THE RELEVANCE OF THE CREDIT CHANNEL IN THE AFRICAN FRANC ZONE: THE CASE OF CEMAC

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ABSTRACT

The procyclicality of the financial system in the dynamics of shock transmission and amplification necessarily calls for a re-examination of the credit channel (Curdia and Woodford 2010) as the transmission channel for monetary policy.

To this end, the present study attempts to assess the relevance of the credit channel from the risk-taking channel analysed on the side of credit providers. Thanks to this channel, monetary policy acts on the supply of credit by taking into account the risk-averse behaviour of banks.

Consequently, taking into account the role of banks in corporate governance, on the one hand, and improving prudential governance, on the other, are likely to strengthen the relevance of such a channel in CEMAC.

Keywords: Credit channel, risk-taking channel, bank capital channel, expected inflation, African franc zone, bank governance.

Code Jel : F32, F37, F41

INTRODUCTION

The procyclicality of the financial system in the dynamics of transmission and amplification of shocks (Bernanke, 2007, 2010; Curdia and Woodford, 2010; and Linde, Smets and Wouters, 2016) necessarily calls for a re-examination of the credit channel as a transmission channel for monetary policy.

The literature on the credit channel is broadly divided into two main generations of work:

1) the first generation (Gertler and Blinder, 1988, 1995; Barran, Coudert and Mojon, 1997; Gertler and Gichrist, 1993; Kiyotaki and Moore, 1997 and Bernanke et al., 1999) justifies the existence of financial intermediaries and analyses the real effects of monetary policy ;
2) the second generation (Levieuge, 2009; Meh and Moran, 2010; Gertler and Kiyotaki, 2010 and Gertler and Karadi, 2011) deals with systemic risk and its relationship with monetary policy in an uncertain environment.

With regard to the first generation, it leads to a distinction between the narrow credit channel and the broad credit channel (Kashyap, Stein and Wilcox, 1993; Oliner and Rudebush, 1994; Mojon, 1999). The narrow credit channel is based on the imperfect substitution of bank credit for other financial assets, notably the assets of lenders (banks) and the liabilities of borrowers (non-financial agents). As a result, monetary policy influences the activity of economic agents dependent on this mode of financing through its effect on the supply of credit by banks (Bernanke and Blinder, 1988; Dale and Haldane, 1993 and Kashyap et al., 1993). The broad credit channel, for its part, is based on the imperfect substitution between internal and

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external (to the bank) modes of financing at the origin of the external financing premium, which allows the central bank to act on the financial constraints of non-financial agents (Kiyotaki and Moore, 1997; Bernanke et al., 1999).

As for the second generation, it is an extension of the gas pedal mechanism to the banking sector because it emphasizes the macroeconomic effects of credit (Smets and Wouters, 2007; Faccini, Yashiv, 2016). Thus, two types of channels, closely linked to the credit channel, are identified:

1) the bank capital channel, which indicates the way in which monetary policy influences economic activity through banks' equity (Van den Heuvel, 2007; Meh and Moran, 2010 and Gertler and Kiyotaki, 2010). Thus, the strengthening of information asymmetries between lenders (banks) and borrowers (non-financial agents) hinders the availability of credit ;
2) the risk-taking channel manifested by the risk-averse behaviour of secondary banks in an uncertain environment (Rajan, 2006; Borio and Zhu, 2008 and Boivin et al., 2010), which leads us to distinguish two paths :
   i. the excessive risk preference of banks, which favours increasing the share of risky assets in their portfolios (Gertler et al., 2010 and Dubecq et al., 2010) ;
   ii. the systematic use of financial leverage, which leads to excessive growth of bank balance sheets (Adrian and Shin, 2010 and Damar et al., 2010).

The purpose of this work is to assess the relevance of the credit channel from the risk-taking channel analysed on the side of credit providers (1). Through this channel, monetary policy acts on the supply of credit by taking into account the risk-averse behaviour of banks.

Indeed, the persistence of low interest rates leads banks that are less risk-averse to increase their supply of credit to risky borrowers and thus to assume more risk in their credit portfolio (Paligorova and Sierra Jimenez, 2012). The specificity of the risk-taking channel is the banks' anticipation bias (Borio and Zhu, 2008).

In such a context, banks can take an expected inflation rate as an indicator for the orientation of their credit policy. Such a rate takes into account the interest rate differential corresponding to the term structure of nominal interest rates and represents the slope of the yield curve (Allégret and Goux, 2003). The contribution of the interest rate differential to the formation of expected inflation thus makes it possible to assess the relevance of the credit channel, by defining the dynamics of the propagation of the credit supply.

The field of analysis of this reflection is the Economic and Monetary Community of Central Africa (CEMAC). Three reasons justify such an option:

1) it is a monetary zone that essentially includes debt savings, since banks are the main providers of funds for financing the economy ;
2) it is a monetary zone whose financial system is poorly developed with, in addition, a strong financial exclusion;
3) the conduct of the common monetary policy takes place in an environment of great uncertainty.

It therefore seems appropriate, in such a framework, to assess the relevance of the credit channel because of, on the one hand, the degree of flexibility and, on the other hand, the degree of stability and solidity of the financial systems (Gelbard et al., 2014 and Beck and Cull, 2014).

The present reflection will therefore focus on the following axes: the determination of the expected inflation rate as a necessary condition for the relevance of the credit channel in

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CEMAC (I) and the improvement of governance as a sufficient condition for the relevance of the credit channel in this zone (II).

1. Determining the expected inflation rate as a necessary condition for the relevance of the credit channel in the CEMAC zone

To assess the relevance of the credit channel in CEMAC, we use an indicator of the expected inflation rate that corresponds to the slope of the yield curve (Estrella and Mishkin, 1995 and Day and Lange, 1997; Allégret and Gout, 2003; Bayangos and Jansen, 2009 and Bayoumi and Melander, 2008) and that captures the transmission mechanism of the effects of bank credit on financial conditions.

We would then like to first present the analytical framework and the articulation of the model, before proceeding to its empirical verification.

1.1- *The analytical framework and articulation of the model*

The theoretical framework of analysis used is the New Keynesian augmented economics of the credit market. Three reasons can be given for this:

1) it is a framework that better accounts for changes in the transmission dynamics of monetary policy through the credit channel. Most of the work on this subject explores a fourth-generation stochastic intertemporal general equilibrium model (Gertler and Kiyotaki, 2010, 2015 and Hun Shim, 2017). It is a formalization that, in addition to taking into account financial intermediation, incorporates financial frictions in credit markets and their implications in terms of the conduct of monetary policy, on the one hand, and the interaction between monetary policy and macroprudential policy, on the other;
2) such a framework also makes it possible to integrate recent developments in behavioral economics, in particular by taking into account the mental mechanisms (4) likely to explain the rational choices of individuals ;
3) finally, it easily integrates central hypotheses such as uncertainty, stochastic shocks, the strategic behaviour of agents, nominal rigidities and intertemporal analysis.

We draw on the model of Bayangos and Jansen (2009), which analyzes the dynamics of credit propagation in an economy with persistent financial instability. Unlike these two authors, we integrate financial frictions to remain consistent with our theoretical framework, which uses fourth-generation DSGE models (Gertler and Kiyotaki, 2010,2015; Gertlet and Karadi, 2011; Gertler et al, 2012; Curdia and Woodford, 2016 and Hun Shim, 2017) and even more so in open economies (Kollmann et al., 2011; Dedola et al., 2013; Bruno and Shin, 2014 and Aoki et al., 2016) due to the connection of the CEMAC banking sector to the international financial system.

Other modifications are made to the reference model to adapt it to the context of the CEMAC zone economies. Our model is then presented as follows:

$$tia = f(eti, X), \qquad [1]$$

where : tia is the expected rate of inflation; eti is the difference between the interest rate on loans and the interest rate on bank deposits; X is the vector of other determinants of the expected rate of inflation, including: the output gap(ep), actual inflation$(infl)$, the rate of growth of the money supply(m), external debt service$(sdext)$, the current account(ctc), and the net capital account(ckn).

Thus, the model for estimation purposes takes the following linear form :

$$tia_t = \alpha_0 + \alpha_1 eti_t + \alpha_i X_t + \varepsilon_t, \qquad [2]$$

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with: $X = (ep; m; infl; sdext; ctc; ckn)$.

$\alpha_i (i = 1,2, \ldots \ldots .6)$, the coefficients of the explanatory variables of the model ; , the constant ; , the error term at period t.

The sign of the interest rate differential coefficient (α_1) can be positive or negative. A positive (respectively negative) sign indicates that financing constraints are not tight (respectively tight) and therefore the credit channel is relevant (respectively not relevant). The signs of the coefficients of the other determinants can be positive or negative.

The model variable we are trying to explain is the expected inflation rate, measured by the lagged inflation rate. This choice is justified in particular by the role that the expected inflation rate plays in the formation of nominal interest rates (Allegret and Goux, 2003).

The explanatory variables are : the interest rate differential(eti): this variable is measured by the difference between the interest rate on loans and the interest rate on bank deposits; the output gap(ep) measured by the difference between actual output and potential output and calculated by the Hodrick and Prescott filter; actual inflation $(infl)$ as measured by the annual change in the consumer price index ; the growth rate of the money supply (m) ; external debt service $(sdext)$; the current account(ctc) ; the net capital account(ckn) .

These other explanatory variables were incorporated into the model in order to increase its predictive power, especially in an environment of great uncertainty.

1.2- *Empirical verification*

The working hypothesis adopted is that the credit channel is relevant when financial conditions influence the expected inflation rate in an environment of uncertainty.

Initial data are annual and come from the World Bank database (World Development Indicators, 2016). They have been quarterlyized using the Goldstein and Khan (1976) data interpolation method to provide short frequency data. The period of analysis extends from 2000 to 2016, which makes it possible to take into account the effects of financial changes that are at the origin of the changes in the behavior of banks in the CEMAC zone. More specifically, it is a question of :

1) The financial liberalization process initiated at the beginning of the 1990s, which has made systematic the almost exclusive recourse of financial agents to market mechanisms;

2) the emergence of the objective of financial stability, even if it is slow to be fully integrated into the behavior of the Bank of Central African States (BEAC).

Since we are dealing with time series, we first analyze the dynamics of the model's variables using the augmented Dickey-Fuller test, the results of which are presented in Table 1 in the appendix. It emerges that all the variables of the model are stationary in first difference.

The cointegration test carried out reveals the existence of at least one cointegrating relationship between the expected inflation rate and the explanatory variables of the model (Appendix 2), which allows the use of the error correction mechanism for the estimation of the model (Appendix 4).

In the short term, the empirical results reveal a heterogeneity in the situations of CEMAC member countries. However, the credit channel is not relevant there, since the change in banks' financing constraints does not depend on the orientation of monetary policy in this zone. The interest rate differential variable affects the expected inflation rate with a statistically insignificant impact in all member countries.

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These results also reveal a contrasting situation for the other determinants of expected inflation. Two cases can then be distinguished:

1) the change in financing constraints depends on the effects of the international financial cycle only in two member countries: the Central African Republic and the Congo. Thus, the external debt service of the Central African Republic, on the one hand, and the net capital account of the Congo, on the other hand, have a negative (-0.03 for the Central African Republic and -0.523 for the Congo, respectively) and statistically significant impact on the expected inflation rate;
2) the change in financing constraints does not depend either on the effects of the economic cycle or on the effects of the financial cycle. In this second case, none of the other variables (the output gap, current inflation, money supply and current account) can explain the expected inflation rate for all CEMAC member countries. All the variables have non-statistically significant coefficients.

In the long term, the credit channel is indeed relevant in the CEMAC zone. However, its relevance is limited, since changes in financing constraints depend on changes in monetary policy, since the expected inflation rate is explained by the interest rate differential. Two situations illustrate this perfectly:

1°) the expected inflation rate is positively related to the interest rate differential in Congo and Equatorial Guinea. The interest rate differential variable has a positive (respectively 0.98 for Congo and 0.501 for Equatorial Guinea) and statistically significant effect in these two countries;

2°) on the other hand, the expected inflation rate is negatively related to the interest rate differential in the four other member countries (Cameroon, Central African Republic, Gabon and Chad). The interest rate differential variable has negative and statistically significant coefficients in Cameroon (-0.58), the Central African Republic (-0.33), Gabon (-0.33) and Chad (-2.18), respectively.

On the other hand, the output gap has a negative impact in Gabon (-0.0011) and Equatorial Guinea (-0.001) and is statistically significant on expected inflation. The current account in Cameroon (-1.13) and Congo (-0.19), on the one hand, and the net capital account in Congo (-1.71), on the other hand, have a negative and statistically significant effect respectively. The growth rate of money supply has a negative (-0.14) and statistically significant impact on expected inflation in Equatorial Guinea.

2. Improvement of governance as a sufficient condition for the relevance of the credit channel in CEMAC

The results obtained show that two essential factors are likely to reinforce the relevance of the credit channel in the CEMAC zone, namely :

1) taking into account the role of banks in corporate governance ;
2) the improvement of prudential governance.

2.1- *Integrating Banks into Corporate Governance*

Although the conditions for the operation of the credit channel are met in CEMAC, the role of secondary banks in corporate governance appears negligible, given the weak development of the financial system in this zone and the high level of financial exclusion, as reflected in indicators of financial depth and the use of formal financial services by businesses and households.

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The values of the indicators presented in the tables in Annex 4 confirm the weak financial intermediation role of banks in the CEMAC zone (Beck et al., 2000, 2010; Beck and Cull, 2014; Guérineau and Jacolin, 2014; Bertho, 2014; Granata et al., 2014 and Allen et al., 2015), although there has been a slight catch-up since the 1990s. By way of comparison, South Africa (Africa's leading financial power) has a financial depth of 143.12 with an average number of bank branches of 7.84 per 100,000 adults over the same period.

The role of secondary banks in corporate governance could be assessed through that of a creditor bank and that of a shareholder bank.

The creditor bank can influence the performance of firms by being part of a logic of strengthening financial inclusion (Granata, Kibuuka and Mascaro, 2014). It would thus make it possible to reduce agency costs and facilitate companies' access to the credit market. More specifically, for small and medium-size companies, which are highly subject to financial constraints, the bank could exploit its position as a holder of private information, provided that such a position does not generate conflicts of interest in the choice of less risky investment projects when financing is provided by bank debt. The existence of a creditor bank is, from this point of view, less costly for the firm as long as it contributes to the creation of value for the bank.

As for the shareholder bank, it has the possibility of acquiring stakes to ensure control of the firm, reduce agency costs related to conflicts of interest between managers and shareholders, on the one hand, and limit the effect on shareholders and creditors (Diamond, 1984 and Lin et al., 2009), on the other hand.

Since conflicts of interest outweigh the supervisory advantage, the presence of a shareholder bank reduces the value of firms, since by holding a significant stake in the firm's capital, the majority shareholder is inclined not only to control the management team in its day-to-day management and strategic decisions, but also to exercise effective control over executives and to convince minority shareholders in the event of opposition from the management team (Lin et al., 2009). The presence of an involved and active majority shareholder thus promotes corporate performance.

2.2- *Improving prudential governance*

One of the positive developments in CEMAC's financial systems has been the continuation of financial liberalization efforts following the first reforms of the 1990s. The best proof of this is the synthetic index of financial liberalization, which takes into account:

i. whether or not interest rates were liberalized;
ii. the number of years in which real (lending and deposit) rates were positive;
iii. the existence of a large informal financial sector;
iv. mechanisms for regulating credit allocation.

Such an index has the advantage of weighting the extent of financial repression, including the existence of informal financial sectors, the existence of informal markets for goods and services, and the organization of credit controls. It also provides information on whether interest rates are market-determined and whether they are positive in real terms (Demirgüç-Kunt and Klapper, 2012; Laeven and Valencia, 2012).

The synthetic index of financial liberalization ranges from 0 to 100, and the higher it is, the greater the liberalization. Its value shows that most countries in the CEMAC region succeeded in the 1990s in liberalizing interest rates, gradually eliminating the credit framework, moving to indirect monetary policy instruments, and restructuring and privatizing banks (Gelbard et al., 2014).

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To this end, interest rates are market-determined and positive in real terms, with greater integration of parallel financial institutions into the formal sector (Rousseau and d'Onofrio, 2013 and Beck and Cull, 2014). Numerous analyses then show that the banking sectors in the CEMAC zone are generally more solid, capitalized and liquid than in the 1990s, during the banking crises.

However, their financial soundness varies depending on whether the country is low or middle-income, due in particular to continued government intervention, favoritism in lending and poor bank governance, factors that are sources of financial friction.

In addition, CEMAC member countries have instituted a minimum 8 percent risk-weighted capital adequacy ratio, which is respected in most countries. Between 2012 and 2013, the equity/total assets ratio was around 11% in middle-income countries (Cameroon, Congo, Gabon and Equatorial Guinea) and 14% in low-income countries (Central African Republic and Chad). During the same period, the ratio of cash to total assets exceeded 25 percent in all countries (Gelbard et al., 2014).

In this regard, the BEAC is subject to multiple constraints in the development of the common monetary policy. Excessive bank liquidity limits the use of financial market instruments due to insufficient credit opportunities for banks, shallow securities markets, inadequate legal framework and government cash management problems.

In these circumstances, the BEAC should adopt a macroprudential approach that places particular emphasis on the vulnerabilities of the financial system and the interaction between macroeconomic developments and financial stability instead of microprudential governance that focuses exclusively on protecting customer deposits (Cartapanis, 2011; Angelini et al., 2012; Beau et al., 2011; Blanchard et al., 2013; Carré et al., 2015; Couppey-Soubeyran and Dehmej, 2016,2017 and Svensson, 2016).

Considering that the CEMAC zone is a monetary union where bank intermediation takes place in the presence of financial frictions, the adoption of a macroprudential policy, targeted by member country and effectively affecting the supply of credit, could complement the common monetary policy, which should improve the functioning of the monetary union.

CONCLUSION

The purpose of this discussion was to show that the credit channel is relevant when changes in financing constraints depend on the stance of monetary policy in an environment of uncertainty. The empirical model tested for this purpose reveals that the credit channel is only truly relevant in the long term in the CEMAC zone. To ensure that it is relevant in the short term, two avenues can be explored:

1. that relating to the external governance of banks (creditor bank and shareholder bank) in the functioning of firms ;
2. that relating to the internal governance of banks, with a view to ensuring that prudential regulation is consistent with the adoption of internal mechanisms for the management and evaluation of financial risks generated by banking activity.

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APPENDICES

Appendix 1: Conclusions of unit root tests

	(tia)	(eti)	(ep)	(infl)	(m)	(sdext)	(ctc)	(ckn)
Cam	I(1)	I(1)	I(1)				I(1)	
RCA	I(1)	I(1)	I(1)			I(1)		
Cog	I(1)	I(1)					I(1)	I(1)
Gab	I(1)	I(1)	I(1)		I(1)			
GE	I(1)	I(1)	I(1)	I(1)	I(1)			
Tch	I(1)	I(1)	I(1)					

Appendix 2: Cointegration Test Results

a- Cameroun

Date: 02/02/18 Time: 15:48
Sample: 2000Q3 2016Q4
Included observations: 66
Series: TIACAM ETICAM EPCAM CTCCAM
Lags interval: 1 to 1

Selected (0.05 level*)	Number of Cointegrating Relations by Model				
Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	0	0	0	1	1
Max-Eig	0	0	0	1	1

b- Centrafrique

Date: 02/02/18 Time: 16:52
Sample: 2000Q3 2016Q4
Included observations: 66
Series: TIARCA ETIRCA EPRCA SDEXTRCA
Lags interval: 1 to 1

Selected (0.05 level*) Number of Cointegrating Relations by Model					
Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	4	0	4	1	2
Max-Eig	0	0	0	1	1

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c- Gabon

Date: 02/04/18 Time: 06:55
Sample: 2000Q3 2016Q4
Included observations: 66
Series: TIAGAB ETIGAB EPGAB MGAB
Lags interval: 1 to 1

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	4	1	4	1	2
Max-Eig	0	0	0	1	1

d- Guinée Equatoriale

Date: 02/04/18 Time: 07:37
Sample: 2000Q3 2016Q4
Included observations: 66
Series: TIAGE ETIGE EPGE INFLGE MGE
Lags interval: 1 to 1

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	1	1	2	1	2
Max-Eig	0	0	0	1	1

e- Tchad

Date: 02/04/18 Time: 07:47
Sample: 2000Q3 2016Q4
Included observations: 66
Series: TIATCHAD ETITCHAD EPTCHAD
Lags interval: 1 to 1

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	3	0	3	1	3
Max-Eig	0	0	0	1	1

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d- Congo

Date: 02/05/18 Time: 02:50
Sample: 2000Q3 2016Q4
Included observations: 66
Series: TIACONG ETICONG EPCONG CTCCONG CKNCONG
Lags interval: 1 to 1

Selected (0.05 level*) Number of Cointegrating Relations by Model					
Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	2	1	1	1	2
Max-Eig	1	0	1	1	1

Appendix 3: Error Correction Template

a- Cameroun

Vector Error Correction Estimates				
Date: 02/02/18 Time: 15:48				
Sample (adjusted): 2000Q3 2016Q4				
Included observations: 66 after adjustments				
Standard errors in ( ) & t-statistics in [ ]				
Cointegrating Eq:	CointEq1			
TIACAM(-1)	1.000000			
ETICAM(-1)	0.580926			
	(0.18989)			
	[3.05932]			
EPCAM(-1)	-0.000194			
	(0.00056)			
	[-0.34621]			
CTCCAM(-1)	-1.134625			
	(0.54523)			
	[-2.08100]			
C	-1.459769			
Error Correction:	D(TIACAM)	D(ETICAM)	D(EPCAM)	D(CTCCAM)
CointEq1	-0.187227	-0.602989	10.37687	0.109708
	(0.04202)	(0.15321)	(36.9497)	(0.04709)
	[-4.45613]	[-3.93572]	[0.28084]	[2.32961]
D(TIACAM(-1))	-0.047139	0.444222	11.55818	-0.001234
	(0.21801)	(0.79497)	(191.724)	(0.24435)

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	[-0.21622]	[0.55879]	[0.06029]	[-0.00505]
D(ETICAM(-1))	-0.007850	-0.286685	-0.798379	-0.019503
	(0.04960)	(0.18085)	(43.6154)	(0.05559)
	[-0.15828]	[-1.58522]	[-0.01830]	[-0.35085]
D(EPCAM(-1))	-6.20E-05	-9.99E-05	-0.191790	5.78E-05
	(0.00015)	(0.00056)	(0.13604)	(0.00017)
	[-0.40075]	[-0.17717]	[-1.40983]	[0.33349]
D(CTCCAM(-1))	-0.120468	-0.412263	-22.10616	-0.113694
	(0.15767)	(0.57495)	(138.661)	(0.17672)
	[-0.76404]	[-0.71705]	[-0.15943]	[-0.64334]
C	-0.013147	-0.068122	5.131872	0.001562
	(0.04155)	(0.15152)	(36.5416)	(0.04657)
	[-0.31639]	[-0.44960]	[0.14044]	[0.03354]
R-squared	0.333235	0.346449	0.037877	0.144286
Adj. R-squared	0.277671	0.291987	-0.042300	0.072976
Sum sq. resids	6.801473	90.43845	5260243.	8.544611
S.E. equation	0.336687	1.227724	296.0924	0.377373
F-statistic	5.997335	6.361241	0.472412	2.023370
Log likelihood	-18.65693	-104.0454	-466.0890	-26.18626
Akaike AIC	0.747180	3.334710	14.30573	0.975341
Schwarz SC	0.946239	3.533769	14.50479	1.174401
Mean dependent	-0.013485	-0.060606	2.323939	0.002879
S.D. dependent	0.396149	1.459084	290.0219	0.391945
Determinant resid covariance (dof adj.)		648.0836		
Determinant resid covariance		442.6498		
Log likelihood		-575.6615		
Akaike information criterion		18.29277		
Schwarz criterion		19.22172		

b- Centrafrique

Vector Error Correction Estimates				
Date: 02/02/18 Time: 16:51				
Sample (adjusted): 2000Q3 2016Q4				
Included observations: 66 after adjustments				
Standard errors in ( ) & t-statistics in [ ]				
Cointegrating Eq:	CointEq1			
TIARCA(-1)	1.000000			
ETIRCA(-1)	-0.333781			
	(0.14511)			
	[-2.30021]			
EPRCA(-1)	-0.009929			
	(0.00679)			

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	[-1.46180]			
SDEXTRCA(-1)	-0.035577			
	(0.02729)			
	[-1.30363]			
C	0.001939			
Error Correction:	D(TIARCA)	D(ETIRCA)	D(EPRCA)	D(SDEXTRCA)
CointEq1	-0.352329	0.125865	3.040416	-0.537263
	(0.11000)	(0.24412)	(3.62905)	(0.89069)
	[-3.20302]	[0.51559]	[0.83780]	[-0.60320]
D(TIARCA(-1))	0.243781	-0.112760	-1.375474	0.053830
	(0.15113)	(0.33540)	(4.98597)	(1.22373)
	[1.61308]	[-0.33620]	[-0.27587]	[0.04399]
D(ETIRCA(-1))	-0.114466	-0.378120	0.761209	-0.374477
	(0.06920)	(0.15357)	(2.28289)	(0.56030)
	[-1.65424]	[-2.46227]	[0.33344]	[-0.66835]
D(EPRCA(-1))	-0.002237	0.001664	-0.115594	0.002320
	(0.00402)	(0.00892)	(0.13263)	(0.03255)
	[-0.55650]	[0.18651]	[-0.87153]	[0.07128]
D(SDEXTRCA(-1))	-0.038184	0.000483	0.220692	-0.269806
	(0.01900)	(0.04218)	(0.62700)	(0.15389)
	[-2.00918]	[0.01146]	[0.35198]	[-1.75328]
C	-0.014939	-0.087123	0.145675	-0.104235
	(0.07643)	(0.16963)	(2.52171)	(0.61891)
	[-0.19545]	[-0.51360]	[0.05777]	[-0.16842]
R-squared	0.206256	0.178745	0.031772	0.110331
Adj. R-squared	0.140111	0.110308	-0.048914	0.036192
Sum sq. resids	23.07316	113.6412	25114.03	1512.812
S.E. equation	0.620123	1.376234	20.45892	5.021308
F-statistic	3.118230	2.611792	0.393776	1.488157
Log likelihood	-58.96745	-111.5819	-289.7203	-197.0083
Akaike AIC	1.968711	3.563087	8.961223	6.151766
Schwarz SC	2.167770	3.762146	9.160282	6.350826
Mean dependent	-0.008636	-0.060606	0.031061	-0.058636
S.D. dependent	0.668739	1.459058	19.97619	5.114716
Determinant resid covariance (dof adj.)		3496.062		
Determinant resid covariance		2387.858		
Log likelihood		-631.2788		
Akaike information criterion		19.97815		
Schwarz criterion		20.90709		

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c- Gabon

Vector Error Correction Estimates				
Date: 02/04/18 Time: 06:54				
Sample (adjusted): 2000Q3 2016Q4				
Included observations: 66 after adjustments				
Standard errors in ( ) & t-statistics in [ ]				
Cointegrating Eq:	CointEq1			
TIAGAB(-1)	1.000000			
ETIGAB(-1)	-0.337080			
	(0.11138)			
	[-3.02647]			
EPGAB(-1)	-0.001089			
	(0.00052)			
	[-2.10033]			
MGAB(-1)	0.089132			
	(0.05290)			
	[1.68481]			
C	-0.132555			
Error Correction:	D(TIAGAB)	D(ETIGAB)	D(EPGAB)	D(MGAB)
CointEq1	-0.246420	0.308270	82.38961	-0.235885
	(0.10040)	(0.28783)	(38.0573)	(0.42338)
	[-2.45430]	[1.07103]	[2.16488]	[-0.55714]
D(TIAGAB(-1))	0.158551	-0.373268	-61.22268	-0.299807
	(0.14507)	(0.41586)	(54.9861)	(0.61171)
	[1.09297]	[-0.89758]	[-1.11342]	[-0.49011]
D(ETIGAB(-1))	-0.097938	-0.313355	16.17595	-0.156227
	(0.05287)	(0.15155)	(20.0384)	(0.22292)
	[-1.85259]	[-2.06767]	[0.80725]	[-0.70080]
D(EPGAB(-1))	-0.000210	0.000202	-0.180790	-0.000123
	(0.00034)	(0.00098)	(0.12990)	(0.00145)
	[-0.61414]	[0.20528]	[-1.39179]	[-0.08516]
D(MGAB(-1))	-0.005346	-0.045027	4.880217	-0.188061
	(0.03355)	(0.09618)	(12.7173)	(0.14148)
	[-0.15934]	[-0.46814]	[0.38375]	[-1.32925]
C	-0.004250	-0.083624	3.777414	-0.013788
	(0.05857)	(0.16790)	(22.1999)	(0.24697)
	[-0.07257]	[-0.49807]	[0.17015]	[-0.05583]
R-squared	0.127646	0.196187	0.112465	0.093283
Adj. R-squared	0.054950	0.129203	0.038503	0.017723

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Sum sq. resids	13.52690	111.1641	1943474.	240.5300
S.E. equation	0.474814	1.361152	179.9757	2.002207
F-statistic	1.755881	2.928852	1.520589	1.234561
Log likelihood	-41.34578	-110.8546	-433.2309	-136.3252
Akaike AIC	1.434721	3.541048	13.31003	4.312885
Schwarz SC	1.633780	3.740107	13.50909	4.511945
Mean dependent	0.000000	-0.060606	1.457727	-0.002879
S.D. dependent	0.488423	1.458640	183.5439	2.020189
Determinant resid covariance (dof adj.)		30960.83		
Determinant resid covariance		21146.67		
Log likelihood		-703.2546		
Akaike information criterion		22.15923		
Schwarz criterion		23.08818		

d- Guinée Equatoriale

Vector Error Correction Estimates					
Date: 02/04/18 Time: 07:37					
Sample (adjusted): 2000Q3 2016Q4					
Included observations: 66 after adjustments					
Standard errors in ( ) & t-statistics in [ ]					
Cointegrating Eq:	CointEq1				
TIAGE(-1)	1.000000				
ETIGE(-1)	0.501540				
	(0.13333)				
	[3.76169]				
EPGE(-1)	-0.001056				
	(0.00046)				
	[-2.27815]				
INFLGE(-1)	0.230816				
	(0.24397)				
	[0.94609]				
MGE(-1)	-0.147676				
	(0.03609)				
	[-4.09135]				
C	-1.076261				
Error Correction:	D(TIAGE)	D(ETIGE)	D(EPGE)	D(INFLGE)	D(MGE)
CointEq1	-0.526562	-1.024867	58.45096	-0.476320	-1.972760
	(0.13331)	(0.21272)	(39.4296)	(0.14183)	(0.94798)
	[-3.94985]	[-4.81799]	[1.48241]	[-3.35847]	[-2.08101]
D(TIAGE(-1))	0.137329	0.625103	-92.75215	0.009605	0.586611

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	(0.26195)	(0.41797)	(77.4759)	(0.27868)	(1.86271)
	[0.52426]	[1.49556]	[-1.19717]	[0.03447]	[0.31492]
D(ETIGE(-1))	0.044670	-0.252276	-10.25926	0.051461	-0.166629
	(0.11825)	(0.18869)	(34.9755)	(0.12581)	(0.84090)
	[0.37775]	[-1.33700]	[-0.29333]	[0.40905]	[-0.19816]
D(EPGE(-1))	-0.000503	-0.000917	-0.202514	-0.000339	-0.002888
	(0.00048)	(0.00076)	(0.14109)	(0.00051)	(0.00339)
	[-1.05349]	[-1.20452]	[-1.43533]	[-0.66839]	[-0.85137]
D(INFLGE(-1))	-0.125150	0.172848	103.1246	-0.002479	0.313317
	(0.22851)	(0.36461)	(67.5853)	(0.24310)	(1.62492)
	[-0.54769]	[0.47406]	[1.52584]	[-0.01020]	[0.19282]
D(MGE(-1))	-0.030317	-0.081211	-2.407389	-0.037476	-0.328904
	(0.03446)	(0.05498)	(10.1915)	(0.03666)	(0.24503)
	[-0.87984]	[-1.47706]	[-0.23622]	[-1.02231]	[-1.34231]
C	-0.025760	-0.049010	4.547191	-0.032407	-0.127410
	(0.08979)	(0.14326)	(26.5558)	(0.09552)	(0.63847)
	[-0.28691]	[-0.34209]	[0.17123]	[-0.33927]	[-0.19956]
R-squared	0.323864	0.407435	0.110004	0.283200	0.198246
Adj. R-squared	0.255104	0.347174	0.019496	0.210305	0.116712
Sum sq. resids	31.13959	79.28263	2724072.	35.24424	1574.620
S.E. equation	0.726491	1.159212	214.8737	0.772891	5.166089
F-statistic	4.710086	6.761192	1.215407	3.885038	2.431450
Log likelihood	-68.86117	-99.70096	-444.3734	-72.94731	-198.3297
Akaike AIC	2.298823	3.233363	13.67798	2.422646	6.222113
Schwarz SC	2.531060	3.465599	13.91022	2.654882	6.454349
Mean dependent	-0.029697	-0.060455	2.948333	-0.034545	-0.136818
S.D. dependent	0.841749	1.434711	216.9994	0.869738	5.496810
Determinant resid covariance (dof adj.)		18593.64			
Determinant resid covariance		10614.63			
Log likelihood		-774.1593			
Akaike information criterion		24.67149			
Schwarz criterion		25.99856			

e- Tchad

Vector Error Correction Estimates			
Date: 02/04/18 Time: 07:47			
Sample (adjusted): 2000Q3 2016Q4			
Included observations: 66 after adjustments			
Standard errors in ( ) & t-statistics in [ ]			
Cointegrating Eq:	CointEq1		
TIATCHAD(-1)	1.000000		
ETITCHAD(-1)	2.185179		

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	(0.65691)		
	[3.32646]		
EPTCHAD(-1)	-0.004560		
	(0.00403)		
	[-1.13192]		
C	-3.148004		
Error Correction:	D(TIATCHAD)	D(ETITCHAD)	D(EPTCHAD)
CointEq1	-0.117588	-0.178826	8.135229
	(0.05027)	(0.04755)	(5.47127)
	[-2.33905]	[-3.76067]	[1.48690]
D(TIATCHAD(-1))	0.079612	0.126096	-9.454423
	(0.13228)	(0.12513)	(14.3971)
	[0.60183]	[1.00775]	[-0.65669]
D(ETITCHAD(-1))	0.006871	-0.248652	-2.462604
	(0.12911)	(0.12213)	(14.0520)
	[0.05321]	[-2.03600]	[-0.17525]
D(EPTCHAD(-1))	-0.000459	-0.000526	-0.180718
	(0.00121)	(0.00115)	(0.13200)
	[-0.37811]	[-0.45824]	[-1.36911]
C	-0.016581	-0.068650	3.470151
	(0.16088)	(0.15218)	(17.5096)
	[-0.10307]	[-0.45112]	[0.19819]
R-squared	0.094431	0.329978	0.077819
Adj. R-squared	0.035049	0.286043	0.017348
Sum sq. resids	103.6205	92.71114	1227376.
S.E. equation	1.303340	1.232824	141.8482
F-statistic	1.590236	7.510460	1.286883
Log likelihood	-108.5356	-104.8645	-418.0642
Akaike AIC	3.440472	3.329226	12.82013
Schwarz SC	3.606355	3.495109	12.98601
Mean dependent	-0.023030	-0.060606	2.529848
S.D. dependent	1.326799	1.459032	143.0949
Determinant resid covariance (dof adj.)		48945.63	
Determinant resid covariance		38643.07	
Log likelihood		-629.4999	
Akaike information criterion		19.62121	
Schwarz criterion		20.21839	

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f- Congo

Vector Error Correction Estimates					
Date: 02/05/18 Time: 02:49					
Sample (adjusted): 2000Q3 2016Q4					
Included observations: 66 after adjustments					
Standard errors in ( ) & t-statistics in [ ]					
Cointegrating Eq:	CointEq1				
TIACONG(-1)	1.000000				
ETICONG(-1)	0.983354				
	(0.20493)				
	[4.79852]				
EPCONG(-1)	0.000372				
	(0.00065)				
	[0.57542]				
CTCONG(-1)	0.193744				
	(0.06949)				
	[2.78790]				
CKNCONG(-1)	-1.719038				
	(0.32248)				
	[-5.33073]				
C	-0.262329				
Error Correction:	D(TIACONG)	D(ETICONG)	D(EPCONG)	D(BCCONG)	D(CCNCONG)
CointEq1	-0.244557	-0.538439	-13.88527	0.168766	-0.084498
	(0.08971)	(0.19235)	(23.3479)	(0.22847)	(0.10828)
	[-2.72601]	[-2.79927]	[-0.59471]	[0.73869]	[-0.78039]
D(TIACONG(-1))	0.297514	0.541092	-16.62993	-0.136976	0.156878
	(0.19475)	(0.41755)	(50.6829)	(0.49595)	(0.23505)
	[1.52770]	[1.29588]	[-0.32812]	[-0.27619]	[0.66744]
D(ETICONG(-1))	0.085282	-0.109007	-0.676600	-0.179481	0.041252
	(0.10783)	(0.23119)	(28.0628)	(0.27460)	(0.13014)
	[0.79090]	[-0.47149]	[-0.02411]	[-0.65360]	[0.31697]
D(EPCONG(-1))	-0.000411	-0.000210	-0.182869	0.001193	-3.91E-06
	(0.00052)	(0.00111)	(0.13490)	(0.00132)	(0.00063)
	[-0.79355]	[-0.18909]	[-1.35563]	[0.90353]	[-0.00625]
D(CTCONG(-1))	0.099577	0.116177	8.697202	-0.212635	0.052467
	(0.05856)	(0.12557)	(15.2414)	(0.14914)	(0.07068)
	[1.70031]	[0.92523]	[0.57063]	[-1.42572]	[0.74229]

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D(CKNCONG(-1))	-0.523026	-0.751576	28.63109	0.431679	-0.595053
	(0.22574)	(0.48401)	(58.7504)	(0.57489)	(0.27246)
	[-2.31690]	[-1.55280]	[0.48733]	[0.75089]	[-2.18401]
C	-0.011098	-0.066147	2.626864	-0.026760	-0.014987
	(0.07464)	(0.16004)	(19.4262)	(0.19009)	(0.09009)
	[-0.14867]	[-0.41331]	[0.13522]	[-0.14077]	[-0.16635]
R-squared	0.227481	0.284283	0.055678	0.057067	0.225539
Adj. R-squared	0.148919	0.211498	-0.040355	-0.038824	0.146780
Sum sq. resids	21.54297	99.03400	1459128.	139.7153	31.38156
S.E. equation	0.604264	1.295586	157.2609	1.538849	0.729309
F-statistic	2.895584	3.905806	0.579781	0.595123	2.863665
Log likelihood	-56.70297	-107.0416	-423.7719	-118.3984	-69.11662
Akaike AIC	1.930393	3.455807	13.05369	3.799950	2.306564
Schwarz SC	2.162629	3.688043	13.28593	4.032186	2.538800
Mean dependent	-0.018030	-0.060606	1.352424	-0.009697	-0.012727
S.D. dependent	0.655000	1.459032	154.1807	1.509819	0.789552
Determinant resid covariance (dof adj.)		1568.039			
Determinant resid covariance		895.1527			
Log likelihood		-692.5505			
Akaike information criterion		22.19850			
Schwarz criterion		23.52556			

Appendix 4: Short- and long-term coefficients

- Short-term coefficients

	explained variable : the expected rate of inflation (tia)							Force de rappel
	$(\Delta(eti))$	$(\Delta(ep))$	$(\Delta(\inf l))$	$(\Delta(m))$	$(\Delta(sdext))$	$(\Delta(ctc))$	$(\Delta(ckn))$	
Ca	−0,0078 (−0,158)	−0,000062 (−0,4007)				−0,12 (−0,764)		−0,187 (−4,456)
RCA	−0,114 (−1,65)	−0,0022 (−0,55)			−0,038 (−2,009)			−0,352 (−3,203)
Con	0,085 (0,79)	−0,0041 (−0,79)				−0,9957 (1,70)	−0,523 (−2,316)	−0,244 (−2,726)
Gab	−0,097 (−1,85)	−0,00021 (−0,61)		−0,0053 (−0,15)				−0,246 (−2,454)
GE	0,044 (0,37)	−0,0005 (−1,65)	−0,125 (−0,54)	−0,03 (−0,87)				−0,526 (−3,949)
Tch	0,0068 (0,05)	−0,0004 (−0,37)						−0,117 (−2,339)

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- Long-term coefficients

	explained variable : the expected rate of inflation (tia)						
	(eti)	(ep)	$(\inf l)$	(m)	$(sdext)$	(ctc)	(ckn)
Ca	$-0{,}58$ $(3{,}05)$	$-0{,}00019$ $(-0{,}34)$				$-1{,}13$ $(-2{,}08)$	
RCA	$-0{,}33$ $(-2{,}30)$	$-0{,}0099$ $(-1{,}46)$			$-0{,}035$ $(-1{,}30)$		
Cog	$0{,}98$ $(4{,}79)$	$-0{,}00037$ $(-0{,}57)$				$-0{,}19$ $(2{,}78)$	$-1{,}71$ $(-5{,}33)$
Gab	$-0{,}33$ $(-3{,}02)$	$-0{,}00108$ $(-2{,}1003)$		$-0{,}089$ $(1{,}68)$			
GE	$0{,}501$ $(3{,}76)$	$-0{,}001$ $(-2{,}27)$	$0{,}23$ $(0{,}94)$	$-0{,}14$ $(-4{,}09)$			
Tch	$-2{,}18$ $(-3{,}32)$	$-0{,}004$ $(-1{,}13)$					

Appendix 5: Financial development indicators in the CEMAC zone

-The average level of financial development (2000-2011)

Pays	Cameroun	Centrafrique	Congo	Gabon	Guinée Equatoriale	Tchad
Ratio « crédits au secteur privé/PIB »	10,42	6,98	4,02	10,33	4,58	3,99

Source: Table prepared by the Author based on IMF data.

- Average number of bank branches per 100,000 Adults (2000-2011)

Pays	Cameroun	Centrafrique	Congo	Gabon	Guinée Equatoriale	Tchad
Nombre de succursales bancaires pour 100 000 Adultes	1,27	0,51	1,48	4,17	4,28	0,49

Source: Table prepared by the Author based on IMF data.

- The average number of bank accounts per 1000 adults (2000-2011)

Pays	Cameroun	Centrafrique	Congo	Gabon	Guinée Equatoriale	Tchad
Nombre de comptes bancaires pour 1000 Adultes	44,91	21,45	43,08	91,02	190,23	12,31

Source: Table prepared by the Author based on IMF data.

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