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An Econometric Analysis of the Nexus between Credit to the Private Sector, Inflation and Economic Growth: Case of Cameroon 1965 – 2010

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Abstract- This work is centered on bringing out the link between credit to the private sector, inflation and economic growth. When lending to the economy is insufficient, it poses a problem of slow growth and when credit to the economy is too high, it poses a problem of hyper-inflation. Using data from world development indicators, it employs a Vector auto regressive model involving a system of three equations, testing for the direction of causality amongst the variables using the VAR Granger causality block exogeneity Wald Tests. The results obtain shows that inflation has a positive and significant effect on growth, economic growth has a positive and significant effect on credit to the economy and credit to the economy has a negative and significant effect on inflation. Inflation granger causes economic growth, economic growth granger causes credit to the private sector and credit to the private sector granger causes inflation.

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I. Introduction

Central banks are of paramount importance in the development of the banking and financial system of a country. Their various tasks consist of : ensuring monetary emission thus setting interest rates; supervising the functioning of financial markets, ensuring the compliance to regulations associated to risks (solvency ratio) and to financial institutions (especially deposit banks) , acting as banker of last resort in the event of a systemic crisis.

According to the Annual Report of the BEAC (1992), in Cameroon, we can find out that the advances offered by the BEAC to commercial banks are not fully utilized (247,700,000,000FCFA uses against a ceiling of 310,400,000,000FCFA to June 30, 1992). This was confirmed by Fouda (2009) who revealed that despite the liberalization of the financial and banking sector in the early 1990s, banks keep holding excess liquidity, but sluggish credit is observed. Under the employment and growth strategy paper (EGSP), we noticed that from 2003 to 2008 (period of implementation of the poverty reduction strategy paper), the long term loans represent an average less than 3.5% of total loans. Yet the long-term credits are essential to the development of a sustainable growth in Cameroon.

Providing a level of credit to the economy that can be up to the growth and price stability objectives is a real task to CEMAC authorities. When the level credit to the economy is weak or insufficient to stimulate consumption and hence growth, it remains a problem, such as that of sub-inflation or suboptimal inflation. However, when they are too high, the risk of limiting the living standards of the population through inflation is very imminent. Research at the level of CEMAC have examined the impact of inflation on growth, for instance, (Bikai and Kamgnia, 2011; Mantsie 2003; Engone, 2009). But to our knowledge, the joint and reciprocal influence of credit to the economy, inflation and growth which is nevertheless real in many developed and developing economies remains an unsolved problem in Cameroon. Showing that credit to the economy, inflation and growth are causal and mutually influential constitute a shade that is yet to be clarified within the context of Cameroon.

The objective of this study is to determine the links and potential effects existing between credit to the economy, inflation and economic growth in Cameroon. The significance of this study stems from the opportunities accruing from a high variability of three variables within an economic environment of positively stable fixed exchange rate regime.

The rest of our inquiry is structured around three sections, the first presents a review of the relevant literature, The second analysis the methodology and the econometric model, while the third section is devoted to results and conclusion.

II. Literature Review

a) Credit to the Economy and Inflation

The Modigliani (1986) - Miller (1991) theorem states that the equivalence of different funding sources dominated the literature in the late 1950s. During the second half of the 1980s, through an extensive literature, many economists tried to demonstrate the specific role of bank credit in the transmission of monetary shocks.

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According Boissieu (1990), it is to integrate the imperfections of the credit and capital markets, and particularly the information asymmetries and all their implications: there are many risk premiums, particularly in the external premium financing. He points out that the credit channel actually has two interlinked components: the channel that passes through the impact of changes in interest rates on the situation and the behavior of borrowers, and those interested in the impact of changes in interest rates on the behavior of lenders, particularly banks. He thus, stressed that the channel of credit rate is therefore generally not independent of the interest rate channel, and both play in the same direction to enhance the impact of monetary policy.

In addition, Cameroon is a member of CEMAC which is a segmentation of the franc area. All these countries have experienced a given period of excess liquidity of their banks. Thus, according to Fouda (2009), the fact that banks hold a certain volume of liquidity is theoretically justified by their liquidity insurance mission. But over the past fifteen years, liquidity holdings of the banks of the franc zone have been abundantly higher than what is necessary in fulfilling this mission and, paradoxically, the loans granted to the economy have been dropping.

According to Nubukpo (2003), since 1989, the monetary policy of the of Bank of West African States (BCEAO) is based on the increased use of market mechanisms, thus devoting to the option of a direct regulation of banking activity. A key role is granted to the interest rate which becomes the main instrument of monetary policy, particularly since the abandonment of the credit crunch that occurred in January 1994. He examined the impact of movements in interest rates of the BCEAO on growth and inflation between 1989 and 1999. He found out that interest rates negatively influence inflation and growth in the short run, but in the long run they positively influence growth and negatively influence inflation. Considering Boissieu (1990), we can talk of a relationship whose direction is to be determined between credit to the economy, inflation and growth.

Tallman and Chandra (1996) in the case of Australia, examined two systems of VAR variables (set of monetary factors and production), three systems variables (including inflation), four systems (including the interest rate) and five systems (including exchange rates). The authors found out that sets of monetary factors did not contain any important information to explain subsequent changes related to output growth or inflation.

The empirical evidence provided by Bullard (1995) tended to suggest that the strength of the relationship between liquid assets and inflation depends on the monetary measure used and the time horizon covered in the research. A broader set of factors offers surprising results whereas closer factors only lead to the balanced proportional theory, stipulated by the quantitative balance proportional relationship results. The extension of the sample size, especially when there is a series of monetary innovations, can lead to an important impact on the results.

b) Credit to the Economy and Economic Growth

The introduction of money in the new growth theories perpetuated a common divide between authors who believe that any monetary policy is doomed to failure and those who believe that, in the Keynesian tradition, an expansionary monetary policy can influence the level of activity. Modern literature on the subject date of work Tobin (1965) who showed that money is able to influence the level of economic activity by changing household portfolios. Money is considered as a financial asset. Given a certain level of wealth, the capital intensity of the economy (capital / head) depends on the distribution of this wealth between capital and money. In the event of a fall in the profitability of money due to inflation, economic agents will prefer to hold real assets in their portfolio, which will lead to a fall in investment and thus lower growth.

Sidrauski (1967) is in a diametrically opposite opinion. He assumes that money enters the household utility function, because it provides a flow of services resulting from its detention. The results lead to the determination of the high neutrality of money. Money in this case would have no effect in the short-run on economic activity and in the long-run as well because it is not likely to influence the GDP growth level.

According to James (1970), money is a means of action. It is not just a "veil" or just a "medium of exchange" and a "standard of values", but a catalyst that promotes the growth of the economy, changes in the distribution of income and a "prime source of power." Beyond certain levels, the development of credit transactions leads to a rise in prices, without any positive effect on the level of economic activity. The monetary authorities must sit in order to determine the growth rate that is more consistent with the monetary equilibrium.

Peg (2003), of the Federal Reserve in St. Louis regresses changes in quarterly GDP growth in subsequent volumes to changes in interest rates on federal funds over the period 1962 -2002. He found out that a 1% increase in interest rates, leads to a reduction of 0.2% in the growth of quarterly activity within the next two years. On the other hand, a 1% decrease in interest rates on federal funds increases the growth of the real activity by only 0.5% over the two years following the shock. We can observe an asymmetry in the response of the real economy to changes in monetary policy instruments, which apparently confirms the idea that the action of the central banks is slower in restoring economies from a recession than pushing them to overheat under an expansionary regime. The weak response of the economy to decreasing interest rate results from the fact that growth is first and foremost a

real phenomenon, as opposed to inflation, which could be a monetary phenomenon.

Goldsmith (1969) conducted a study using a multiple regression model to show the effect of domestic credit on the growth rate of GDP per capita. He concluded that domestic credit and the per capita GDP growth are positively correlated. De Gregorio and Guidotti (1995) conducted a study on 100 countries for the period from 1960 to 1985 and the same study of 12 countries of Latin America for the period 1950 to 1985. They used a regression model to show the effect of credit on per capita GDP growth. Using domestic credit to the private sector as a percentage of GDP as an exogenous variable, they carried out the same study for 100 countries, and revealed that credits permitted an increase in the rate of economic growth for 12 countries in Latin America. The Credit granted to the domestic private sector was significant and negatively related to economic growth, due to liberalization within an environment poorly regulated by the government.

Acaravci et al (2007) in Turkey conducted a study covering the period 1970 to 1992 using a dynamic time series model to determine whether there is a causal relationship between GDP growth and domestic credit granted by the banking sector. The result showed that in Turkey there is a one-way relationship between credits granted by the banking sector and economic growth, there was also an absence of a long-term relationship between these two variables. The Granger causality test showed that domestic credit granted by the banking sector led to economic growth in Turkey.

c) Inflation and Growth

The classical economists believe that in the short run, monetary impulses exert only limited effects on economic activity. According to them, household savings and investments of firms are not very responsive to changes in the interest rates. Thus, the proponents of this view believe that money is a veil, in other words, it is neutral.

However, according to the monetarists, monetary policy has an active role in economic growth. From their point of view, a restrictive monetary policy leads to lower relative prices of monetary, financial and real assets. This results to a change in aggregate demand which is consumption and investment, as well as cumulated real stocks. Thus Friedman (1968), considers that short-term variations in the quantity of money can have temporary real effects due to the initial price rigidity. But in the long run, under the assumption of price flexibility and labor markets, changes in the money supply have an effect on the general price level. Production and employment are not affected. Mantsie (2003), determined within the framework of CEMAC area, the effect of inflation nuisance on growth. He found out that there is an inflation rate below 4.75% in the CEMAC area. In the same vein, other authors such as Fisher [1993] working on panel data for 13 non-OPEC countries and for the period 1961 1988, Barro [1995] working on data in longitudinal sections of 100 countries and three decades (1960-1990) found an impact on the annual per capita growth respectively of -0.13% and - 0.024% and of a 1% increase in inflation beyond the threshold potential.

III. Methodology

The data used in this work are from a secondary source, originating from the annual publication of the World Bank, more specifically from the CD-ROM (WBI-2011). The study covers the period from 1965 to 2010. This choice is justified by the need to integrate the various evolutions in money and credit policies within the CEMAC area with a specificity accorded to the Cameroonian economy.

a) Variables

i. *The rate of inflation*

In order to measure inflation, we use the example of Claus (1997) and Blix (1995) cited by Engone (2003), which is the GDP deflator. When searching the target level of inflation in the CEMAC zone for the latter, the relationship between the observed inflation measured by the GDP deflator, on one hand, economic growth and money supply, on the other hand. It provides information about the macro-economic stability and has a permanent effect on economic growth. Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. The implicit GDP deflator is the annual percentage change in GDP.

ii. *The growth rate*

In order to consider growth, we use the natural log of real GDP as Fischer (1993) and Sarel (1996) cited by Mantsie (2003) when determining a threshold at which inflation is harmful to the economy. We also drew inspiration from Nubukpo (2003) who measured the impact of key interest rate on inflation and growth in the UEMOA area, and used the GDP deflator and the natural log of real GDP respectively to account for inflation and growth. The gross domestic product (GDP) at market prices is the sum total of gross value added by all resident producers in the economy plus (+) any product taxes and minus (-) any subsidies not included in the value of the products. GDP per capita is gross domestic product divided by midyear population. The growth rate is the rate of change in gross domestic product.

iii. *Credits to the economy*

It is credit granted by the banking sector to the private sector and to households. It includes all loans in various sectors on a gross basis, with the exception of credit to the central government, which is net. The banking sector includes monetary authorities and banks. The variable considered in this study is bank credit to the private sector.

Table1 : Abbreviation of variables

Variables	Abbreviations	Measures
Credit to the economy	CE	CE in % of GDP
Inflation rate	TINFL	Change in the real GDP deflator
Growth rate of the GDP	TPIBR	$(PIBO_t - PIBO_{t-1})/ PIBO_{t-1}$

Source: Based on a literature review and comments.

b) Relationship Between Credit To The Economy, Inflation And Growth

Authors such as Aiyagari and Gertler (1985), Leeper (1991), Sims (1994) and Woodford (1995, 1997) studied the configurations of monetary and fiscal policies, where one would be exogenous to the long-term equilibrium (it is dominant) and the other endogenous to the balance (it is dominated and must ensure compliance with the budget constraint of the state).The model used is a direct generalization of autoregressive models. It is a VAR (Vector Autoregressive) model which 'was popularized by Sims (1980). Beyond estimating individual coefficients, it will estimate the overall system dynamics. The functional form of the model is as follows:

$$\Delta TPIBR_t = \gamma_1 z_{t-1} + \sum_i \beta_i \Delta TPIBR_{t-i} + \sum_j \alpha \Delta TINFL_{t-j} + \sum_k \tau_k \Delta CE_{t-k} + \epsilon_{t1} \quad (1)$$

$$\Delta CE_t = \gamma_2 z_{t-1} + \sum_i \beta'_i \Delta TPIBR_{t-i} + \sum_j \alpha'_i \Delta CE_{t-j} + \sum_k \tau'_k \Delta TINFL_{t-k} + \epsilon_{t2} \quad (2)$$

$$\Delta TINFL_t = \gamma_3 z_{t-1} + \sum_i \beta"_i \Delta TPIBR_{t-i} + \sum_j \alpha"_i \Delta CE_{t-j} + \sum_k \tau"_k \Delta TINFL_{t-k} + \epsilon_{t3} \quad (3)$$

With γ, β, α, d as coefficients and ϵ_i the stochastic error terms.

Table 2 : Summary of the expected signs

Dependent variables / Independent variables	TPIBR	TINFL	CE
CE	+	+	? ±
TINFL	? ±	? ±	+
TPIBR	? ±	? ±	+

Source: Author, based on a literature review

IV. Presentation of Results

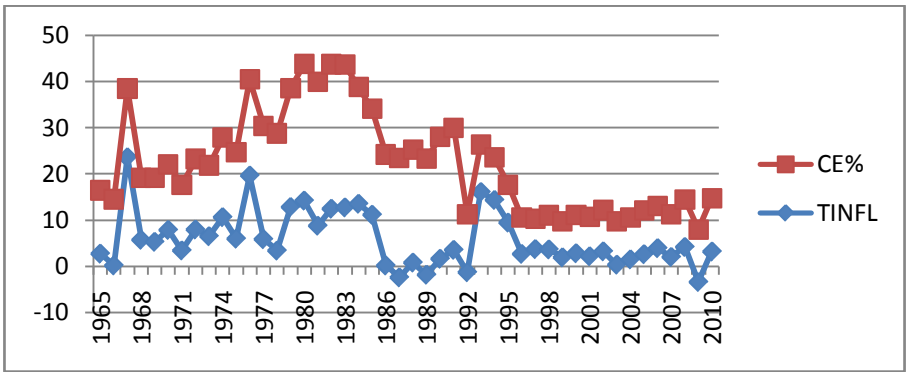
In this section, it is necessary to conduct a comparative analysis of the evolution of our variables, to conduct an analysis of causality between growth, credit to the economy and inflation, and finally to estimate VAR (Vector Autoregressive) model.

a) Comparative Evolution of Some Variables

i. *Comparative evolution of credit to the economy and inflation*

The effectiveness of the distribution policy of credits expected to result to changes in two indicators in the same direction. That does not seem to be indicated by visual inspection. Indeed, over the period of study, it is generally observed a limited identical trend in the inflation rate and the change in credit to the economy. This is shown on figure 1 below.

Figure 1 : Comparative evolution of credit to the private sector and inflation from 1965 to 2010

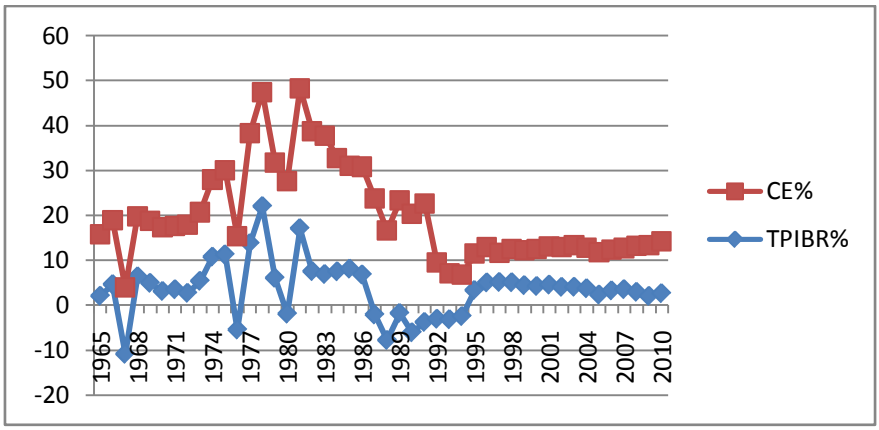


Source: author's computation using excel and WDI (2011)

ii. *Comparative evolution between credit to the economy and growth rate*

The analysis of the figure below(figure 2) shows an almost similar trend in both indicators between 1965 and 1993. In this same period, credit to the economy did not fluctuate much, while the rate of growth has been a saw tooth evolution. Since 1994, growth has become very sensitive to changes in credit to the economy which are slim. The two curves are almost superimposed over the entire period, which implies the sensitivity of growth to changes in credit.

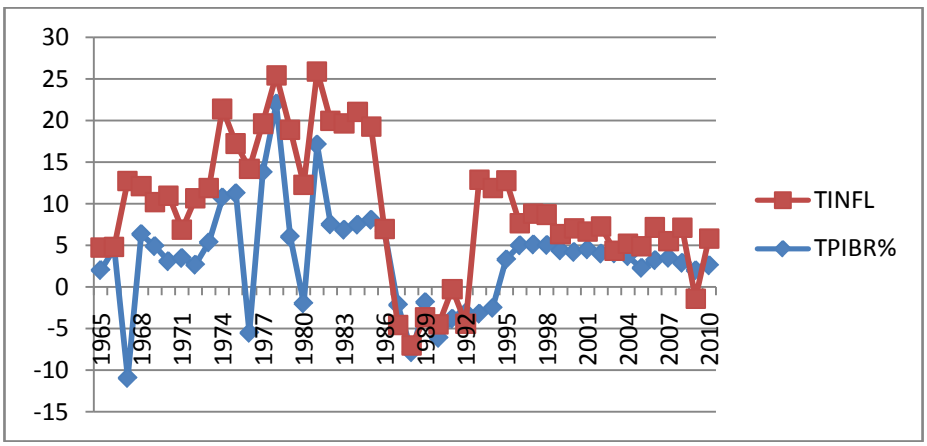
Figure 2 : Comparative evolution between credit to the economy and growth rate



iii. *Comparative evolution between growth and inflation from 1965 to 2011*

From figure 3 below, it is observed that the evolution is similar with the fluctuation of inflation and growth increasing until they arrived their peak in 1978 but slowed down between 1980 1986. From 1986 these two variables began falling till 1992 for GDP growth and 1994 for inflation, which can be explained by the economic and financial crisis during this period. Afterward, the two variables observed a progressive evolution but at a slow rate till 2008. After this period, the growth rate of GDP and inflation decreased basically caused by the subprime mortgages of 2008 until 2010 where they witnessed a rise again.

Figure 3 : comparative evolution between growth and inflation from 1965 to 2010



Source: author's computation using excel and WDI (2011)

The analyses of the figures presented above, while providing an insight of the evolution of these macroeconomic indicators, is an insufficient to assess the existence of any correlation between the variables. This justifies the need for further studies with a view to a better appreciation of the real and mutual impacts of changes in credit to the economy econometric model of inflation and growth. At the end of this section, we can conclude that in Cameroon, the economic environment is very unfavorable considering the evolution of credit to the economy, inflation and growth.

b) Presentation and Analyses of Results

The unit root test using the ADF test shows that all the variables are non stationary at level form (appendix 1) but stationary at first difference(appendix 2).

After determining the optimal number of lags which showed the optimum lag length to be 2 for all the

variables(appendix 4) from the Akaike and Schwarz criteria, the criterion being the choice of the lag corresponding to the minimum value selected by two criteria coefficients.

It is necessary to determine the causal link between the variables (credit, inflation and growth) and to determine the interplay between these three variables. The decision rule was opted comparing the corresponding probability thresholds for each coefficient significant at the 1%, 5%, 10%. When the probability is less than the significance level, the associated variable y becomes the dependent variable. From appendix 4 ,table 2, it is clear that in the short-term credit will not cause growth, which makes sense because most of the loans to investors are short term and highly selective and generally with high interest rates. Inflation in turn causes the short-term growth with a threshold of 1%. This can be explained by the fact that a change in the inflation rate translates directly into economy since it stimulates private sector investment through the quest for high profit. Credit to the economy is caused by the short-term growth with a threshold of 5%. This finds its full meaning when credit providers grant loans to investors as functions of their previous results. On the other hand, inflation does not cause short-term credit, which can be explained by the fact that inflation has very diverse sources, the ability of investors and creditors themselves to anticipate the future is limited. The inflation rate cause growth in the short term, we may well think that the effects of other variables on inflation can only transmit the effects that it receives with a delay. Credits cause inflation in the short term with a threshold of 1%. This is explained by the fact that lending rates are too high in Cameroon leading to an increase in the cost of production. This is then transmitted to higher prices in the market.

c) Estimation of Model

The objective of the study is not being able to identify in their diversity, all the variables that influence inflation and growth, but to highlight the combined effects of credit, inflation and growth. That is why our exogenous variables are variables whose short-term variation is important.

These results are interpreted taking into account that each variable in turn is a dependent variable. When growth is a dependent variable, it is positively and significantly (at 5%), influenced by the growth rate with a lag period of 1. the inflation rate both at lag period of 1 and 2 influence GDP positively and significantly at 5% and 1% respectively . So in Cameroon, current growth is significantly influenced by passed growth. The coefficient of inflation rate at lag 1 and 2 have positive signs showing that a short-term rise in inflation is challenging for growth because when prices rise in the short term, producers make profits on their stocks. But as stocks run out, they are forced to integrate different production costs in new stocks. Credits on the other hand have an insignificant effect on growth in the short term. The reason may be the non-significance of the same amount of credits and the low profitability of some investments due to poor monitoring of the implementation and finance of projects.

Furthermore, credit to the private sector is influenced positively and significantly at 5% by the GDP at a lag period of 2. This show the results of the previous companies are a key factor for future funding. The inflation rate meanwhile, has no significant effect on credit. If the effect of the change in the inflation rate is transmitted to interest rates, inflation could have an effect on supply.

About inflation as the dependent variable, it is found that growth has no effect on it. This is a satisfactory outcome to the extent to boost growth will have a significant impact on inflation; it will still increase lending to the economy. It is well noticed that there are still many opportunities available in terms of financing loans to run towards the objectives of growth and hence welfare of the people. Passed credits negatively and significantly affects inflation, since most loans are short term loans with high interest rates in Cameroon. Inflation lagged one period has a negative and significant effect on the current inflation rate. This result is satisfactory to the extent that past inflation increase current inflation in the short term. This is advantageous because in this case it is sure to increase funding in order to seek growth, stable framework, in order to increase growth in the long run. This is possibly the reason why Cameroon operates a fixed exchange rate regime with some western currencies.

The coefficients of determination are 0.32, 0.19 and 0.43 respectively for the variables growth, credit to the economy and inflation. They are all relatively small, but they do not have great importance for the objective of this exercise is to check the combined effects of the three variables. It was necessary for sacrificing the presence of other explanatory variables such as exchange rate, interest rate and many others.

For model appropriateness, autocorrelation is absent as shown by the Langrange-multiplier test. Both at lag 1 and 2, the probabilities of 0.28 and 0.23 are all greater than the critical test statistics of 1%, 5% and 10%. Our VAR model equally satisfies stability condition since using the Eigen value stability test, all the eigenvalues lie inside the unit circle.

V. Conclusion

Our study aimed at determining the joint effects of the credit to the economy, inflation and growth in Cameroon. We opted for two objectives stated as follows: To determine whether the three variables granger causes each other in Cameroon, and to determine the reciprocal joint effects of these three variables in Cameroon.

determine the reciprocal joint effects of these three variables in Cameroon.

We drew some lessons: firstly, inflation causes growth rate which in turn causes the credit to the economy, which in turn causes inflation. Secondly growth is driven upward by the lagged growth and the lagged rate of inflation. Credit to the economy is stimulated to increase by an earlier growth. The inflation rate is driven down by the short term loans and past inflation rates. In a stable economy, short-term variations can be preserved for the benefit of the expected structural changes. The Cameroon fixed exchange rate regime has the advantage of easing economic stability thus permitting to seize the opportunities offered by funding policies or funding requirements. It is hence obvious that a less restrictive monetary policy in an environment where monetary authorities are independent (which would allow more effective action and policy control of the currency) will be a good complement to the fiscal policy for achieving internal balance (full employment equilibrium) and external balance (balance between import and export). It is important to decide on the contribution to the development of various monetary policy instruments that have evolved within the CEMAC sub region.

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Appendices

1. Adf Test At Level Form

Null Hypothesis: TPIBR has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.681718	0.1081
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.695836	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: TPIBR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.151295	0.10170
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: CE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.038059	0.7316
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: CE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.561100	0.7925
Test critical values:	1% level	-4.175640	
	5% level	-3.513075	
	10% level	-3.186854	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: TINFL has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.762106	0.0003
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: TINFL has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.589975	0.0002
Test critical values:	1% level	-4.175640	
	5% level	-3.513075	
	10% level	-3.186854	

*MacKinnon (1996) one-sided p-values.

2. ADF Test at First Difference

Null Hypothesis: D(TPIBR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.428057	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(TPIBR) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.562923	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(CE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.085948	0.0001
Test critical values:	1% level	-3.588509	
	5% level	-2.929734	
	10% level	-2.603064	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(CE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.072350	0.0009
Test critical values:	1% level	-4.180911	
	5% level	-3.515523	
	10% level	-3.188259	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(TINFL) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.20755	0.0000
Test critical values:	1% level	-3.588509	
	5% level	-2.929734	
	10% level	-2.603064	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(TINFL) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.14002	0.0000
Test critical values:	1% level	-4.180911	
	5% level	-3.515523	
	10% level	-3.188259	

*MacKinnon (1996) one-sided p-values.

3. Vector Autoregressive Estimate

```
Sample:  1968 - 2010                            No. of obs      =        43
Log likelihood = -145.0771                      AIC             =  7.724516
FPE            =  .4582468                      HQIC            =  8.041702
Det(Sigma_ml)  =  .1710397                      SBIC            =  8.584637

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
D_tpibr                7     .049128   0.3219   20.41691   0.0023
D_ce                   7     2.59772   0.1871   9.895133   0.1291
D_tinfl                7     5.06983   0.4252   31.81346   0.0000
------------------------------------------------------------------
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_tpibr						
tpibr						
LD.	.4741511	.1664375	2.85	0.004	.1479396	.8003626
L2D.	-.0283264	.1667748	-0.17	0.865	-.355199	.2985463
ce						
LD.	.0031546	.0027583	1.14	0.253	-.0022516	.0085608
L2D.	.0029291	.002895	1.01	0.312	-.0027449	.0086031
tinfl						
LD.	.003456	.0015223	2.27	0.023	.0004724	.0064396
L2D.	.0033205	.0012282	2.70	0.007	.0009134	.0057277
_cons	.0077952	.0069748	1.12	0.264	-.0058752	.0214656

D_ce						
tpibr						
LD.	-.2724753	8.800645	-0.03	0.975	-17.52142	16.97647
L2D.	19.48561	8.818482	2.21	0.027	2.201699	36.76951
ce						
LD.	.1933099	.14585	1.33	0.185	-.0925509	.4791707
L2D.	-.1554603	.1530758	-1.02	0.310	-.4554835	.1445628
tinfl						
LD.	-.0671074	.0804928	-0.83	0.404	-.2248705	.0906556
L2D.	.0382486	.0649404	0.59	0.556	-.0890322	.1655294
_cons	-.2207088	.3688049	-0.60	0.550	-.943553	.5021355
D_tinfl						
tpibr						
LD.	13.8462	17.17573	0.81	0.420	-19.8176	47.51001
L2D.	2.033827	17.21054	0.12	0.906	-31.6982	35.76586
ce						
LD.	-.8600464	.2846473	-3.02	0.003	-1.417945	-.302148
L2D.	.3484167	.2987495	1.17	0.244	-.2371216	.933955
tinfl						
LD.	-.3988222	.1570933	-2.54	0.011	-.7067195	-.090925
L2D.	-.2218823	.1267405	-1.75	0.080	-.4702892	.0265246
_cons	-.6386001	.7197758	-0.89	0.375	-2.049335	.7721344

.

4. Optimum Lag Selection, Causality Test and Autocorrelation Test

```
. varsoc
```

Selection-order criteria
Sample: 1968 - 2010 Number of obs = 43

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-172.793				.713789	8.17644	8.22175	8.29931
1	-154.48	36.627	9	0.000	.463588	7.74325	7.9245*	8.23475*
2	-145.077	18.806*	9	0.027	.458247*	7.72452*	8.0417	8.58464

Endogenous: D.tpibr D.ce D.tinfl
Exogenous: _cons

```
. vargranger
```

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
D_tpibr	D.ce	2.9662	2	0.227
D_tpibr	D.tinfl	10.085	2	0.006
D_tpibr	ALL	13.6	4	0.009
D_ce	D.tpibr	6.3014	2	0.043
D_ce	D.tinfl	1.359	2	0.507
D_ce	ALL	6.8221	4	0.146
D_tinfl	D.tpibr	.98938	2	0.610
D_tinfl	D.ce	9.4092	2	0.009
D_tinfl	ALL	9.5927	4	0.048

```
. varlmar
```

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	10.9456	9	0.27946
2	11.6439	9	0.23414

H0: no autocorrelation at lag order

5. Stability and Normality Tests

. varstable

Eigenvalue stability condition

Eigenvalue	Modulus
.7158797	.71588
-.2256031 + .5493089*i*	.593833
-.2256031 - .5493089*i*	.593833
.2319384 + .5052626*i*	.555955
.2319384 - .5052626*i*	.555955
-.4599116	.459912

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.

. varnorm, jbera skewness kurtosis

Jarque-Bera test

Equation	chi2	df	Prob > chi2
D_tpibr	3.992	2	0.13591
D_ce	267.477	2	0.00000
D_tinfl	0.705	2	0.70310
ALL	272.173	6	0.00000

Skewness test

Equation	Skewness	chi2	df	Prob > chi2
D_tpibr	-.35739	0.915	1	0.33869
D_ce	-2.8422	57.894	1	0.00000
D_tinfl	-.30633	0.673	1	0.41218
ALL		59.482	3	0.00000

Kurtosis test

Equation	Kurtosis	chi2	df	Prob > chi2
D_tpibr	4.3103	3.076	1	0.07945
D_ce	13.816	209.583	1	0.00000
D_tinfl	2.8664	0.032	1	0.85806
ALL		212.691	3	0.00000