622144)	-9.393361 (4.70713)	---	---	-7.731385 (4.737713)	-8.791454 (4.777328)
Constant	2.581763 (2.388665)	1.851544 (2.154925)	-4.576934 (4.770956)	3.229758 (2.002402)	2.817383 (2.399147)	1.35499 (2.54886)	-4.625519 (4.85446)
Observation R^2Within Country	156 36,2% 6	156 47,9% 6	156 59,6% 6	156 29,8% 6	162 39,2% 6	162 27,9% 6	162 40,5% 6

Note: Standard errors in parentheses; The significance of coefficient is controlled from 5 %(*), 1% (**) to 0.1% (***).

Source: Authors calculations using BEAC and WDI data

5.2.2. Effect of financial development on inflation in EMCCA: main results

The main results of the system GMM, presented in Table 8, confirm the results of the fixed effects model (Table 7). The one-step estimation, preferred to the two-step estimation, is justified by the fact that since too many instruments can lead to a problem of over-instrumentation, not allowing to extract the exogenous component and leading to a bias in the coefficients (Roodman, 2009), the set of instruments is compressed to limit a proliferation of instruments, and therefore an upward bias in the Hansen test statistic shows that robust type errors are rejected (all variables on the right are assumed to be endogenous and instrumented with lags from 1 to 2).

The standard Hansen over-identification test, where the null hypothesis is that the instrumental variables are uncorrelated with the residual, and the correlation test, where the null hypothesis is that the errors have no second-order correlation, confirm the validity of the instruments. The GMM method, designed to deal appropriately with model specifications with a

lagged dependent variable, confirms the existence of an inverse relationship between financial sector development and inflation in EMCCA.

Table 8: Effect of financial development on inflation in EMCCA

Dependent variable: Inflation in GMM model							
Inflation	a	b	c	d	e	f	g
Lag inflation	-0.211347 (0.08187)	-0.222142 (0.08207)	-0.225492 (0.08979)	-0.22109 (0.08975)	-0.22018 (0.08182)	-0.2404804 (0.08587)	-0.2419672 (0.075662)
Credit	-1.35942* (0.34569)	-1.28222* (0.35419)	-1.228858* (0.363337)	-1.221315* (0.363193)	-1.24937* (0.362809)	-1.218653* (0.361723)	-1.223597* (0.361917)
Lag credit	1.426878 (0.49733)	1.208763* (0.35267)	1.198197** (0.351525)	1.223479** (0.353239)	1.21648** (0.3575)	1.35275** (0.350879)	1.347371** (0.351082)
Credit Risk	---	5.74981** (6.98264)	5.46864** (6.98197)	4.003** (7.17509)	4.53320** (7.182491)	3.150243** (6.854922)	3.668679** (7.031633)
Lag credit risk	---	2.25852** (6.75356)	2.026794** (6.744327)	1.006025** (6.901505)	1.63992** (6.950862)	-0.857523 (6.732838)	-0.43874 (6.822965)
TIAO	---	---	0.2615533 (0.432364)	0.29447 (0.43442)	---	0.6471212 (0.452129)	0.654585 (0.449539)
GDP rate	---	---	---	---	0.03276* (0.070205)	---	0.05284* (0.06952)
Oil trend	---	---	---	0.127411** (0.019983)	0.11698** (0.01869)	---	0.074341** (0.019833)
Budget balance	---	---	---	---	---	-9.822013 (3.580235)	-10.3831 (3.90518)
Constant	3.957903 (1.20577)	2.771415 (1.82251)	1.251696 (3.100429)	1.999423 (3.29699)	3.39598 (2.30921)	-1.96232 (3.244517)	-2.57615 (3.630682)
Observation	150	150	150	150	150	150	150
Instruments	35	45	54	57	35	45	56
Number of group	6	6	6	6	6	6	6
P-value AR(1)	0.002	0.004	0.000	0.001	0.001	0.001	0.001
P-value AR(2)	0.246	0.135	0.138	0.148	0.292	0.279	0.282
Hansen test	150.91	151.43	151.97	151.84	151.11	151.88	151.81
Sargan stat	0.243	0.196	0.190	0.179	0.167	0.133	0.132
Note: Standard errors in parentheses; The significance of coefficient is controlled from 5 %(*), 1% (**) to 0.1% (***).Table displays Arellano-Bond robust one-step estimators, with exception of Sargan test, and model specification considering endogeneity with time dummies. The instruments used in this study are the lagged variables of the following variables: lag inflation, lag credit and lag credit risk.							

Source**:** Authors

In the Sargan test, we find apparent support for the hypothesis of joint validity of the instruments, although the p-values are too high. Based on Roodman (2009), it is probable that the large number of instruments invalidates the Sargan test. However, the Arellano-Bond test for autocorrelation appears to be a valid alternative; it informs us that the instruments used are valid. Indeed, econometric theory (Roodman, 2009) implies that first-order autocorrelation in differences is allowed because the idiosyncratic errors are serially correlated, whereas second-order autocorrelation is not. This expected result is confirmed in our case.

Table 8 also confirms that credit risk acts as an amplifier. In addition, the inflation rate of the previous period tends to increase the current inflation rate by almost 22%. This relationship implies that in EMCCA, the inflation of the previous period acts as a determinant of the next period. In addition, this result confirms the authenticity and importance of the role of the central banker, as noted by Effiong et al. (2020). The central banker's main instrument (the policy rate) does not eliminate the inverse relationship between inflation and financial sector development but still manages to mitigate

it. In Table 7 above, expected inflation retains the same effect as in the fixed effects model. Moreover, in all regressions, we find a negative and significant effect between the level of inflation and the level of credit to the private sector. Similarly, non-performing loans have the same effect as in the fixed effects model. It should also be noted that other factors allow us to explain the variation in the level of inflation in the EMCCA. This is the case for the evolution of the oil price, the fiscal balance, and the GDP growth rate.

The central bank's interest rate may not suppress inflation in EMCCA. This result is similar to the one proposed by Bikai and Essiane (2018). However, the presence of this interest rate limits the occurrence of a scenario in which an increase in credit supply, observed after the period of development of the financial system, would maintain credit risk, which in turn leads to high price variability, resulting in an upward fluctuation of inflation rates, which reduces the performance of the financial sector. The other control variables have a mitigated effect on inflation. The GDP growth rate increases the inflation rate between 3.276% and 5.284%; the effect can be sized by 4.28% if the mean of the two values is computed. For that reason, the growth of the GDP rate can be counted among those factors that favor inflation in EMCCA, in contradiction to what Khan et al. (2022) found in their sample. As this relationship is significant, it shows that it would be inconvenient to encourage an increase in the inflation rate to improve economic activity. The supply shock reported through the oil price increases the inflation rate in the EMCCA. If this positive relationship is independent of the rule of instrumental strategies, it confirms what Liu and Sharma (2022) discover: that oil price volatility remains one of the main factors explaining the level of inflation.

The negative sign attached to the budget balance variable has a different meaning from the other variables. In fact, this sign implies that the monetary policy target moves in the opposite direction from fiscal policy. Such a relationship for EMCCA assumes that the fiscal policy instrument of expansionary budgets can't coexist with a restrictive monetary policy objective. The existence of both instruments and their use do not prevent both instruments from having different orientations. The other fact is that the expected sign for the TIAO variable was not achieved. In fact, this result releases a scenario of the relation between interest variable and inflation state by Kobou and Mbanga (2022). The interest rate power is limited because during the faster period, an increase in credit supply, perceived as a financial system development indicator, is due to environmental shocks. This environment weakens the action of the central bank and exacerbates credit risk, which in turn leads to high price variability, the most important root of the upward variation in inflation rates.

6. Findings and conclusion discussion.

This paper assesses the impact of financial sector development on inflation in the Central African Economic and Monetary Community (EMCCA). Panel regressions show a strong relationship between financial development and inflation, suggesting that the financial system is effective in reducing inflation. The abysmal level of financial depth in the EMCCA requires an independent and credible central bank, a well-functioning money market, a sound institutional environment, and higher international financial capital mobility. However, African countries still have a small formal financial sector with less developed markets, limited competition, and weak institutional and regulatory environments. The credit risk associated with lending activity also increases inflation in EMCCA countries.

This study examined the impact of financial sector development on inflation in EMCCA countries from 1996 to 2022. Macroeconomic variables like oil prices and fiscal balance affected inflation, and the results confirmed previous empirical analyses. The inverse relationship between inflation and financial sector development remains significant, despite low inflation targets. To mitigate this relationship, economic policymakers can use a prudential tool to increase central bank effectiveness and combat financial sector performance reduction. Future studies should introduce this prudential framework to test its impact.

The main contribution of the financial system lies in ensuring the operation of an efficient and scalable payment system, mobilising savings and improving their allocation to investment. In addition, the development of financial intermediation can ensure a better mobilisation of available savings and support economic growth. By extension, this study seeks to show that financial development also makes it possible to reduce the level of inflation in an economy. This is because, as we can see, inflation can occur when consumer and business confidence is high, when public spending increases or when interest rates are low, encouraging borrowing and spending. Credit granted by financial intermediaries thus affects the level of credit needed to finance public and private expenditure. The central bank should control the credit policy of the community in order to maintain the level of inflation at a relatively moderate rhythm.

References

Abbey, E, N, (2012), Inflation and Financial Development: Evidence. *American Journal of Economics and Business Administration*, *4*(4), 2012. https://doi.org/10.3844/ajebasp.2012.227.236

Aglietta, M, & Scialom, L, (2009), Permanence and Innovation in Central Banking Policy for Financial Stability. In *Financial Institutions and Markets* (pp. 187–211). Palgrave Macmillan US.

Antonin, C, Levasseur, S, & Touzé, V, (2019), L'Union bancaire face au défi des prêts non performants. *Revue de l'OFCE*, *N° 158*(4), 227–252. https://doi.org/10.3917/reof.158.0227

Arellano, M, & Bond, S, (1991), some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies*, *58* (2), 277-297.

Batayneh, K, Al Salamat, W, & Momani, M.Q, (2021), The impact of inflation on the financial sector development: Empirical evidence from Jordan. *Taylor & Francis*, *9*(1). https://doi.org/10.1080/23322039.2021.1970869

Bikai, JL, & Essiane, P-N.D, (2018), *Politique monétaire, stabilité monétaire et croissance économique dans la CEMAC : une approche SVAR bayésienne*. https://www.researchgate.net/publication/330041804

Blundell, R, & Bond, S, (1998), Initial conditions and moment restrictions in dynamic panel data models. In *Journal of Econometrics* (Vol. 87). https://www.sciencedirect.com/science/article/pii/S0304407698000098

Boyd, J.H, Levine, R., & Smith, B.D, (2000), The Impact of Inflation on Financial Sector Performance*. In *Elsevier*. https://www.sciencedirect.com/science/article/pii/S0304393201000496

Cecchetti, S, & Krause, S, (2001), *Financial structure, macroeconomic stability and monetary policy*. https://www.nber.org/papers/w8354

Creel, J, Hubert, P, & Labondance, F, (2016), *The Intertwining of Bank Credit and Bank Instability*. https://www.boeckler.de/pdf/v_2016_10_22_creel.pdf

Effiong, E.L, Esu, G.E, & Chuku, C, (2020), Financial development and monetary policy effectiveness in Africa. *Journal of Social and Economic Development*, *22*(1), 160–181.

Finance, G. K.-J, (1999), Openness and the effects of monetary policy. *Elsevier*. Retrieved August 29, 2022, from https://www.sciencedirect.com/science/article/pii/S0261560698000370

Foglia, M, (2022), Non-Performing Loans and Macroeconomics Factors: The Italian Case. *Mdpi.Com*. https://doi.org/10.3390/risks10010021

Gaffard, J, (2018), Hétérogénéité des agents, interconnexions financières et politique monétaire: une approche non conventionnelle. *Cairn.Info*. Retrieved August 29, 2022, from https://www.cairn.info/revue-francaise-d-economie-2018-3-page-201.htm

Gallic, E, Poutineau, J, économique, G. V.-R, (2017), L'impact de la crise financière sur la performance de la politique monétaire conventionnelle de la zone euro. *Cairn.Info*. Retrieved August 29, 2022, from https://www.cairn.info/revue-economique-2017-HS1-page-63.html

Geoffroy, P, & Nyanda, N, (2021), Déterminants et effets économiques de l'inflation dans la CEMAC Déterminants et effets économiques de l'inflation dans la CEMAC Determinants and economic effects of inflation in CEMAC. *Journal of Academic Finance*, *12*. https://www.scientific-society.com/journal/index.php/AF/article/view/427

Im, K.S, Pesaran, M.H, & Shin, Y, (2003), Testing for unit roots in heterogeneous panels. *Journal of econometrics*, *115*(1), 53-74.

Kobou, G, & Mbanga Pagal, E.D, (2022), The Impact of Financial Sector Development on Inflation in CEMAC. Sch J Econ Bus Manag, Sept 9(9): 177-184.

Korinek, A, & Sandri, D, (2014), *NBER WORKING PAPER SERIES CAPITAL CONTROLS OR MACROPRUDENTIAL REGULATION? Capital Controls or Macroprudential Regulation?* http://www.nber.org/papers/w20805

Krause, S, & Rioja, F, (2006), Financial Development and Monetary Policy Efficiency. In *Citeseer*.https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.460.8335&rep=rep1&type=pdf

Levin, A, Lin, C.F, Chia-Shang, J.C, (2002). Unit Root Tests in Panel Data: Asymptotic and Finite Sample Properties. Journal of Econometrics 108, 1–24.

Minegishi, M, & Cournède, B, (2010), *Monetary Policy Responses to the Crisis and Exit Strategies*. https://doi.org/10.1787/5kml6xm7qgs6-en

Niklas Uliczka, (2021), "The Impact of Mergers and Acquisitions on Top Income Shares" Tohoku University Policy Design Lab Discussion, IZA working Paper series July 2021

Noumba, I, & Enguene, A.A, (2022), The Effects of Minimum Bank Capital and Governance on the Financing of the EMCCA Economies. In *Monetary and Financial Systems in Africa* (pp. 143–168). Springer International Publishing. https://doi.org/10.1007/978-3-030-96225-8_7

Roodman, D, (2009), How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, *9*(1), 86–136. https://doi.org/10.1177/1536867x0900900106

Rousseau, P.L, & Wachtel, P, (2002), Inflation thresholds and the finance-growth nexus. In *Journal of International Money and Finance* (Vol. 21). www.elsevier.com/locate/econbase

Scialom, L, (2010), *Économie bancaire: La meilleure synthése actuelle sur l'économie bancaire*.