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CEMAC: A SVAR and SPVAR  
Approaches**

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12 January 2015

Online at <https://mpra.ub.uni-muenchen.de/78227/>

MPRA Paper No. 78227, posted 16 Apr 2017 15:13 UTC

# Analysis and evaluation of the Monetary Policy Transmission Channels in the CEMAC: A SVAR and SPVAR Approaches

BIKAI Jacques Landry\*, and KENKOUO GUY-Albert<sup>†</sup>

January 2015

## Résumé

Cette étude a pour objectif d'identifier et analyser les effets des décisions de politique monétaire sur l'activité économique et l'inflation, et détermine le canal de transmission le plus opérant dans la CEMAC. Il ressort de nos résultats que : (i) la prise en compte des pays individuellement dans un SVAR, permet de mettre en exergue une faiblesse des canaux de transmission et une asymétrie des chocs et des délais d'action de la politique monétaire sur l'activité. On observe une inopérabilité quasi-totale des canaux de transmission au Congo, en Centrafrique, au Gabon, au Tchad et en Guinée Equatoriale. Par ailleurs, les chocs sur le taux directeur et la masse monétaire n'ont de réels effets significatifs qu'au Cameroun bien que ces effets soient de faible ampleur ; et (ii) la prise en compte de l'ensemble des pays dans un VAR en panel, permet de confirmer la faiblesse des canaux de transmission dans la CEMAC. Toutefois, un choc positif sur les crédits l'économie a de faibles effets inflationnistes pendant trois trimestres environ.

Classification JEL : C32, E52, E58, P24

Mots cls : Politique monétaire, modèle SVAR, modèle PVAR.

## Abstract

This paper's main objective is to analyse and identify the effects of monetary policy decisions on activity and inflation, and determines the main transmission channel in the CEMAC area. The results suggest that: (i) for each country, using a SVAR, the transmission mechanisms are very weak, and the common monetary policy has asymmetrical lagged effects on activity. We specifically found that the transmission mechanisms barely work in Congo, the Central African Republic, Gabon, Tchad and Equatorial Guinea, but a shock on broad money and the policy rate of the central bank has significant but weak effects on activity in Cameroon; and (ii) the Panel VAR analysis also confirms the weakness of the transmission mechanisms in the sub region. However, a positive shock on credit exhibits inflationary effects that last about three quarters.

JEL Code :C32, E52, E58, P24

Keywords: Monetary policy, SVAR model, PVAR model.

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<sup>‡</sup>The authors thank the researchers of the BEAC and Erik De Vrijer for their comments. Any errors or omissions in the paper are at the sole responsibility of the authors.

# Contents

<b>Non technical summary</b>	<b>3</b>
<b>Introduction</b>	<b>6</b>
<b>1 Monetary policy and financial sector in CEMAC.</b>	<b>8</b>
1.1 Evolutions of the monetary policy . . . . .	8
1.2 Financial Market and Banking sector . . . . .	12
<b>2 The transmission channels of monetary policy in developing countries: a brief literature review</b>	<b>15</b>
<b>3 Empirical evaluation of the money-output link in a SVAR model</b>	<b>19</b>
3.1 The models used to analyze the money-output relationship . . . . .	19
3.2 Presentation of the SVAR model . . . . .	21
<b>4 Results, interpretations and monetary policy recommendations</b>	<b>25</b>
4.1 Results and interpretations . . . . .	25
4.2 Monetary policy recommendations . . . . .	29
<b>Conclusion</b>	<b>31</b>
<b>References</b>	<b>32</b>
<b>Appendix</b>	<b>39</b>

## Non-technical summary

The present study analyses the channels through which monetary policy decisions of the BEAC affect the economic activity and inflation. The standard analysis of the transmission channels generally holds that a monetary policy decision can affect interest rates (the interest rate channel), the stock prices or the exchange rate (asset price channel), and amount of loans offered by commercial banks (the credit channel). It is however possible to identify other channels according to the complexity of the economies.

In a monetary union such as the UMAC, where the economies are not similar and thus to some extent heterogeneous, the transmission channels and the response times of the economies can be different from one country to another and generate in the same time the ineffectiveness of the monetary policy, which would translate into asymmetric effects on the activity of each of the countries. Therefore, an optimal conduct of the monetary policy in a union requires first of all a good command of the channels through which monetary policy decisions impact the economic activity and inflation in each of countries of the union.

The objective of this paper is thus to identify the most effective transmission channel in the UMAC, and to derive from it the effects of the common monetary policy on inflation and output in the countries of the region.

Indeed, several factors may limit the action of the Central Bank in the CEMAC, making ineffective the transmission channels of the monetary policy. These factors include: the excess bank liquidity, the low depth of financial markets, and the dysfunctions in the banking sector (weakness of the exchanges, concentration, restrictions on banking competition, etc.). It was therefore necessary through an econometric approach (a SVAR model for each of the countries, and a PVAR model for the entire region) to verify the effectiveness of the transmission channels in CEMAC.

The main results of our study show that:

(i) The analysis of the countries taken individually confirms the weakness the transmission channels in the region. The obtained effects are of small-scale and asymmetric from one country to another. For example, in Cameroon, although the magnitude of the effects is slow, we notice that an increase of the TIAO (positive shock) reduces the economic growth during approximately four (04) quarters without any significant effects on prices. Furthermore, a positive shock on money supply has a positive impact on the output during approximately five (05) quarters. Concerning Congo, it appears that the shocks on credits and money supply have no significant effects on the economic activity and prices, but in contrary, a positive shock on the TIAO reduces the economic growth if one considers a less binding confidence interval (one standard deviation instead of two). Although the magnitude of these effects is low, it is important to mention that these findings are consistent with the economic theory. Besides, for the CAR, Gabon, Equatorial Guinea and Chad, the shocks on the TIAO, the money supply and the credits have no significant effect on the economic activity and prices. In other words, the monetary policy transmission channels are ineffective in these countries.

(ii) When the analysis is carried out at the whole region, and not individually, we confirm the weakness of the monetary policy transmission channels in the CEMAC. The shocks on the money supply and the TIAO have no significant effects on prices and output. However, a positive shock on credits to the economy has weak inflationary effects during approximately three quarters, what could partially validate the credit channel despite the low magnitude of its effect. This result can be justified by the fact that the credits granted by the banks in the sub-region are for the great part short-term loans. In fact, a fast increase of short-term credits can only finance consumption and not investment and consequently, affect the demand increase and finally the prices.

In terms of recommendations, in front of the weakness of the transmission channels, the action of the Central Bank can only be effective if a set of decisions are taken, in particular: decisions consisting in developing the financial market in CEMAC, in reducing the bank excess of liquidity and in encouraging the granting of the medium and long-term credits. More specifically, and without being exhaustive, it is about promoting the issuance

of securities by States and by companies, which contribute to dry up the liquidity of banks. Besides, the granting of medium and long-term credits requires among others, a convenient business climate to boost the private investment. Therefore, the States should also take a set of policy actions which are not necessarily within the scope of the Central Bank actions. In particular, it is about the improvement of the business climate, structural reforms in the labor market, the development of public infrastructure, the improvement of the intra-regional trade, the strengthening of institutions, notably the legal system and the implementation of contra-cyclical fiscal policies which are consistent with the monetary policy.

## Introduction

Identify the monetary policy transmission channels, means looking for the ways by which the decisions of monetary policy affects the economic activity and prices. The effects of monetary policy on the output has led the economists to agree on two consensus according to which : the money has effects on the economic activity at least in the short run (keynesian view) and a too big increase of the money supply generates inflation in the long run (monetarist view).

Although there is a difference on the ways through which the money may affect the real-economy, most of the time, the economic theory holds that the monetary policy decisions are transmitted on prices and output via various channels such as: the interest rate, the share price, the exchange rate, credit, expectations, etc.

The identification of the monetary policy transmission channels allows, according to Meltzer (1995) to determine and to master the effects of monetary policy decisions on the economic activity. In other words, the ignorance of these channels by the Central Bank, or an erroneous appreciation of the latter, may explain the ineffectiveness of the monetary policy and according to Nelson Edward (2007), is the source of the ineffectiveness of the monetary policies of the sixties and seventies<sup>1</sup>. Furthermore, the determination of the delays in the transmission of the monetary impulses on the economic activity allows the monetary authority to better control its actions during the period separating the decision-making and the moment when the effects of these decisions become visible on the macroeconomic variables. In fact, as stressed by Meltzer (1995), during this interlude, the pressure on the central bank to make it give up to its rule or to change its policy is often intense.

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<sup>1</sup>Nelson adds that the progress achieved by the Bank of England to understand these mechanisms, explains the successes of the Bank's policies.

In a monetary union where economies are not always similar and thus heterogeneous, the transmission channels and the response time of economies can differ from a country to another and induces at the same time the ineffectiveness of monetary policy, which would translate into asymmetric effects on the activity of each of the countries. Therefore, an optimal implementation of the monetary policy in a union requires first of all a good knowledge of the mechanisms by which the monetary policy decisions affect the economic activity of each of the countries of the union.

Indeed, the asymmetric reactions generated by a common monetary policy on heterogeneous economies, are generally translated into an acceleration of the deviation in the cyclical and structural evolutions of economies. The consequence of the heterogeneity can thus make ineffective the implementation of economic policies in a monetary area, especially as the Central Banks sometimes act without taking into account the disparity which exist between the countries of the union (single monetary policy). However, the existence of heterogeneities between countries does not necessarily constitute a fate because most of the big Central Banks are facing this issue, as it is the case for the European Central Bank (ECB) or the Reserve Federal Board (voir Brissimis and Delis 2010<sup>2</sup>).

With regard to the cyclical and structural disparities, observed between the economies of the Central African Economic and Monetary Community (CEMAC), it is necessary to look for the ways by which, the decisions of the Bank of the States of Central Africa (BEAC), affects the activity in the countries of CEMAC. Therefore, we seek to answer the following question: how the decisions of monetary policy are passed on in the economy? Is it through the interest rate (Taylor, 1995), asset prices (Tobin, 1969; Modigliani, 1971) or then the bank credit (Bernanke and Gertler, 1995; Meltzer, 1995)?

To answer these questions, a meticulous analysis should be made concerning the financial and monetary environment of the CEMAC. Indeed in the CEMAC, considering

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<sup>2</sup>S.N. Brissimis and M.D. Delis (2010): "Bank Heterogeneity and Monetary Policy Transmission", ECB working papers series N1233 August 2010.



the quasi-non-existence the direct finance, and the adoption of the fixed exchange rate<sup>3</sup>, asset price channel (the channel of share prices and exchange rate) can turn out to be ineffective. Furthermore, with regard to the situation of excess liquidity of the credit institutions, which do not almost refinance themselves or little with the BEAC, it would be vain that the interest rate channel is completely functional. It is therefore more likely that the credit channel would be the most effective in the CEMAC zone, and this postulate is moreover justified in the economic literature because countries which have a dominant banking<sup>4</sup> are more inclined to see their economic activities stimulated through the credit channel. In contrast, countries having a very developed financial sector, are the most exposed to the interest rate channel and the asset price channel (Hamid Davoodi et al, 2013).

The objective of this study is thus to identify the most effective channel in the CEMAC and deduct from it the effects of the common monetary policy on the economic activity of the countries of the regions.

In the remaining part of this paper, we are going to present in the first section an analysis of the current monetary policy and the characteristics of the financial sector in CEMAC. The second section will be devoted to a brief review of the literature while insisting on African countries. The third section will be dedicated to the presentation of the SVAR and PAVAR models. Finally, in the fourth section, will be presented the results, as well as the policy recommendations.

## **1 Monetary policy and financial sector in CEMAC.**

### **1.1 Evolutions of the monetary policy**

Before the reforms introduced from October 16th 1990, the monetary policy of the BEAC was based on the use of the direct instruments (preferential rates for priority sectors, rediscount ceilings, selectivity of credits). The interest rate policy was characterized by a

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<sup>3</sup>It is worth noting that the choice of the fixed exchange rate can be a structural obstacle to the monetary policy in case of the free movement of capital. The exchange controls allow to address this constraint.

<sup>4</sup>En CEMAC, le secteur bancaire représente plus de 80% des actifs financiers.

strong rigidity with regard to a very fluctuating internal and external fluctuations. The selective credit policy did not have the expected effect, but in contrary introduced certain distortions at the level of resource allocation and generated a waste of monetary resources in the public and parastatal sectors, in some national entrepreneurs and agricultural marketing organizations. The technique of the global ceiling was partial, stiff and constituted a binding factor for the competition between banks.

The reserve requirement policy was not advisedly used, and the constitution of reserves appeared as a penalty for the banks, while it is an instrument of regulation of the global liquidity of the economy. As an illustration in Gabon, during the implementation of the 1977-1979 stabilization plan, the National Monetary Committee has decided, as a penalty, to force banks having granted credit beyond the authorized limit to hold at the Central Bank mandatory reserves, not remunerated and equal to the amount of the noticed overtaking.

After 1990, the monetary policy of the BEAC witnessed deep changes and rest since then on the monetary stability<sup>5</sup>. The BEAC shifted toward the use of indirect instruments, with in particular an harmonized and more flexible policy<sup>6</sup>, the institution of monetary programming intended to identify the states's needs in liquidity (and no longer the bank) in order to encourage the competition between banks, the use of the minimum reserve as an instrument of regulation of the liquidity, and especially the setting up of a money market in 1994, allowing an exchange of liquidity between credit institutions on one hand, and between the latter and the BEAC on the other hand.

Concerning the minimum reserves whose the rate is differentiated according to the level of liquidity of countries, it should be noted that this approach is not optimal in a monetary union and may contribute to limit the effectiveness of monetary policy instruments. Indeed,

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<sup>5</sup>That is to maintain on one hand the internal stability with a low rate of inflation (the standard in CEMAC is 3%) and on the other hand an external stability with a sufficient currency's external coverage rate (minimum 20%).

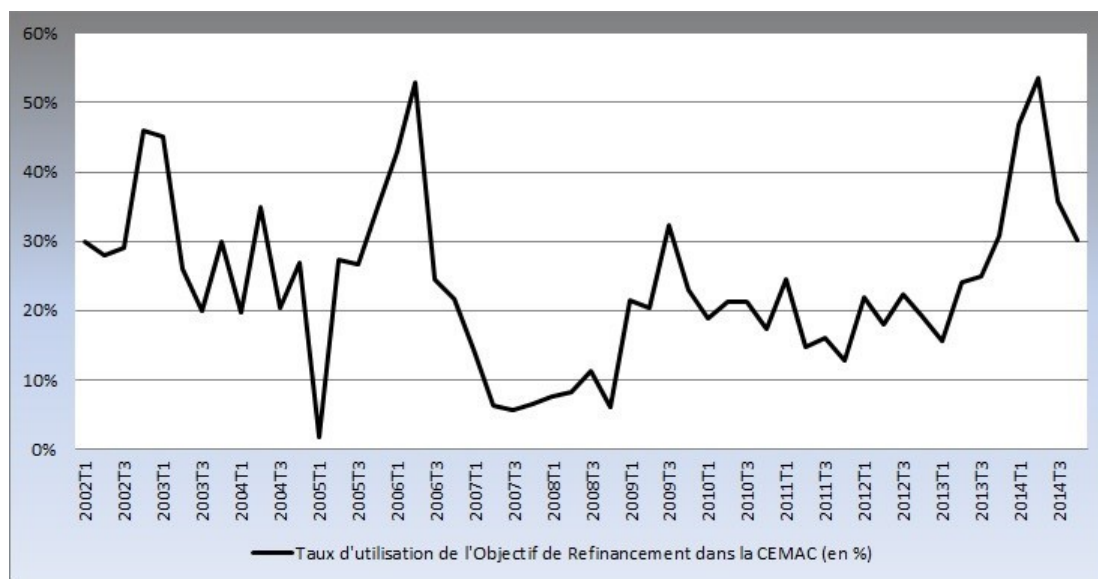
<sup>6</sup>The key lending rate (TIAO) of the BEAC has been modified nineteen times (19) between January 1996 and July 2009, against only seven (07) modifications before the reform by the board of directors in sixteen years (1974-1990).

the minimum reserves are sometimes considered as a safety net and therefore a guarantee for the depositors to get at least a part of their deposits back by the mean of the Central Bank in case of bank crisis. So, to allow some banks not to constitute a minimum reserve represents a risk in a case of emergence of a crisis. Besides, to allow some banks to constitute the minimum reserves less than others in the same union limit the competition and at the same time the effectiveness of the monetary policy.

The reforms of the 90s certainly allowed the sub-region to avoid the collapse of the financial system of the CEMAC during the crisis of the 80-90. However, from the beginning of 2000s, one observes the excess of liquidity of the credit institutions which could limit the effectiveness of the transmission channels and thus the monetary policy (see Kamgna and Ndambendia, 2008). Indeed, the bank's excess of liquidity urges the latter to be inactive on the money market. Banks request only very few liquid assets with the market. Furthermore, the transactions of this market are almost always between the credit institutions of the same group. It is one of the reason why the reform of the current monetary policy seeks to find ways to revitalize the money market and specifically the interbank compartment. It is however necessary to note that the low participation of banks in the interbank market limits significantly the effectiveness of the monetary policy and in particular the interest rate channel (see Laurens, 2005).

As can be seen in Chart 1 below, the amounts of refinancing determined within the framework of monetary programming are little used oscillating on average between 20 and 30% of the ceiling. In addition, there are only very few transactions in the interbank compartment. The intermediate objective of the BEAC being to control the broad money and credit in order to regulate the inflation, it could be difficult for central bank to achieve its ultimate objective of price stability if this situation persists.

Figure 1: Use of the refinancing target in CEMAC, 2002-2014 (in % of the ceiling)



Source: Authors with data from BEAC

On the other hand, the increase in government bond issuances in the sub-region, which is also encouraged by the Central Bank, helps to reduce excess liquidity in the money market and limit monetary financing of deficits which has an inflationary nature. Thus, in view of their importance, the BEAC has decided<sup>7</sup> since 2013 to accept government bonds as collateral for refinancing of credit institutions. Indeed, banks have subscribed to securities issued by states and generally keep them in their investment portfolio in the absence of an active secondary market. An active secondary market would thus allow banks to invest the securities held in their portfolios in the event of cash tension to use an existing liquidity instead of making use of the central bank for an additional injection of liquidity into the economy.

Indeed, in case of cash tension in a context where banks hold large amounts of government securities, deemed to be highly liquid, they can sell them on the secondary market (to the economic agents) in order to use an already existing liquidity and limit the inflationary

<sup>7</sup>See Decision N.04/CMP/2013 of 31 October 2013 relating to eligible financial assets as collateral for refinancing operations at the Bank of the States of Central Africa.

pressures that could generate an additional injection of liquidity by the Central Bank. This could also help to enhance the effect of the transmission channels in the sub-region.

## 1.2 Financial Market and Banking sector

The analysis of the banking sector and the financial market is important in this study because the preponderance of banking sector in an economy is generally favorable to the emergence of the credit channel. Moreover, countries with a large financial market are generally more exposed to interest rate channel (see Mohanty and Turner, 2008).

In the CEMAC, according to the weakness of direct finance (paradoxically with two stock exchanges whose the merging is planned<sup>8</sup>), it is obvious that the banking sector, on which we will focus, is the most important source of financing of the economy. According to the Banking Commission of Central Africa (COBAC)<sup>9</sup>, the banking sector holds nearly 85% of financial assets and liabilities. And theoretically, when the banking sector is dominant in an economy where credit is the main source of financing, monetary policy should be more effective.

However, the existence of a large informal sector<sup>10</sup> is likely to depress the already weak bank account penetration rate in CEMAC, which helps to limit the effectiveness of the credit channel, despite a dominant banking sector. Moreover, other factors in the banking sector are likely to limit the effectiveness of monetary policy in particular: the level of competition between credit institutions and the high degree of banking concentration.

In terms of competition among credit institutions, when it is high, it significantly contributes to the enhancement of the transmission channels and thus the effectiveness of mon-

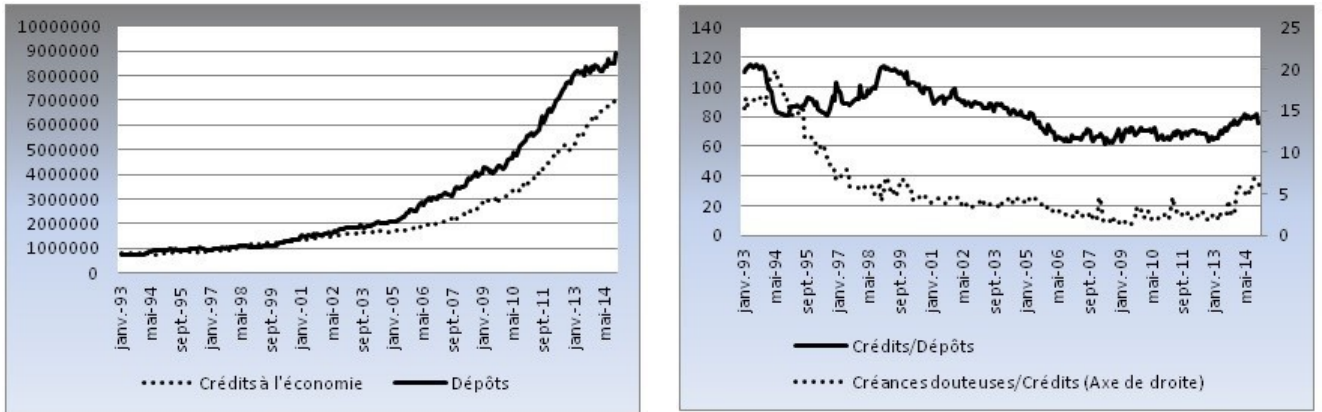
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<sup>8</sup>With only three companies listed on the Douala Stock Exchange (DSX) and none in Stock Security Exchange of Central Africa (BVMAC)

<sup>9</sup>See the COBAC 2010 report.

<sup>10</sup>As an illustration, according to the National Employment and the Informal Sector Survey (EISS) in Cameroon conducted by the National Institute of Statistics, almost 90% of the active population works in the informal economy. This figure has also been confirmed by the World Bank in February 2012, adding that nearly 70% of the workforce is facing underemployment.

Figure 2: Loans and deposits in CEMAC, 1993-2014



Source: Authors based on data of BEAC.

Note: In the left graph, data are in millions CFA francs

etary policy. In contrast, a weakly competitive banking sector limit the effect of the action of the central bank on the output. One of the basic measures sometimes used to analyze the competition, is the ratio Loans/Deposits. This ratio relates the liquidity management with the banking performance. The higher the ratio, the higher the banks grant loans from their main source of funding (deposits), and the lower is the liquidity. However, a very high amount of this ratio can also indicate tremendous risk exposures at the risk of borrowers defaults. In the CEMAC, the level of banking competition is increasingly weak as evidenced by the decline in the ratio Loans / Deposits (see the continuous line in Chart 2), which stood at 78% in December 2014 against 110% in January 1993. An deeper analysis however allow us to understand that the credits rationing made by banks during this period, has significantly reduced bad debts which rose from 15% of total loans in January 1993 to 5.7% in December 2014 (see the dashed line in chart 2).

Since the crisis of the 90s, a drop of competition is observed, which reflects the banks' reluctance to extend credit in an environment that was characterized, before the crisis, by large volumes of bad debts. The banks have restricted their credit supply which is less and less important than deposits, despite the growing needs of economic agents and mainly SMEs / SMIs which depend on bank credit. The crisis of confidence generated during this period was gradually extended to the interbank market made up of banks less liquid than others, to the extent that the Central Bank is obliged sometimes to inject liquid assets in a sub-region which is globally in excess of liquidity. It would therefore be difficult for

monetary policy to be effective in this environment because the changes in the policy rate can influence the excess liquidity banks credit supply policy.

Thus, to improve the effectiveness of monetary policy, we must find measures<sup>11</sup> allowing to boost the granting of loans and lower lending rates<sup>12</sup> because this will strengthen the transmission channels of monetary policy. However, to prevent abuses like those observed in 80-90 years or during the recent financial crisis in Europe and the United States, prudential regulation should be strengthened in CEMAC including the introduction of optimal<sup>13</sup> ratios that could be catalysts for the competition in CEMAC.

As for the banking concentration that is sometimes discussed as an element of competition, when it is too high, it becomes harmful to competition and thus limit the efficiency of the transmission channels. COBAC in its various reports shows through concentration indexes<sup>14</sup> that the CEMAC banking sector is highly concentrated. By way of illustration, according to the 2010 report of the COBAC, the banking system was dominated in 2010 by foreign banks that mobilized about 63% of banking assets. Among these banks with foreign capital, (which have a lower cost source of funding unlike local banks) two of them were present in five CEMAC countries managing about one third (1/3) of resources of the CEMAC banking sector, which currently has about fifty banks. And overall, four (04)<sup>15</sup> financial conglomerates and groups realized most of the sub-regional financial transactions. Moreover, Cameroon and Gabon banking systems accounted for over 80% of the CEMAC banking market in the distribution of loans and collecting deposits. These disparities are likely to lead to an asymmetric reaction of the economies of the CEMAC to common

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<sup>11</sup>The measures to be applied to boost the granting of loans, do not fall only to the responsibility of commercial banks, but also to the Central Bank and states. Everyone has a responsibility.

<sup>12</sup>These lending rates are high because of the business environment which is not always conducive to the development of private investment, thus contributing to raising risk premiums charged by commercial banks. The weight of the policy rate is very low in setting lending rates.

<sup>13</sup>As an illustration, a ratio credit / deposit best could for example be close to 100% to reduce the indebtedness of credit institutions as well as the weight of bad loans, and at the same time encourage competition in the banking sector.

<sup>14</sup>It generally make use of the Herfindal Hirschmann concentration index.

<sup>15</sup>Société Générale, IUB Holding, BGFBI Bank and Afriland First Bank.

monetary policy decisions.

To go further, of the 12 banks operating in Cameroon in 2010, 3 banks shared 57.6% market share in terms of total balance sheet, 55.2% market share in terms of total deposits and 60.7% market share in terms of total credits. In Congo, 3 of 6 banks share 86.8% market share in terms of total balance sheet, 78.6% of deposits and 73.1% of loans. In Gabon, the first three banks out of the 9 that counted the banking system in 2010 had 72% market share in terms of total balance sheet, 83.6% in deposits and 87.4% in terms of credits. In Chad, the first 3 banks on 8 in activity held respectively 71.2%, 69.7% and 68% market share for total balance sheet, total deposits and total loans. All these trends still persist nowadays. From this analysis, we can thus hold that in each CEMAC countries, there are at least 3 banks whose a potential bankruptcy would entail the collapse of the financial system of the country. This imbalance is detrimental to banking competition and therefore limits the action of the Central Bank since the common monetary policy, when restrictive, will be binding for the smaller banks. Moreover, in case of serious crisis, the bankruptcy of a bank holding most of the financial assets of a country can lead to huge costs, operate a ripple effect on other banks and accentuate the crisis of confidence on the interbank market.

Given all the limitations mentioned above, it is not surprising that monetary policy decisions may have little or no effect on real activity, thus emphasizing the weakness of the transmission channels in the area, and even if that were the case, the effects of monetary policy would be unbalanced from one state to another. However, a deeper analysis of the literature is necessary for a more refined understanding of these mechanisms.

## **2 The transmission channels of monetary policy in developing countries: a brief literature review**

In theory, the traditional analysis of transmission channels generally holds that a monetary policy decision can affect interest rates (interest rate channel), the stock price, the exchange rate (channel of prices of other assets), the amount of loans offered by commercial



banks (credit channel). It is possible to identify other channels depending on the complexity of economies (see Landais, 2008). According to theoretical developments of Bernanke and Blinder (1992) or Kierzenkowski (2004) the effects of monetary policy on output and prices depend on the combination of the effects of three traditional channels: interest rate, credit and exchange rate. In other words, the responses of output and prices to monetary policy shocks will be amplified or diminished according to intensity of the response of the money demand to changes in interest rates, according to the response of credits or that of the exchange rate. Several channels can thus coexist with different magnitudes in an economy.

Indeed, the transmission channels of monetary policy are not fixed, and differ mostly from one country to another depending on the importance of the banking sector, the depth of the financial sector but also the reforms undertaken by the states<sup>16</sup>.

Regarding developing countries, Mishra, Montiel, and Spilimbergo (2010) showed that the transmission mechanisms in low-income countries are fundamentally different from those of countries with sophisticated financial sectors. According to these authors, the traditional mechanisms of transmission of monetary policy would be weak and sometimes ineffective in low income countries because of the weakness of the institutional framework, the imperfect competition in the banking sector, embryonic financial markets and the high costs of bank loans.

Like the work of Romer and Romer (1989), other studies have focused on a narrative approach to show that the transmission mechanisms are not always weak in developing countries, particularly those in sub-Saharan Africa . Berg et al. (2013) show in this regard that the use of very sophisticated models<sup>17</sup> may underestimate the weight of some channels in the transmission of monetary policy. The authors illustrate by the narrative approach that traditional channels are operative in some countries of East Africa such as Kenya,

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<sup>16</sup>See Prachi Mishra and Peter Montiel (2012) for a survey of empirical studies on the transmission channels in low income countries

<sup>17</sup>It is for example the case of VAR, SVAR or VECM models.

Uganda, Tanzania and Rwanda.

Davoodi et al. (2013) wrong-foot this analysis and show that these channels are weak when using standard statistical inferences. Thus, using the Bayesian VAR and FAVAR, they highlighted the channel of interest rates, credit and foreign exchange rates in East African countries, stating that the rate channel seems more relevant in countries with a significant depth of financial markets.

In the CEMAC zone, studies were conducted to analyze the effectiveness of the monetary policy of the Central Bank in a context of excess liquidity of banks and thus analyze the effectiveness of the transmission channels of monetary policy. Saxegaard (2006) and uses a threshold VAR model to highlight non-linearities in the transmission of monetary policy in the CEMAC zone, Nigeria and Uganda. According to this author one must first distinguish involuntary excess liquidity from the excess liquidity for precautionary purposes. He shows that the transmission of monetary policy to the output is weak when the involuntary liquidity is high (from 2000s in CEMAC). However, according to the author, the transmission of monetary policy on prices would be weak in Nigeria and Uganda when the involuntary liquidity held by banks is high. CEMAC, in contrary, he found that even when liquidity is not too high, the transmission remains weak. This situation highlights the existence of other factors that may induce weak transmission channels outside the situation of voluntary or involuntary liquidity of banks. In other words, the excess liquidity is not the only factor that may limit the efficiency of the transmission channels in the CEMAC.

Kamgna and Ndambendia (2008) also show that the excess liquidity of banks in the CEMAC zone significantly limits the effectiveness of monetary policy. This inefficiency is related, according to these authors, to a low sensitivity of the interbank rate to monetary policy decisions and ineffective reserve requirement policy.

Very few studies focus on the most relevant channel in sub-Saharan Africa and particularly in CEMAC. However, concerning for example the interest rate channel, Fielding (1994) showed that in Cameroon, the elasticity of interest rates relative to the money

demand is much lower than in countries such as Nigeria , Ivory Coast and Kenya where financial markets although embryonic, are more developed than in CEMAC zone. Indeed, the strength of this channel depends on two sensitivities: firstly, the intensity of the response of interest rates to changes in the money supply, and secondly, the intensity of the response of the aggregate money demand to changes in key interest rates. In other words, the rate channel would operate less well in Cameroon than in Nigeria, Ivory Coast and Kenya. Nubukpo (2007) has highlighted the channel of interest rates in the UEMOA zone, although its magnitude is low according to the author. In the CEMAC, in contrary studies have confirmed the stability of the money demand function and thus a certain homogeneity of behavior between Cameroon and other countries in the region (see MOUNKALA, 2012) and, with reference to studies of Fieldings (1994) and Nubukpo (2007), it is difficult that the interest rate channel may be operating in the CEMAC, and even if it does, its effectiveness will inevitably be reduced and lower than in the UEMOA zone with regard to differences in the depth of financial markets.

Mixed results have been found in other sub-Saharan countries about the channel rate through sometimes distinct approaches. These studies argue (i) sometimes to an effectiveness if the interest rate channel like Uanguta and Ikhide (2002) for Namibia, Cheng (2006) for Kenya and Ogunkula TARAWALIE (2008) for Sierra Leone (ii) sometimes ineffectiveness for that channel like Abradu-Otoo Amoah and Bawumia (2003) for Ghana, Buigut (2009) for Kenya, Tanzania and Uganda or Ramcharan (2010 ) for Botswana, Lesotho, Namibia and Malawi. Studies also show limited effects of this channel like Sexegaard (2006) for CEMAC, Lungu (2008) for Botswana, Malawi, Namibia, South Africa and Zambia (see Davoodi, Dixit and Pinter, 2012; Montiel, Adam Mboe and O'Connel, 2012).

As for the credit channel, it is generally accepted that countries with predominant banking sectors are more exposed to this channel. As such, Creel and L'vasseur (2006) have shown for some countries of Central and Eastern Europe (CEE) that the dependence of economic agents in the banking sector for consumption spending and investment, result in a credit channel which is more effective than in the countries of the euro area where the rate channel appears operational due to a relatively developed financial market (see also Ganev

et al, 2002; European Central Bank, 2002; Angeloni et al, 2003). According to this school of thought and in line with the work of Davoodi et al. (2013) for East African countries, monetary policy will have a greater impact on spending of small and medium enterprises, which are more dependent on bank credit than large companies that have direct access to capital markets. Therefore, in market economies, where banks play a less important role in credit markets, the bank lending channel is less effective (see also Edwards and Mishkin 1995).

Thus, given the non-expansion of the direct finance in CEMAC, the credit channel is more likely to occur in the area because almost all businesses operating in the formal sector use banks for their financing needs.

Overall, a good command of the transmission channels of the monetary authorities, allows them to better understand the impact of their decisions on the economy, mainly the production and prices of each country. In a currency area and heterogeneous as CEMAC, the good command of these channels is an asset to analyze the effectiveness of the monetary policy of the BEAC as well as the orientation to be given to future monetary impulses.

### **3 Empirical evaluation of the money-output link in a SVAR model**

#### **3.1 The models used to analyze the money-output relationship**

It is worth mentioning that there are different models used to assess the impact of monetary policy on economic activity. The existence of these models can be explained largely by the Keynesian-classical cleavage. However, a consensus exists: there is a strong correlation between money and prices over the long term. In the short term however, things get complicated and methods follow one another.

We thus shifted from the St. Louis equations<sup>18</sup> (which just required the past series) to error correction models. But these models have encountered the Lucas critique that under

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<sup>18</sup>Referring to the Federal Reserve (FED) of Saint Louis.

rational expectations, coefficients of such models are not always stable. And furthermore, these models (especially that of St. Louis) did not take into account the possible twoway causality between variables (King and Plosser 1984).

Another method is to construct theoretical macroeconomic models (see Lavigne and Villieu, 1996). These models are used to determine different elasticities with proven robustness. However, when the model specification differs, it is difficult to compare countries to each other through such models (see Coudert and Mojon, 1997) and furthermore, the elasticities are sometimes overestimated due to restrictions imposed a priori. Romer and Romer (1990), introduced models based on a qualitative and institutional design of monetary policy: for example, they take into account the minutes of the meetings of monetary policy committees and analyze reports. However, for Hoover and Penz (1994), this method suffers from the mistake of assimilation between precedence and causality.

VAR models, widely used in today's economy, have emerged and popularized in the 1980s by Sims, notably following the Lucas critique, and taking into account in some equations of rational expectations. However, the peculiarity of the structural VAR models that we use in this paper, is that one imposes constraints extracted from economic theory in the considered VAR. However, following Sims (1980), works as part of the VAR methodology and its variants will succeed in an attempt to prove or disprove a monetary explanation of economic fluctuations (Bernanke, 1986; Blanchard and Watson, 1986; Blanchard, 1989; Blanchard and Quah, 1989).

In the context of monetary unions, a more recent approach is to use panel VAR models. Canova and Ciccarelli (2013) make a comprehensive survey of this methodology. However, another more complex method and initiated by the economists of the real business cycle theory is increasingly used today in central banks: these are dynamic stochastic general equilibrium models abbreviated DSGE (see Woodford 2003; Smets and Wouters, 2003; Shanaka Peiris and Saxegaard, 2007).

### 3.2 Presentation of the SVAR model

The structural VAR models (SVAR) were introduced in the mid-eighties to meet the criticisms<sup>19</sup> of the unconstrained VAR models to analyze the impulse response along the lines recommended by Sims (1980). Indeed, as Sims points out, if the shocks in a VAR are not independent, one performs a "statistical" orthogonalization through a variance decomposition or Choleski decomposition. However, no economic interpretation is possible with such a method. Authors such as Shapiro and Watson (1988), Blanchard and Quah (1989), King et al (1991) therefore proposed to identify the economically interpretable structural impulse response. However, in our case, the VAR used has the following form:

$$A_0 X_t = \sum_{i=1}^p A_i X_{t-i} + \varepsilon_t, \quad t = 1, \dots, T \quad (1)$$

Where  $X_t = (X_{1t}, X_{2t}, \dots, X_{nt})'$  represents a vector of n variables at each time t. In our case, we have five variables of the real and monetary area for each country over the period 1998-2008 in quarterly data. The variables taken into account are as follows: GDP, the consumer prices index (CPI), the broad money (M2), credits to the economy (CE), the central bank rate (Tiao). Only the GDP was transformed from annual to quarterly data following the procedure of Goldstein and Khan (1976).

As regards the number of selected variables, note that Stock and Watson (2001) show that a VAR with a low number of variables (two or three) often leads to unstable estimates, moreover, a very large number of variables reduces the degree of freedom and increases volatility. In expression (1),  $\varepsilon_t$  is a vector of structural shocks, the  $A_i$  are square matrices of order n such that:

$$\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t}, \dots, \varepsilon_{nt})' \quad \text{and} \quad A_i = \begin{pmatrix} a_{11}^i & \cdot & \cdot & \cdot & a_{1n}^i \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ a_{n1}^i & \cdot & \cdot & \cdot & a_{nn}^i \end{pmatrix}$$

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<sup>19</sup>Particularly that related to the lack of theoretical foundation in the use of such models

The VAR represented by equation (1) is called structural VAR if we assume that the structural shocks are orthogonal (that is to say, the variance-covariance matrix of the error term is diagonal). It is thus obvious that if the  $A_i$  matrices are known, we can calculate the effect of a shock of a variable in the financial sphere, on a variable of the real sphere, particularly the effect of a monetary shock on production or prices. For this purpose, one must write the first relationship in the form of a VMA( $\infty$ ), It is a moving average specification (Moving Average) and Wold decomposition, which is made as follows :

$$A_0 X_t = A(L) X_t + \varepsilon_t$$

From where

$$X_t = (A_0 - A(L))^{-1} \varepsilon_t$$

$$\begin{pmatrix} X_{1t} \\ \cdot \\ \cdot \\ \cdot \\ X_{nt} \end{pmatrix} = \sum_{i=0}^{\infty} \begin{pmatrix} C_{11}^i & \cdot & \cdot & \cdot & C_{1n}^i \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ C_{n1}^i & \cdot & \cdot & \cdot & C_{nn}^i \end{pmatrix} \begin{pmatrix} \varepsilon_{1t} \\ \cdot \\ \cdot \\ \cdot \\ \varepsilon_{nt} \end{pmatrix} \quad (2)$$

or

$$X_t = \sum_{i=0}^{\infty} C_i \varepsilon_{t-i}$$

$$X_t = C(L) \varepsilon_t \quad (3)$$

We can therefore measure the impact of the monetary sphere of the real economy using dynamic multipliers:

$$\frac{\partial X_{it}}{\partial \varepsilon_{js}} = C_{js}^i$$

This is an impulse response function because  $\forall$  the horizon,  $h \geq 0$ ,  $h \rightarrow C_{js,h}^i$

However, to characterize the system's responses to structural impulses ( $u_{js}$ ), we will identify the structural dynamic multipliers ( $\Theta_{ij,t-s}$ ) from the following moving average process:

$$X_t = \sum_{i=0}^{\infty} (C_h A_0)(A_0^{-1} \varepsilon_{t-h}) \quad (4)$$

$$X_t = \sum_{i=0}^{\infty} (\Theta_h)(u_{t-h}) \quad (5)$$

where  $\Theta_h = C_h A_0$  and  $u_{t-h} = A_0^{-1} \varepsilon_{t-h}$

Thus we derive the dynamic multiplier by:

$$\frac{\partial X_{it}}{\partial u} = \Theta_{js}^i$$

Our results will therefore be presented as graphic and structural responses will be as:  $\forall$  the horizon,  $h \geq 0$ ,  $h \rightarrow \Theta_{js}^i$

However, the impulse responses can also be analyzed with the study of the variance decomposition of the forecast error of each series according to the principles of Sims (1980). Moreover, not knowing the elements of the matrices  $A_i$ , we first estimate the reduced form of expression (1) which is as follows:

$$A_0 X_t = \sum_{i=1}^p B_i X_{t-1} + u_t \quad (6)$$

where  $B_i = A_0^{-1} A_i$

The error terms  $u_{1t}, (u_{2t}, u_{3t}, \dots, u_{nt})'$  are only residuals and represent linear combinations of the structural shocks. Indeed,  $u_t = A_0^{-1} \varepsilon_t$ .

However, the estimate of the VAR of the reduced form does not allow us to identify all the elements of the matrix  $A_0$  and those of the variance-covariance matrix of structural shocks. Indeed, the variance-covariance matrix  $\Sigma_u$  is :



$$\Sigma_u = A_0^{-1} \Sigma_\varepsilon (A_0^{-1})' \quad (7)$$

We therefore have  $(n^2 - n) \times 2$  parameters to be identified which gives a total of forty since we have twenty  $(n^2 - n)$  unknown in each of matrices  $A_0$  and  $\Sigma_u$ .

Yet, the variance-covariance matrix estimated from the reduced form only provides us fifteen  $((n^2 - n)(n - 1))/2$  non-identical values as by construction, this matrix is symmetrical. So we have a problem of identification in Equation 7 because we have more unknowns  $n^2$  than equations  $(n(n - 1))/2$ . To solve it, we need additional identification assumptions and a total of 10  $(n(n - 1))/2$  additional restrictions.

These assumptions are often drawn from the economic theory unlike unconstrained VAR popularized by Sims (1980), which instead uses Cholesky decomposition which consist in forcing the matrix  $\Sigma_u$  to be diagonal and standardizing to 1 the main diagonal of the matrix  $A_0$  and to impose an upper or lower triangular structure so that:

$$\Sigma_u = A_0 A_0'$$

Such that  $\Sigma_u = Id_n$

However, there are two additional possibilities:

1. One can apply for short-term constraints on the  $A_0$  matrix that binds current shocks;
2. One can apply long-run constraints on the matrix of the long-term multipliers defined in the moving average representation.

Most constraints, particularly those of the short-term, correspond to a number of null coefficients. In contrast, the long term constraints are introduced in the case of non-stationary processes and in the usual manner, a long-term constraint expresses the absence of a long-term response of a component of  $X$  to any impulse, and is reflected by the nullity of the corresponding coefficient. These long-term constraints were initiated

by Blanchard and Quah (1989). However, it is possible to make a mixture of the two possibilities to obtain the desired number of constraints.

In our case and for each country, the vector  $X_t$  is respectively made up of GDP, CPI, the EC, TIAO, and M2. Following Christiano, Eichenbaum and Evans (2005) we apply short-term constraints on  $A_0$  so that this matrix is triangular. Which is to say that the variables do not instantaneously respond to economic policy shocks. The cause of this lack of response in the short term, is due to the adjustment phenomena that are usually slow with the existence of nominal rigidities<sup>20</sup>, the existence of possible delays in response.

After estimating for each country, a SVAR model, the same exercise will be done on a panel data model composed of the six CEMAC States. We estimate for the whole area, a panel SVAR model inspired from the work of Goodhart and Hofmann (2008). The approach is similar to that of SVAR, but an individual dimension is added to the model (For more details see Canova and Ciccarelli, 2013).

## 4 Results, interpretations and monetary policy recommendations

### 4.1 Results and interpretations

#### Stationarity of variables

We used growth rate for GDP, CPI, credit to the economy and the money supply. Only TIAO is taken in logarithm. Stationarity tests show that:

1. In the individual analysis, the TIAO is integrated of order 1, the other variables are stationary except GDP in CAR which is integrated of order 1;
2. For the panel analysis, only the TIAO is integrated of order 1

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<sup>20</sup>The explanation for these nominal rigidities is exposed in the theory of menu costs. See Blanchard and Kiyotaki (1987).

## Country analysis

Overall, SVARs applied by countries confirms the weakness of the transmission channels of monetary policy in CEMAC (see impulse response functions by country in appendix).

The obtained effects are weak and asymmetric from one country to another. Regarding the Cameroon example, although the magnitude of the effect is small, however, we note that a positive shock on TIAO depresses economic growth during approximately four (04) quarters, without any significant effect on prices. In addition, a positive impact on the money supply has a positive impact on the output for about five (05) quarters. It should nevertheless be noted that, with regard to the interconnection of some credit institutions in the sub-region, the loans granted by the Cameroonian banks can finance the activities of other CEMAC countries; which would in such circumstances would allow to convey the effects of the interest rate channel in other countries.

For Congo, it appears that the shocks on credit and money have no significant effects on real activity and prices but rather, a positive impact on the TIAO depresses growth considering a confidence interval of one (01) standard deviation instead of two (02). Although the magnitude of these effects is low, it must still be noted that this is consistent with economic theory.

Besides, for CAR, Gabon, Equatorial Guinea and Chad, the shocks on TIAO, money supply and credit have no significant effect on output and prices. In other words, the transmission channels of monetary policy are totally ineffective in these countries.

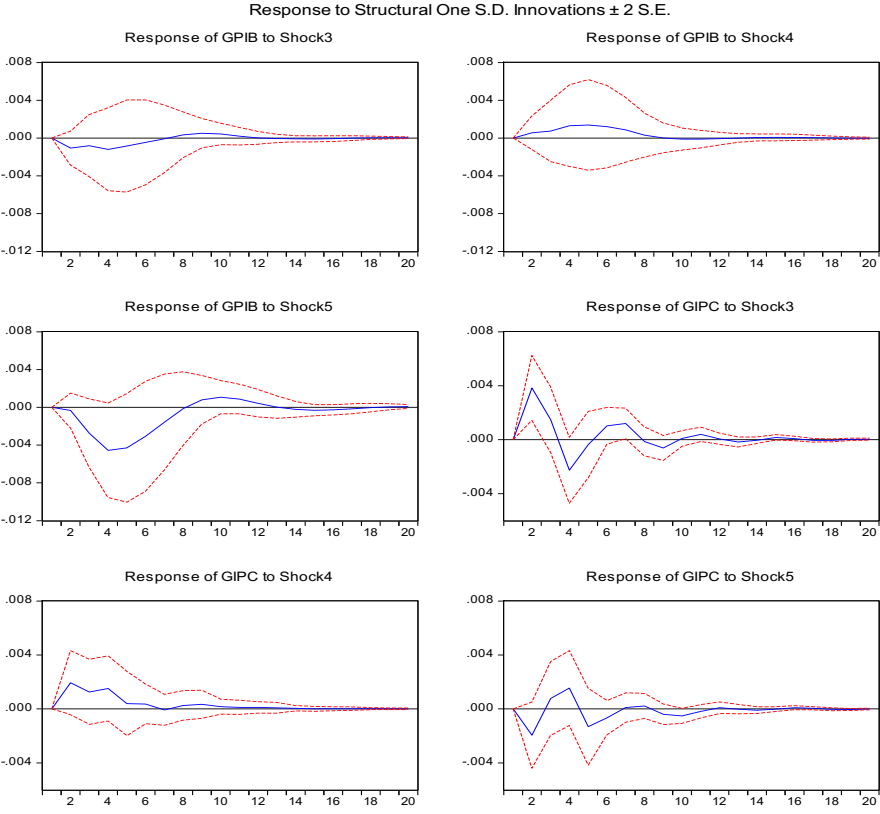
Indeed, asymmetric shocks observed in the sub-region, are consistent with results of Keynesian-inspired models (Clarida et al, 1999; Karras, 2007; Alfonso and Furceri, 2008) according to which the main disadvantage of monetary union between different countries is the importance of asymmetric shocks. Using a model SVAR, Fielding and Shields (2001) were also interested in the case of countries of the CFA franc zone and showed that only the price shocks are converging in these countries because of the use of a common monetary policy.

However, Tapsoba (2009) assessed the size of asymmetries shock of output in different unions and it shows that the proportion of asymmetric shocks in GDP growth rate is for example 71% for CEMAC, 74% for COMESA (Common Market for Eastern and Southern Africa), 87% for ECOWAS (Economic Community of West African States), 81% for the UEMOA (Economic and Monetary Union of West Africa), and 71% for AMU (Arab Maghreb Union). These asymmetries are due to the heterogeneity observed in these areas.

### **Panel data analysis**

The results of the panel VAR model allow to conclude with certainty to the weakness of transmission channels in the CEMAC. Indeed, as can be seen in the impulse response functions below, the shocks on the TIAO and money supply do not have a significant effect on output and prices. However, a positive impact on credit to the economy has weak inflationary effects during approximately three quarters in the CEMAC, what could partially validate the credit channel despite the weakness of its magnitude. This can be justified by the nature of credits granted by banks of the sub-region which are generally of short term. In other words, a rapid increase in short-term loans can only finance consumption, not investment, and consequently, increase demand and ultimately prices.

Figure 3 – impulse response functions of the response of GDP (GPIB) and Price (GIPC) to the positive shocks on credits (Shock 3), on money supply (Shock 4), and on the interest rate (Shock 5).



## 4.2 Monetary policy recommendations

As a recommendation, it should be emphasized that the inoperability of the interest rate channel reveals dysfunctions in the financial market (still embryonic in the CEMAC) and the money market, particularly in the area of BEAC interventions primarily due to the excess liquidity of banks. Certainly, the credit channel seems to be operating, but its effectiveness is reduced by the credit crunch and the nature of credits that are mostly of short term.

Measures consisting of developing the financial market in the CEMAC, to reabsorb the liquidity of banks and to encourage the granting of medium- and long-term credit should be taken, in particular by promoting the issuance of securities by the states and by companies<sup>21</sup>. These securities that banks and other market participants can acquire on their behalf and on behalf of economic agents will use the existing liquidity, but also explore the benefits of market finance.

It is also necessary to remove the remuneration of required reserves as in many Central Banks and possibly raise the reserve requirement ratio which should also be harmonized within the CEMAC to encourage competition between banks.

BEAC is also expected to provide financial institutions with reliable information, which may boost the credit. These include the central payment incidents, the central balance sheets, and credit reporting agencies.

However, stimulation of medium and long-term credit requires a business environment that is conducive to private investment. Other measures can be taken, but that does not necessarily fall under the action of the Central Bank, these include improving the business

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<sup>21</sup>This can be made possible by accelerating the process of merging the two financial markets in the sub-region, and encouraging companies to use capital markets. Certainly BEAC already accept government securities to refinance, but it should push the envelope further by also accepting securities issued by companies with a good rating on markets. It therefore requires the rapid establishment of Negotiable Debt Securities (TCN) representing collateral likely to restore confidence between banks.

climate, structural reforms in the labor market, the development of infrastructure, improving intra-regional trade, the strengthening of institutions and particularly the judiciary, the establishment of countercyclical fiscal policies, consistent with monetary policy. These measures are the responsibility of States, but limit the transmission channels of monetary policy while conditioning the effectiveness of the latter.

## Conclusion

This study aimed to identify the most operating channel in the CEMAC, and to derive the effects of monetary policy on the output of the economies of the region through a SVAR model by country incorporating nominal rigidities inspired by the work of Christiano, Eichenbaum and Evans (2005), then a SPVAR covering the six CEMAC countries and inspired by the work of Goodhart and Hofmann (2008).

It is clear from our analysis that the credit channel seems to be the more effective<sup>22</sup> but its effectiveness is still impaired by the credit rationing operated by banks in a paradoxical context of excess liquidity, and the nature of the loans which are generally of short term. On the other hand, countries in the region, react asymmetrically to common shocks of monetary policy, this situation highlights the heterogeneity of the economies in the sub-region.

Overall, monetary policy has asymmetric and disproportionate impact from one state to another in the area and the transmission channels of monetary policy are almost ineffective. It should therefore be advisable to put in place more structural measures that would help make more symmetric effects of monetary policy on each country, while absorbing the high liquidity in the CEMAC and pushing to the granting of loans. These measures not only fall under the responsibility of monetary authorities, but also of governments.

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<sup>22</sup>The credit channel positively impacts output in some countries (Congo, CAR, Chad) and on prices for other countries (Cameroon, Gabon, Equatorial Guinea)



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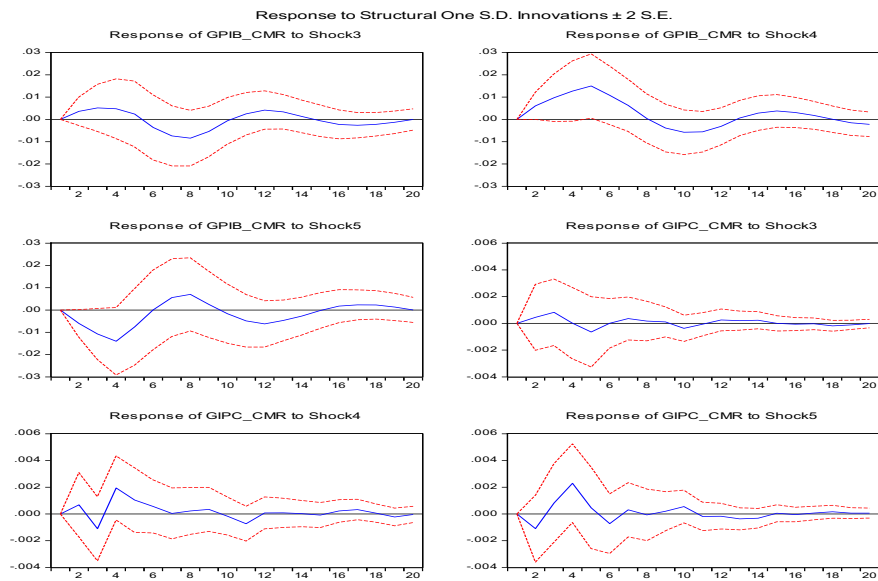
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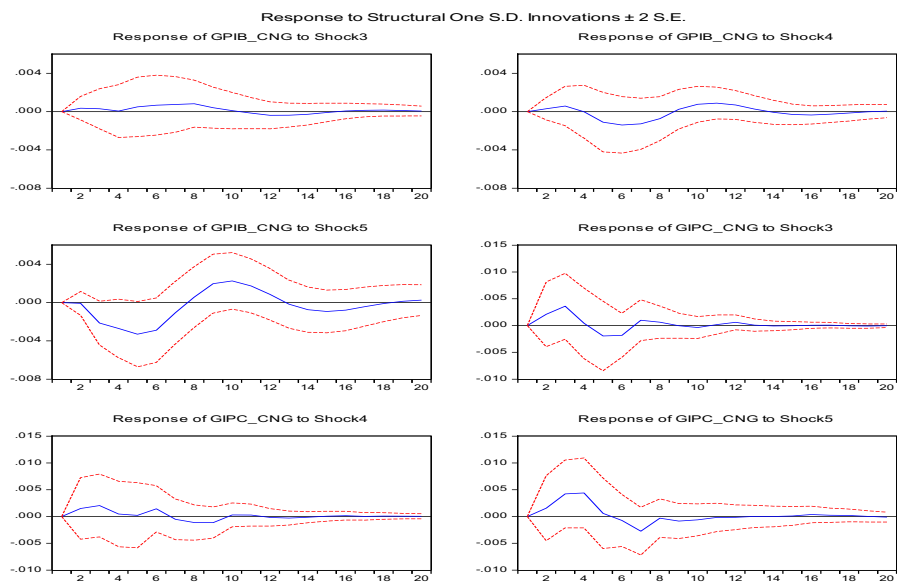
## Appendix

**Figure 4 :** Impulse response functions of Cameroon to credit shocks, broad money and interest rates (Shock 3= positive shock on credit; Shock 4=positive shock on the Money Supply; Shock 5=positive shock on TIAO).



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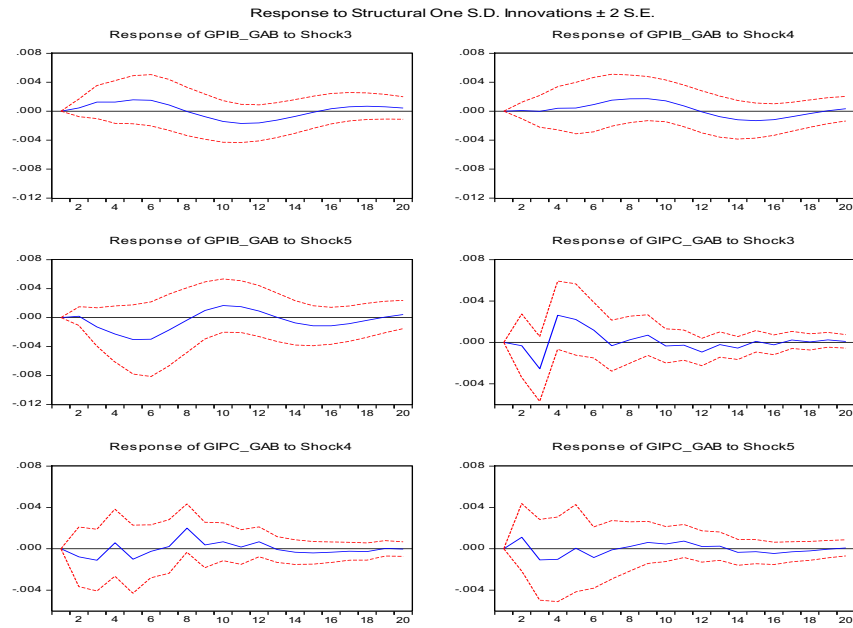
**Figure 5 :** Impulse response functions of Congo to credit shocks, broad money and interest rates (Shock 3= positive shock on credit; Shock 4=positive shock on the Money Supply; Shock 5=positive shock on TIAO).



39  
Source : Authors based on Eviews

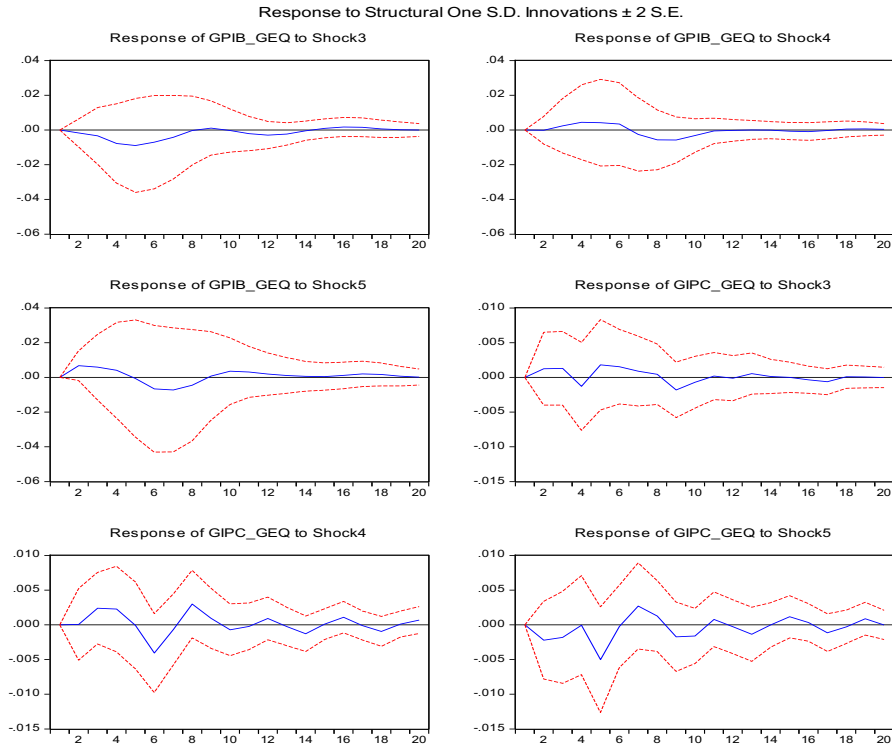


Figure 6 : Impulse response functions of Gabon to credit shocks, broad money and interest rates (Shock 3= positive shock on credit; Shock 4=positive shock on the Money Supply; Shock 5=positive shock on TIAO).



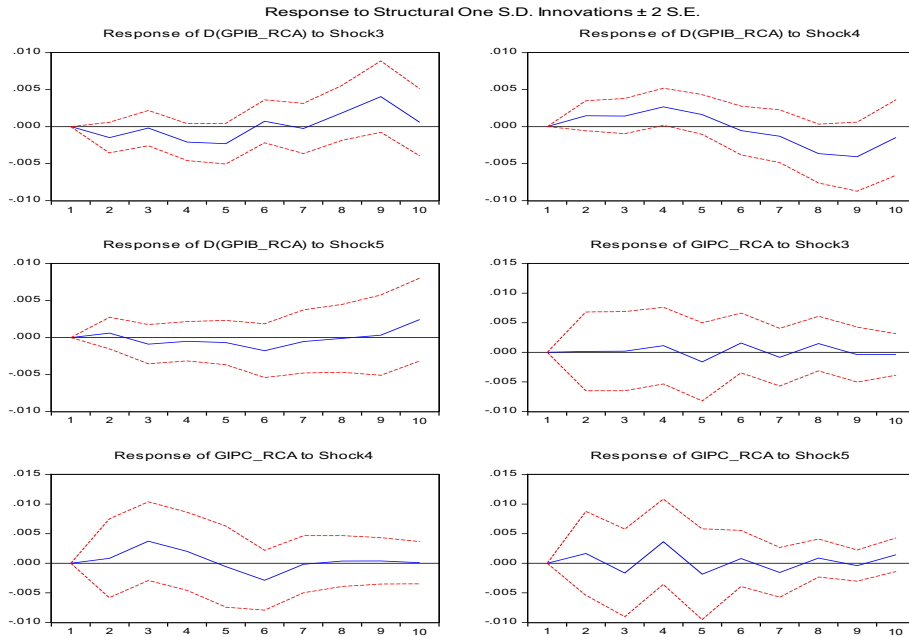
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Figure 7 : Impulse response functions of Equatorial Guinea to credit shocks, broad money and interest rates (Shock 3= Positive shock on credit ; 4=Shock positive shock on the broad money; Shock 5=Positive shock on TIAO).



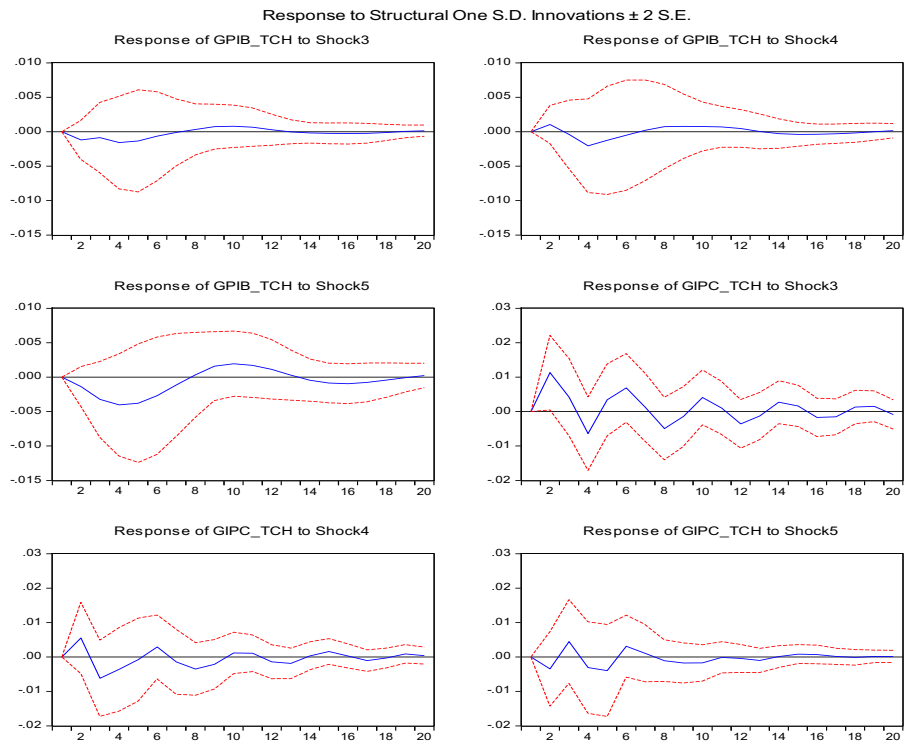
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Figure 8 : Impulse response functions of RCA to credit shocks, broad money and interest rates (Shock 3= Positive shock on credit ; 4=Shock positive shock on the broad money; Shock 5=Positive shock on TIAO).



Source : Authors based on Eviews

**Figure 9** : Impulse response functions of Chad to credit shocks, broad money and interest rates (Shock 3= Positive shock on credit ; 4=Shock positive shock on the broad money; Shock 5=Positive shock on TIAO).



Source : Authors based on Eviews