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BANKING INTERMEDIATION AND ECONOMIC GROWTH IN THE CONGO : CORRELATION AND CAUSALITY

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ABSTRACT

This article on the linear relationship between banking intermediation and economic growth consisted in determining the correlative and causal relationship between these two phenomena in Congo for the period from 1973 to 2015. Estimates using the Johansen cointegration test and the Vector Error Correction Model (VCEM) on seven variables (GROWTH, PRIV, GOV, OPEN, INFL, TBSS, and IPRIV) revealed a negative and significant correlative relationship between these two phenomena in the case of Congo. This result corroborates that of the post-Keynesians. In this case, the causal relationship goes from economic growth to bank intermediation.
Keywords: bank intermediation, economic growth, correlation, causality.

I-INTRODUCTION

In the economic literature, the thesis that a liberalized financial system has a positive impact on the financing of economic growth is largely proven by the neoclassical school (McKinnon, 1973; Shaw, 1973; King and Levine, 1993). However, the post-Keynesian school of thought shows that interest rate deregulation has a dominant negative effect. The latter is reflected in an increase in savings that reduces aggregate demand, leading to a decline in profits, investment, and economic growth (Burkett and Dutt, 1991).

In CEMAC countries, the relationship between the financial sector and the real sector in a context of financial liberalization in the sense of McKinnon (1973) and Shaw (1973) was first experimented with in the 1990s (Eggoh, 2009). It consisted of encouraging the disengagement of public authorities from the capital of banks in favor of private interests; redefining the rules of supervision and liberalizing interest rates and conditions of access to the financial sector (Ndeffo and Ningaye, 2011). To this end, between 1973 and 2015, the number of banks in operation increased by 73.33%, from thirty to fifty-two (COBAC, 2018). At the same time, these countries experienced increasing economic growth.

In Congo, during the same period, the number of banking intermediaries increased from four to eleven banks, an increase of 275%. During this time, the average rate of economic growth was 4.6% over this period.

The problem that arises from such a finding is whether such economic growth is attributable to the expansion of the size of the banking sector in Congo or vice versa. From such a consideration, several questions come to mind:

- What is the nature of the correlative relationship between banking intermediation and economic growth in Congo?
- What is the nature of the causal relationship between bank intermediation and economic growth in the Congo?

The general objective of this study is to determine the correlative and causal relationship between banking intermediation and economic growth in Congo. This leads us to two specific objectives, namely

- To determine the nature of the correlative relationship between banking intermediation and economic growth in the Congo;
- to determine the nature of the causal relationship between bank intermediation and economic growth in Congo.

To this end, the following subsidiary hypotheses are formulated:

- H1: the correlative relationship between bank intermediation and economic growth is positive in Congo (Levine, Loayza and Beck, 2000; Eggoh, 2009);
- H2: The causal relationship between these two phenomena is unidirectional in Congo. It goes from banking intermediation to economic growth (Kpodar, 2006; Igue, 2013).

This article is structured around three (3) sections: the first concerns the review of the theoretical and empirical literature; the second concerns the research methodology and finally, the third section concerns the data processing and the interpretation of the results.

II - REVIEW OF THE LITERATURE

Concerning the review of the literature, the neoclassical conception and the post-Keynesian conception oppose each other both theoretically and empirically on the correlative and causal relationship between bank intermediation and economic growth.

II - THEORETICAL REVIEW

On the theoretical level, four theories support neoclassical thinking. These are: the theory of interest and income of Gurley and Shaw (1955); the theory of financial liberalization of McKinnon (1973) and Shaw (1973), the revised theory of financial liberalization of McKinnon (1991) and his followers; and finally, the theoretical models of endogenous growth (Roubini and Sala-i-Martin, 1992, 1995; Pagano, 1993; Levine, 1997).

On the other hand, three theories defend the post-Keynesian conception: Minsky's (1964) theory of financial instability; Giovanini's (1983, 1985) theory of the savings behaviour of economic agents following variations in the interest rate; and Morisset's (1993) theory of the increase in interest rates.

II.2 - EMPIRICAL REVIEW

Empirically, the neoclassical work highlights the existence of a positive correlative relationship between bank intermediation and economic growth and a causal relationship either univocal, going from bank intermediation to economic growth; or bidirectional (King and Levine, 1992; Beck, Levine and Loayza, 2000; Rioja and Valen, 2004; Kpodar, 2006; Eggoh, 2009; Igue, 2013). While, post-Keynesian works show a negative correlative relationship between bank intermediation and economic growth and a direction of causality from economic growth to bank intermediation (Rancière, Tornell and Westermann, 2006; Demirgüç-kunt and Detragiache, 1999).

III - METHODOLOGY

The methodology adopted in this article is to analyze statistically and econometrically the correlative and causal relationship between bank intermediation and economic growth from time series data from 1973 to 2015.

III.1 - THEORETICAL MODEL

The theoretical model in the context of the relationship between finance and economic growth is an adhoc model as taught in the economic literature (Levine, Loayza and Beck, 2000; Eggoh, 2009).

III.2 - EMPIRICAL MODEL

The empirical model to be estimated in this article is inspired by the work of Levine, Loayza and Beck (2000) and Eggoh (2009). Recall that Levine, Loayza, and Beck (2000) focused on financial intermediation and economic growth: causality and causes and Eggoh (2009) on financial development, economic growth, and financial instability. According to the above authors, the relationship between financial intermediation and economic growth can be expressed as follows:

GROWTH = α + ß FINANCE + Ɣ CONDITIONING SET+ ε Where: GROWTH is the real growth rate of GDP per capita; FINANCE expresses the financial variables ; Conditioning SET represents the control variables.

Since economic growth is captured by the GROWTH variable, financial intermediation by the PRIV (or M3) variable and the control variables used are: GOV, OPEN, INFL, TBSS and IPRIV; the previous equation can therefore be written:

GROWTH = k + aPRIV + b GOV + c OPEN + e INFL + f TBSS + g IPRIV+ ε

III.3 - MODEL TO BE ESTIMATED

The VAR model consists of estimating the relationship between two variables. In order to avoid the hazards of applying classical linear regression methods to data that evolve over time, time series econometrics has been used in recent developments. Yao (2000), argues that the links between two variables can be multiple. Taking this point of view into account, we have chosen a Vector Autoregressive Model (VAR) for our research, and possibly a Vector Error Correction Model (VECM) if there is at least one cointegrating relationship. VAR models do not make any a priori restrictions on the endogeneity or exogeneity of the variables. It is a model with no other a priori restrictions than the choice of the selected variables and the number of lags.

Developed by Sims (1980), the Vector Autoregressive Model (VAR) allows us to understand the interdependencies between several time series. In this model, the variables are treated in such a way that each of them is explained by its own past values and those of the other variables. There is therefore no distinction between the variables (explained and explanatory). All variables are considered as endogenous.

Let Yt be a random process with K variables and P lags, the representation of VAR with k variables and P lags VAR (P) is as follows:

$Y_t = A_0 + A_1 Y_{t-1} + \ldots + A_p Y_{t-p} + \varepsilon_t \quad (1)$ où :

$$Y_t = \begin{bmatrix} Y^1_t \\ Y^2_t \\ \vdots \\ Y^k_t \\ . \end{bmatrix} \quad Ai = \alpha^1_{1i}\ \alpha^1_{1i} \quad \begin{bmatrix} \alpha^1_{1i} & a^2_{1i} \ldots & \alpha^k_{1i} \\ a^1_{2i} & a^2_{2i} \ldots & a^k_{2i} \\ \vdots & \vdots & \vdots \\ \alpha^1_{ki} & a^2_{ki} \ldots & \alpha^k_{ki} \end{bmatrix} \quad A_0 = \begin{bmatrix} \alpha^0_1 \\ a^0_2 \\ \vdots \\ a^0_k \end{bmatrix} \quad \varepsilon_t = \begin{bmatrix} \varepsilon^1_t \\ \varepsilon^2_t \\ \vdots \\ \varepsilon^k_t \end{bmatrix}$$

The error covariance matrix Σ = E(εt'εtε) is unknown here. We can then denote A(L) Yt = A0 + εt where A is a matrix polynomial (KXK), with A(z) = I - A1z - A2z2 - ... - Apzp.
The determinant of A(z) [det (A(z)] is called the characteristic polynomial, with I the identity matrix. A(L) is the delay matrix polynomial.Note that the VAR writing here assumes that the ith equation defining Yit does not involve any Yjt whereas this is not always the case: consider stationary processes (Xt) and (Yt) such that :

$$\begin{cases} X_t = \alpha + \beta_1 X_{t-1} + \ldots + \beta_p X_{t-p} - \delta Y_t + \gamma_1 Y_{t-1} + \ldots + \gamma_q Y_{1-q} + \varepsilon_t \\ Y_t = a + b_1 Y_{t-1} + \ldots + b_r Y_{t-1} - dX_t + C_1 X_{t-1} + \ldots + C_s X_{t-s} + \eta_t \end{cases} \quad (2)$$

be written in matrix form:

$DZ_t = A + \phi 1 z_{t-1} + \ldots + \phi n z_{t-n} + u_t$ (3) où max (p, q, r, s), avec :

$Z_t = \begin{bmatrix} X_t \\ Y_t \\ Yt \end{bmatrix}$ $D = \begin{bmatrix} X_t \\ Y_t \\ Yt \end{bmatrix}$ $A \begin{bmatrix} X_t \\ Y_t \\ Yt \end{bmatrix}$ and for i = 1, …, n $A_i = \begin{bmatrix} \beta_i \\ \gamma_i \\ bi \quad c_i \end{bmatrix}$, $\mu t = \begin{bmatrix} \varepsilon_t \\ \eta_t \\ Yt \end{bmatrix}$

With the convention, for example, that βi = 0 for p < i ≤ n. it is assumed that the noises εt and ηt are uncorrelated. Under these conditions, we can then write the equation in the reduced form by multiplying Zt by D-1 and find Zt = Ψ + Ψ1Zt-1 + ... + Ψnzt-n + Vt with Vt = D-1ut.
In this equation, we then find that the innovations (Vt) are a function of the structural form innovations (εt and ηt) and can be correlated:
Vt =((xεt- δηt)/(1- δa),(ηt-dεt)/(1- δd))
The study of a time series requires prior knowledge of the behavior of its stochastic characteristics (its expectation, variance and covariance), in order to realize whether or not it is stationary. The constancy of the value of its characteristics in time proves the existence of a stationarity of the considered time series, while if it is modified in time, the considered series is non-stationary. Thus, if Yt is a random process, we will say that it is stationary if the following three conditions are met:
Vt, E(Yt) = E(yt+m) = μ: the mean is constant and independent of time.Vt, Var (Yt) < α: the variance is finite and independent of time.
Vt, Cov(Yt; Yt+m) = E([Yt - μ][Yt+m - μ]) = λm: the covariance is constant and independent of time.
The stationarity of a VAR(P) can be determined from its characteristic polynomial given by the formula det (I - A1z - A2z2 - ... - Apzp). Thus a VAR(P) process is assumed to be stationary if the roots of its characteristic polynomial are all outside the unit circle, i.e. their absolute value is greater than 1.
The estimation procedure consists in testing the stationarity of the variables by means of unit root tests. To do this, we will use the augmented Dickey-Fuller test or ADF test (ADF, 1981), the Phillips-Perron test and the Kwiatkowsky-Phillips-Schmidt-Shin test. After that, we use the Johansen (1988) test to test for the presence of a cointegrating relationship between financial intermediation and economic growth in Congo. In case of the existence of at least one cointegrating relationship, we will use the Vector Error Correction Model (VECM) to determine it (them). We will proceed to tests on the residuals to assess the relevance of the model. Finally,

we will determine the direction of causality between bank intermediation and economic growth in Congo using the Johansen (1988) test.

III.3 - PRESENTATION OF DATA AND VARIABLES

The data used in this study are taken from the World Bank database. They cover the period from 1973 to 2017 and concern all CEMAC countries, notably Congo, Gabon, Cameroon, Chad, Central African Republic and Equatorial Guinea.

The wording of each variable, its method of calculation, its expected sign and its source are recorded in the table below :

Table 1: Presentation of variables, calculation method, sign and source

Variables (%)	Method of calculation	Expected sign	
GROWTH	$(PIB_n - PIB_{n-1}) / PIB_{n-1}$	+	BM
PRIV	Private sector credit/GDP	+	BM
GOV	Government Expenditures / GDP	+	BM
OPEN	(export + import) / GDP	+	BM
INFL	Inflation rate calculated from the consumer price index	-	BM
IPRIV	Standard deviation of PRIV growth rate	-	Autheur

Source: Author from World Bank database

The variables used are labeled as follows: GROWTH, the variable approximating economic growth; PRIV, the variable of interest capturing financial intermediation; GOV expresses the percentage of government spending to GDP; OPEN refers to the percentage of trade openness to GDP; INFL is inflation as a percentage; and finally, IPRIV is the instability of the financial intermediation variable (PRIV).

Table 2: Descriptive statistics of variables

	GROWTH	PRIV	GOV	OPEN	INFL	TBSS	IPRIV
Mean	3,951163	0,092443	0,318640	1,141165	5,923256	43,22558	0,161931
Median	3,600000	0,056474	0,323466	1,184488	4,500000	44,70000	0,034955
Maximum	23,60000	0,316802	0,428845	1,617266	42,40000	96,80000	3,112760
Minimum	-6,900000	0,011310	0,202680	0,751402	-3,900000	3,300000	2,08E-05
Std, Dev,	5,799523	0,078211	0,054581	0,239957	7,884036	26,92610	0,518034
Jarque-Bera	27,94347	12,41116	1,288492	2,171051	181,7213	1,162955	1184,449
Probability	0,000001	0,002018	0,525058	0,337724	0,000000	0,559072	0,000000
Observations	43	43	43	43	43	43	43

Source : Author from Eviews 9.

Descriptive statistics reveal that in the period from 1973 to 2017, the average growth rate of Congo's GDP is 3.95%. The average credit to the private sector expressed as a percentage of GDP was 0.092%. Also, government spending expressed as a percentage of GDP was 0.32%; trade openness expressed as a percentage of GDP was 1.14%; the inflation rate was 5.92%; the gross secondary school enrollment rate was 43.23%; and the instability of bank intermediation was 0.16%. The maximum values of the GROWTH, PRIV, GOV, OPEN, INFL, TBSS and IPRIV variables are 23.60%, 0.31%, 0.42%, 1.61%, 42.40%, 96.80% and 3.11% respectively. Similarly, their minimum values are -6.90%; 0.01%; 0.20%; 0.75%; -3.90%; 3.30% and 2.08.10-5 respectively. The probabilities associated with the Jarque-Bera test show that the variables GROWTH, PRIV, INFL and IPRIV follow the normal distribution. However, the variables GOV, OPEN and TBSS do not follow it.

Table 3: Matrix of correlation coefficients

Correlation Probability	GROWTH	PRIV	GOV	OPEN	INFL	TBSS	IPRIV
GROWTH	1,000000 -----						
PRIV	0,427957 (0,0042) -	1,000000 -----					
GOV	0,059251 (0,7059)	0,456986 (0,0021) -	1,000000 -----				
OPEN	0,180048 (0,2480)	0,262203 (0,0894) -	0,019652 (0,9005)	1,000000 -----			
INFL	0,077817 (0,6199) -	0,351658 (0,0208)	0,100827 (0,5200)	0,051655 (0,7422)	1,000000 ----- -		
TBSS	0,244505 (0,1141)	0,352066 (0,0206) -	0,401241 (0,0077) -	0,590491 (0,0000)	0,181275 (0,2447) -	1,000000 -----	
IPRIV	0,194905 (0,2104)	0,186095 (0,2322)	0,140636 (0,3684)	-0,032473 (0,8362)	0,018625 (0,9056)	-0,165120 (0,2900)	1,000000 -----

Source: Author based on Eviews 9.

The correlation coefficient matrix shows that the bank intermediation variable (PRIV) is negatively and significantly associated with the economic growth variable (GROWTH). This result reflects the existence of a negative and significant correlative relationship between these two phenomena. Thus, these two phenomena evolve in opposite directions in the case of the Congo.

Table n°4 : Test of stationarity of the variables

	GROWTH		PRIV		GOV		OPEN		INFL		TBSS		IPRIV	
TESTS	**t-stat**	**Prob.**	**t-stat**	**Prob.**	**t-stat**	**Prob.**	**t-stat**	**Prob.**	**t-stat**	**Prob.**	**t-stat**	**Prob.**	**t-stat**	**Prob.**
LEVEL PARKING														
ADF	-3,26	0,08	-1,88	0,64	-3,34	0,07	-2,70	0,24	-5,22	0,00*	-6,43	0,00*	-6,55	0,00*
PP	-3,25	0,08	-1,88	0,64	-3,30	0,07	-2,75	0,22	-5,26	0,00*	-1,93	0,61	-6,59	0,00*
STATIONARITY IN FIRST DIFFERENCE														
ADF	-7,46	0,00*	-6,42	0,00*	-6,31	0,00*	-7,28	0,00*	-7,54	0,00*	-6,67	0,00*	-10,74	0,00*
PP	-7,62	0,00*	-6,42	0,00*	-10,32	0,00*	-7,31	0,00*	-9,98	0,00*	-6,67	0,00*	-40,67	0,00*

* : Significance at the 5% level,

Source: Author based on Eviews 9.

All the variables are not stationary at level. However, they are in first difference because the probability associated with the t-statistic of these tests in first difference is significant at the 5% level. After the unit root tests, we implement the information criterion test of Akaike and Schwartz and the cointegration test of Johansen (1991, 1995).

Table 5: Akaike and Schwartz information criterion test

Lag	LogL	AIC	SC
0	-334,7122	17,08561	17,38116
1	-220,0786	13,80393*	16,16836*
2	-185,5912	14,52956	18,96287
3	-140,8439	14,74219	21,24438

*: Indicates significant lag,

Source: Author from Eviews 9.

The Akaike and Schwartz information test shows an optimal delay number equal to one.

Table 6: Johansen cointegration test

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	1	1	2
Max-Eig	1	1	1	2	2

Source : Author from Eviews 9.

The result of the Johansen cointegration test, considering the linear model with intercept and trend, shows that there is one cointegration relationship according to the trace criterion and two cointegration relationships according to the maximum likelihood criterion. Thus, we refer to the maximum likelihood criterion which shows us two cointegrating relationships. This choice allows us to use the vector error correction model (VECM). The estimation results of this model are as follows:

Table 7: Rate of adjustment towards the long-term target (cointEq1)

D(PRIV)	D(GOV)	D(OPEN)	D(INFL)	D(TBSS)	D(IPRIV)
-0.003012	0.001277	-0.003161	0.031517	-0.376711	-0.008363
[-1.70053] *	[0.81584]	[-0.85618]	[0.09871]	[-1.08197]	[-0.44047]

Source : Author from Eviews 9.
[ ] : t-statistic, * : significant at the 5% level

This result shows that in the long run, bank intermediation has a significant negative influence on economic growth in Congo. However, this influence is very weak. This result also confirms the existence of a negative correlation between bank intermediation and economic growth in the Congo. This case refers to the post-Keynesian conception. Thus, the direction of causality of the relationship between these two phenomena is from economic growth to financial intermediation.

Table 8: Estimation results of the short-term model

Variables	Coefficients	T-statistiques
PRIV (-1)	-53,536	-2,39*
GOV (-1)	76,139	3,042*
OPEN (-1)	-12,227	-1,602
INFL (-1)	-0,614	-3,525*
TBSS (-1)	0,018	0,284
IPRIV (-1)	-23,340	-9,016*

Source: Author based on Eviews 9.
* : significant at the 5% level

This result shows that in the short run, bank intermediation has a significant negative impact on economic growth in the Congo. The direction of causality of the relationship between these two phenomena is always from economic growth to financial intermediation.

Table 9: Model validity test

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |** |	. |** |	1	0,215	0,215	2,0415	0,153
. |*. |	. |*. |	2	0,157	0,116	3,1505	0,207
.*| . |	.*| . |	3	-0,073	-0,135	3,3949	0,335
. | . |	. | . |	4	0,015	0,007	3,4059	0,492
.*| . |	.*| . |	5	-0,144	-0,120	4,4282	0,490
**| . |	.*| . |	6	0,210	0,182	6,6472	0,355
**| . |	**| . |	7	-0,343	-0,263	12,765	0,078
.*| . |	. | . |	8	-0,093	-0,041	13,223	0,104
.*| . |	.*| . |	9	0,147	0,117	14,419	0,108
. | . |	. | . |	10	0,013	0,017	14,429	0,154
. | . |	. | . |	11	0,044	0,044	14,544	0,204
. |*. |	. |*. |	12	0,212	0,111	17,269	0,140
. | . |	.*| . |	13	-0,068	-0,108	17,563	0,175
. |*. |	.*| . |	14	-0,074	-0,068	17,925	0,210
.*| . |	**| . |	15	0,164	0,221	19,737	0,182
. | . |	. | . |	16	0,063	0,058	20,014	0,220
.*| . |	.*| . |	17	-0,155	-0,153	21,770	0,194
.*| . |	. | . |	18	-0,088	-0,062	22,370	0,216
.*| . |	. | . |	19	-0,082	-0,070	22,910	0,241
. | . |	. | . |	20	0,007	0,046	22,914	0,293

Source : Autheur from Eviews 9.

The validity test of the model shows that the residuals are stationary (stable). This is because all the sticks are inside the dotted lines and all the probabilities are greater than 0.05. This test shows that the model used is valid.

IV-CONCLUSION

To examine the linear relationship between financial intermediation and economic growth, two objectives were set. To determine the correlative relationship and to determine the causal relationship between these two phenomena in the case of Congo. To this end, the Johansen test and the Vector Error Correction Model (VCEM) were used to identify a negative and significant correlative relationship between financial intermediation and economic growth in the case of Congo for the period from 1973 to 2015. This result corroborates that of the post-Keynesians. In this case, the causal relationship runs from economic growth to bank intermediation in the Congo case. However, the two subsidiary hypotheses of the neoclassical view formulated in this article are not validated. For, in the Congo context, the percentage of private sector credit to GDP (PRIV) is still low, unable to positively influence economic growth. Therefore, it is economic growth that causes financial intermediation in the case of Congo.

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