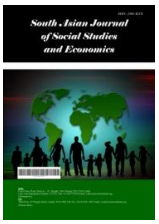

South Asian Journal of Social Studies and Economics

9(3): 1-7, 2021; Article no.SAJSSE.61187
ISSN: 2581-821X

Sustainability of Fiscal Policy in Economic and Monetary Community of Central Africa: An Analysis Based on Panel Data

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/SAJSSE/2021/v9i330240
Editor(s):
(1) Dr. John M. Polimeni, Albany College of Pharmacy and Health Sciences, New York.
Reviewers:
(1) Abhaykumar Gasti, Karnataka State Rural Development and Panchayat Raj University, India.
(2) A. Anitha, Sri Venkateswara Veterinary University, India.
(3) Maciel Rodrigues Borges, Universidade Federal do Goias, Brasil.
Complete Peer review History: http://www.sdiarticle4.com/review-history/61187

Original Research Article

Received 10 July 2020
Accepted 16 September 2020
Published 01 February 2021

ABSTRACT

The objective of this paper is to study the long-term sustainability of fiscal policies in CEMAC, following the pioneering approach of Hamilton and Flavin [10]. Over the period from 1992 to 2012, first and second generation panel stationarity tests suggest that total public expenditures, total revenues, the primary budget balance and public debt are stationary. As a result, fiscal policies are sustainable in the long run within the area. There is a unidirectional causality between government revenues and expenditures. Decisions to increase expenditures are made on the basis of the availability of revenues.

Keywords: Fiscal sustainability; panel data; CEMAC.

JEL Code: *C23, E62, H68.*

ABBREVIATIONS

CEMAC: Economic and Monetary Community of Central Africa; IMF: International Monetary Fund WDI: World Development Indicators; IFS: International Financial Statistics; GDF: Global Development Finance.

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1. INTRODUCTION

At the beginning of the 1980s, the CEMAC countries, like other developing countries in general, were to be largely affected by a series of unfavorable external shocks, including the fall in commodity prices. This situation will plunge these countries into a financial crisis in the middle of this decade. Governments will therefore adopt, under proposals from donors, measures to reduce their budget deficits and debt levels. Moreover, since 1994, they have introduced multilateral surveillance of budgetary policies.

However, following the drop in oil prices in 2013, budget deficits have accumulated and public debt continues to grow in the various countries of the zone (IMF, 2017). Thus, these countries need to save during periods of rising commodity (oil) prices in order to avoid the accumulation of budget deficits and the risk of over-indebtedness.

Following the pioneering work of Hamilton and Flavin [10], if the present value of the government's intertemporal budget constraint is satisfied, then fiscal policy is sustainable in the long run. The amount of current government debt must be equal to the present value of future budget surpluses, or the expected future government debt tends towards zero at infinity.

Starting from this equilibrium condition, the authors offer theoretical demonstrations leading to empirical frameworks for verifying the long-term sustainability of fiscal policy. For some, the empirical verification is based on the stationarity or cointegration of the primary budget balance and the public debt (Hamilton and Flavin, [10]; Trethan and Walsh, [17]; Baglioni and Cherubint, [2]). While for others, Hakkio and Rush [9], it is based on the cointegration of public expenditure (including debt interest) and budget revenues. These authors mentioned above provide theoretical demonstrations based on the assumption that the discount factor, or rather the debt interest rate, is constant. While Wilcox [18] proposes a stationarity test based on a stochastic interest rate. Bohn [4] demonstrates that the rejection of the sustainability of fiscal policy based on the stationarity or cointegration tests of the variables public debt and primary balance, or public expenditures and budget revenues are not valid. It proposes a test based on the positive relationship between the primary balance and public debt.

The first empirical results are therefore obtained over time series. Using US data, Hamilton and Flavin [10], Trethan and Walsh [17] and Hakkio and Rush [9] find that fiscal policy is sustainable in the long term. Wilcox, taking up the work of Hamilton and Flavin [10], finds it unsustainable. Baglioni and Cherubint [2] also find unsustainable behaviour in Italy. Considering the test based on the positive relationship between the primary balance and the public debt, as he will advise later, Bohn [3] finds that fiscal policy is sustainable in the long term in the United States.

With the advent of the stationarity and cointegration panel tests, it is not necessarily possible to say that all countries have a sustainable fiscal policy in the long run, but rather that there is at least one within the panel.

Based on first-generation panel stationarity tests, Lau and Baharumshah [12] find that fiscal policies are sustainable in the long term in four Asian countries. Similarly, Ehrhart and al [7] find that these policies are sustainable over a panel of 6 southern Mediterranean countries. But the conclusion of the latter is based rather on the existing cointegration relationship between total public expenditure and total revenues.

Other authors also use second generation stationarity tests in their work, which allow to take into account possible dependencies between individuals in the panel. For example, we have Brady and Magazzino [5], who find that there is a cointegration relationship between the primary budget balance and public debt, as well as between expenditures and revenues over a panel of 28 European Union countries. While Magazzino and al [14] find a cointegrating relationship between the primary budget balance and public debt, and not between expenditure and revenue in a panel of 7 G-7 countries. On the other hand, Brady and Magazzino [6] find that the public debt is stationary on a panel of 19 countries of the European Monetary Union.

Thus, this article proposes a first empirical verification of the sustainability of fiscal policies in CEMAC following the pioneering approach of Hamilton and Flavin [10]. It is also a question of analyzing, using Granger's causality test [8], whether there is savings behavior among governments.

2. METHODOLOGY

2.1 Data and Variables

The study period is from 1992 to 2012. The data are expressed in terms of nominal GDP ratios. They come on the one hand from the French Bank (the 1994 to 2013-franc zone reports): total expenditure (with interest), total revenues, primary balance (total revenues minus total expenditure excluding interest), and on the other hand from the World Bank (WDI and GDF), the IMF (IFS) and the French Bank (franc zone annual reports): total public debt.

Indeed, data on Cameroon's public debt comes from the World Bank (GDF and WDI). Those for Gabon come from the French Bank (annual reports), the IMF (IFS) and the World Bank (WDI). Public debt data for Equatorial Guinea, Congo and Chad come from the IMF (IFS). Those for Congo start from 1999. Finally, data on the public debt of the Central African Republic are absent for the entire period of the study.

2.2 Panel Stationarity Test

The sustainability of fiscal policy is therefore studied on the basis of the analysis of the characteristic properties (stationarity or cointegration) of the fiscal variables (total expenditure, total revenue, primary balance and public debt). Since the variables are defined in terms of nominal GDP ratios, they provide more credible information in relation to fiscal variables in real or nominal terms (Hakkio and Rush, [9], Afonso, [1], Bohn, [3]).

Due to the characteristics of the study sample, size (6) and number of years (21), the test of Im, Pesaran and Shin is appropriate. Indeed, under the hypothesis of the absence of autocorrelation of residuals, the authors propose 3 types of statistics to test the stationarity of variables on panel data: the first is constructed under the assumption that the number of years T tends towards infinity, then the number of individuals N also; the second, T is fixed but N tends towards infinity; and finally the last, where T and N are fixed. According to Hurlin and Mignon [11], the test of Madala and Wu [13] is slightly more powerful and robust than that of Im, Pesaran, and Shin.

Subsequently, we will perform the test for the existence of an inter-individual dependency of Pesaran [16]. If necessary, the Pesaran second generation stationarity tests [15] and [17] will be implemented.

Pesaran [15] proposes a test that takes into account possible dependencies between individuals. The test is carried out on a simple Dickey and Fuller or Dickey and Augmented Fuller model, to which are added the individual means of the series and its primary differences (Cross Sectionally Augmented Dickey-Fuller). The presence of a unit root in all individuals is the null hypothesis of the test. Pesaran [17] proposes another more robust test.

2.3 Granger Causality Test

Ultimately, according to Granger [8], revenues cause expenditures, if the predictability of expenditures is improved when revenue information is incorporated into the analysis. The test is performed using a VAR(p) model in which both variables are stationary. The optimal lag is that proposed by the information criteria (schwarz or akaike) and for which the estimated residuals of the VAR(p) model are not autocorrelated. We perform Johannsen's LM autocorrelation test, which allows us to know if there is an autocorrelation of the residuals for a p-order lag. Subsequently, we will also perform the coat hanger autocorrelation test, which allows us to know if there is an autocorrelation of the residuals after a p-order lag. These autocorrelation tests allow us to be sure that we do not lose information on the dynamics of the variables in each equation.

For reasons of data availability, the study will be devoted to 5 CEMAC countries (excluding the Central African Republic) and then to all 6 countries.

3. RESULTS AND DISCUSSION

According to the four statistics (P, Z, L*, Pm) of the Maddala and Wu test, the budgetary variables are stationary at 1% risk, except for revenues and public debt, which are stationary at 5% risk according to the P statistic.

Since the associated probabilities are all zero, the null hypothesis of individual independence for all budget variables is rejected. Therefore, there is a correlation between individuals. We will therefore subsequently test for stationarity in the case of heterogeneous panels.

Table 1. Stationarity test of Maddala and Wu [13]

Variables	Statistics:	P	Z	L*	Pm
		Model without constant or trend			
Public expenditures/GDP		25,97***	-2,88***	-3,03***	3,57***
Revenues/GDP		22,62**	-2,53***	-2,55***	2,82***
Primary balance/GDP		31,36***	-3,59***	-3,77***	4,77***
Debt/GDP		6,36	0,65	0,61	-0,81
		Constant model			
Debt/GDP		23,08**	-2,74***	-2,7***	2,92***

, **, *, means stationary at 10%, 5% and 1%. P=inverse chi-squared (10); Z=inverse normal; L*=inverse logit t(21); Pm=modified inv. chi-square*

Table 2. Pesaran inter-individual dependency test [16]

Variables	CD-test	Prob.
Public expenditures/GDP	3,95	0,000
Revenues/GDP	3,39	0,000
Primary balance/GDP	4,36	0,000
Debt/GDP	9,36	0,000

Table 3. Pesaran stationarity test [15]

Variables	Statistics	t-bar	Z (t-bar)	Prob.
			Constant model	
Public expenditures/GDP		2,59	1,92	0,027
Revenues/GDP		3,63	4,32	0,000
Primary balance/GDP		3,12	3,15	0,000
Debt/GDP			3,2	0,000

Table 4. Pesaran stationarity test [17]

Statistics:	Z(t-bar)	Prob.
Variables	Constant model	
Public expenditures/GDP	2,5	0,006
Revenues/GDP	3,72	0,000
Primary balance/GDP	2,92	0,002
Debt/GDP	3,2	0,001

Table 5. Granger causality test [8]

Null hypothesis	Chi-sq	Prob.
Expenditures do not cause revenues	4,24	0,2366
Revenues do not cause expenditures	19,2	0,0002

According with Pesaran [15], the probability of rejecting the null hypothesis of unit root is less than 5% for public expenditures and less than 1% for revenues, the budget balance and public debt. It is concluded that all fiscal variables are stationary. Due to missing data, t-bar statistic is not calculated for government debt.

Since the associated probabilities are all zero, we reject the null hypothesis of the presence of a unit root for all budget variables.

Moreover, the Maddala and Wu [13] and Pesaran [17] tests also show that for the six CEMAC countries, the budgetary variables are stationary. Consequently, fiscal policies are sustainable in the long term in CEMAC.

The table above represents the granger causality tests on the 6 CEMAC countries. The probability of rejection of the null hypothesis: public expenditures do not cause revenues, is greater than 10%, so we accept this hypothesis. While that of the second test is less than 1%, we therefore reject the null hypothesis: revenues do not cause public expenditures. Consequently, revenues cause public expenditures in CEMAC, and not the reverse. Decisions to increase expenditures are made according to the availability of revenues.

4. CONCLUSION

The objective of this paper was to study the long-term sustainability of fiscal policies in CEMAC. Based on the stationarity tests of Maddala and Wu [13] and Pesaran [15] and [17], we find that the fiscal variables (public debt, public expenditures, budget revenues and primary

balance all relative to nominal GDP) are stationary over the period 1992 to 2012. Therefore, fiscal policies in CEMAC are sustainable in the long run. This result can also be justified by the fiscal discipline established through the multilateral surveillance criteria introduced since 1994.

The results of the Granger causality test between budget variables indicate that decisions to increase expenditures are made based on the availability of revenues. Governments in this area save, but not enough to cope with the magnitude of an oil shock (lower oil prices).

COMPETING INTERESTS

Author has declared that no competing interests exist.

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Appendix 1. Stationarity test of Maddala and Wu (1999) and the Pesaran test (2007) on the six CEMAC countries

(A) Maddala and Wu (1999) Panel Unit Root test (MW)

	Specification without trend		
Variable	lags	chi_sq	p-value
dppib	0	33.839	0.001
rbpib	0	36.659	0.000
sbppib	0	43.982	0.000
sbpib	0	35.679	0.000

	Specification with trend		
Variable	lags	chi_sq	p-value
dppib	0	21.724	0.041
rbpib	0	53.008	0.000
sbppib	0	45.244	0.000
sbpib	0	47.541	0.000

(B) Pesaran (2007) Panel Unit Root test (CIPS)

	Specification without trend			
Variable	lags	Zt-bar	p-value	t-bar
dppib	0	-2.743	0.003	.
rbpib	0	-5.572	0.000	.
sbppib	0	-4.515	0.000	.
sbpib	0	-4.630	0.000	.

	Specification with trend			
Variable	lags	Zt-bar	p-value	t-bar
dppib	0	-2.936	0.002	.
rbpib	0	-4.611	0.000	.
sbppib	0	-4.651	0.000	.
sbpib	0	-4.780	0.000	.

Null for MW and CIPS tests: series is I(1).
MW test assumes cross-section independence.
CIPS test assumes cross-section dependence is in
form of a single unobserved common factor.

-multipurt- uses Scott Merryman's -xtfisher- and
Piotr Lewandowski's -pescadf-.

Appendix 2. Dependence test between individuals in the panel (5 CEMAC countries)

```
Average correlation coefficients & Pesaran (2004) CD test

Variables series tested: dppib rbpib sbppib sbpib dettePIB
                                Group variable: code
                              Number of groups: 5
                    Average # of observations: 23.10
                                      Panel is: unbalanced
```

Variable	CD-test	p-value	corr	abs(corr)
dppib	3.95	0.000	0.278	0.301
rbpib	3.39	0.001	0.252	0.378
sbppib	4.36	0.000	0.307	0.346
sbpib	5.75	0.000	0.408	0.414
dettePIB	9.36	0.000	0.708	0.708

```
Notes: Under the null hypothesis of cross-section
       independence CD ~ N(0,1)
```

APPENDIX 3. Granger causality test (6 CEMAC countries)

Dependent variable: RB_PIB			
Excluded	**Chi-sq**	**df**	**Prob.**
DPPIB	4.240861	3	0.2366
All	4.240861	3	0.2366
Dependent variable: DP_PIB			
Excluded	**Chi-sq**	**df**	**Prob.**
RBGDP	19.20050	3	0.0002
All	19.20050	3	0.0002

dppib= public expenditures/GDP; rbpib= revenues/GDP; sbpib= Primary balance/GDP; sbppib= global balance/GDP; dettePIB= Total Debt/GDP

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/61187