

Empirical Performances of Divisia versus Traditional Monetary Aggregates in BEAC and BCEAO

Mondjeli Mwa Ndjokou

Research Paper 412

AFRICAN ECONOMIC RESEARCH CONSORTIUM
CONSORTIUM POUR LA RECHERCHE ÉCONOMIQUE EN AFRIQUE

Empirical Performances of Divisia versus Traditional Monetary Aggregates in BEAC and BCEAO

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AERC Research Paper 412
African Economic Research Consortium, Nairobi
January 2021

THIS RESEARCH STUDY was supported by a grant from the African Economic Research Consortium. The findings, opinions and recommendations are, however, those of the author and do not necessarily reflect the views of the Consortium, its individual members or the AERC Secretariat.

Published by: The African Economic Research Consortium
P.O. Box 62882 - City Square
Nairobi 00200, Kenya

ISBN 978-9966-61-107-9

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Abstract

The purpose of the paper is to evaluate empirical performances of Divisia relative to traditional monetary aggregates in terms of growth and inflation within the period 1992.1- 2009.4 in BEAC² and BCEAO³. The methodology of the paper is focused on variance decomposition analysis derived from VAR/VECM specification to evaluate the contribution to price level and real GDP's fluctuations of each type of monetary aggregate. The following conclusions are derived from the empirical analysis. Traditional monetary aggregates have better empirical performances. In BEAC, traditional M2 perform better in explaining price and real GDP fluctuations. The variations of price level are mostly due to traditional monetary aggregate M1 while simple sum monetary aggregate M2 is the best indicator of real GDP in BCEAO.

JEL Classification: B22 C32 C43 E52

Keywords: Divisia Monetary Aggregates; Simple Sum Monetary Aggregates; VAR/VECM Specification: Variance Decomposition Analysis.

1. Introduction

During the 1970s, monetary aggregates were assigned an important role in implementation of monetary policy. Monetary aggregates M1 and M2 were considered as good guides for monetary policy. Since the 1980s, the traditional relationship between money and policy target variables has deteriorated in many countries. In fact, Porter et al (1980) demonstrate that M1 and M2 have lost their properties as indicators of monetary policy. For instance, M1 growth rate in the United States decreased by 4.3% while GDP in nominal terms increased by 15.6% in the fourth quarter of 1978. Moreover, the contribution of M1 in price's fluctuations increased rapidly in 1974; after 1981, this contribution decreased and since then has become negligible (Friedman, 1997). Consequently, money growth targets have begun to lose their importance in the conduct of monetary policy. Therefore, there is no consensus in the literature concerning the role of monetary aggregates in implementation of monetary policy. Three ideas can be drawn from the existing literature. Firstly, monetary aggregates are no longer useful in the conduct of monetary policy. Friedman (1997) confirms the downgrading of monetary aggregates due to financial innovations. According to Kim et al (2012), monetary aggregates ought to be given a central role not with respect to their traditional role as a mirror of real activity and inflation, but instead as a part of the financial stability mandate of the Central Bank. The second idea brings together advocates of monetary targeting policy, among them Adam and Hendry (2000). They demonstrate that money conserves its role in implementation of monetary policy.

The third idea focuses on studies that compare the empirical performances of Divisia and simple sum monetary aggregates. A review of the literature shows that there is no convergence in the findings. In fact, some studies confirm the empirical superiority of Divisia monetary aggregates on the traditional ones in implementation of monetary policy (Schunk, 2001; Dahalan et al, 2005; Darrat et al, 2005). For Drake and Mills (2005), the superiority of Divisia monetary aggregates on empirical ground is not always established. However, these studies are limited to developed countries, although Dahalan et al (2005) created Divisia monetary aggregates in some Asian countries. In African countries, papers on Divisia monetary aggregates have been somewhat more limited, although exceptions include a study on Kenya by Adams (1992), which is mainly focused on the estimation of money demand function.

In this paper, two African Central Banks are taken as case studies, namely BEAC and BCEAO. Like most Central Banks, official monetary aggregates of BEAC and BCEAO

are computed by simple addition of monetary assets. Despite their widespread use, economists have long recognized that the simple summation approach to monetary aggregation is less than optimal. The main justification is that monetary assets enter in the simple sum aggregate with a weight equal to unity. This implies that there is a perfect substitution between all component assets. According to microeconomic demand theory, if indeed these assets were perfect substitutes, rational economic agents would choose to hold only one asset class unless all assets have the same user cost. However, there is sufficient evidence on differences in user costs and on imperfect substitution between components of monetary aggregates. Divisia monetary aggregates were introduced by the seminal work of Barnett (1980) to overcome the theoretical deficiencies of traditional monetary aggregates. Barnett (1980) constructs monetary aggregates that consider the degree of monetarity of different monetary assets with a rigorous application of theories of aggregation and index numbers. Therefore, Divisia index is theoretically the most relevant in the sense that it is constructed with solid theoretical foundations.

The purpose of this study is to evaluate empirical performances of Divisia relative to traditional monetary aggregates in terms of growth and inflation. This study contributes to the debate in several respects. Firstly, apart from Adams (1992) who constructed Divisia monetary aggregates for Kenya, to the best of our knowledge, there is no study that compares Divisia monetary aggregates and traditional monetary aggregates in the African context. Secondly, this paper demonstrates whether monetary targeting is still useful for monetary policy. In this vein, the demonstration goes beyond the evaluation of traditional monetary aggregates by considering monetary aggregates that are rigorously computed. Thirdly, the paper tries to examine to what extent prices and growth fluctuations are linked to monetary aggregates, and what can enable policy makers to use monetary policy for stabilization purposes.

The main finding of the study is that traditional monetary aggregates have better empirical performances. For instance, traditional M2 perform better in explaining price and real GDP's fluctuations in BEAC. The variations of price level are mostly due to traditional monetary aggregate M1 while simple sum monetary aggregate M2 is the best indicator of real GDP in BCEAO.

The paper is organized as follows. Section 2 presents stylized facts. Section 3 provides a brief review of literature on the empirical performances of Divisia monetary aggregates versus simple sum monetary aggregates. Section 4 describes the construction of Divisia monetary aggregates and other data of study. Section 5 proposes the results and section 6 concludes the paper.

2. Stylized facts

As in most Central Banks around the world, the ultimate goal of BEAC and BCEAO is to ensure price stability. Stable and low inflation was presented as the primary, if not exclusive, mandate of Central Banks (Blanchard et al, 2010). However, monetary authorities can provide support to economic growth. In BEAC, the monetary policy strategy has adopted an approach based on the evolution of monetary aggregates. These monetary aggregates play the role of intermediate targets in implementation of monetary policy. Also, BEAC uses indirect instruments, including refinancing policy and reserves requirements. The same instruments are used in BCEAO, although it is not explicitly stated that its monetary policy is focused on monetary aggregates. But, we can consider that BCEAO pursues monetary targeting since actions of monetary authorities influence bank liquidity by using indirect instruments to achieve price stability.

On the empirical ground, the following evidences can be drawn from monetary policy perspectives. Since the 1990s, BEAC and BCEAO were engaged in some important financial reforms. These reforms introduced the liberalization of interest rates and the removal of credit ceilings, which are ingredients for financial innovations. Generally, financial innovations lead to substantial changes in the behaviour of monetary aggregates in terms of their capacity to predict price level and GDP. For example, in BEAC, two lessons are drawn from stylized facts. The first lesson is that there is a gap between the announced and achieved objectives of money growth. Statistics show that money growth is 9% beyond a forecast of 5.4% in 1999. In 2001, the forecast was between 7.8% and 9.8% for a result of 7.1%. The second lesson is derived from the evolution of monetary aggregates, which contrast with changes in price level. M2 recorded a growth rate of 9% in 1999 and 22.4% in 2000 while inflation was 0.5% and 1.5% for the two years, respectively. It is assumed in theory that changes in money growth influence inflation with at least one-year lag. Therefore, an increase of 9% in money supply leads to an increase of 1.5% in inflation. Furthermore, a decrease of money growth does not lead to a fall in inflation rate. Between 2000 and 2001, the growth rate of M2 has declined from 22.4% to 7.1% while inflation rose from 1.5% in 2000 to 3% in 2002. Figures 1 and 2 describe the evolution of fiduciary money, demand deposits and quasi money in BEAC and BCEAO, respectively.

Figure 1: The evolution of fiduciary money (MFBEAC), demand deposits (DDBEAC) and quasi money (QMBEAC), BEAC

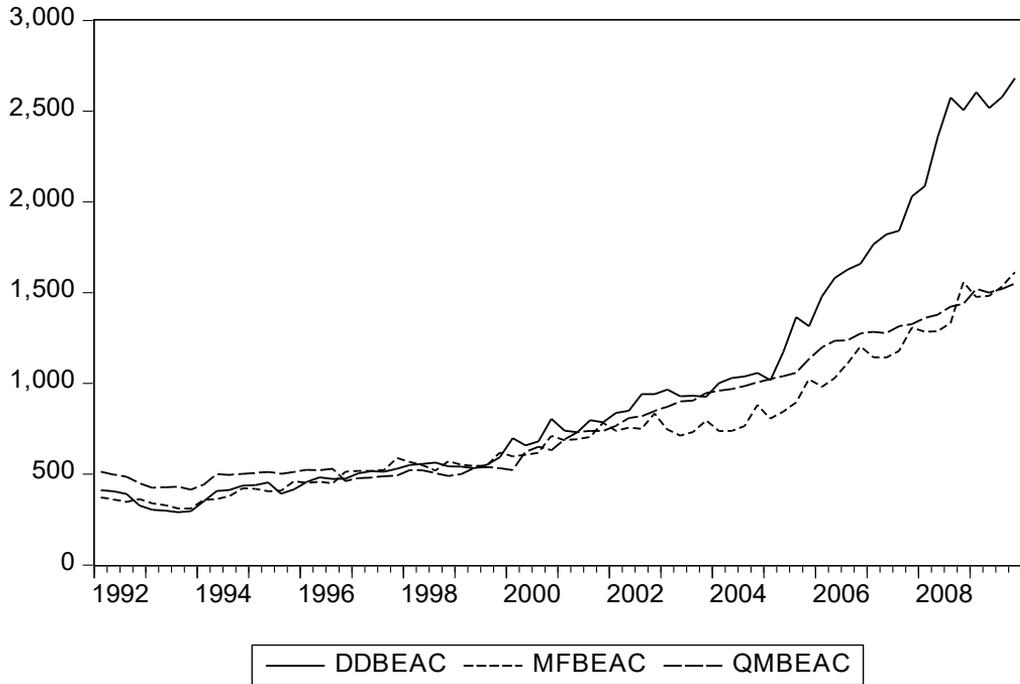


Figure 2: The evolution of fiduciary money (MFBCEAO), demand deposits (DDBCEAO) and quasi money (QMBCEAO), BCEAO

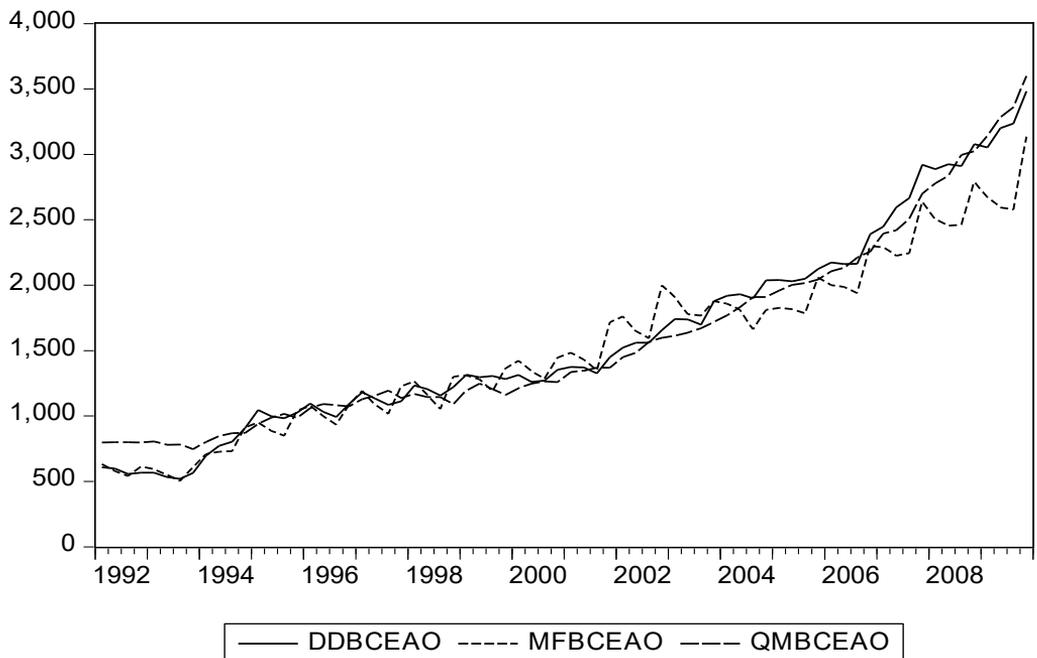


Figure 1 illustrates that the volume of demand deposits (DDBEAC) and quasi money (QMBEAC) increases more than the quantity of fiduciary money (MFBEAC) in BEAC. This evidence suggests an increasing proportion of monetary components, which have a positive implicit or explicit rate of return. In BCEAO, furthermore, there is no substantial change in the evolution of components of monetary aggregates over the period (Figure 2).

3. Divisia versus simple sum monetary aggregates: A Review of empirical literature

Following the seminal work of Barnett (1980), many studies have examined the usefulness of Divisia monetary aggregates in implementation of monetary policy. Most of the studies emphasize the superiority of Divisia monetary aggregates. However, some studies do not confirm or invalidate the usefulness of Divisia monetary aggregates in the conduct of monetary policy.

Better empirical performance of Divisia monetary aggregates

According to Barnett and Chauvet (2011) and Anderson and Jones (2011), the close connection in microeconomic theory between monetary index numbers, agents' anticipated income and expenditure suggests that Divisia monetary assets should be more closely related to economic activity than conventional simple-sum monetary aggregates. This superiority is confirmed in many studies irrespective of the criteria of comparison used. Schunk (2001) provided evidence on the forecasting performance of Divisia aggregates relative to the traditional simple sum monetary aggregates in USA. The author focused on VAR specification and uses visual inspection to compare the root mean square error (RMSE) and mean error (ME) of the forecasts. He found that the broad Divisia aggregates produced real GDP forecasts that are superior to those generated by their simple sum counterparts. In their paper, Darat et al (2005) revisited the relationship between different measures of money, real income and interest rates when the sample is expanded to include data from the post-1980 period. Using the Johansen–Juselius cointegration methodology and the Hansen–Johansen test of cointegration constancy, they suggested that, contrary to simple sum aggregates, Divisia monetary aggregates continue to share a robust and stable long-run relation with the macroeconomy. Dahalan et al (2005) compared the Divisia measures to simple sum M1 and M2 in a money demand function. Using error correction model, they concluded that the Divisia monetary aggregates, particularly DM2, are more stable compared to their simple sum analogs. Therefore, it can be useful in predicting inflation and real economic activity.

Empirical results are not conclusive

Fluri and Spoerndli (2000) found that Divisia M1 predicts short-run price movements better than simple sum M1 but does not predict long-run price movements more accurately. Lecarpentier and Renou (2000) studied the properties of Divisia monetary aggregate M3 compared to the simple-sum monetary aggregate M3 from 1982 to 1997. They concluded that the result of causality between money and income are very close for the two alternative monetary aggregates. But by looking at the information content, the superiority of Divisia monetary aggregate is confirmed. Along the same line, Elger et al (2006) demonstrated that the aggregation method has no significant impact on inflation and growth forecasting. To arrive at this conclusion, they use vector autoregressive (VAR) and regime-switching (RS) VAR models to investigate the out-of-sample forecasting performance of various monetary aggregates.

4. Divisia monetary aggregates and other data of the study

Data

The Divisia monetary aggregates are computed for each country. Regional Divisia monetary aggregates are the sum of national Divisia monetary aggregates. The following variables are used to construct Divisia monetary aggregates: M1, M2, savings and time savings deposit rates, statutory reserves requirements, the interbank money market, and total deposits for each Central Bank. The other data used in the study are real GDP, and inflation. Inflation is captured by the consumer price index (CPI). Although the CPI excludes expenditure on investment goods, it is a good approximation of prices. The reason is that most total expenditure especially in developing countries is on consumption. From the database, we have national CPI. To compute the regional CPI, we follow the methodology used by the different Central Banks. They compute CPI of the region as a GDP weighted average of national consumer price index. Economic growth is measured by Real GDP. Real GDP of each zone is the sum of real GDP across the member countries. The series of real GDP are reported only annually. An interpolation exercise is required to create suitable quarterly data. For this purpose, we follow the procedure of Goldstein and Khan (1976). The paper uses annual data from the World Bank (2013) World Development Indicators and World Bank (2012) International Financial Statistics (2012).

Construction of Divisia monetary aggregates

To construct Divisia monetary aggregates, the following steps are necessary: selection of monetary assets, computation of user cost money and the choice of the weighted and aggregation method.

Selection of monetary assets

The chosen monetary aggregates are M1 and M2 for BEAC and BCEAO. The reason for the choice is that M1 and M2 are the two monetary aggregates in the two Central Banks. Their composition is as follows:

- M1: currency in circulation (coins+ bank notes) + demand deposits
- M2: M1+ saving and time deposits

Computation of the user cost of money

Following Barnett (1980), the user cost of money is the price of transaction service of each monetary asset. The user cost of each component is proportional to the interest income forgone by holding it rather than a pure store of wealth asset, which is an asset that yields a high rate of return but provides no monetary services. It plays an essential role in monetary aggregation theory (Anderson and Jones, 2011). In nominal terms, the user cost is defined as:

$$\pi_{it}^* = \frac{P_t(R_t - r_{it})}{(1 + R_t)} \quad (1)$$

where π_{it}^* is the user cost of monetary asset i at time t , R_t is the benchmark rate at time t , r_{it} is asset i 's rate of return at time t and P_t is the consumer price index. Equation (1) is divided by P_t to obtain equation (2). Equation (2) describes the real user cost.

$$\pi_{it}^* = \frac{(R_t - r_{it})}{(1 + R_t)} \quad (2)$$

The user cost of a monetary asset depends on the return of that asset. Currency is seen as pure money and is given a zero rate of return. Demand deposits also bear no explicit interest rate. However, if explicit interest is not paid to depositors, a bank can make indirect payments to customers, such as granting loans to depositors at preferential interest rate, providing free consultations and offering gifts. Therefore, demand deposit can bear an implicit interest rate. Then, to set a rate of return of demand deposits, we follow Dahalan et al (2005). They use the implicit rate of return defined by Klein (1974), which claims that banks indirectly pay a competitive rate of return to their depositors. Klein's return on demand deposits is computed as:

$r_D = r_A \left(1 - \left[\frac{R}{D} \right] \right)$ where r_D is the implicit rate of return, $\left[\frac{R}{D} \right]$ is ratio of reserves to deposit, r_A is the bank's base lending rate.

The benchmark rate of return is defined as the maximum expected yield of a pure store-of-value asset. This benchmark asset is specifically assumed to provide no liquidity or any monetary service and is held solely to transfer wealth inter-temporally. As explained by Barnett et al. (1992), it is included to establish a non-monetary alternative. While the conceptual definition of the benchmark asset is straightforward,

measuring that concept is not at all so (Anderson and Jones, 2011). Empirically, the interest rate that has the higher return will be taken as the benchmark rate (Dahalan et al, 2005). This is justified by the fact that in theory, the benchmark rate offers the highest return (Serletis and Molik, 2000). Concerning the issue of the empirical choice of benchmark rate, we can draw two remarks. First, since the financial market is quasi-inexistent in the CFA Franc Zone, there is no substitution between money and other financial assets. To transfer their wealth inter-temporally, the only alternative is to hold either monetary assets or real assets. Secondly, savings and time deposits offer an expected positive return to the holders. From the database, however, interest rate on savings and time deposits are almost the same in countries of the CFA Franc Zone. Therefore, using them would give a zero to the user cost of money. To overcome this difficulty and give the opportunity to have a positive and variable user cost of money, we follow Binner et al (2009) by taking the inter-bank lending rate as benchmark rate in our study.

Aggregation and weighted method

Following Barnett (1980) and Barnett et al (1984), the Tornquist–Theil discrete time approximation to the Divisia quantity index is used to compute each Divisia monetary aggregate (DM):

$$DM_t = DM_{t-1} \prod_{i=1}^n \left(\frac{M_{it}}{M_{it-1}} \right)^{S_{it}^*} \quad (3)$$

where S_{it} is the average of s_{it} and s_{it-1} with s_{it} defined as the expenditure share of monetary asset i at time t and M_{it} represents the balance of asset i at time t .

The expenditure share is:

$$s_{it} = \frac{\pi_{it} M_{it}}{\sum_{j=1}^n \pi_{jt} M_{jt}} \quad (4)$$

Figures 3 and 4 give the evolution of expenditure shares in BEAC and BCEAO.

Figure 3: The evolution of expenditure shares in BEAC

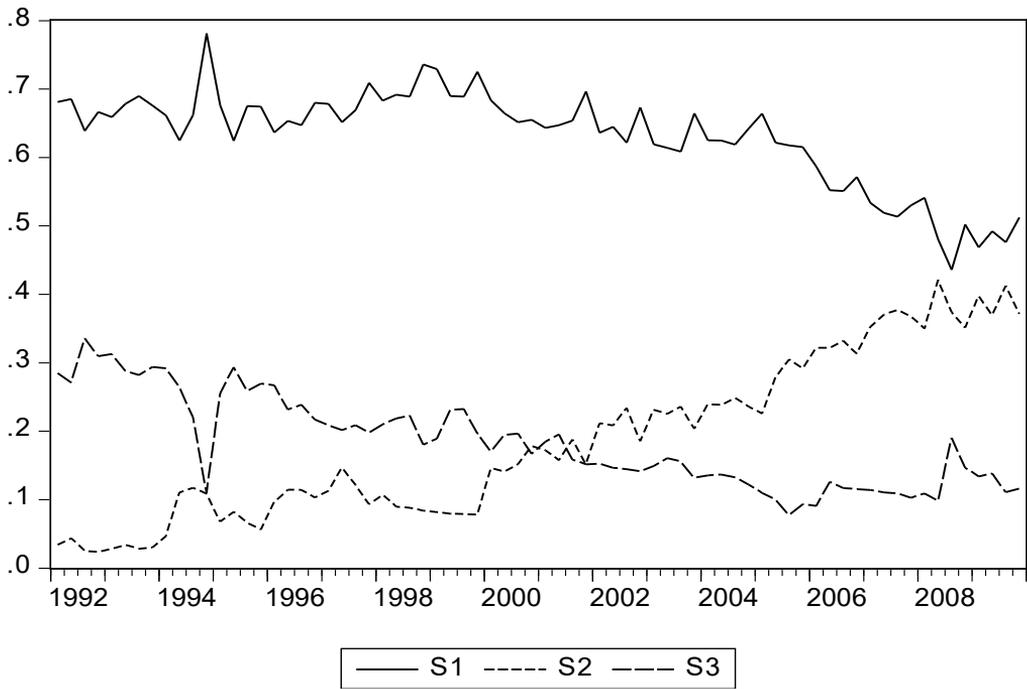
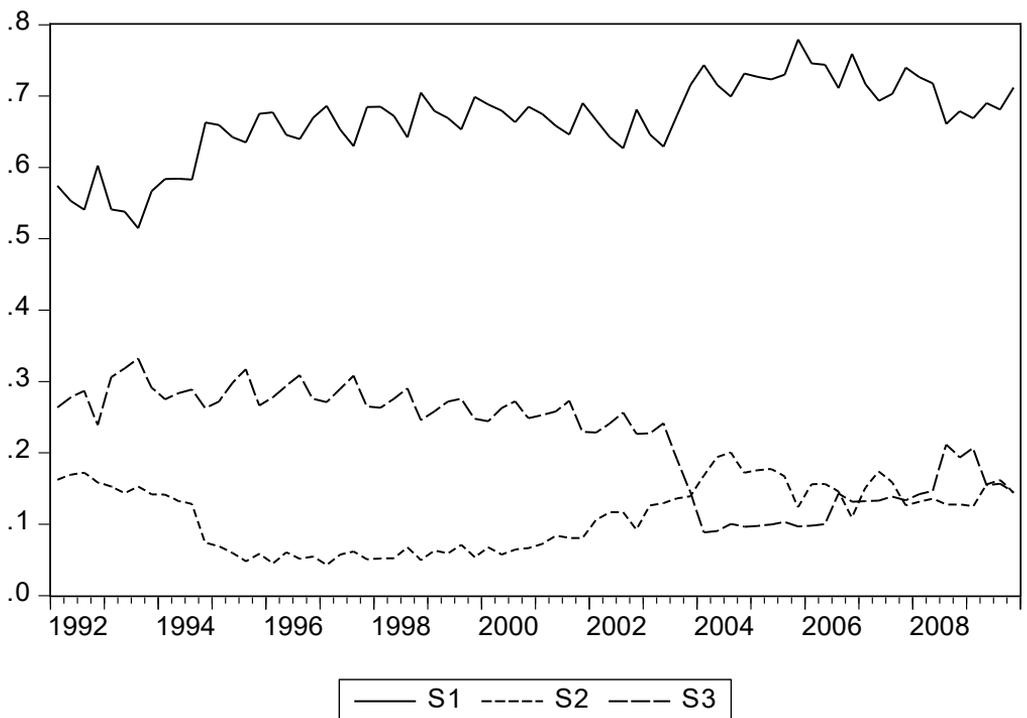


Figure 4: The evolution of expenditure shares in BCEAO



S1, S2 and S3 are the weighted coefficient on currency, demand deposits and quasi money respectively. The expenditure shares lie between 0 and 1, meaning that they have coherent economic values. However, the weighted coefficient on currency is the highest one. This confirms the fact that as an asset is closer to pure money, the expenditure share is close to one. The evolution of S3 confirms equally the theoretical predictions. In fact, the expenditure share is close to zero as we drive away from pure money. Figures 3 and 4 show that the weighted coefficient varies over time. In BEAC, we observe that after 2001Q1, the expenditure share on demand deposits becomes greater than the expenditure share on quasi money. The explanation behind this feature can be the increasing proportion of demand deposits in the total assets relative to quasi money.

Divisia versus simple sum monetary aggregates

Table 1 summarizes the descriptive statistics of simple sum monetary aggregates (M1 and M2) and Divisia monetary aggregates (M1D and M2D).

Table 1: Summary statistic of monetary aggregates

Central Bank	Variables	Mean	Standard deviation
BEAC	M1	7.167	0.455
	M1D	6.237	0.511
	M2	7.588	0.421
	M2D	6.471	0.410
BCEAO	M1	7.845	0.434
	M1D	6.984	0.459
	M2	8.261	0.401
	M2D	7.158	0.413

Table 1 shows that the values of the mean and standard deviation are closed. This highlights the fact that there can be a little difference between the two types of monetary aggregates. The graphical evolution of the monetary aggregates confirms this point (see figures 5, 6, 7 and 8).

Figure 5: Simple sum M1 (M1) and Divisia M1 (M1D), BEAC

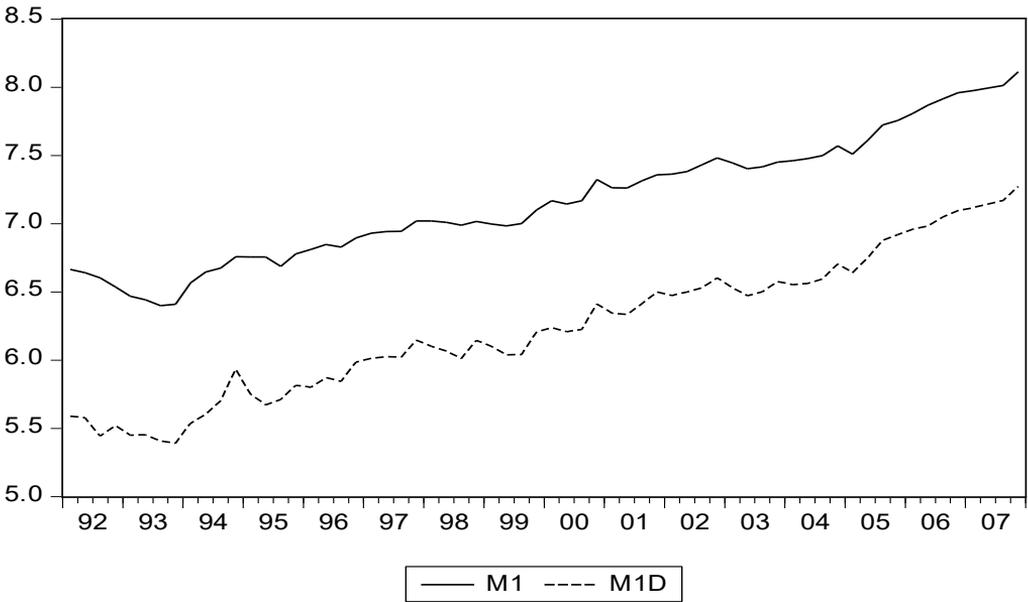


Figure 6: Simple sum M2 (M2) and Divisia M2 (M2D), BEAC

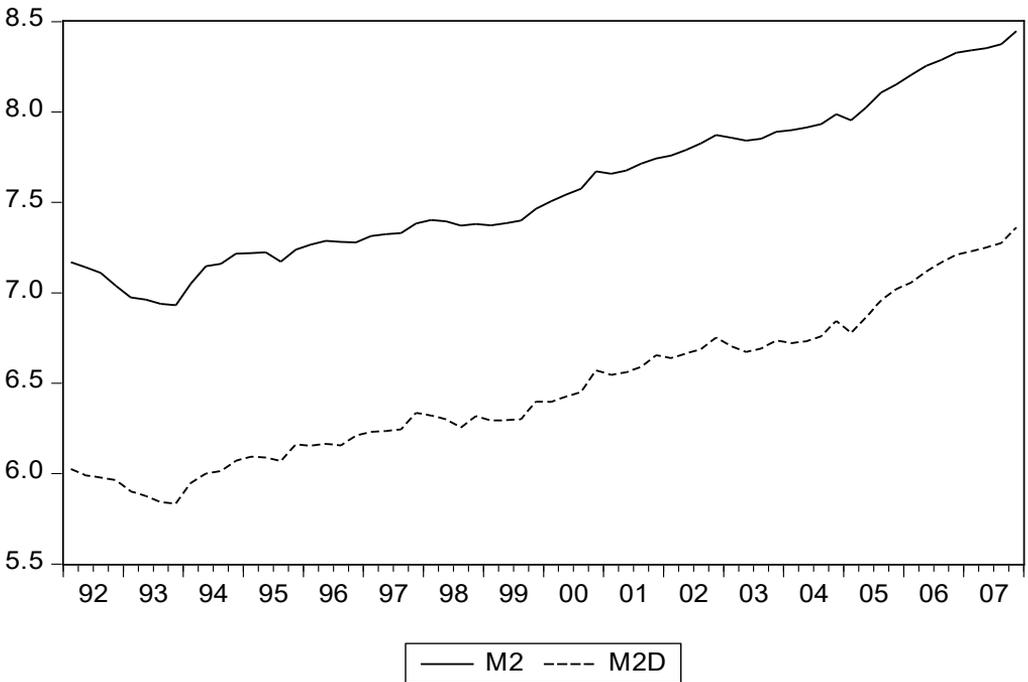


Figure 7: Simple sum M1 (M1) and Divisia M1 (M1D), BCEAO

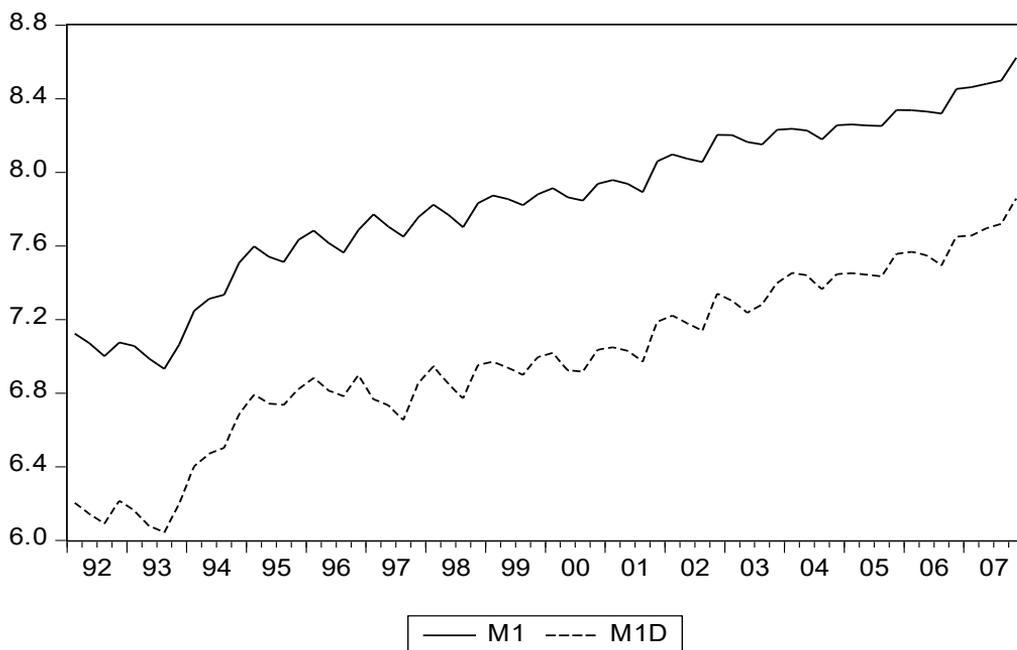
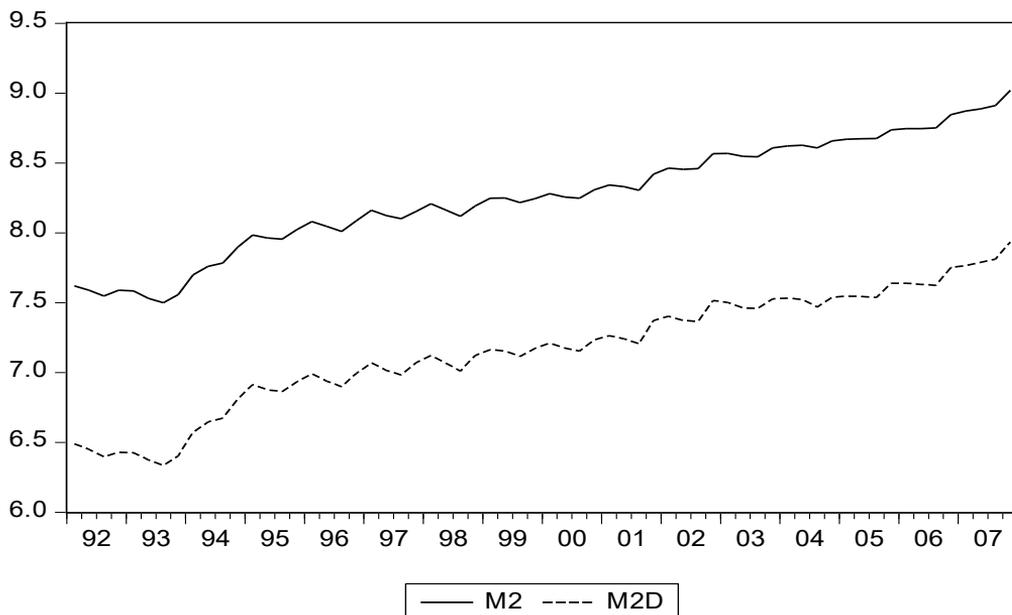


Figure 8: Simple Sum M2 (M2) and Divisia M2 (M2D), BCEAO



Growth differences between the two types of monetary aggregates are plotted in figures 9, 10, 11 and 12.

Figure 9: Growth rate of simple sum (tm1) and Divisia (tm1d), BEAC

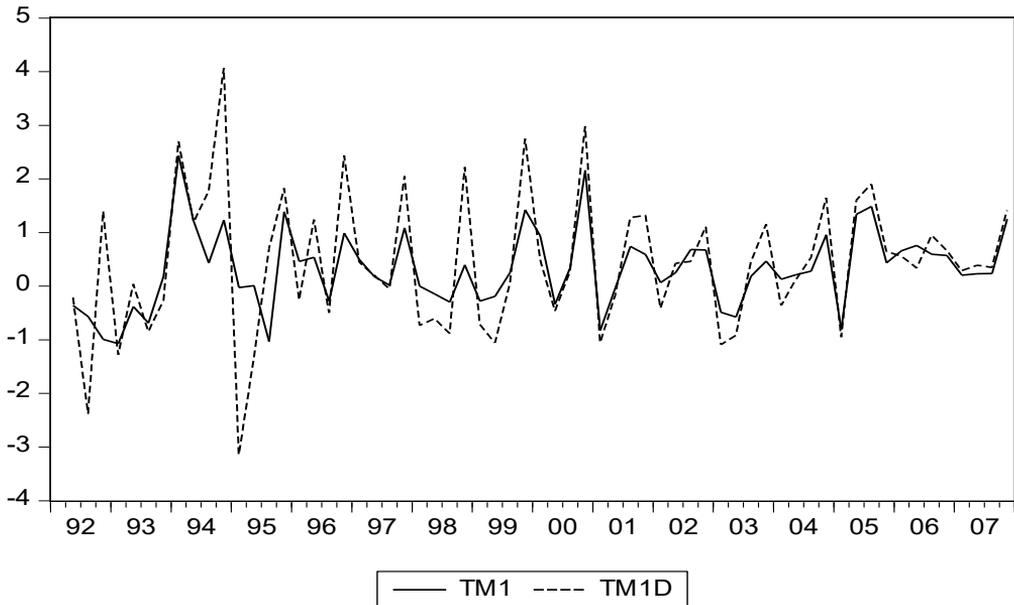


Figure 10: Growth rate of simple sum (tm2) and Divisia (tm2d), BEAC

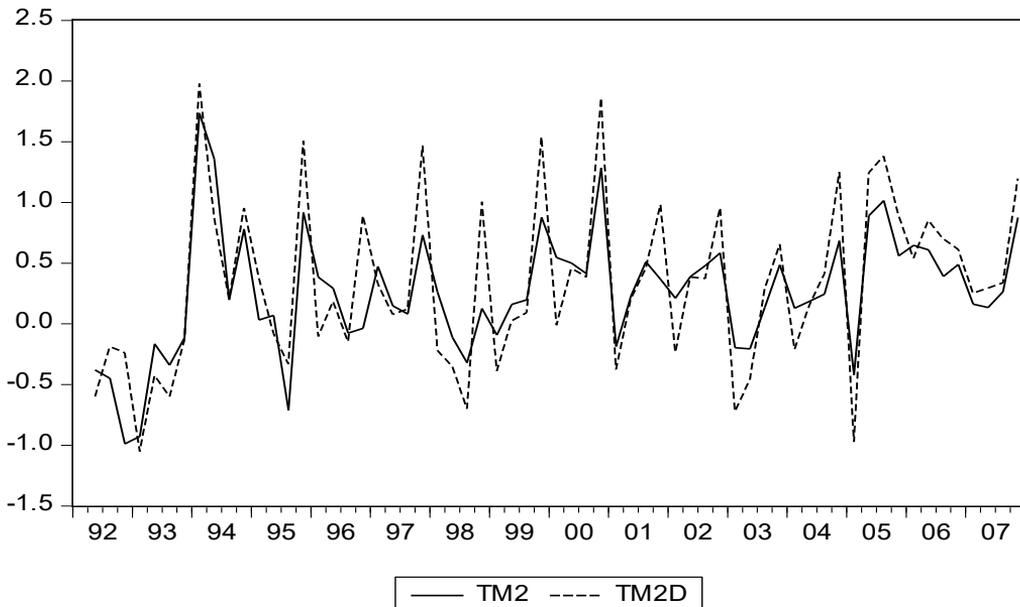


Figure 11: Growth rate of simple sum (m1) and Divisia (m1d), BCEAO

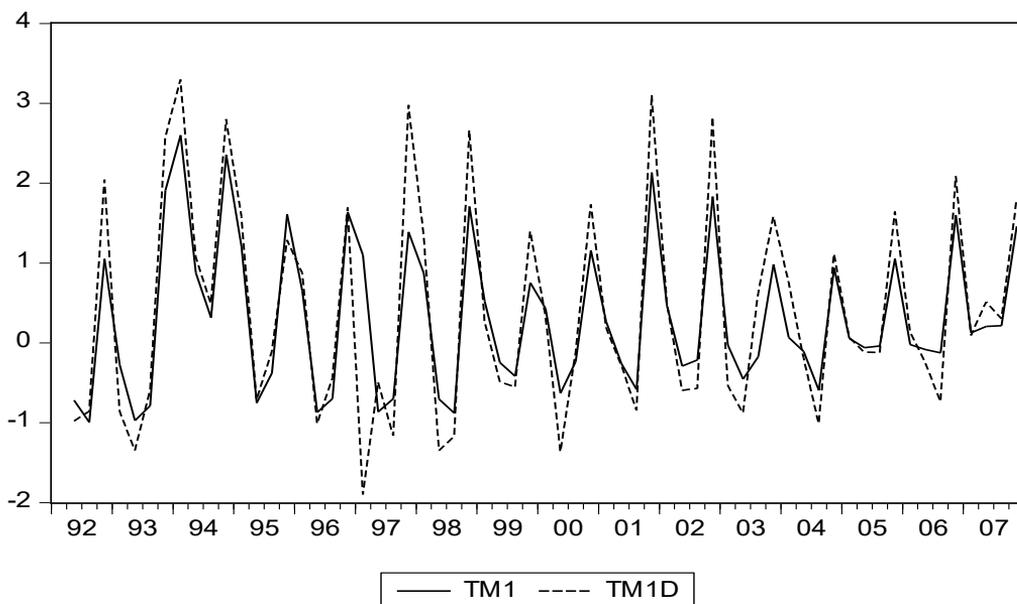
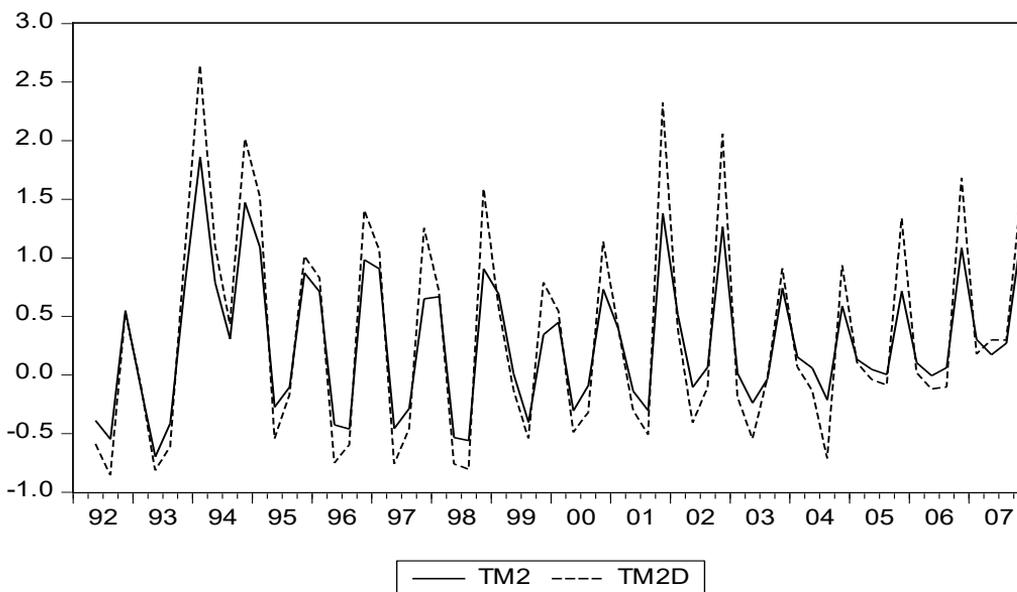


Figure 12: Growth rate of simple sum (m2) and Divisia (m2d), BCEAO



Divisia monetary aggregates are more volatile than their simple-sum counterparts in BEAC. The same remark can be made for BCEAO. The computation of standard deviation of the growth rate of each monetary aggregate gives some insight to this observation. For instance, standard deviations for growth rate in BEAC are 5.28 for tm1, 8.05 for tm1d, 3.82 for tm2 and 4.54 for tm2d. Overall, the evolution of the growth rates of monetary aggregates in BEAC show some differences. In this light, the correlation between growth rates tm1 and tm1d is 0.7749 and between tm2 and tm2d is 0.8618. Ishida and Nakamura (2000) reported a diverse result. The reason is that despite financial liberalization, the financial assets in m2 are still less. In BCEAO, the correlations are 0.9054 and 0.9820 between tm1 and tm1d, and tm2 and tm2d, respectively, meaning there is no difference in the evolution of the growth rates. This is justified by the fact that within the period, the evolution of different monetary assets shows the same path.

5. Results

Time series analysis of the data

In this sub-section, we investigate the time series characteristics of the data to assess the possibility of co-integration in the data. The co-integration results will help choose between a VAR and VECM for variance decomposition analysis. We use Augmented Dicker-Fuller (ADF) test and Phillips and Perron (PP) test to determine the stationarity of the times series tests. In the case of a conflict between the two tests, we consider the PP results as indicated in the literature. To save space and in the case when the series are not stationary in level, only the test statistics for the first difference are reported in Table 2.

Table 2: Units root tests

Variables	ADF Test	PP Test	Critical values			Order of integration
			1%	5%	10%	
BEAC			1%	5%	10%	
M1	-6.95***	-7.00***	-4.11	-3.48	-2.60	I (1)
M2	-5.64***	-5.64***	-4.11	-3.48	-2.60	I (1)
M1D	-8.57***	-8.61***	-4.11	-3.48	-2.60	I (1)
M2D	-6.62***	-6.78***	-4.11	-3.48	-2.60	I (1)
CPI	-5.11***	-6.59***	-4.11	-3.48	-2.60	I (1)
GDP	-12.44***	-26.67***	-4.11	-3.48	-2.60	I (1)
TD	-5.36***	-10.91***	-4.11	-3.48	-2.60	I (1)
BCEAO						
M1	-0.73	-6.20***	-4.11	-3.48	-2.60	I (1)
M2	-1.01	-5.11***	-4.11	-3.48	-2.60	I (1)
M1D	-8.45***	-8.44***	-4.11	-3.48	-2.60	I (1)
M2D	-8.28***	-8.27***	-4.11	-3.48	-2.60	I (1)
CPI	-3.32*	-5.63***	-4.11	-3.48	-2.60	I (1)
GDP	-2.29	-5.77***	-4.11	-3.48	-2.60	I (0)
TD	-4.40***	-3.12*	-4.11	-3.48	-2.60	I (0)

Note: Significance level: (***) 1%; (*) 10%.

Test statistics show that except for the GDP and the interbank money market in BCEAO, all the variables are not stationary at the conventional level of significance. These variables become stationary after first differencing. However, the values of the test statistics obtained from each series indicate that the null hypothesis or the alternative hypothesis (in the two cases mentioned previously) of a unit root is rejected unambiguously by both tests except for M1 and M2 in BCEAO. This suggests that all variables are best modelled as $I(0)$ or $I(1)$.

Cointegration analysis

Since all the variables are $I(1)$ in BEAC, we test for the existence of a co-integrating relation between the variables with the purpose to estimate a VECM. To determine the number of co-integrating vectors, we use the λ -max and λ -trace test proposed by Johansen (1988) and Johansen and Juselius (1990) at 5% level. The λ -trace tests whether the number of distinct co-integrating vectors is less than or equal to r . The λ -max tests the null hypothesis that the number of co-integrating vectors is r against an $r+1$. Johansen and Juselius (1990) propose the critical values of these statistics. We test for the co-integrating relation between each monetary aggregate, interbank money market and either CPI or real GDP giving eight relations to be tested. To obtain the number of lags to include in the VECM, we use the Akaike's information criteria (AIC). According to the Akaike's information criteria, we have one lag for each specification. Table 3 presents the result of λ -max and λ -trace test for the relation between each monetary aggregate, interbank money market and CPI while Table 4 gives the result for the relation between each monetary aggregate, interbank money market and real GDP. From Table 3, we conclude that there are at least two co-integrating relations for each monetary aggregate. For each test, the null hypothesis is rejected since the critical value is superior to the tabulated value at 5%. Table 4 reveals that we have at least one co-integrating between each monetary aggregate, interbank money market and real GDP. The variables in BCEAO do not have the same order of integration and there is no doubt that we have no co-integrating relation between the variables. Therefore, we will run a VAR estimation for variance decomposition analysis.

Table 3: Johansen trace and λ -max test statistics for the number of co-integrating vectors

	Trace Statistic Test					λ -max Test				
	M1	M2	M1D	M2D	C.V. at 5%	M1	M2	M1D	M2D	C.V. at 5%
N° of CE										
None	62.12132	62.80220	59.51435	63.98190	29.79707	41.87258	42.13626	41.50736	42.79548	29.79707
At least one	20.24874	20.66593	18.00699	21.18642	15.49471	17.80249	18.26350	15.19323	18.57142	15.49471
At least two	2.446247	2.402432	2.813765	2.615003	3.841466	2.446247	2.402432	2.813765	2.615003	3.841466

Table 4: Johansen trace and λ -max test statistics for the number of co-integrating vectors

	Trace Statistic Test					λ -max Test				
	M1	M2	M1D	M2D	C.V. at 5%	M1	M2	M1D	M2D	C.V. at 5%
N° of CE										
None	35.80348	40.93835	36.41168	42.98563	29.79707	26.19613	29.63792	27.91360	33.90307	29.79707
At least one	9.607357	11.30043	8.498085	9.082555	15.49471	7.701031	8.719392	7.501172	7.882580	15.49471
At least two	1.906326	2.581040	0.996914	1.199975	3.841466	1.906326	2.581040	0.996914	1.199975	3.841466

Evolution of inflation and GDP in FZC countries: A weak contribution of monetary aggregates

The evaluation of the contribution of monetary aggregates in terms of inflation and GDP is made by means of variance decomposition analysis. In our specification, we do not consider Sims's classic variables consisting in the interest rate, the logged money supply, the logged price level and logged real GDP, in that order. Inflation and real GDP are put in different specifications with each monetary aggregate and interbank money market. Two justifications can be made. Firstly, there is no theoretical background underlying the choice of the order and the variance decomposition analysis is sensitive to that order. Secondly, we need to have the maximum contribution of each monetary aggregate in explaining the evolution of inflation and real GDP since the inclusion of the two variables in the same equation can reduce its contribution.

In BEAC, since the variables are integrated and co-integrated, the variance decomposition analysis is derived from a VECM. A VECM is used to investigate causal relationships among variables that provide the short-run dynamics towards a long-run equilibrium. On the contrary, for BCEAO, the variance decomposition analysis is drawn from a VAR. According to the purpose of the paper and to save space, we report only the results of the variance decomposition analysis. Tables 5 and 6 report these results, respectively, in BEAC and BCEAO.

Table 5: Variance decomposition results, BEAC

Horizon	Price Level				Real GDP			
	M1	M1D	M2	M2D	M1	M1D	M2	M2D
4	12.553	7.899	20.298	19.707	33.117	31.167	43.566	39.106
6	12.729	7.733	21.642	21.301	35.586	33.347	47.549	41.992
8	12.456	7.369	21.946	21.750	37.303	34.936	50.088	43.817
10	12.021	6.943	21.870	21.433	38.590	36.136	51.906	45.089

Table 5 gives the results of variance decomposition analysis in BEAC. First, the contribution of monetary aggregate to price fluctuations is weak, at less than 25% and far from the one-to-one variation postulated by the quantitative theory of money. The intuition behind this result is that other variables explain price-level fluctuations in short term (Roffia and Zaghini, 2007). This result is also confirmed by the empirical literature (Assenmacher-Wesche and Gerlach, 2006), which demonstrates that in an environment of price stability, the ability of monetary aggregate in explaining price fluctuations is weak. Secondly, traditional monetary aggregates give better outcomes. After the eighth quarter, the contribution of M1 to price level is about 12.45% while it is 7.36% for Divisia M1. This result confirms that at the narrowest level, traditional monetary aggregate have better empirical performances. At the higher level, the contribution of the two types of monetary aggregate is quite similar. The percentage of inflation fluctuations due to traditional and Divisia M2 is 21.94% and 21.75%,

respectively. Thirdly, variance decomposition analysis also reveals that innovations in money explain more than 30% of real GDP fluctuations. In this case, the difference between the two types of monetary aggregate is more pronounced at the higher level of aggregation. In terms of comparison, traditional monetary aggregates explain more real GDP. Therefore, we can conclude that in a monetary policy perspective, traditional monetary aggregates are more useful than Divisia monetary aggregate, and traditional M2 is the best monetary aggregate.

Table 6 contains the results of variance decomposition for BCEAO.

Table 6: Variance decomposition results, BCEAO

Horizon	Price Level				Real GDP			
	M1	M1D	M2	M2D	M1	M1D	M2	M2D
4	6.877	2.219	3.804	2.520	9.604	0.063	9.947	0.040
6	6.872	2.218	3.801	2.518	7.799	0.078	8.453	0.079
8	6.869	2.217	3.800	2.517	10.745	0.094	12.676	0.109
10	6.868	2.217	3.800	2.517	9.613	0.106	11.787	0.129

From the table, we observe that traditional monetary aggregate is the best indicator of monetary policy in BCEAO. Regarding real GDP, traditional M2 leads to the highest contribution and, contrary to BEAC, price level is better explained by traditional M1. However, the contribution of monetary aggregate to price level and output variability is at the very worst. In fact, each monetary aggregate explains less than 10% of price level and not more than 13% of real GDP. We can also mention that the contribution of Divisia monetary aggregate to real GDP fluctuations is less than 1%. The difference in the two Central Banks can be explained by the fact that in BEAC, the use of monetary aggregate as guideline of monetary policy is explicitly stated while it is not the case in BCEAO. Therefore, the evolution of price level and real GDP is, among others, probably linked to monetary aggregate fluctuations. This feature could explain this very weak contribution in BCEAO.

Overall, the construction of Divisia monetary aggregate is not useful for monetary policy perspective in BEAC and BCEAO. The main reason is that the two Central Banks do not face, at this stage, important financial innovations. According to Darrat (2005), the theoretical superiority is confirmed empirically in the context of financial innovations and deregulation. Despite the process of financial liberalization engaged since the year 1990 in the two Central Banks, the characteristics of banking sector do not favour the emergence of financial innovations. The number of commercial banks is still low and there is a concentration of commercial banks in urban areas. In addition, activities are concentrated in a few commercial banks and financial products are not diversified. Since activities of commercial banks are already profitable, they are not encouraged to bring to market new financial products that encourage financial innovations.

6. Conclusion

The purpose of this study is to evaluate empirical performances of Divisia aggregates relative to traditional monetary aggregates in terms of growth and inflation within the period 1992.1-2009.4 in BEAC and BCEAO. Divisia monetary aggregates were introduced by the seminal work of Barnett (1980) to overcome the theoretical deficiencies of traditional monetary aggregates. Numerous studies have provided empirical comparisons of the Divisia aggregates to traditional aggregates.

This paper has mainly focused on the contribution of alternative monetary aggregate to price-level and real GDP fluctuations in the African context. Variance decomposition analysis is, therefore, the approach used to run empirical analysis. The main results of the study are the following. In BEAC, the contribution of monetary aggregate to price fluctuations is weak at less than 25%. Traditional monetary aggregates have better performances. The contribution of M1 to price level is about 12.45% while it is 7.36% for Divisia M1 and the percentage of inflation fluctuations due to traditional and Divisia M2 is 21.94% and 21.75%, respectively. Innovations in money explain more than 30% of real GDP's fluctuations, with traditional M2 having better outcome. A similar conclusion is derived from the empirical analysis in BCEAO. Traditional M2 leads to the highest contribution in real GDP variations, and price level is better explained by traditional M1. Comparison of results in the two Central Banks shows that the contribution of monetary aggregate to price level and output variability is at the very worst in BCEAO. Overall, the results suggest that traditional monetary aggregates are a better guide of monetary policy in BEAC and BCEAO. Therefore, Divisia monetary aggregates are not useful to conduct their monetary policy.

Notes

1. Centre d'Etudes et de Recherche en Economie et Gestion (CEREG), University of Yaoundé II- Soa, Email: motande@yahoo.fr. I am grateful to referees for excellent, helpful comments and suggestions.
2. The BEAC is a common Central Bank for six countries, namely: Cameroon, Central Africa Republic, Congo, Gabon, Chad and Equatorial Guinea.
3. The BCEAO is in charge of the monetary policy of eight (8) countries, namely: Ivory Coast, Senegal, Togo, Burkina Faso, Mali, Benin, Bissau-Guinea and Niger.

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