

# QUANTITATIVE EXPLORATION OF FISCAL RULES FOR WAEMU COUNTRIES

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## Abstract

The West African Economic and Monetary Union (WAEMU) has integrated capital market and design jointly their monetary policies and fiscal rules. To start, I document a significant heterogeneity in government revenue, spending, and debt across WAEMU countries. This paper offers a quantitative analysis of the fiscal rule in this economic and monetary union and characterizes an optimal reform. The theoretical framework is a model of fiscal policy where present-biased governments face shocks to their fiscal needs. The model features a trade-off between flexibility for the government to react to shocks and commitment to limit its incentives to overborrow. I found that the current uniform 3% deficit rule improves the citizenry's welfare for all WAEMU countries compared to a counterfactual scenario with no fiscal rule. Country-specific fiscal rules allow for a Pareto improving reform over the current uniform rule. Each country's optimal deficit limit level is influenced by the volatility of the shocks its government faces and the level of the political economy frictions of this government.

**Keywords:** *Fiscal Rule; Economic and Monetary Union; Present-bias preferences; Welfare analysis; Uncoordinated Rule; Coordinated Rule; Optimal reform; WAEMU*

**JEL Classification:** *E62 – F42 – F68 ...*

## Introduction

Fiscal rules are long-lasting constraints on fiscal policy through numerical limits on budget aggregates. The objective of fiscal rules is to contain pressures to overspend by ensuring fiscal responsibility and debt sustainability. Since 1985 there is a growing number of countries that adopted fiscal rules<sup>1</sup>. A country can adopt either a national fiscal rule, a supranational fiscal rule or both. The supranational fiscal rules are designed for a group of countries generally constituted in union such as the Central African Economic and Monetary Community (CEMAC), the East Africa Economic and Monetary Community, the Eastern Caribbean Currency Union(ECCU), the European Union, the West African Economic and Monetary

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<sup>1</sup>[Davoodi et al. \(2022\)](#): from 9 countries in 1985 to 105 countries in 2021

Union (WAEMU)<sup>2</sup>. This paper investigates the design of a fiscal rule for an economic union with a focus on the WAEMU. Considering that the fiscal behavior of one country, in economic and monetary union, could impact the other members, I show that the coordination of the design of fiscal that includes the specificity of each country is beneficial for the union.

My paper is motivated by two observations. The first observation is that the eight WAEMU countries are subjected to the same fiscal rules as described in section 1.1. The main rule is either a balance budget rule ( from 2000 to 2014) or a maximum of 3% deficit limit rule ( since 2015). The second observation is the heterogeneity of fiscal needs and fiscal implementation of WAEMU countries that I documented in section 1.2. I show that the budget deficits over GDP, the government expenditures over GDP, the government revenues over GDP, and the government debts over GDP are globally and significantly different across WAEMU countries. The two observations rise some questions such as: i) How the current common fiscal rule is compared to a counterfactual scenario with no fiscal rule for WAEMU countries? ii) Is there a Pareto improving reform of the current fiscal rule for WAEMU? The aim of this project is then to evaluate and propose a potential reform of current fiscal rule for WAEMU countries.

This paper proposes a design of a fiscal rule for an Economic and Monetary Union where all the countries are equitably treated. In the practice of Economic and Monetary Unions, the objectives being primarily convergence and stability of the union, a uniform rules are set for all the members of the union. Numerical targets are set on the main fiscal aggregates of the union. The rationale behind these measures is certainly political: the members of the union should be treated equally. If the fiscal needs and fiscal implementation are different across the union countries, a uniform fiscal rule would be unjust. Moreover, the common monetary policy in an economic and monetary union ensures the automatic coordination of responses to symmetric shocks (Canzoneri and Gray (1985)) so that fiscal policy is the only remaining tool for stabilizing the national business cycle of member countries. Therefore, it seems reasonable to design a fiscal rule that takes into account the specificity of each country.

I use a theoretical framework where the central authority, in designing the fiscal rules for the union, considers the specificity of each economy and can internalize the spillovers effects of each country's decisions on the other members of the union. I rely on a standard model of fiscal policy from the literature (Halac and Yared (2018)). In this framework, the central authority observes the characteristics of each government in the union when setting the rule. A government is charac-

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<sup>2</sup>The WAEMU has 8 member states

terized by its fiscal needs and its fiscal behaviors. The government's fiscal needs represent the economic shocks that the country experiences. The political economy frictions determine the fiscal behaviors of a government modeled through the government hyperbolic preferences. The role of the rule in the framework is then to provide enough flexibility to each government, in one hand, according to the shocks it faces. In other hand, the rule should discipline the government from overspend as he is subjected to political economy frictions. Besides, I distinguish two cases in my analysis: the central authority, when designing the rule, internalizes the spillover effects and does not internalize them. In the first case, when it ignores the spillover effects, the central authority considers each member country of union as a small open economy so that each government take the interest rate as given. The rule in this case is called an "uncoordinated fiscal rule" in the sense that it is equivalent to each country individually designing its fiscal rule. In the second case, the central authority internalizes the effects of each country's fiscal decision on the members: it is the "coordinated fiscal rule". In the model, the channel of transmission of the spillover effects is the union interest rate. More specifically, a fiscal irresponsibility of one member of union, by running excess deficit, can increase the risk premium on regional bond market leading to an increase of regional interest rate.

I calibrate the model's parameters and discipline this model using data from the common Central Bank database "La Base de Données Economiques et Financières de la BCEAO<sup>3</sup>". Using the model as laboratory, I evaluate and propose reforms to current homogeneous fiscal rule. I found that all the WAEMU countries benefit from the current homogeneous rule of a maximum of 3% deficit limit compared to a counterfactual scenario with no fiscal rule. In this context, the results imply that, for all the WAEMU countries, the political economic frictions are high enough such that disciplining the governments by this rule enhances the welfare of citizenry. However, we can even do better than the current homogeneous rule by setting a country-specific fiscal rule for the members of the union. I find that constraining all the countries to a uniform fiscal rule forgoes at least 24% of the welfare that we could achieve with country-specific fiscal rule. When each country individually designs its rule, I find that the tightest optimal deficit limit rule is 0.64%, provided for Benin, and the loosest fiscal limit rule is 3.5% for Guinea Bissau. Except Burkina Faso and Guinea Bissau, the six other countries would optimally choose tighter rule than the current 3% deficit limit. When the central authority internalizes the spillover effects, when designing the rule, I find that the

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<sup>3</sup>BCEAO (Banque Centrale des Etats de l'Afrique de l'Ouest) is the Central Bank of West African states using the CFA currency

tightest deficit rule is 2% provided for Burkina Faso and the loosest deficit rule is 12% provided for Benin. Globally, the optimal fiscal rule for countries is more flexible when it is coordinately designed compared to when it is uncoordinately designed. Thus, the spillover effects, through the interest, matter for the designing of the fiscal rule for the WAEMU.

## Literature Review

This paper relates to the literature on the design of rules to discipline authority such that their decisions benefit more the citizens ([Athey, Atkeson, and Kehoe \(2005\)](#), [Amador, Werning, and Angeletos \(2006\)](#), [Ambrus and Egorov \(2013\)](#), [Amador and Bagwell \(2013\)](#), [Halac and Yared \(2014\)](#)). It is built on the seminal paper of Amador, Werning, and Angeletos ([2006](#)), and the contribution of Halac and Yared ([2018](#)) to study the design of fiscal rule for economic union. More specifically, the paper quantifies the optimal fiscal rule to discipline the members of the WAEMU.

This paper is also related to the literature on the necessity of fiscal coordination in monetary union ([Grauwe \(1992\)](#), [Buiter, Corsetti, and Roubini \(1993\)](#), [Kenen and Kenen \(1995\)](#), [Chari and Kehoe \(2004\)](#), [Hamada \(1985\)](#)). These papers discuss the importance of fiscal rules in monetary union as the only tool to stabilize the national business cycle, and the necessity of fiscal coordination to internalize the spillover effects of one member behavior on the others in order to limit the free-riding behaviors. This paper shows that the fiscal coordination doesn't imply a common rule for all the members of the union; a country-specific rule could be optimal.

This paper contributes to the literature on fiscal rules design for WAEMU countries ( [David, Nguyen-Duong, and Selim \(2022\)](#), [Basdevant, Imam, Kinda, and Zdzienicka \(2015\)](#), [Dessus, Diaz-Sanchez, and Varoudakis \(2016\)](#)). Those works focus on the analysis of effectiveness and adequacy of fiscal rules in the union through the econometric estimation of structural models. My approach, in this paper, consist in calibrating a theoretical model and performing a counterfactual welfare analysis of the fiscal rules.

# 1 The WAEMU System of Fiscal Rules and Empirical Facts on Countries Heterogeneity

This section presents the backgrounds of fiscal rules in WAEMU countries and a descriptive analysis of the fiscal practises of those countries.

## 1.1 The WAEMU System of Fiscal Rules

Seven countries of the West Africa sharing the common West African CFA franc currency established, by signing a Treaty in 1994, the West African Economic and Monetary Union. The member states are Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal and Togo. Lately in 1997, these countries were joined by Guinea Bissau. The union was established to strengthen the economic and financial competitiveness of the Member States through the market integration and monetary union established earlier in 1962. The union aimed also to reinforce the fiscal discipline and coordination of fiscal and monetary policy after the devaluation of CFA franc occurred in 1994. To this end, the eight members states adopted on December 1999 the "Growth, Stability, Convergence and Solidarity Pact (GSCSP)". The Pact has been revised in 2015.

The initial pact lasted from 1999 to 2015. It stated eight rules divided in two orders of convergence criteria. First-order convergence criteria gathered ceiling on fiscal deficit and debt to GDP and on CPI inflation and no accumulation of arrears. The second-order convergence criteria included ceilings on wages and salaries, floor on tax revenues, limits on current account deficits, and floor on investment-expenditures to revenue ratio. This paper is interested in evaluating the fiscal rules of the first-order convergence criteria. The deficit rule is defined as basic fiscal balance which is fiscal balance excluding grants. The debt ceiling was set at 70 % of GDP. I am interested, in this paper, in the evaluation of the current fiscal rule of maximum of 3% deficit limit.

The GSCSP has been revised in 2015. The number of rules was reduced by three. The rule on accumulation of arrears was withdrawn from the first-order criteria while the rules on current account deficit and investment-expenditures to revenue ratio were withdrawn from the second-order convergence criteria. The deficit rule was also modified such as the overall fiscal balance (grants included and externally financed capital expenditures) to be a maximum of 3% of GDP. This revised GSCSP is in application since 2015 excepted that it has been suspended in 2020 in order to allow countries to overcome the COVID-19 pandemic crisis.

Indeed, the main reason of GSCSP's revision is the violation of the fiscal rules

by member states from 2000 to 2014. As display in table [A.1](#), at least six out of eight countries have violated the basic deficit balance rule during the period 2000 to 2014. The high number of countries that have violated the prevailing rule may suggest an inadequacy of that rule. I will present next my investigations on fiscal needs and fiscal practises across WAEMU countries which may explain the inadequacy of the uniform fiscal rules for the union.

## 1.2 Empirical Facts on WAEMU Countries Heterogeneity

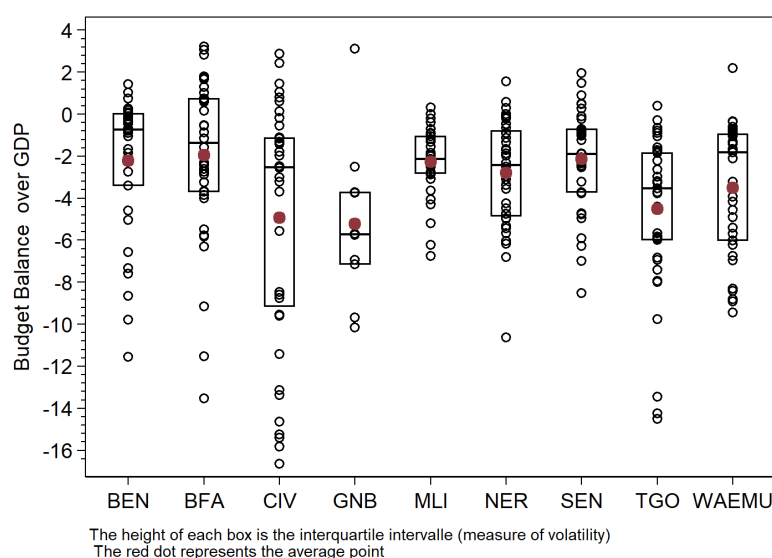
This section presents the facts on the heterogeneity of member states of WAEMU. To this aim, I investigate the fiscal needs and fiscal behaviors across countries. I find that WAEMU countries are heterogeneous in the mean and the volatility of their budget deficits over GDP, government revenues over GDP, government spending over GDP, and government debt over GDP.

I use macro data from " La Base de Données Economiques et Financières de la BCEAO". This data is constructed by the Central Bank of West African States serving the eight west African countries of WAEMU. I compare the means and volatility of budget balance, government revenue, government spending and current debt across WEAMU countries.

*Fact 1 : Before the adoption of the fiscal rule WAEMU countries were heterogeneous in their fiscal needs and fiscal implementation.* I use time series from 1960 to 1999 to show that member states of WAEMU were heterogeneous before the setting of the uniform fiscal rule in GSCSP. As shown in figure (1) the budget deficit is very different across countries in mean as well as in volatility. For example the average budget deficit for Côte d'Ivoire is about two times that of Burkina Faso and the standard deviation of budget deficit for Côte d'Ivoire is three times that of Mali. The differences in the mean and the volatility of budget deficit across WAEMU countries before 2000 is confirmed by statistics tests reported in table [B.1](#). As for budget deficit, the WAEMU countries had differences in the mean and the volatility, before 2000, of their government revenue over GDP, government spending over GDP and debt over GDP as reported in table ([B.1](#)) and shown figures [A.1](#), [A.2](#) and [A.3](#).

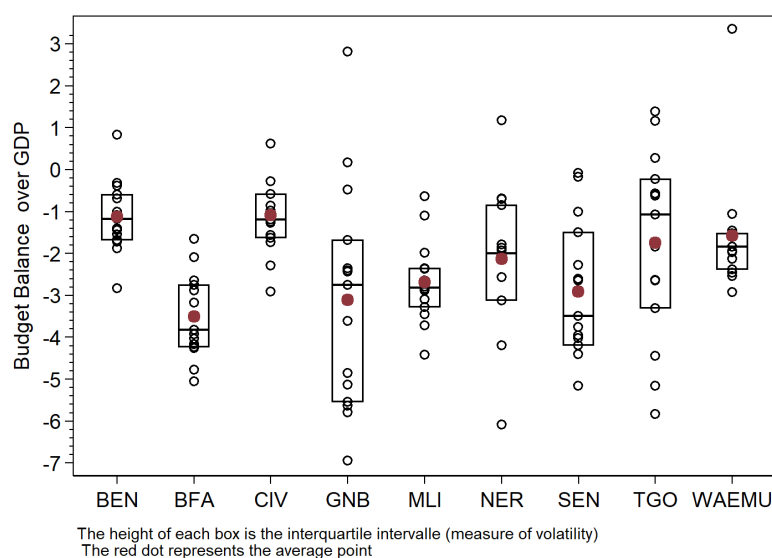
*Fact 2: During the application phase of the fiscal rule WAEMU countries were heterogeneous in their fiscal needs and fiscal implementation .* I use time series from 2000 to 2014 to show that member states of WAEMU are still heterogeneous during the years of application of fiscal rule leading to the modification of GSCSP. During this period, the average of budget deficit for Burkina Faso was around three times that of Benin and Togo's budget deficit volatility was about the double of that of Mali. Those differences of mean and volatility of budget deficit across WAEMU

Figure 1: Budget Balance over GDP from 1960-1999



from 2000-2014 hold from statistics tests I performed. We can observe the same pattern of heterogeneity in mean and volatility on government revenue over GDP, government expenditure over GDP and government debt over GDP during this period (see figures B.1, B.2 and B.3 and table B.2).

Figure 2: Budget Balance over GDP from 2000-2014



Facts 1 and 2 show that WAEMU countries are different from the perspective of their fiscal needs and fiscal practises. The design of fiscal rules for this union should consider the heterogeneity observed.

## 2 Theoretical Framework

This section presents the economic environment and model used to investigate the fiscal rule for WAEMU countries. The government objectives on spending and borrowing come from the interaction of the preference shocks it experiences and the degree of present-bias measuring the political economic frictions toward spending of the government.

### 2.1 Setup

I rely on a simple model of fiscal policy for the quantitative evaluation of fiscal rules. The model is built on [Halac and Yared \(2018\)](#). I consider an Economic and Monetary Union of  $N$  countries in which each government makes decisions of spending and borrowing.

I will describe a two periods models extendable to infinite horizon. At the begin of the first period the government  $i$  observes a shock  $\theta_i > 0$  to its economy draw from a bounded set  $\Theta_i = [\underline{\theta}_i, \bar{\theta}_i]$  with a continuously differentiable distribution function  $F_i(\theta_i)$ . After this shock, the government  $i$  chooses the first period spending  $g_i$  and the second period asset holding  $x_i$  according to its budget constraint:

$$g_i + \frac{x_i}{R} = \tau_i, \quad (1)$$

where  $\tau_i$  is the government revenue at the initial period, and  $R$  is the gross interest rate that is endogenously determined in the Union.

In the view of social planner, the citizenry welfare when the government  $i$  spends  $g_i$  and hold assets  $x_i$  is

$$\mathbb{E}[\theta_i U(g_i) + \beta W(x_i)] \quad (2)$$

Where  $\beta$  is the discount factor,  $U'(\cdot) > 0$ ,  $U''(\cdot) < 0$ ,  $W'(\cdot) > 0$  and  $W''(\cdot) < 0$ .  $U(g_i)$  represents the government  $i$ 's utility from spending  $g_i$  and  $W(x_i)$  is the second-period utility from carrying forward assets  $x_i$  ( $W$  is the continuation value). I consider  $U(\cdot)$  to be an exponential function so that I can interpret  $\theta_i$  as a shock to government  $i$ 's revenue (see section 5.4 of [Amador et al. \(2006\)](#)). For a general utility function,  $\theta_i$  is a taste shock multiplying the first-period utility. As explained in [Halac and Yared \(2018\)](#) the task shock is a tractable way to introduce flexibility in the model: therefore the marginal benefit of government spending increases with a high value of  $\theta_i$ . This implies that the higher the shocks are more desirable the first period spending are.



After the realisation of the shock to the economy the government  $i$ 's objective when choosing  $g_i$  and  $x_i$  is

$$\theta_i U(g_i) + \delta_i \beta W(x_i), \quad (3)$$

where  $\delta_i \in (0, 1]$ .

The government objective (3) differs from the social planner objective (2) through the way they discount the future. The government discounts more the future than he would in the view of the social planner. The implications of this difference is explained below.

To close the model, we assume that the members of the Union borrow or lend from each other such that the aggregate net borrowing in this Union is zero in equilibrium. Let  $g_i(\theta_i, R)$  and  $x_i(\theta_i, R)$  be respectively government  $i$ 's spending and asset holding when he experiences shock  $\theta_i$ , the Union gross interest rate adjusts then for global resource constraint (4) to be hold.

$$\sum_{i=1}^N (g_i(\theta_i, R) - \tau_i) = 0 \quad (4)$$

## 2.2 Fiscal Rules

There are two frictions in the setting that impose a trade-off for the rule-making body. Unless  $\delta_i = 1$  there is a disagreement between the social planner objective (2) and that of government  $i$  (3). Compared to the social planner, the government is present-biased in the sense that he discounts more the future. Then, the government  $i$  tends to overspend in the first period compared to the allocations of the social planner. I use this structure of the preference to model the political economic frictions of each country. Nevertheless, in literature, there are two arguments of such disagreements (see [Jackson and Yariv 2014, 2015](#)). It can arise because the government aggregates an heterogeneous citizen's preferences such that even if they are time consistent, the government become time inconsistent. The other argument of such preference is the political turnover. Indeed, when there is a political uncertainty, for instance, when the government in power places a higher value on its spending, it discounts more the future. The latter argument is an example of political economic frictions that motivated the use of present bias preferences in my model.

The second frictions in the setting is the shock that experiences each government. Ideally, the rule should be contingent to the shocks. But due to the large set of the realisation of the shocks, we cannot design the rule for each value of the

shock. Other reasons are that the shocks cannot be observable or even if it does its value cannot be verified.

In overall, the two frictions in the model justify the need for a rule, and they induce a trade-off between flexibility and commitment. In one hand, a desirable rule should offer a sufficient flexibility to the government to react to the shocks it experiences and, in the other hand, the rule should discipline him from overspend.

I define the fiscal rule as a cutoff on the shock of each government  $i$ ,  $\theta_i^*$ , such that when this government experiences a shock higher than the cutoff  $\theta_i > \theta_i^*$  its first-period spending and second-period asset are respectively  $g_i^f(\theta_i^*, R)$  and  $x_i^f(\theta_i^*, R)$ , whereas when the shock is below the cutoff,  $\theta_i < \theta_i^*$ , its first-period spending and second-period asset are respectively  $g_i^f(\theta_i, R)$  and  $x_i^f(\theta_i, R)$ : they are given full flexibility. Where  $g_i^f(\cdot)$  and  $x_i^f(\cdot)$  are the optimal decision rules of government  $i$ 's objective when given full flexibility.  $g_i^f(\cdot)$  and  $x_i^f(\cdot)$  maximize (3) subject to (1) and verify (5).

$$\theta_i U'(g_i^f(\theta_i, R)) = \delta_i \beta W'(x_i^f(\theta_i, R)) \quad (5)$$

As each government decision rule is one to one mapping with the preference shock, the definition of fiscal rule is equivalent to a cap on government spending  $g_i^f(\theta_i^*, R)$ . Also, as I assume a constant government revenue, this definition of fiscal can be implemented with maximum deficit limit as the current fiscal rule in WAEMU countries. I rely on this model to evaluate the current fiscal rule in WAEMU countries and to propose some reforms. The following section presents the quantitative strategies I use to answer my questions.

### 3 Evaluation of Current Uniform Fiscal Rule over No Rule

I start by the evaluation of the current fiscal rule stated in GSCSP before investigating a potential reform to that rule. I will focus in evaluating the main rule of maximum of 3% deficit limit in application since 2015. I compute for that evaluation the welfare variation from no rule situation for WAEMU countries to the uniform maximum of 3% deficit limit. Indeed, before the adoption of GSCSP any WAEMU country was subjected to a fiscal rule. For the evaluation of the current fiscal rule, I compare the 3% deficit limit rule to no rule situation for each country of WAEMU individually. Before presenting the results, I show the calibration strategy I adopted.

### 3.1 Calibration

As mentioned in section 2 there are two main ingredients in the model: the preference shock and the present-bias parameter. The identification of those ingredients are then crucial for my quantitative analysis.

**Preference shock inference** I infer the preference shock using data from 1960 to 1999 to identify the behavior of government in absence of fiscal rule. I start by assuming a CARA utility function to interpret the preference shocks as shocks on government revenue :  $U(g) = 1 - e^{-\alpha g}$ . I infer the distribution of the shocks on government revenue using the time series of public saving (which is also the new debt issues by the government). Using the cyclical component of public saving time series, I infer the distribution of shock to government revenue through non parametric approach. I back up the distribution of preference shocks using the relation  $\theta = e^{-\alpha \epsilon}$ ; where  $\epsilon$  is the shock on government revenue. Let  $f_\epsilon(\cdot)$  and  $f_\theta(\cdot)$  be the density function  $\epsilon$  and  $\theta$  respectively; the relation between them is :

$$f_\theta(y) = \frac{1}{\alpha y} f_\epsilon\left(-\frac{1}{\alpha} \ln(y)\right) \quad (6)$$

#### $\alpha$ and $\delta$ parameters calibration

For each country, I choose the risk aversion parameter for utility function  $\alpha$  and the government present-bias parameter  $\delta$  such that the theoretical mean and variance of the budget balance match the first and the second moment of the budget deficit in data from 1960 to 1999. The calibration results are summarised in table 1. All the WAEMU countries are risk-averse as  $\alpha > 0$ . The more  $\delta$  is far from 1 the more the government is present biased. My calibration results show that Côte d'Ivoire is the most present biased government and Mali the least present biased government in WAEMU.

The calibration procedure of the present-bias parameter for each country suggest the value found depend highly on the government behavior from 1960 to 1999. As this parameter is not observable and its calibration is not identified, I will assume the same present-bias value for all the government as robustness check. Considering the same present-bias parameter for all the countries helps identifying also the influence of preference shocks on the fiscal rule.

Table 1: Calibration

	<i>BEN</i>	<i>BFA</i>	<i>CIV</i>	<i>GNB</i>	<i>MLI</i>	<i>NER</i>	<i>SEN</i>	<i>TGO</i>
$\alpha$	<b>0.365</b>	<b>0.121</b>	<b>0.621</b>	<b>0.654</b>	<b>0.178</b>	<b>0.482</b>	<b>0.533</b>	<b>0.569</b>
$\delta$	<b>0.954</b>	<b>0.966</b>	<b>0.896</b>	<b>0.901</b>	<b>0.981</b>	<b>0.951</b>	<b>0.958</b>	<b>0.918</b>

### 3.2 Welfare analysis

I use a notion of government spending equivalent variation to evaluate the welfare variation from a benchmark policy to an alternative policy. Let a subscripts  $bp$  and  $ap$  denote respectively benchmark policy and alternative policy allocations;  $\Lambda$  the government spending equivalent verifies:

$$\mathbb{E}[\theta U(g^{bp}(\theta, R)(1 + \Lambda)) + \beta W(x^{bp}(\theta, R))] = \mathbb{E}[\theta U(g^{ap}(\theta, R)) + \beta W(x^{ap}(\theta, R))] \quad (7)$$

$\Lambda$  is the maximum fraction of government expenditure that the citizen would be willing to forgo for the government to choose the allocations of the alternative economy instead of that of the benchmark economy. In other words, it is the amount of government spending that makes the government indifferent between the benchmark economy and the alternative one. When the benchmark economy displays more welfare for citizens compared to the alternative economy,  $\Lambda < 0$ . This implies the citizenry would be willing to give  $100 * \Lambda\%$  of government spending each year for the government to choose the benchmark allocations. In opposite, when the alternative economy gives higher welfare,  $\Lambda > 0$ . The implication is that the citizens would be willing to give  $100 * \Lambda\%$  of government spending every period for the government to choose the alternative economy allocations.

I use the parameters calibrated in table 1 to quantify the welfare variation, for each member of WAEMU, from a counterfactual scenario with no fiscal rule to the current uniform fiscal rule. The results are summarized in table 3. It comes out, from this table, that all WAEMU countries are better off moving from no rule to 3% maximum deficit limit rule. For example, Benin citizen would be willing to provide an increase of government expenditures by 0.5% each period for the government to move from no rule economy to maximum of 3% deficit rule.

In overall, the WAEMU homogeneous fiscal rule benefits all countries as  $\Lambda > 0$  compared to a counterfactual scenario with no fiscal rule. Guinea Bissau benefits the most from the 3% deficit limit rule and Mali benefits the least from this rule compared to the counterfactual scenario with no fiscal rule.

Indeed, there exists a threshold of present-bias parameter below which the current fiscal benefits a country compared to no rule situation. The results in table (2) shows that the present-bias parameter calibrated for country of the union is below the threshold. This means the political economic frictions of WAEMU countries are high enough so that disciplining them by the current fiscal rule is beneficial for their citizens.

Even if the current fiscal improves the welfare of WAEMU countries, could we

Table 2:  $\delta$  and  $\delta^*$ 

	<i>BEN</i>	<i>BFA</i>	<i>CIV</i>	<i>GNB</i>	<i>MLI</i>	<i>NER</i>	<i>SEN</i>	<i>TGO</i>
$\delta^*$	<b>0.976</b>	<b>0.987</b>	<b>0.929</b>	<b>0.943</b>	<b>0.988</b>	<b>0.970</b>	<b>0.975</b>	<b>0.945</b>
$\delta$	<b>0.954</b>	<b>0.966</b>	<b>0.896</b>	<b>0.901</b>	<b>0.981</b>	<b>0.951</b>	<b>0.958</b>	<b>0.918</b>

do better than the homogeneous fiscal rule? The next section presents the design and the quantitative evaluation of a national optimal fiscal rule.

Table 3

<i>From no rule to 3% deficit limit in %</i>								
	<i>BEN</i>	<i>BFA</i>	<i>CIV</i>	<i>GNB</i>	<i>MLI</i>	<i>NER</i>	<i>SEN</i>	<i>TGO</i>
$\delta$	<b>0.954</b>	<b>0.966</b>	<b>0.896</b>	<b>0.901</b>	<b>0.981</b>	<b>0.951</b>	<b>0.958</b>	<b>0.918</b>
$\Lambda$ (in%)	<b>0.51</b>	<b>0.71</b>	<b>0.69</b>	<b>1.77</b>	<b>0.11</b>	<b>0.38</b>	<b>0.16</b>	<b>0.61</b>

## 4 Uncoordinated Optimal Fiscal Rule

The section 3 shows that the governments overspend when they are provided a full discretion such that a fiscal rule of a maximum 3% deficit limit of GDP is beneficial for all WAEMU countries compared to no rule situation. This section explores a potential reform to current fiscal rule for WAEMU countries in the case when the central authority that set the rule consider each country of the union as a small open economy.

### 4.1 Uncoordinated Fiscal Rule Design

The central authority consider that each country of the union takes as given the interest rate they face on their borrowing. This implies the fiscal rule design ignores the spillover effects of each country behavior. In this case, the rule setting is as if each country individually choose its rule. The maximization of the welfare union is equivalent to each government setting its rule to maximize the social welfare given that those allocations satisfy its objectives: it is an uncoordinated fiscal rule.

The government  $i$  sets its fiscal rule such that it maximizes the expected welfare

as follow:

$$\max_{\theta_i^* \in [\underline{\theta}_i, \bar{\theta}_i]} \left\{ \int_{\underline{\theta}_i}^{\theta_i^*} \left( \theta_i U(g_i^f(\theta_i, R)) + \beta W(x_i^f(\theta_i, R)) \right) f_i(\theta_i) d\theta_i + \int_{\theta_i^*}^{\bar{\theta}_i} \left( \theta_i U(g_i^f(\theta_i^*, R)) + \beta W(x_i^f(\theta_i^*, R)) \right) f_i(\theta_i) d\theta_i \right\} \quad (8)$$

The optimal uncoordinated fiscal rule (national rule) is defined as - given the interest rate  $R$ , it is a cutoff  $\theta_{iu}^*$  satisfying:

$$\frac{\mathbb{E}[\theta_i | \theta_i \geq \theta_{iu}^*]}{\theta_{iu}^*} = \frac{1}{\delta_i} \quad (9)$$

In practice however, as it is currently for WAEMU, the central authority constrained all the countries in the union to adopt the same fiscal rule. In this case with exogenous interest rate, to set the constraint uniform uncoordinated rule we must treat the union as a country. Indeed, a necessary condition for all the countries to set the same rule is when they experience the same preference shocks and they have the same present bias parameter. The constrained uniform fiscal under exogenous interest rate is defined as - given the interest rate  $R$ , a cutoff  $\theta_{cu}^*$  satisfying:

$$\frac{\mathbb{E}[\theta | \theta \geq \theta_{cu}^*]}{\theta_{cu}^*} = \frac{1}{\delta} \quad (10)$$

Where  $\theta$  represents the common shock to the union and  $\delta$  the common present-bias parameter for the union.

I compare the uncoordinated fiscal rule in one hand to the current homogeneous 3% deficit limit rule and in the other hand to the constraint fiscal rule.

## 4.2 Quantifying Optimal Uncoordinated Fiscal Rule for WAEMU Countries

I use data to quantify the optimal uncoordinated fiscal rule for each country from the equation (7). Then using the notion of the government spending equivalent variation (equation 7), I compare the welfare variation from the current homogeneous maximum of 3% deficit limit rule to the optimal uncoordinated fiscal rule for each country. The results I found are presented in table (4). The table shows that when the WAEMU countries independently design their fiscal Benin, Côte d'Ivoire, Mali, Niger, Senegal and Togo would have chosen a tighter rule than 3% deficit rule in place while Burkina-Faso and Guinea Bissau would have set optimally a slacker deficit limit rule than the current 3% rule. The tightest rule is

chosen by Benin with a maximum of 0.64% budget deficit. The loosest rule is set by Burkina Faso with a maximum of 3.9% budget deficit. Moving from the current rule to the optimal rule would increase the citizenry's welfare for each country. In particular, the Benin citizens would be willing to give, each year, 0.125% of government spending for the adoption of the optimal fiscal rule (a maximum of 0.64% budget deficit rule) by the government of Benin.

As robustness check, I suppose that all the union countries face the same political economic frictions when setting the optimal uncoordinated rule. The results are displayed in Table C.1. The optimal fiscal rule chosen by each country, when I assume that all the countries experience the same political economic frictions, is qualitatively similar to the rule when the countries experience different political economic frictions. Indeed, only Guinea Bissau government would have set looser rule than 3% deficit limit; the remaining countries would set more tighter rules.

#### **Comparison between constrain uniform rule an country-specific uncoordinated rule**

The country-specific fiscal rule design shows that six countries out of the eight countries would optimally set a tighter rule than 3% deficit limit. In my model, when the central authority constrained the countries to a uniform rule, the optimal rule for WAEMU countries is a maximum of 0.73% budget deficit rule. The optimal uniform rule is tighter than the current uniform rule. The goal of this exercise is to compare the country-specific fiscal rule and the constrained fiscal rule. I find that constraining the countries to a uniform rule forgoes 37% of welfare that could have been achieved with a country-specific rule.

to sum up, I find that the current fiscal rule benefit to all WAEMU countries compared to no rule situation. However, we can do better than the homogeneous fiscal rule by setting a country-specific rule. When the central authority ignores the spillover effects, constraining the countries forgoes a lot in terms of welfare. The next section examines the implication for the optimal fiscal rule design when the spillover effects are taken into account.

Table 4

<i>Optimal deficit limit (DL) and <math>\Lambda</math> from 3% to optimal rule in %</i>								
	<i>BEN</i>	<i>BFA</i>	<i>CIV</i>	<i>GNB</i>	<i>MLI</i>	<i>NER</i>	<i>SEN</i>	<i>TGO</i>
$\delta$	0.954	0.966	0.896	0.901	0.981	0.951	0.958	0.918
DL (in%)	0.64	3.91	1.79	3.50	2.06	1.80	1.06	2.17
$\Lambda$ (in%)	0.125	0.000	0.019	0.013	0.006	0.025	0.038	0.013

## 5 Coordinated Optimal Fiscal Rule

The precedent section 4 started the investigation of potential reform of fiscal rules in WAEMU countries when central government considers the interest rate is specific for each country in the union. This section explores a potential reform of fiscal rule in the union considering that each government decisions impact the remaining countries through the interest rate. The interest rate is then endogenously determined in the model from the interactions of the decisions of WAEMU's members states.

### 5.1 Design of coordinated Fiscal Rule

The central authority jointly chooses a fiscal rule for each country by maximizing the union's social welfare knowing that the allocation are chosen to satisfy each government objective: it is a coordinated fiscal rule. This setting differs from the uncoordinated rule as it takes into account the externality effects of each member state of union fiscal behavior on the rest of members: this externality is through the interest rate. Indeed, the union interest rate  $R$  level varies with the borrowing demand and lend offer such that when country  $i$ , for example, increases its demand, everything else equals,  $R$  increases. The central authority in this setting internalizes this externality effect while it did not when designing the uncoordinated fiscal rule.

The central authority chooses a specific fiscal rule for each member state by maximizing the social welfare of the union. The program solved is :

$$\max_{\otimes_{i=1}^n \theta_i^* \in \otimes_{i=1}^n [\underline{\theta}_i, \bar{\theta}_i]} \sum_i^n v_i \left[ \int_{\underline{\theta}_i}^{\theta_i^*} \left( \theta_i U(g_i^f(\theta_i, R(\theta^*))) + \beta W(x_i^f(\theta_i, R(\theta^*))) \right) f_i(\theta_i) d\theta_i \right. \\ \left. + \int_{\theta_i^*}^{\bar{\theta}_i} \left( \theta_i U(g_i^f(\theta_i^*, R(\theta^*))) + \beta W(x_i^f(\theta_i^*, R(\theta^*))) \right) f_i(\theta_i) d\theta \right] \quad (11)$$

$$\text{s.t. } \sum_i^n v_i \int_{\underline{\theta}_i}^{\bar{\theta}_i} \left( (g_i^f(\theta_i, R)) \right) f_i(\theta_i) d\theta_i = \sum_i^n v_i \int_{\underline{\theta}_i}^{\bar{\theta}_i} \tau_i f_i(\theta_i) d\theta_i,$$

where  $\theta^* = (\otimes_{i=1}^n \theta_i^*)$  and  $\sum_i^n v_i = 1$  with  $v_i$  being the weight of country  $i$ .

The optimal coordinated fiscal rule is a cutoff  $\theta_c^* = (\otimes_{i=1}^n \theta_{ic}^*)$  and its associated interest rate  $R = R(\theta_c^*)$  satisfying,  $\forall \quad \theta_c^* < \bar{\theta} = (\otimes_{i=1}^n \bar{\theta}_i)$  and  $\forall \quad i \in 1, 2, \dots, N$ :

$$\begin{cases} \frac{\mathbb{E}[\theta_i | \theta_i \geq \theta_{ic}^*]}{\theta_{ic}^*} = \frac{1}{\delta_i} + \frac{R'(\theta_{ic}^*)}{(1-F(\theta_{ic}^*))\theta_{ic}^* U'(g_i^f(\theta_{ic}^*, R)) \frac{\partial g_i^f(\theta_{ic}^*, R)}{\partial \theta_{ic}^*}} (\rho_i + \lambda_i) \\ \sum_i^n v_i \int_{\underline{\theta}_i}^{\bar{\theta}_i} \left( g_i^f(\theta_i, R) \right) f_i(\theta_i) d\theta_i = \sum_i^n v_i \int_{\underline{\theta}_i}^{\bar{\theta}_i} \tau_i f_i(\theta_i) d\theta_i \end{cases} \quad (12)$$



Where  $\rho_i \equiv$  redistributive effect and  $\lambda_i \equiv$  Discipline effect;

$$\rho_i = -\frac{1}{R} \left[ \int_{\theta_i}^{\theta_{ic}^*} W'(x_i^f(\theta_i, R)) x_i^f(\theta_i, R) f_i(\theta_i) d\theta_i + \int_{\theta_{ic}^*}^{\bar{\theta}_i} W'(x_i^f(\theta_{ic}^*, R)) x_i^f(\theta_{ic}^*, R) f_i(\theta_i) d\theta_i \right]$$

$$\lambda_i = - \left( \int_{\theta_i}^{\theta_{ic}^*} \left( \theta_i U'(g_i^f(\theta_i, R)) - R W'(x_i^f(\theta_i, R)) \right) \frac{dg_i^f(\theta_i, R)}{dR} f_i(\theta_i) d\theta_i \right. \\ \left. + \int_{\theta_{ic}^*}^{\bar{\theta}_i} \left( \theta_i U'(g_i^f(\theta_{ic}^*, R)) - R W'(x_i^f(\theta_{ic}^*, R)) \right) \frac{dg_i^f(\theta_{ic}^*, R)}{dR} f_i(\theta_i) d\theta_i \right)$$

The redistributive effects  $\rho_i$  capture the impact of interest on lenders and borrowers. Indeed, higher the preference shocks of a government are, higher government expenditures would be and more likely the government will increase its borrowing. In this case, the next period marginal cost of this debt depends on the level of interest rate such that high level of interest rate harms more government that experiences a high shock. The central authority, searching to maximize the social welfare, will put more weight on the high type governments; it will be optimal to design a rule that lower the interest rate. The objective to redistribute from lower type to higher type leads the central government to reduce the governments flexibility, which will reduce the interest rate compared to the interest rate when designing the uncoordinated fiscal rule.

The second externality effects that are not internalized when designing the uncoordinated fiscal rule are the disciple effects  $\lambda_i$ . They capture the sensibility of government spending and borrowing on interest rate. Thus, assuming that a high level of interest rate limits the government expenditures, this effect discourages governments that overborrow. In overall, a high interest rate benefits more the governments that experience a low shock and overborrowed relative to the first best allocation. In other side a high interest rate harms governments that experience a high shock because they underborrowed relative to their first best allocation.

In the program solved by the central authority in equation (11), the fiscal rule is specific for each country. I will evaluate a similar design of rule where the central government constrained all the members of the union to set the same rule as we observe currently in WAEMU countries. To this end, I consider that all the countries experience the same political economic frictions such that I can compare the results to what I found the uncoordinated fiscal rule design. I am going to compare the welfare implication of designing a country-specific joint rules and a constraint joint rule for WAEMU countries.

## 5.2 Quantifying Coordinated Fiscal Rule for WAEMU Countries

I use the calibrated parameters in table 1 to evaluate the coordinated fiscal rule; the results are summarized in table 5. The country-specific coordinated fiscal rule optimally provides large deficit limit for Benin and Mali, a medium deficit limit for Senegal, Niger, Togo, Côte d'Ivoire and Guinea Bissau and a small deficit limit for Burkina Faso. Comparing those rules to the current 3% deficit limit, only Burkina Faso is given less flexibility while more discretion is given to Benin, Mali, Senegal and Niger. Moving from the current fiscal rule to the country-specific joint rule would benefit the union. The tightest rule is provided for Burkina Faso with a maximum of 2% budget deficit rule while the loosest rule is provided for Benin with a maximum of 12% budget deficit. Moving from 3% deficit rule to the optimal country-specific coordinated rule would improve not only the welfare of the citizens of each country but also the welfare of the whole union's citizens.

The equilibrium interest rate associated with the coordinated fiscal rule is 6.8% a year. This implies that internalizing the impact of a WAEMU's country decisions to the other members rise the interest from 5% to 6.8%. This level of interest rate reflect the net effect of redistributive and discipline effect. The increase of the interest rate reflects that it is optimal, from the view of the central authority, to give more flexibility to some governments (especially those experiencing high) to increase fiscal discipline in the union (especially for governments experiencing low shocks).

As robustness check I evaluate the coordinated fiscal rule by considering that all the union countries experience the same political economy frictions. The results in table C.2 are consistent with the results I obtain for heterogeneous political economy frictions. Besides, I evaluate the constrained uniform coordinated fiscal rule and compare it to the country-specific coordinated fiscal. It turns out that the constraining the countries to a uniform rule forgoes 24% of welfare that would be achieved with a country-specific fiscal rule.

The main message when comparing the coordinated and the uncoordinated fiscal rule is that the spillover effects matter for the design of the rule for the union. First, the interactions of the fiscal behaviors of members of the union induce an increase of the regional interest rate. Second, internalizing the spillover effects implies a global more lax fiscal rule for WAEMU countries than the uncoordinated rule. Those results suggest that it would more beneficial to increase the fiscal flexibility for the government of WAEMU.

Table 5

<i>Optimal coordinated fiscal rule</i>								
	<i>BEN</i>	<i>BFA</i>	<i>CIV</i>	<i>GNB</i>	<i>MLI</i>	<i>NER</i>	<i>SEN</i>	<i>TGO</i>
$\delta$	<b>0.954</b>	<b>0.966</b>	<b>0.896</b>	<b>0.901</b>	<b>0.981</b>	<b>0.951</b>	<b>0.958</b>	<b>0.918</b>
DL (in%)	<b>12.40</b>	<b>2.11</b>	<b>3.21</b>	<b>2.98</b>	<b>9.79</b>	<b>4.19</b>	<b>5.22</b>	<b>3.33</b>
$\Lambda$ (in%)	<b>0.019</b>	<b>0.581</b>	<b>0.656</b>	<b>1.875</b>	<b>0.000</b>	<b>0.263</b>	<b>0.050</b>	<b>0.575</b>

## Conclusion

This paper evaluates the current uniform fiscal rule for West African Economic and Monetary Union (WAEMU) and proposes avenues for reforms. Indeed, the current main fiscal rule in place in WAEMU is a maximum of 3% deficit limit rule and I document that the countries in this union are heterogeneous in their fiscal needs and their fiscal implementation. I found that, compared to a counterfactual scenario with no fiscal rule, all the union countries benefit from the uniform fiscal rule of maximum of 3% deficit limit. However, we could even do better than the uniform rule in place.

The reforms to current fiscal rule is a country-specific rule. My results show that when all the countries are constrained to a uniform rule, at least, 24% of welfare are forgone compared to a country-specific rule.

I also found that the spillover effects matter in the design of the rule for WAEMU countries. This reinforces the necessity of coordination of the rule for the union. Indeed, my findings suggest that much more flexibility is required for the governments when the spillover effects are considered in designing the rules. Thus, the interest rate of the union increase so to discipline governments to overborrow.

The implementation of a country-specific rule for an Economic an Monetary Union could, in practice, encounters some resistance. However, this research rise some debate in the way of designing rules for union. The significant loss in welfare induced by the uniform rule deserves a rethink of how to design these rules.

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## Appendix

### A Figure A: Heterogeneity in fiscal needs for WAEMU countries from 1960-1999

Figure A.1: Government revenue over GDP from 1960-1999

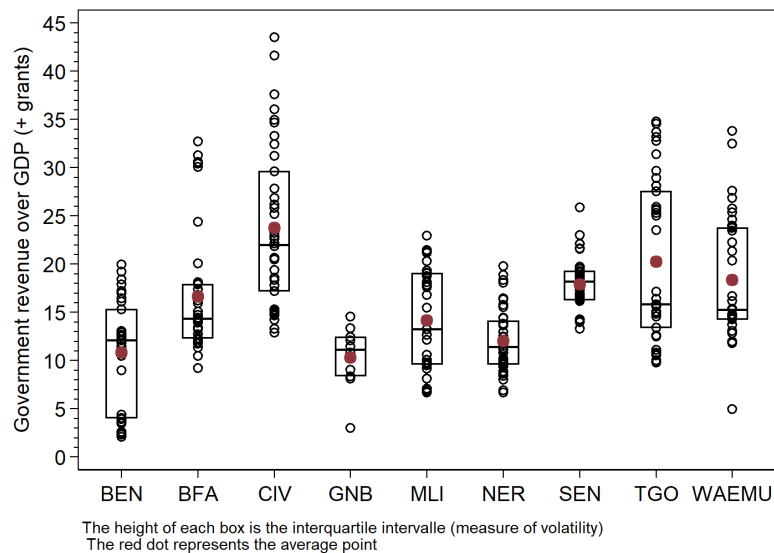


Figure A.2: Government Spending over GDP from 1960-1999

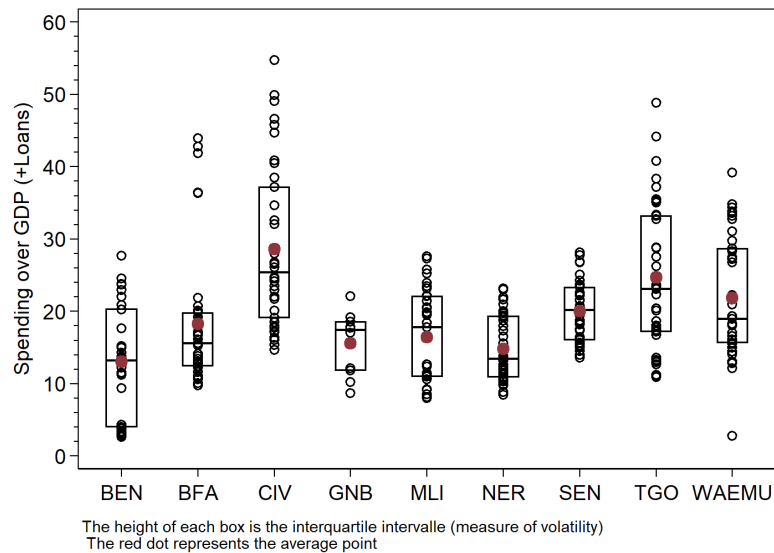
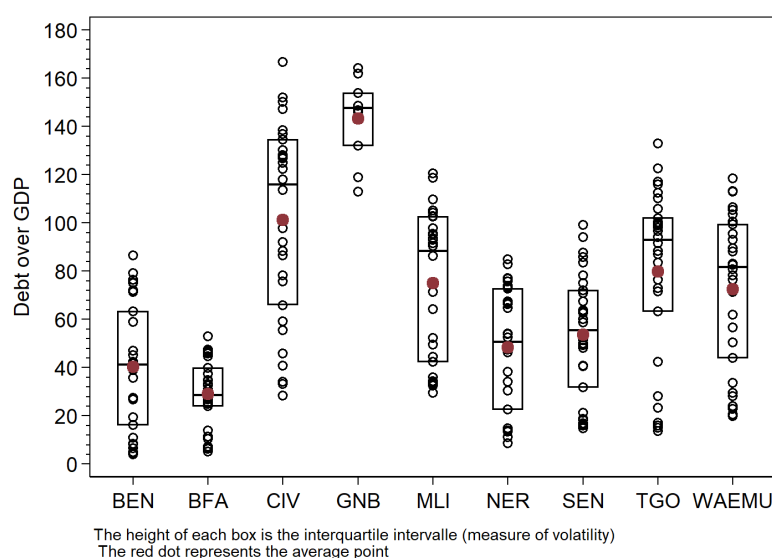


Figure A.3: Government debt over GDP from 1960-1999



## B Figure B: Heterogeneity in fiscal needs for WAEMU countries from 2000-2014

Figure B.1: Government revenue over GDP from 2000-2014

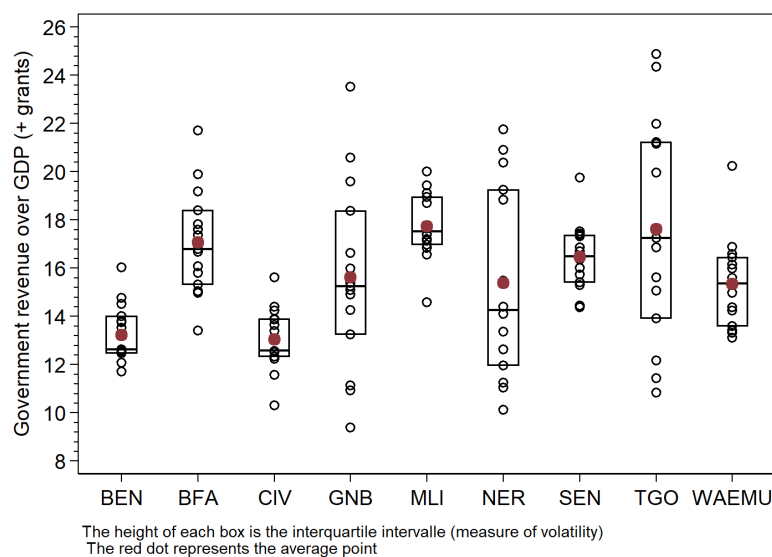


Figure B.2: Government Spending over GDP from 2000-2014

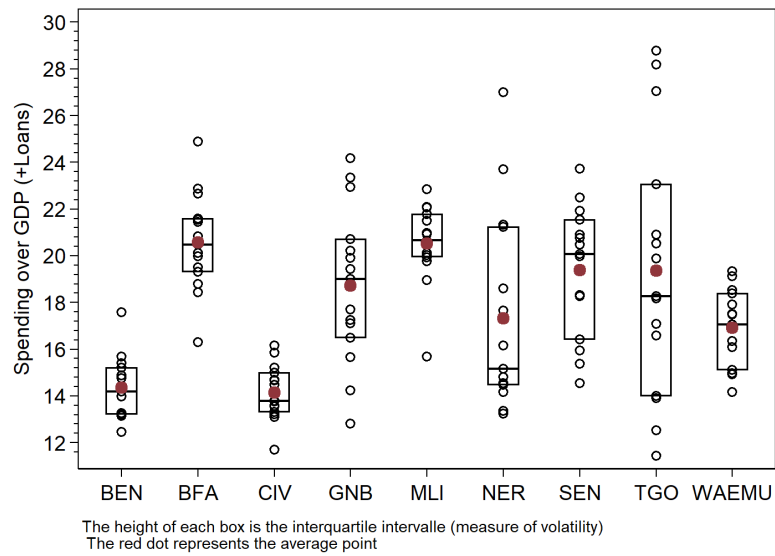
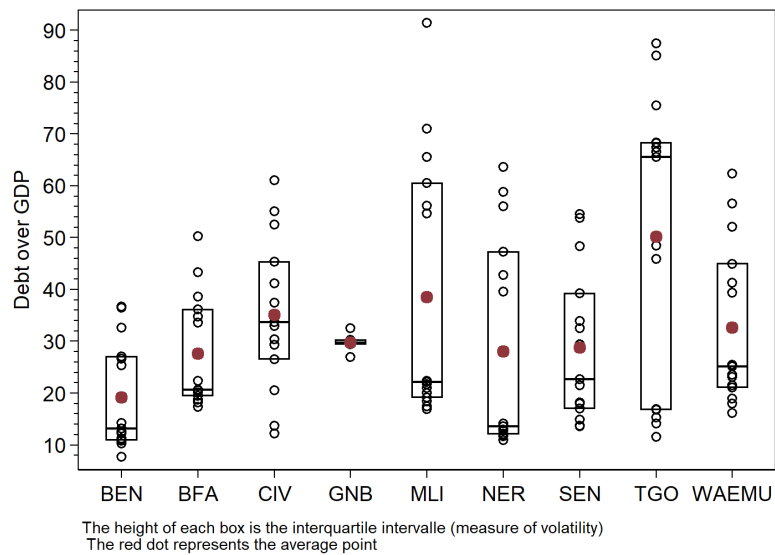


Figure B.3: Government debt over GDP from 2000-2014





## A Table A: Number of countries that derogate the deficit rule between 2000-2014

Table A.1

	2002	2004	2006	2008	2010	2012	2014
<b>Deficit limit* &gt;3% GDP</b>	3	2	2	3	2	2	2
<b>Deficit limit &gt;0% GDP</b>	8	7	6	7	6	8	8

Deficit limit \* excluded externally financed capital expenditures

## B Table B: Homogeneity tests

Table B.1

<i>Homogeneity tests between WAEMU countries 1960-1999</i>			
		<i>Fstat</i>	<i>p-values</i>
<i>Revenue</i>	H0: Mean equality	<b>19.023</b>	<b>0.000</b>
	H0: Variance equality	<b>12.256</b>	<b>0.000</b>
<i>Spending</i>	H0: Mean equality	<b>16.359</b>	<b>0.000</b>
	H0: Variance equality	<b>9.942</b>	<b>0.000</b>
<i>Budget Balance</i>	H0: Mean equality	<b>4.484</b>	<b>0.000</b>
	H0: Variance equality	<b>9.111</b>	<b>0.000</b>
<i>Debts</i>	H0: Mean equality	<b>30.454</b>	<b>0.000</b>
	H0: Variance equality	<b>7.817</b>	<b>0.000</b>

Levene's test for equality of variances is used for test of variances homogeneity

Table B.2

<i>Homogeneity tests between WAEMU countries 2000-2014</i>			
		<i>Fstat</i>	<i>p-values</i>
<i>Revenue</i>	H0: Mean equality	<b>3.385</b>	<b>0.003</b>
	H0: Variance equality	<b>3.250</b>	<b>0.004</b>
<i>Spending</i>	H0: Mean equality	<b>10.240</b>	<b>0.000</b>
	H0: Variance equality	<b>7.667</b>	<b>0.000</b>
<i>Budget Balance</i>	H0: Mean equality	<b>1.294</b>	<b>0.260</b>
	H0: Variance equality	<b>2.150</b>	<b>0.044</b>
<i>Debts</i>	H0: Mean equality	<b>15.971</b>	<b>0.000</b>
	H0: Variance equality	<b>19.085</b>	<b>0.000</b>

Levene's test for equality of variances is used for test of variances homogeneity

Table B.3

<i>Homogeneity tests between WAEMU countries 1960-2019</i>			
		<i>Fstat</i>	<i>p-values</i>
<i>Revenue</i>	H0: Mean equality	<b>13.601</b>	<b>0.000</b>
	H0: Variance equality	<b>12.558</b>	<b>0.000</b>
<i>Spending</i>	H0: Mean equality	<b>12.583</b>	<b>0.000</b>
	H0: Variance equality	<b>14.435</b>	<b>0.000</b>
<i>Budget Balance</i>	H0: Mean equality	<b>2.040</b>	<b>0.049</b>
	H0: Variance equality	<b>3.454</b>	<b>0.001</b>
<i>Debts</i>	H0: Mean equality	<b>25.544</b>	<b>0.000</b>
	H0: Variance equality	<b>26.042</b>	<b>0.000</b>

Levene's test for equality of variances is used for test of variances homogeneity

## C Table C: Robustness Check

Table C.1

<i>Optimal deficit limit (DL) and GEV from 3% to optimal rule in %</i>								
	<i>BEN</i>	<i>BFA</i>	<i>CIV</i>	<i>GNB</i>	<i>MLI</i>	<i>NER</i>	<i>SEN</i>	<i>TGO</i>
$\delta$	<b>0.93</b>	<b>0.93</b>	<b>0.93</b>	<b>0.93</b>	<b>0.93</b>	<b>0.93</b>	<b>0.93</b>	<b>0.93</b>
DL (in%)	<b>0.84</b>	<b>1.56</b>	<b>0.39</b>	<b>3.49</b>	<b>1.83</b>	<b>1.56</b>	<b>0.70</b>	<b>2.32</b>
$\Lambda$ (in%)	<b>0.17</b>	<b>0.03</b>	<b>0.06</b>	<b>0.01</b>	<b>0.03</b>	<b>0.05</b>	<b>0.11</b>	<b>0.01</b>

Table C.2

<i>Joint country-specific fiscal rule</i>								
	<i>BEN</i>	<i>BFA</i>	<i>CIV</i>	<i>GNB</i>	<i>MLI</i>	<i>NER</i>	<i>SEN</i>	<i>TGO</i>
$\delta$	<b>0.930</b>	<b>0.930</b>	<b>0.930</b>	<b>0.930</b>	<b>0.930</b>	<b>0.930</b>	<b>0.930</b>	<b>0.930</b>
DL (in%)	<b>11.81</b>	<b>3.36</b>	<b>9.21</b>	<b>2.86</b>	<b>6.41</b>	<b>4.17</b>	<b>4.13</b>	<b>8.02</b>
$\Lambda$ (in%)	<b>0.019</b>	<b>0.025</b>	<b>0.200</b>	<b>1.056</b>	<b>0.181</b>	<b>0.344</b>	<b>0.138</b>	<b>0.138</b>

- The equilibrium interest rate is 7.24%