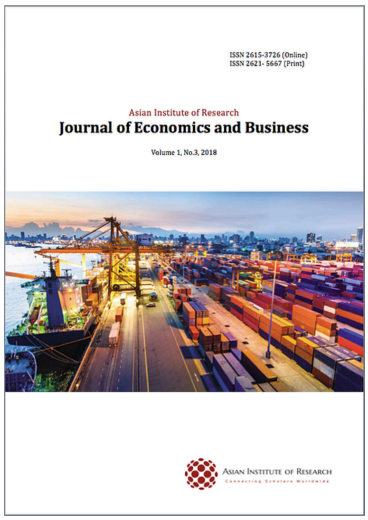

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Importance of Monetary Policy in Côte d'Ivoire's Economic Growth

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Abstract
Studies analyzing the link between monetary policy and the growth of real production in WAEMU and particularly in Côte d'Ivoire are still very rare. This study analyzes the relationship between monetary policy and economic growth in Côte d'Ivoire.[1] The data come from the World Bank and the BCEAO[2] and cover the period 1980-2012. The ARDL approach and the Toda-Yamamoto causality test are used. The interest rate has a negative and significant influence on economic growth in Côte d'Ivoire, while inflation and the money supply ratio have a positive and significant effect. In addition, there is a two-way causality between these indicators and economic growth in Côte d'Ivoire. It is necessary to monitor the evolution of the fundamental macroeconomic variables of the Ivorian economy simultaneously and this within the overall framework of WAEMU.

Key Words: Monetary Policy, Economic Growth, ARDI

J.E.L. Classification: E52, O4, C01

1. INTRODUCTION

The relationship between money supply and economic growth has received particular attention in the area of the money economy. Since Fisher's (1911) work on the Quantitative Theory of Money (TQM), we have witnessed a plethora of theoretical works. It is among others, Keynes (1936) which challenges the point of view of Fisher (1911). Indeed, it has the merit of having highlighted the uncertainty that characterizes modern economies. Starting from the idea that money is active and must respond to the needs of the economy, he proposes the possibility of expansionary monetary policy to stimulate economic activity. But in 1968, Friedman and the monetarist school will challenge Keynesian thinking. This position will be further radicalized by Lucas (1970) with the new classical school (NEC) by asserting the neutrality of monetary policy even in the short term on production.

[1] The Republic of Côte d'Ivoire is a member country of the African Union. Covering an area of 322,462 km2, it is bordered on the north by Mali and Burkina Faso, on the west by Liberia and Guinea, on the east by Ghana and on the south by the Atlantic Ocean. The population was estimated at 26,578,367 inhabitants in 2015. Côte d'Ivoire's political and administrative capital is Yamoussoukro; Abidjan is its main economic center. Its official language is French and for currency, the CFA franc. The country is part of ECOWAS.
[2] The Central Bank of West African States (BCEAO) is the issuing institution common to the eight (8) member states of the West African Economic and Monetary Union (WAEMU).

This divergence at the theoretical level will also become empirically sustainable. In fact, Twinoburyo & Odhiambo (2018), looking through the existing literature both theoretical and empirical, note the relevance of monetary policy support for economic growth in financially developed economies with relatively independent central banks. While the relationship tends to be weaker in developing economies. But in general, their study concludes that monetary policy is important for short- and long-term growth despite the prevailing ambiguous relationship. Ayodeji & Oluwole (2018), in examining the impact of monetary policy on economic growth in Nigeria, find that the money supply and the exchange rate have a positive but relatively small impact on economic growth. Zhang & Shen (2017) show that economic growth is closely linked to monetary policy and that there is a stable, long-term equilibrium relationship between them in China. However, their study shows that the effect of monetary policy is less than fiscal policy. Studies by Srithilat & Sun (2017) show that monetary policy has a significant impact on real GDP per capita over the long term in Laos. Alavinasab (2016) shows that in the long term, economic growth has been significantly influenced by monetary policy in Iran in both the short and long term. The work of Nwoko, Ihemeje & Anumadu (2016) indicates that the money supply was not significant in Nigeria while the interest rate had a negative and statistically significant sign. Twinoburyo & Odhiambo (2016) support the neutrality of both short and long-term monetary policy in Kenya. Ahmad, D., Afzal & Ghani (2016) highlight the importance of monetary measures in promoting Pakistan's economic growth. Giblova (2015) highlights the negative aspects of the Bank of Russia's policy. Precious & Palesa (2014) show that monetary policy instruments such as money supply, the repo rate, and the exchange rate have a weak influence on growth in South Africa, in contrast to inflation. Sulaiman & Migiro (2014) report that in Nigeria, monetary policy has a significant influence on the growth of the economy, while the latter does not influence monetary policy significantly.

Regarding the franc zone, Mallaye (2009), studying the impact of monetary reforms on economic growth in the CEMAC zone, concludes that monetary reforms have mixed effects on economic growth. Evidently, empirical studies on the link between monetary policy and the growth of real output in WAEMU and particularly in Côte d'Ivoire are still very rare. Our study is, therefore, trying to fill this gap. It seeks to examine the causal relationship between monetary policy and economic growth. It is quite conceivable that this relationship is compatible with a long-term growth model where causality is bidirectional.

The rest of the article is then organized as follows: Section 2 is dedicated to the literature review. Section 3 presents the methodological approach. Section 4 highlights the results as well as their interpretations. Section 5 is devoted to the conclusion and the resulting economic policy recommendations.

2. REVIEW OF THE LITERATURE

The review of the economic literature highlights both theoretically and empirically a debate on the impact of monetary policy on economic activity. On the theoretical level, neoclassicals say that money has no influence on real variables. It would, therefore, be neutral so that any monetary action has no effect on activity and leads only to inflation. This position formalized by Fisher (1911) in the quantitative theory of money (TQM) will be disputed by Keynes (1936). Starting from the idea that money is active and must respond to the needs of the economy, Keynes (1936) suggests the possibility of expansionary monetary policy to stimulate economic activity. But in 1968, Keynesian thought will be challenged by Friedman and the monetarist school. Indeed, for Friedman (1968), the effects of monetary policy are only transitory and therefore neutral in the long run. He suggests the introduction of a monetary policy based on strict rules that tie the growth of the money supply to the growth of production (rule of %). Subsequently, Lucas (1970) and Sargent (1972) with the new classical school (NEC) introduce rational expectations. These authors will radicalise the monetarist position and affirm that monetary action has no effect even in the short term on production.

In addition, this divergence of the point of view will become empirically sustainable. Indeed, in reviewing the literature review, Twinoburyo & Odhiambo (2018) find that in most studies on the relationship between monetary policy and economic growth, very few highlights a link between the two. Overall, this study shows that the majority of the results support the relevance of monetary policy to support economic growth, mainly in financially developed economies with relatively independent central banks. On the other hand, the relationship

tends to be weaker in developing economies with structural weaknesses and underdeveloped financial markets that are poorly integrated into global markets. Their study concludes, however, that monetary policy is important for short- and long-term growth despite an ambiguous relationship. The paper, therefore, recommends an intensive financial development measure for developing countries as well as structural reforms to address supply shortfalls. Ayodeji & Oluwole (2018) examine the impact of monetary policy on economic growth in Nigeria by developing a model able to study the influence of the government's monetary policy on economic growth through the use of the analysis multi-variable regression. For this, they calculate the variables of the monetary policy instruments to include the money supply, the exchange rate, the interest rate, and the liquidity ratio. Economic growth was represented by gross domestic product (income) at constant prices. The unit root test was performed, and all the estimation variables were stationary at the first difference except the interest rate. The error correction model was used to have a parsimonious model. Their results show that the money supply and the exchange rate have a positive but relatively insignificant impact on economic growth. In addition, the Engle-Granger co-integration test was conducted and indicated the existence of a long-term relationship between monetary policy and economic growth in Nigeria. Finally, a Granger causality test was performed on the variables.

The results show a unidirectional causality between money supply and economic growth, the liquidity rate, and exchange rates, while a two-way causality exists between interest and economic growth. These authors, therefore, recommend that partial autonomy is replaced by full autonomy for Nigeria's central banks, which are invariably subject to government interference and policies. In addition, they want monetary policies to be used to create a favorable investment climate by facilitating the emergence of a market-based interest rate and exchange rate regimes to attract domestic and foreign investment. Zhang & Shen (2017), through the establishment of the VAR model, study the relationship between monetary policy, fiscal policy and economic growth in China. The research range is from 1990 to 2016. The results show that economic growth is closely linked to monetary policy and fiscal policy and that there is a stable long-run equilibrium relationship between them. The effect of monetary policy on economic growth is more noticeable than that of short-term fiscal policy, while in the long run, fiscal policy is more effective. However, the role of monetary policy is weaker than fiscal policy. Srithilat & Sun (2017) examine the impact of monetary policy on economic development using 1989-2016 annual time series in Laos. The result of the unit root test suggests that all variables are stationary at the first difference; allowing the use of an error correction model. It also shows that the money supply, the interest rate, and the inflation rate have a negative effect on real GDP per capita over the long term and that only the real exchange rate has a positive sign. The result of the error correction model indicates the existence of a short-term causality between the money supply, the real exchange rate and the real GDP per capita.

Alavinasab (2016) empirically examines the impact of monetary policy on economic growth in Iran over the period 1971-2011. The results show that in the long term, economic growth has been significantly influenced by the money supply, the exchange rate, and the inflation rate. In the short term, the results of the estimated error correction model indicate that the money supply and the exchange rate have a significant impact on economic growth. Nwoko, Ihemeje & Anumadu (2016) examine the extent to which the monetary policies of the Central Bank of Nigeria could actually be used to promote economic growth over the period 1990-2011. The influence of money supply, average price, interest rate, and the labor force was tested on the gross domestic product using multiple regression models. The empirical results of their study indicate that the average price and the labor force have a significant influence on the gross domestic product whereas the money supply was not significant. The sign of the interest rate was negative and statistically significant. They, therefore, recommend that the Central Bank's monetary policy be an effective tool to encourage investment, reduce unemployment, reduce interest rates and stabilize Nigeria's economy. As for Twinoburyo & Odhiambo (2016), they examine the short- and long-term impact of monetary policy on economic growth in Kenya over the period 1973-2013. The autoregressive phased delay approach (ARDL) is used.

The study uses both the broad money supply and the 3-month Treasury bill rate. The empirical results support the neutrality of monetary policy in the short and long term, implying the ineffectiveness of monetary policy on economic growth. The study recommends that policies improve the institutional and regulatory environment for the financial sector and the conduct of monetary policy be pursued in Kenya. In addition, the results highlight

the need to improve policy coordination, especially monetary and fiscal policies. Ahmad, Afzal & Ghani (2016) study the importance of monetary measures in promoting Pakistan's economic growth. The study uses annual time series data covering the period 1973 to 2014. The Autoregressive Ladder Delayed Approach (ARDL) is used. The empirical results mention a positive long-term influence between the money supply, the exchange rate, and economic growth. In addition, inflation and interest rates have a negative effect on economic growth. The study suggests that a stable exchange rate policy is ensured to strengthen the country's economic growth and that monetary policy is used to generate a business-friendly environment to stimulate economic growth.

Giblova (2015) seeks to identify the main trends in monetary management and analyze the main orientations of the monetary policy of the Bank of Russia and then assess their economic efficiency in Russia. During the course of the research, the statistical method was used as a basis as well as the methods of scientific abstraction, analogy, comparison and analysis of diagrams. The author highlights the negative aspects of the policy of the Bank of Russia. In line with international experience and major trends in this area, possible directions for improving Russia's monetary policy are proposed. Adigwe, Echekoba & Onyeagba (2015) examine the impact of monetary policy on the Nigerian economy. To do this, the ordinary least squares (OLS) method is used over the period 1980 to 2010. The result of the analysis shows that the monetary policy represented by the money supply has a positive impact on GDP growth. The recommendations made mention that monetary policy should foster a favorable investment climate through the appropriate interest rate, exchange rate, and liquidity mechanisms. In addition, they suggest that the money market provides more financial instruments that meet the requirements of sophisticated operators.

Precious & Palesa (2014) explore the role of monetary policy in promoting economic growth in the South African economy over the period 2000-2010. The study uses the Johansen co-integration test and the error correction mechanism to identify long-term and short-term dynamics among the variables. The study shows that a long-term relationship exists between the variables. In addition, the main conclusion of this study shows that monetary policy instruments, namely the money supply, the repo rate and the exchange rate, which are monetary policy instruments, have a weak influence on growth in South Africa. to inflation. The study, therefore, recommends that monetary policies be used to create a favorable investment climate that attracts both domestic and foreign investment to boost sustainable economic growth. Their study also recommends that the government increase public spending in the productive sectors of the economy to promote economic growth, as monetary policy alone can't effectively stimulate economic growth. Sulaiman & Migiro (2014) estimate the link between Nigerian economic growth and monetary policy from 1981 to 2012. They measure economic growth using the gross domestic product and monetary policy indices that include the ratio of reserves, the exchange rate, the money supply, and the interest rate. The result of the co-integration test shows that the variables are cointegrated with each other, and the causality test indicates that monetary policy has a significant influence on the growth of the economy, while economic growth does not influence monetary policy in a significative way. The study concludes that the transmission mechanisms of monetary policy contribute positively to the productivity of the Nigerian economy, thus improving economic growth.

The careful reading of the literature on the relationship between monetary policy and economic growth has allowed us to discover that there are very few studies in this area concerning the WAEMU countries. In addition, existing studies in the literature lead to divergent results. This, therefore, requires new research.

3. METHODOLOGICAL APPROACH

This section presents the model for determining growth on the one hand and the estimation method on the other hand.

3.1. MODEL SPECIFICATION

To capture the impact of monetary policy on economic growth, the empirical equation is based on the hypothesis of the Keynesian IS-LM function. Therefore, the functional form of the specified model is presented in Equation 1:

$$PIB = f(M2,\ EXR,\ INT,\ INF) \qquad (1)$$

Explicitly, equation 3 can be written as in Equation 2:

$$PIB = \beta_0 + \beta_1 M2 + \beta_2 EXR + \beta_3 INT + \beta_4 INF + \mu \qquad (2)$$

Equation 3 presents the logarithmic and operational form of Equation 2:

$$Log(PIB) = \beta_0 + \beta_1\, log(M2) + \beta_2\, log(EXR) + \beta_3\, log(INT) + \beta_4 INF + \mu \qquad (3)$$

Where: PIB = real gross domestic product, INT = interest rate, $M2$ = money supply, EXR = exchange rate, INF = inflation rate, and μ = error term.

Theoretically the signs of the parameters β_2 , β_3 , β_4 should be negative while that would be β_1 positive.

3.2. ESTIMATION METHOD

This subsection first describes the stages of the self-regressive approach with staggered delays, and secondly the Toda and Yamamoto causality test.

3.2.1. THE REGRESSIVE AUTO APPROACH WITH STAGGERED DELAYS (ARDL)

Most studies of causal relationships favor VAR modeling. However, the implementation of this method requires that the series be integrated in the same order. However, in most macroeconomic series this condition is not verified (Nelson & Plosser, 1982). Faced with this shortcoming, Pesaran, Shin & Smith (2001) defined the Auto-Regressive Distribution Lag (ARDL) approach.

Given the nature of our data and our working assumptions, we will use this model as part of this study. In addition, this approach provides better estimates for small samples. This method requires that the model's explained variables be at most I (1). Our ARDL model, considering real gross domestic product per capita as the variable explained, is presented in equation 4:

$$\begin{aligned}\Delta \log(PIB)_t = {} & \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \log(PIB)_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta \log(M2)_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta \log(EXR)_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta \log(INT)_{t-i} \\ & + \sum_{i=0}^{n} \beta_{5i} \Delta INF_{t-1} + \alpha_1 \log(PIB)_{t-1} + \alpha_2 \log(M2)_{t-1} + \alpha_3 \log(EXR)_{t-1} + \alpha_4 \log(INT)_{t-1} + \alpha_5 INF_{t-1} + \varepsilon_t\end{aligned} \qquad (4)$$

In this equation, Δ denotes the first difference operator, ε_t represents the error term which is white noise, n is the optimal delay, β_0 is the constant. The parameters that go from α_1 to α_5 characterize the long-run equilibrium between the variables while the coefficients β_1 to β_5 represent the short-run equilibrium between the series studied. The delay p is determined by the information criteria AIC and SC. It corresponds to the delay that minimizes these criteria. To test the absence of cointegration, Pesaran, M.,H., Shin, Y., & Smith, R.,J., (2001) proceeded to the following test:

$H_0 = \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ (No cointegration)

Against the alternative hypothesis

H1: (Presence of cointegration) using Fisher (or Wald) tests according to a non-standard law (Ghorbani & Motabelli, 2009).

The use of the Wald test or the F statistic makes it possible to test the significance of the delay of the variables by taking into account the constraint of an error correction model (ECM). The asymptotic distribution of this test (Fisher's respectively) is non-standardized under the null hypothesis of no cointegration between the variables. Therefore, the calculated value of this statistic must, to validate or invalidate one of the hypotheses, be compared to the critical values established by the procedure of Pesaran, Shin & Smith (2001).

It is important to note that critical values based on large samples differ significantly from those of small size. Narayan (2005) reports small critical values of the sample. The critical values of the upper bound are estimated assuming that all variables of the ARDL model are integrated by order one [I (1)], and the lower bound critical values are computed assuming the variables are built-in order zero [I (0)]. At any chosen level of significance, if the calculated F statistic is between the lower and upper critical values, the decision on cointegration between the underlying variables is inconclusive. However, if the calculated F statistic exceeds the critical value of the upper limit, the null hypothesis is rejected, and the decision is that the underlying variables are cointegrated. On the other hand, if the calculated F statistic is less than the critical value of the lower limit, the null hypothesis is not rejected, and it is concluded that the variables are not cointegrated.

If there is cointegration, we develop an error correction model (ECM) as presented in equation 5:

$$\Delta\log(PIB)_t = \beta_0 + \sum_{i=1}^{p}\beta_{1i}\Delta\log(M2)_{t-i} + \sum_{i=1}^{p}\beta_{2i}\Delta\log(EXR)_{t-i} + \sum_{i=0}^{n}\beta_{3i}\Delta\log(INT)_{t-i} + \sum_{i=0}^{n}\beta_{4i}\Delta INF_{t-1} + \lambda EC + \varepsilon_t \quad (5)$$

Where λ is the rate of adjustment of the parameter and represent the residuals obtained from the estimate of the equation of the cointegrated model. It is now necessary to examine the causal relationships between these variables through the approach of Toda & Yamamoto (1995).

3.2.2. THE TODA-YAMAMOTO CAUSALITY TEST

The most used approach in the economic literature is that proposed by Engle & Granger (1987). But, its implementation can lead to significant biases. The approach proposed by Toda & Yamamoto (1995) overcomes the shortcomings of this approach. Two steps are involved in the implementation of the procedure. The first step includes the determination of the offset duration (m) and the second is the selection of the maximum integration order (dmax) for the variables. Information criteria such as Akaike (AIC), Schwarz (SC) can be used to determine the appropriate delay order of the VAR. We use the Dickey-Fuller test (ADF) for which the null hypothesis is the non-stationarity as well as the Kwiatkowski-Phillips-Schmidt-Shin test (KPSS) for which the null hypothesis is stationarity to determine the maximum order of integration. In addition, the Toda and Yamamoto approach as applied to the Granger non-causality test could be performed by the SURE method which is an apparently unrelated equation system estimation technique. For example, a two-variable VAR (X and Y) can be expressed as the SURE (equation 6 and 7):

$$X_t = \omega + \sum_{i=1}^{m}\theta_i X_{t-i} + \sum_{i=m+1}^{m+d\max}\theta_i X_{t-i} + \sum_{i=1}^{m}\delta_i Y_{t-i} + \sum_{i=m+1}^{m+d\max}\theta_i Y_{t-i} + v_1 \quad (6)$$

$$Y_t = \psi + \sum_{i=1}^{m}\phi_i Y_{t-i} + \sum_{i=m+1}^{m+d\max}\phi_i Y_{t-i} + \sum_{i=1}^{m}\beta_i X_{t-i} + \sum_{i=m+1}^{m+d\max}\beta_i X_{t-i} + v_1 \quad (7)$$

Where X = growth rate of real gross domestic product per capita, Y: the effects of monetary policy; the ω, ψ, θ_i, δ_i, ϕ_i, β_i are the system parameters. The null hypothesis of non-causality of real per capita growth rate at the real exchange rate can be expressed in the form $H_0: \delta_i = 0, \forall i = 1,2,..., m.$

3.3. THE DATA

The data of the study cover the period 1980-2016. They come from the World Development Indicators of the World Bank website. Interest rate data were collected from the BCEAO. Table 1 summarizes the description of the variables, the source of the data and the expected signs.

Table 1: Description of Variables and Data Sources

Symbols	Description variables	Sources	Signs expected
PIB	Gross domestic product	Word Development Indicator from the World Bank	
$M2$	The money supply indicator	Word Development Indicator from the World Bank	+ ou -
INF	The inflation rate is measured on the basis of the GDP deflator as an annual percentage	Word Development Indicator from the World Bank	-
EXR	The official exchange rate	Word Development Indicator from the World Bank	-
INT	Debit interest rate	Central Bank of West Africa	-

Source: The author from the economic literature

In the analysis, it appears that the money supply seems to explain the level of production in Côte d'Ivoire (see Appendix). It is, therefore, reasonable to try to understand the reasons for this situation. How does monetary policy affect wealth creation in Côte d'Ivoire? What are the interactions between production and monetary policy in Côte d'Ivoire?

4. PRESENTATION AND INTERPRETATION OF THE RESULTS

We present the results of the model estimation and their interpretations.

4.1. UNIT ROOT AND COINTEGRATION TESTS

The requirement for time series econometric analysis is to submit each time series to stationary tests or unit root tests. The methods used for this test were the Augmented Dickey-Fuller (ADF) and Kwiatkowski, Phillips, Schmidt, Shin (KPSS) tests. The KPSS test assumes stationarity as a null hypothesis while the ADF test assumes the presence of unit roots as the null hypothesis. Thus, for the ADF test, if the calculated statistic is greater than the critical value, the series is non-stationary, while the series will be declared in the case of the stationary KPSS test. Table 3 summarizes the results of the ADF and KPSS tests. The results show that the variables are at most integrated of order one (1), as indicated by the critical values at the level of 5%. Only the variable *INT* is stationary in level whereas the series *PIB* , $M2$ *INF* and *EXR* are stationary in first difference. Therefore, VAR models will only add an additional offset (i.e., dmax = 1) for the implementation of the causality test.

Table 3: Stationarity test results

	In level		In first differences	
	ADF	**KPSS**	**ADF**	**KPSS**
PIB	-3,050** (-2,893)	0,279** (0,146)	-3,451** (-2,893)	0,0865 (0,164)
$M2$	-3,298** (-2,891)	0,257** (0,146)	-3,675** (-2,893)	0,0672 (0,164)
INF	-4,918** (-2,893)	0,307** (0,146)	-3,723** (-2,893)	0,0675 (0,164)
EXR	-6,511**	0,0534	-8,674**	0,0148

	(-2,893)	(0,146)	(-2,893)	(0,164)
INT	-2,596	0,112	-7,065**	0,0489
	(-2,893)	(0,146)	(-2,893)	(0,164)
Note: ** indicates the rejection of the null hypothesis at 5%				

Source: Author's estimate based on data from WDI (2017) and BCEAO (2017)

This result invites us to test the existence of a cointegrating relationship. After determining the optimal delay, we perform the cointegration test.

Table 4: Optimal VAR delay

Delays	LogL	LR	FPE	AIC	SC	HQ
0	-251,91	NA	145,44	17,80	16,52	17,53
1	-169,81	198,02*	0,58*	11,88*	10,04*	11,15*
2	-19,39	19,48	0,63	11,08	10,91	10,57

Source: Author's estimate based on data from WDI (2017) and BCEAO (2017)

Table 4 presents the results of the cointegration tests. The F statistics obtained from the equations were compared to the critical values of Narayan (2005). The results show that there is a long-term relationship between economic growth and the change in the real effective exchange rate and gross fixed capital formation (6.261 is above the critical limit greater than 1% critical values, 5 % and 10% From the results of Table 5, we can consider that there is a cointegration relationship between growth, inflation, the money supply indicator, changes in exchange rate misalignment and capital stock.

Table 5: Limit Testing for Cointegration Analysis

Dependent variables	**F-Statistic**	**CV à 10% [K=4, T=34]**		**CV à 5% [K=4, T=34]**		**CV à 1% [K=4, T=34]**		**Remarks**
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	
ΔPIB	6,261	2,465	3,472	2,957	4,117	4,165	5,650	Yes
$\Delta M2$	3,572	2,465	3,472	2,957	4,117	4,165	5,650	No
ΔINF	3,178	2,465	3,472	2,957	4,117	4,165	5,650	No
ΔEXR	3,657	2,465	3,472	2,957	4,117	4,165	5,650	No
ΔINT	2,644	2,465	3,472	2,957	4,117	4,165	5,650	No

Source: Author's estimate based on data from WDI (2017) and BCEAO (2017)

The results of the estimate are summarized in Table 6. They confirm the long-term relationship. The recovery force is negative and non-zero statistically. In addition, Fisher's p-value associated with the statistic indicates that our model is globally significant at the 95% confidence level. And finally, the model's exogenous variables account for 85% of GDP per capita.

Table 6: Result of the estimate

ARDL (1 1 1 0 1) selected based on AIC Dependent variable: economic growth			
Independent variables	Coefficients	T-Ratios	p-value
Constant	0,15	1,088	0,25
PIB (-1)	-0,09	-3,82	0,00
$M2$ (-1)	0,49	4,25	0,01
INF (-1)	0,51	3,54	0,01
EXR (-1)	-0,16	-0,45	0,65
INT (-1)	-3,27	-2,67	0,00
D. PIB (-1)	0,64	2,89	0,01

D. $M2$ (-1)	0,86	4,58	0,00
D. INF (-1)	0,32	3,65	0,00
D. EXR (-1)	0,66	0,80	0,52
D. INT (-1)	0,71	0,55	0,79
Model Criteria R-squared = 0, 85 AIC = -3,94* Adj R-squared = 0,63 SBC = -3.48* F(6, 25) = 6,10 Prob> F = 0,0023 DW = 1,87			

Source: Author's estimate based on data from WDI (2017) and BCEAO (2017)

Now, we will conduct a validation test of our model.

4.2. RESIDUE DIAGNOSTIC TESTS

For the validity of our model, the tests carried out (normality, homoscedasticity, the absence of autocorrelation and stationarity of our residues) confirm its robustness. They are summarized in Table 7.

Table 7: Diagnostic Tests

Test	Chi2	Prob> chi2
Normality test	0,00	0,77
heteroskedasticity (ARDL)	0,45	0,62
Breusch Godfrey LM test	0,37	0,82
Breusch-Pagan	0,01	0,99
Ramsey RESET	0,28	0,84

Source: Author's estimate based on data from WDI (2017) and BCEAO (2017)

4.3. TODA-YAMAMOTO'S CAUSALITY TEST

Once the VAR determined the optimal delay in level and the known maximum integration order, the estimation of equations (7) and (8) was done by the SURE method. Table 7 presents the results of our causality test for a delay.

The existence of a long-run relationship between exchange rate changes and economic growth suggests causality between these two variables in at least one direction. The p-value associated with the non-causality test ranging from long-term misalignment to economic growth and from economic growth to long-term misalignment is less than 5%. This reflects the presence of bidirectional causality between the two variables.

Table 8: Toda-Yamamoto's causality test

Null hypothesis	Stat du Khi-Deux	p-value
Growth does not cause the exchange rate	15,54	0,00**
The exchange rate does not cause growth	2,62	0,69
Growth does not cause the interest rate	16,76	0,00***
The interest rate does not cause growth	10,01	0,023**
Growth does not cause money supply	43,74	0,00***
Money supply does not cause growth	48,42	0,00***
Inflation does not cause growth	42,59	0,00***
Growth does not cause inflation	34,54	0,00***

NB: (**) (***) = significance at the 5% and 1% threshold respectively

Source: Author's estimate based on data from WDI (2017) and BCEAO (2017)

4.4. RESULTS INTERPRETATION

The results of the estimation of our model show that economic growth depends negatively on the interest rate at the 5% threshold (-3.27). These results confirm those of Ayodeji & Oluwole (2018) and Nwoko, Ihemeje & Anumadu (2016) who find a negative impact of the interest rate on growth in Nigeria. In addition, there is a two-

way causality between GDP per capita and the interest rate according to the study by Ayodeji & Oluwole (2018) on Nigeria. As for the money supply, it positively impacts economic growth at the 5% threshold in the short term (0.86) and long-term (0.49). Our results confirm those of Ahmad, Afzal, & Ghani (2016) in Pakistan. As for inflation, our results confirm those of Mundell (1965) and Tobin (1965) who predict a positive relationship between the rate of inflation and the rate of economic growth. Indeed, we get a positive and significant relationship in both short (0.32) and long-term (0.51). However, these results contradict those obtained by Srithilat & Sun (2017) in Laos. Thus, this result leads us to question the level of the optimal inflation rate for the WAEMU countries, given that the criteria adopted in the context of the conduct of the union's common monetary policy inflation target at 2%. It, therefore, appears that a relaxation of this criterion could constitute a way of revitalizing economic growth in Côte d'Ivoire but also in WAEMU. Also, we note a bidirectional causality between these two economic quantities in Côte d'Ivoire (p-value = 0.000).

5. CONCLUSION AND RECOMMENDATION

The main objective of this study is to analyze the relationship between monetary policy innovations and economic growth in Côte d'Ivoire. To do this, we used monetary policy indicators such as the exchange rate, inflation, the interest rate, and the money supply. The data on the money supply, the exchange rate, the inflation rate, and the Gross Domestic Product come from the World Bank. As for the interest rate, it was collected from the BCEAO. All these data cover the period 1980-2016. The ARDL approach and the Toda-Yamamoto causality test allowed us to overcome any bias that may be due to the size of our sample. The results show that there is a long-term relationship between inflation, money supply, and economic growth. In addition, the causality test confirms the existence of a two-way causality between these indicators and economic growth in Côte d'Ivoire. The Ivorian authorities must, therefore, observe and monitor the evolution of monetary policy through the control of the level and evolution of the fundamental macroeconomic variables of the Ivorian economy simultaneously and this within the overall framework of the Economic Union and West African currency.

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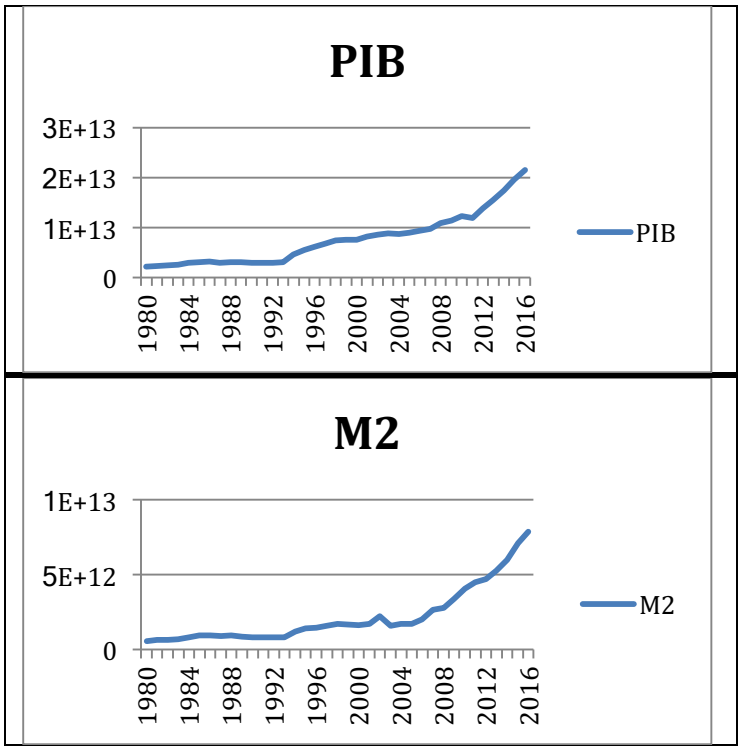
Appendix A: Changes in the money supply and the level of production



Source: Author's calculation based on WDI data (2017)