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PUBLIC EXPENDITURES AND GROWTH IN A MONETARY UNION: THE CASE OF WAEMU*

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Abstract

The focus of the paper is on how public spending volume, composition (current versus capital) and quality are linked to economic growth in lower-income countries that are members of a monetary union. We specifically investigate the case of the West Africa Economic and Monetary Union (WAEMU) countries, which have fluctuating growth rates and relatively low-income levels compared to other parts of the world. The empirical analysis covers the period 2000-2013. The results indicate that total public spending has a significant impact on growth. While the impact of the capital component is positive and statistically significant, the effect of the current component tends to be negative, but not significant. When the capital component is further split into two: public fixed capital investment and public other capital expenditures, defined as total public capital expenditure minus public fixed capital investment, the results show that not only physical capital formation but also human capital spending is important for growth. While the volatility measure for public investment has a clear negative and statistically significant impact on growth, the quality of public fixed investment has a positive impact. The findings also indicate that fiscal deficits have not been an important constraint to the effectiveness of government spending on growth, reflecting the fiscal discipline achieved in the union. On the other hand, the debt-to-GDP ratio clearly shows a significant negative impact on growth, indicating the risk associated with debt distress. Total fiscal revenue has a significant and positive effect on growth, most likely indicating relatively low levels of fiscal revenues to GDP ratios, partially boosted by natural resources, coupled with grants. In each regression specification, it is observed that the contributions of both trade openness and private investment on growth are positive and significant. The results also indicate that the quality of institutions, measured by an index of bureaucracy quality, is critical to enhancing the positive effect of public spending on growth. The findings are robust to different regression methodologies, as well as the inclusion of short- and medium-term data.

Keywords: Public Spending, Current and Capital Components, Growth, WAEMU Countries

1. Introduction

Monetary unions help member countries have price and fiscal stability, but they also introduce significant restrictions. In a monetary union, countries can face appreciating real exchange rates

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(leading to lower exports) and/or excess reserve accumulations. If they are resource rich, “Dutch Disease” can be experienced commonly. Another big constraint that member countries have to handle is related to how to finance public spending. The available options are limited in a monetary union. One of the commonly used ways of increasing public funds by lower-income countries is a monetary policy supporting higher money supply. This cannot be a choice in a monetary union. In the absence of the “printing–money” option, public funds can be only raised through higher taxes or borrowing. But unfortunately, such options cannot be easily applied in low-income countries. For low-income countries, grants can be another source of high public revenues, but they are also limited and unstable. All these restrictions force member countries to control the level of government expenditures. Countries have to be more careful about how to allocate limited resources among different public spending options (see, for example, Rusek (2014) for the experience of the European Monetary Union).

This study tries to understand which components of public spending can be more effective on growth so that member countries of a monetary union can allocate their limited resources effectively. In order to accomplish this purpose, this paper empirically studies the importance of public spending volume, composition (current/capital), and quality in determining growth rates in a group of countries belonging to a monetary union, the West African Economic and Monetary Union (WAEMU). WAEMU consists of 8 countries: Benin, Burkina Faso, Cote d’Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo. Out of this group, Cote d’Ivoire, Guinea-Bissau, Togo and Burkina Faso experienced political turmoil during the period of analysis, while Mali and Niger remain vulnerable to security issues, which have contributed to the fragility of the group. From the fiscal revenue viewpoint, none are considered predominantly natural resource-rich; however, many generate fiscal revenues from natural resources (mining, oil) with an increasing economic and fiscal potential (see, for example, Guleryuz (2017) to understand the positive impact on natural resource rents on economic growth).

WAEMU countries have among the lowest GDP per capita levels in the world and exhibit relatively low and irregular GDP per capita growth rates, mainly because their economies are not well diversified and they have relatively high population growth rates. Given that they participate in the currency union in which the CFA Franc, their common currency, is pegged to the Euro, the use of monetary and exchange rate policies as macroeconomic tools is not possible at the individual country levels; therefore, fiscal policies, and especially the composition of their public spending, become critical determinants of growth and development. Their trade partnership with China has helped them further (see Bayraktar (2017) for details).

As a benefit of the currency union, the WAEMU countries have managed to maintain relatively low fiscal deficits. Their fiscal revenue levels, however, are still relatively low and volatile, which limits their ability to finance public expenditure. Most countries are still heavily dependent on foreign aid.

The plan of the paper is as follows. Section 2 summarizes the literature on public spending and its composition and effects on growth. In section 3, data and graphical analysis are presented. In section 3.1, growth rates in the union are investigated. Section 3.2 provides data information on total public spending and presents their trends in comparison with the growth paths observed during the last decades. Section 3.3 focuses on the analysis of the current and capital categories of public spending and their links to growth rates in the union. Section 3.4 considers the effects of the quality of institutions. Section 4 presents the regression results investigating the effects of public spending and its current and capital components on growth. It also includes robustness checks. Section 5 concludes with policy implications.

2. Literature Review

Despite the fact that the link between public expenditure and economic growth has been investigated extensively, it has been difficult to establish robust conclusions (see Slemrod *et al.* (1995) for the literature review on the relationship between growth, government expenditures, and taxes). In recent years, there has been some convergence in terms of the importance of public expenditures on growth.

Folster and Henrekson (2001) present that, as econometric problems are addressed, the relationship between government size and economic growth gets more robust. Gupta *et al.* (2005) show that government spending, especially the capital component, has a positive effect on growth for low-income countries when the link is combined with a lower budget deficit. Baldacci *et al.* (2008) find that after explicitly controlling for governance, and incorporating nonlinearity, both education and health spending lead to higher growth rates in developing countries. Ramirez (2004), Ang (2009), and Colombier (2011) studying the case of Mexico, Malaysia, and Switzerland respectively, and Wahab (2004) and Colombier (2009), focusing on OECD countries; all support the importance of public capital expenditure, especially infrastructure spending, for higher growth.

Even when we focus on the empirical studies, using specifications and/or estimation methods similar to the one used in this paper, we continue to observe conflicting empirical results. Using a set of 22 developed countries, Kneller *et al.* (1999) and Bleaney *et al.* (2001) conclude that productive expenditure is good for growth, but distortionary taxes lower its impact. Using a panel of 30 developing countries over the 1970s and 1980s and a setting where government budget surplus/deficit and tax revenue are introduced, Bose *et al.* (2007) find that while the capital component of government expenditure, especially education expenditure, has a positive effect on growth, the current component does not have any significant impact. Acosta-Ormaechea and Morozumi (2013) show that public capital spending relative to the current component appears to be associated with higher growth. Similar to our paper, Benos (2009) uses GMM for panel datasets and considers the revenue side of the budget constraint, as well as the budget balance. Benos (2009) shows, using European Union countries, that reallocating government expenditure, especially toward infrastructure and human capital, can improve growth. Sennoga and Matovu (2013) show that reallocation of public expenditures away from the unproductive sectors to the productive sectors leads to higher economic growth and accelerates poverty reduction in Uganda. Moreno-Dodson (2008) and Bayraktar and Moreno-Dodson (2015) include fast-growing developing countries versus a mixed group of countries. They indicate that the relationship between total public spending, especially productive components, and growth is overall positive.

One missing component in the literature on public spending and growth is a systematic study of low-income countries which are members of monetary unions. Monetary unions help individual countries gain fiscal and price discipline, but at the same time introduce many restrictions (see, for example, Mbemba, 2011). Most importantly, the use of monetary policies is going to be out of question to finance their fiscal spending. It means that such low-income countries will have very limited public resources and heavily depend on unstable foreign aid and grants. In the presence of significant restrictions, it becomes more important to analyze what the best ways of allocating limited public revenues would be for such countries.

In this paper, the focus is specifically on the WAEMU countries, which are relatively homogenous. This way, we can understand how the link between growth and public spending works for lower-income countries which are members of a monetary and economic union. In the literature, there is a limited number of papers on public spending or investment in the WAEMU region. For example, Dessus *et al.* (2014) study pro-cyclicality of public investment; Dore and Masson (2002) investigate budgetary convergence; Hitaj and Onder (2013) study fiscal discipline in WAEMU region. To our best knowledge, our paper is the only empirical study attempting to systematically investigate the relationship between growth and government spending, specifically for the WAEMU countries. Despite the fact that data limitations constitute a challenge, we can still introduce many different types of regression specifications and estimation techniques to better understand the link between public expenditure and growth.

3. Data Analysis

In this section, we investigate the growth performance of the WAEMU countries and the link between public spending and growth. We consider different components of public spending. The data analysis also includes the investigation of related variables, such as quality of governance in the WAEMU group.

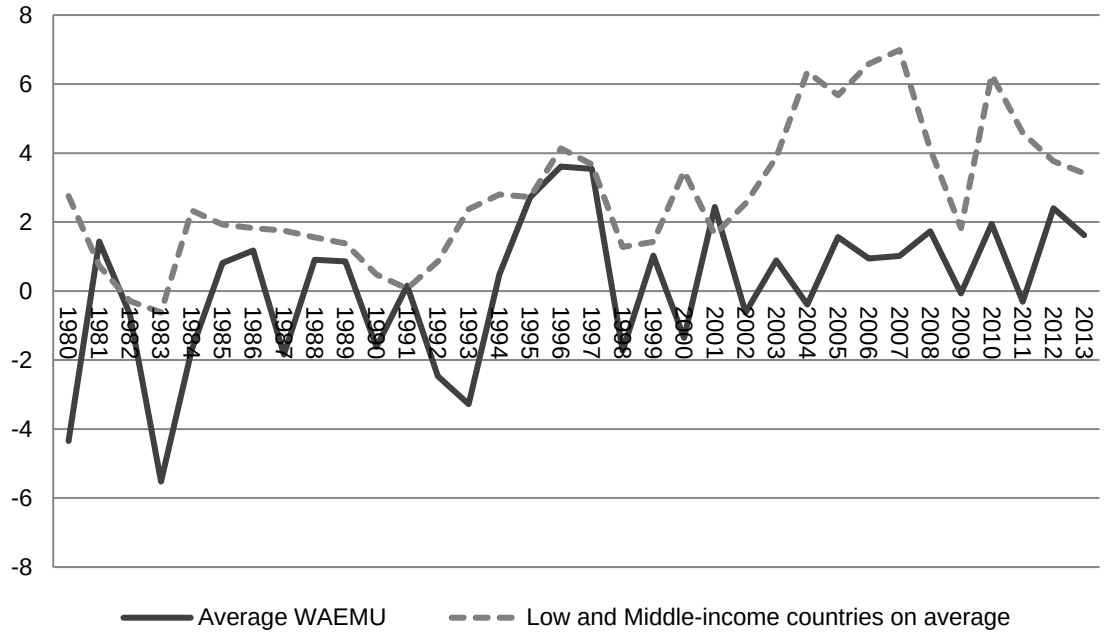

Figure 1. GDP per capita (% growth)

3.1. Analysis of growth rates in the WAEMU group

Figure 1 shows that, since the 1980s, per capita growth rates and income levels have been relatively low with enormous fluctuations despite higher GDP growth rates in the last decade. Figure 1 presents the time-trend of the average GDP per capita growth rate between 1980 and 2013 in the region and, for comparison purposes, in low- and middle-income countries. The average value of the GDP per capita growth rate in the region is choppy around the zero line. GDP per capita growth rates in the WAEMU are almost always below the growth rates of the comparator group of countries. In addition, while other groups' average per capita growth rates jumped in the first half of the 2000s, we do not observe such improvements for the WAEMU group.

Table 1 compares GDP per capita and growth rates of the WAEMU group with the SSA region as a whole and with the group of low- and middle-income countries. The average growth rate of the WAEMU countries is close to the SSA average. But the gap between the growth rates in the WAEMU and the rest of the developing countries is close to 1.5 percentage points. While Benin, Burkina Faso and Mali are above the SSA average, the countries most affected by political instability, Cote d'Ivoire, Togo, Guinea Bissau, and Niger, exhibit negative GDP per capita growth rates.

Table 1. GDP Growth and Growth Per Capita Rates (averages 1980-2013)

	GDP growth (annual %)	GDP per capita (constant 2005 US$)	GDP per capita growth (annual %)
Benin	4.10	499	0.94
Burkina Faso	5.01	339	2.17
Cote d'Ivoire	1.30	1068	-1.46
Guinea-Bissau	2.12	448	-0.10
Mali	3.21	385	0.69
Niger	2.38	292	-1.02
Senegal	3.09	721	0.23
Togo	2.63	412	-0.19
Average for WAEMU	**2.98**	**520**	**0.16**
Sub-Saharan Africa	**3.03**	**841**	**0.27**
Low & middle income	**4.49**	**1452**	**2.77**

We also investigate the time trend for the growth rate of GDP per capita in each individual country for the period between 1980 and 2013 (figures are available upon request). There is no single country without sharp fluctuations in their growth rates. The growth rates in Guinea-Bissau fluctuate the most, between +15 percent and -30 percent. This range is relatively narrower for Benin, Burkina Faso, and Senegal. Interestingly, the fluctuations in growth rates are not synchronized, often reflecting unrelated shocks and political events specific to each country. The growth rates of the individual countries do not follow average growth rates for the region.

3.2. Analysis of total public spending and public capital formation in the WAEMU countries

A priori, the level of public spending, including capital items, can be an important determinant of the growth rates in the group (see, for example, Agénor *et al.* 2008). The share of general government total expenditure in GDP increased almost continuously in the WAEMU countries between 1985 and 2013, as demonstrated in Figure 2. This increase was impressive between 1985 and 1993 (the decade preceding the CFA Franc devaluation in 1994), as the ratio jumped from 12 percent to 21 percent. Its level in 2013 was close to the average for low-middle income countries, although still lower than the SSA average by 2 percentage points, and much lower than the world average of the ratio of public expenditures to GDP, which was approximately 10 percentage points higher (Figure 2).

Gross public fixed capital formation is an important component of total government spending. This component includes those investments in infrastructure which are considered essential for private sector activity and, as a result, for higher growth rates (Bayraktar and Fofack, 2011). The shares of gross public fixed capital formation as a percentage of GDP are relatively low on average for the WAEMU countries (Figure 3). The share is low, but it has been increasing in the recent years, from 4 percent of GDP in 1994 to 8 percent of GDP in 2013. Despite this recent upward trend, the average value of the share of public fixed capital formation in GDP is still below the rates observed in the first half of the 1980s. When the WAEMU countries are compared with other low-income countries and SSA countries, the value is lowest in the WAEMU countries.

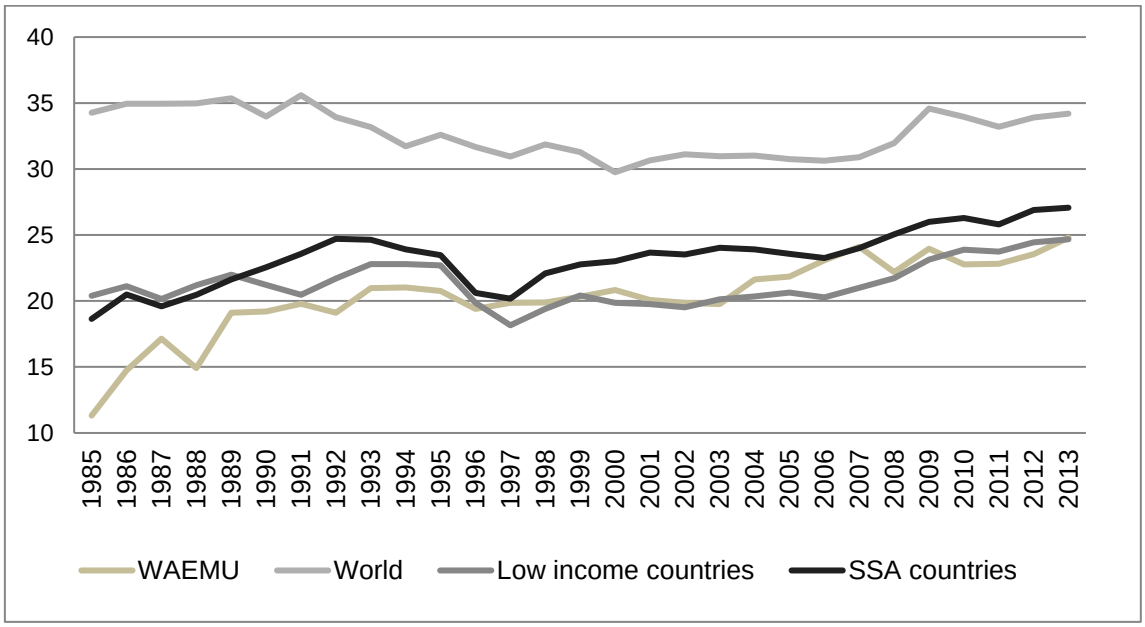

Figure 2. General government total expenditure (% of GDP)

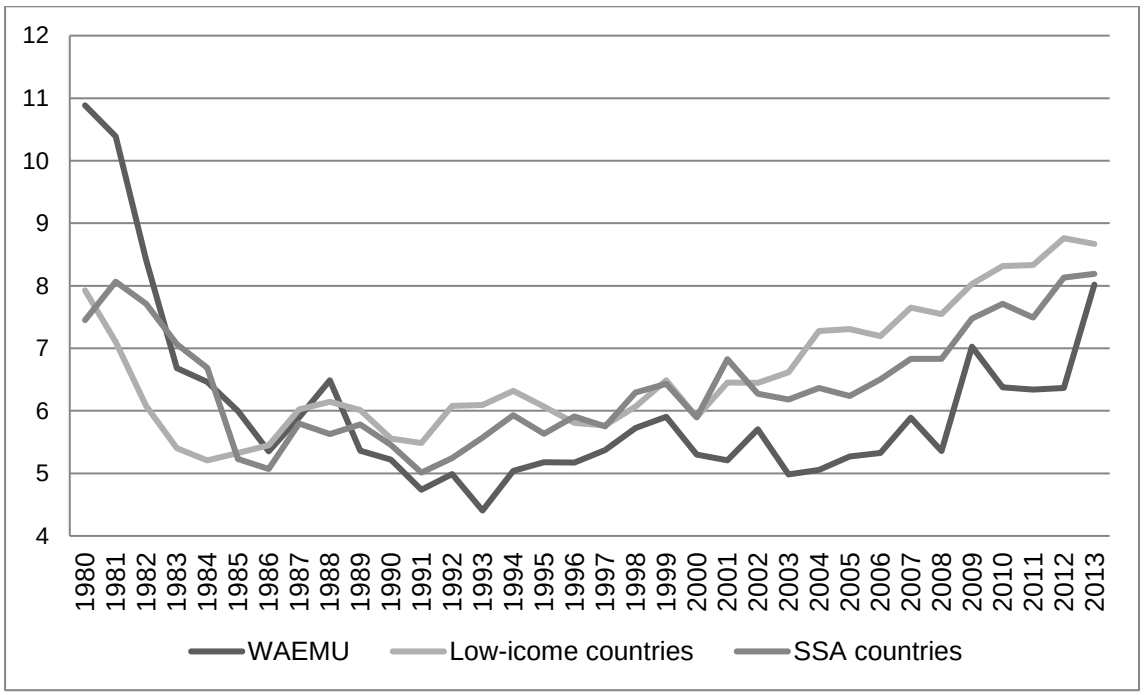

Figure 3. Average gross fixed public capital formation (% of GDP)

A priori, the link between the average share of public fixed capital formation in GDP and growth rates is expected to be strongly positive (see, for example, Agénor *et al.* 2008). It should be noted that the statistical and graphical analyses in this and the following section do not indicate any causality between the variables. We can see the evolution of these variables in Figures 4 and 5 for the growth rate of GDP and the growth rate of real GDP per capita, respectively. The averages are calculated for the period of 1980 and 2013. The linear trend lines are also included in the figures. Burkina Faso, Benin, Mali, and Togo have higher rates of growth; and, at the same

time, they also have high shares of public fixed capital formation. On the other hand, the countries with lower average growth rates also tend to have lower public fixed capital formation. One exception is Cote d'Ivoire. Despite the fact that the country has almost 5 percent public investment, it has the lowest average growth rate in the group. This may be indicative of the quality of the investment and/or its management, but more analysis is necessary to understand other factors, such as the amount of financing available, contributing to this result.

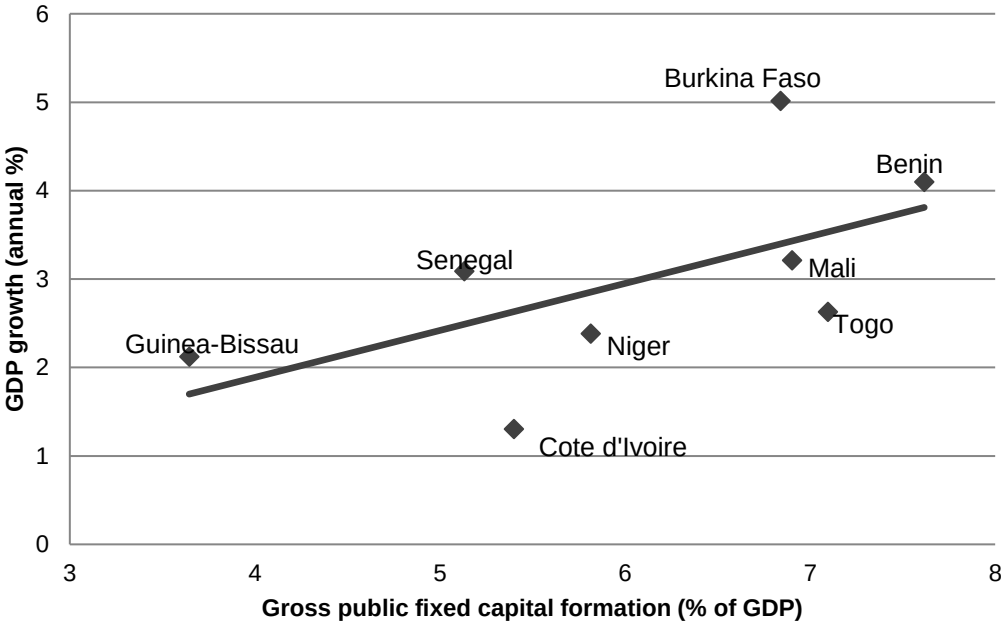

Figure 4. WAEMU- Gross fixed public capital formation and Growth (averages 1980-2013)

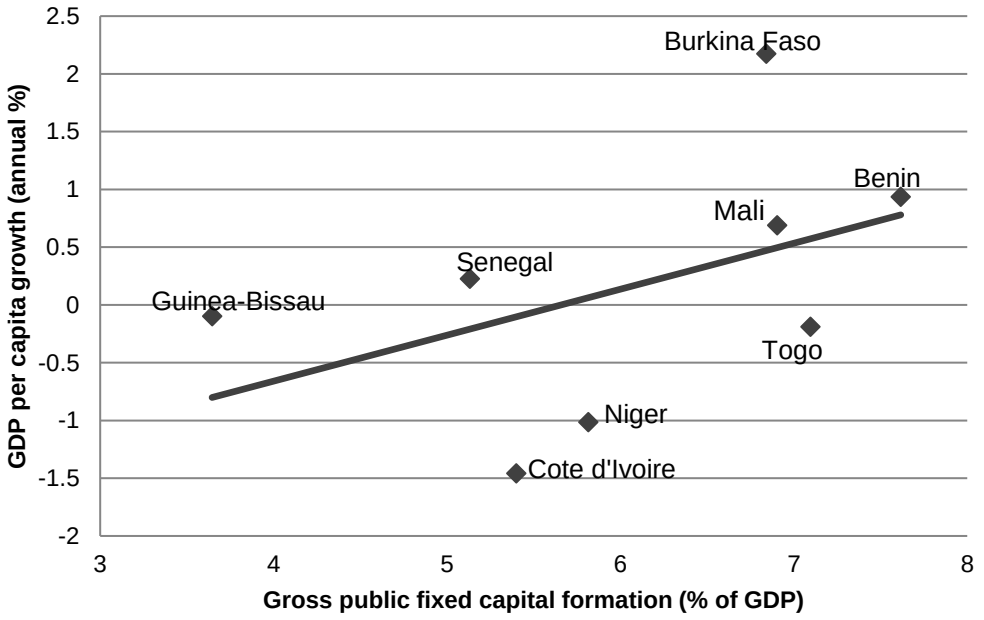

Figure 5. WAEMU- Gross fixed public capital formation and Per Capita Growth (Averages 1980-2013)

These empirical observations indicate that there must be a link between growth performance of countries and their fixed public capital formation. Thus, we included public capital formation and fixed capital formation in the empirical regression specification.

3.3. Analysis of current and capital classification of public spending

Public spending is classified into capital and current components and their average values are calculated for the period of 2000-2013. Current and capital expenditures are defined in Section 4. It should be noted that the definitions of capital expenditures and public gross capital formation are different. While capital expenditure includes all types of assets in the areas of, for example, health, education, and infrastructure, public gross capital formation covers only fixed assets such as infrastructure. Public gross capital formation (gross investment) consists of outlays in addition to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.

While Figure 6 presents a comparison of trends for the average growth rate and the current component of public spending, Figure 7 shows the same comparison with the capital component. The figures include simple linear trends. As can be seen in Figure 6, Niger has the lowest average current spending, and its growth performance is relatively good. Current spending includes government wages and salaries, debt service payments, recurrent expenditures, such as operations and maintenance, and other current expenditures such as transfers. The observed negative correlation, a priori, could indicate that the large amounts allocated to debt service repayment in many countries do not contribute to growth (see, for example, Fosu, 2010). However, this result has to be interpreted in consideration of other factors, as indicated in the next sections. Even though the share of current spending is similar both in Burkina Faso and Guinea-Bissau, the latter has grown much slower, possibly due to conflict and political instability factors. Cote d'Ivoire has the highest share of the current public spending component, and at the same time the lowest average growth rates.

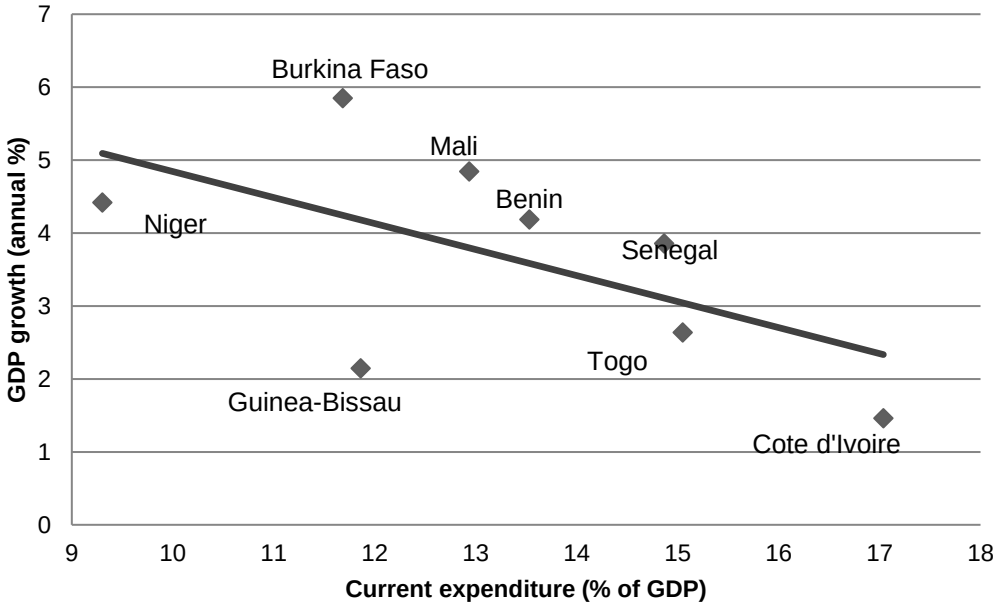

Figure 6. GDP Growth Rates and Current Public Expenditure (averages 2000-2013)

The results in Figure 7 show almost the reverse ordering of countries when compared to the results in Figure 6. Cote d'Ivoire appears in the left-hand corner of the figure with the lowest

growth rate and lowest capital spending. On the other hand, Burkina Faso has the highest capital expenditure and the highest average growth rates between 2000 and 2013. The results indicate that in Guinea-Bissau growth has not followed the same evolution as public investment. While the share of capital spending is relatively high in that country, its average growth rate is the lowest in the group. Even though Niger and Benin have almost the same capital spending ratios like Guinea-Bissau, their growth rates are almost 2.5 percentage points higher.

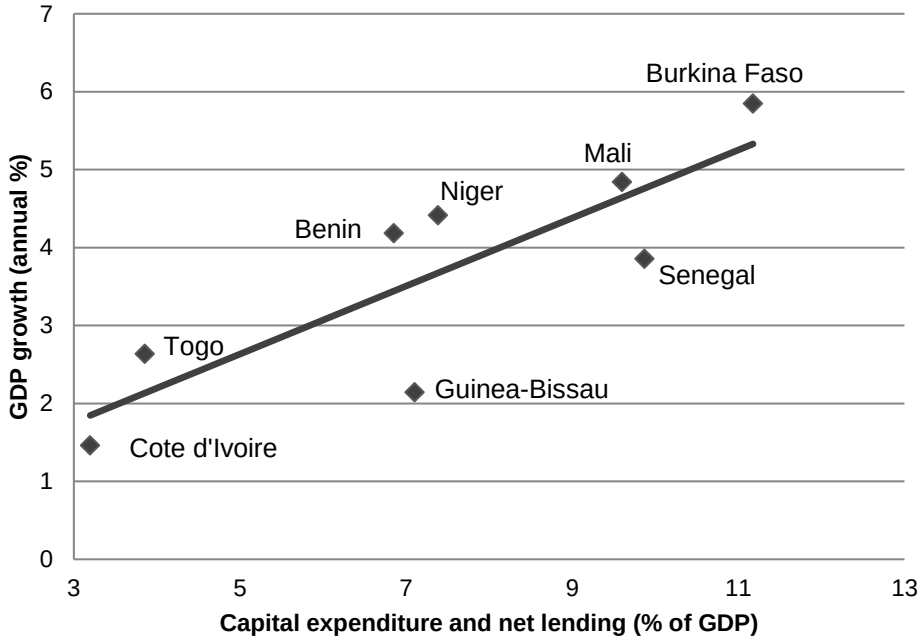

Figure 7. GDP Growth Rates and Capital Public Expenditure (averages 2000-2013)

These simple graphical presentations show that there is a link between growth rates and the share or capital versus current public spending. Thus, we have included these two variables in our regression specification.

3.4. Analysis of the Quality of Institutions

Improvements in the quality and effectiveness of government institutions are essential ingredients of a balanced economic development process. Without solid institutions and good governance, public spending can be easily wasted.

In our analysis, the bureaucracy quality indicator measures the quality of institutions. The series are collected from the International Country Risk Guide Database. The range of the series is between 0 and 4, where 0 corresponds to the lowest quality. The indicator's methodology is defined in the ICRG User Guide in the following way: "The institutional strength and quality of the bureaucracy is another shock absorber that tends to minimize revisions of policy when governments change. Therefore, high points are given to countries where the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services. In these low-risk countries, the bureaucracy tends to be somewhat autonomous from political pressure and to have an established mechanism for recruitment and training. Countries that lack the cushioning effect of a strong bureaucracy receive low points because a change in government tends to be traumatic in terms of policy formulation and day-to-day administrative functions."

Figure 8 presents the time trend of this indicator for seven WAEMU countries for the period of 1990 to 2014. It should be noted that Benin is excluded due to the lack of data. In the figure, we observe a declining trend. The quality of bureaucracy has been clearly dropping for the

WAEMU countries. Throughout the period, the value of the indicator has been continuously zero for Mali. Cote d'Ivoire faced the highest drop in the group from 3 to 0 between 1990 and 2001 and stayed at the zero level after that. Senegal dropped by 1 point from 2 to 1 between 1990 and 1998; then it stays at the 1-point level throughout the period. In recent years, the indicators only in Niger and Guinea-Bissau have improved very slightly, moving from the 1 point range to the 1.5 points range.

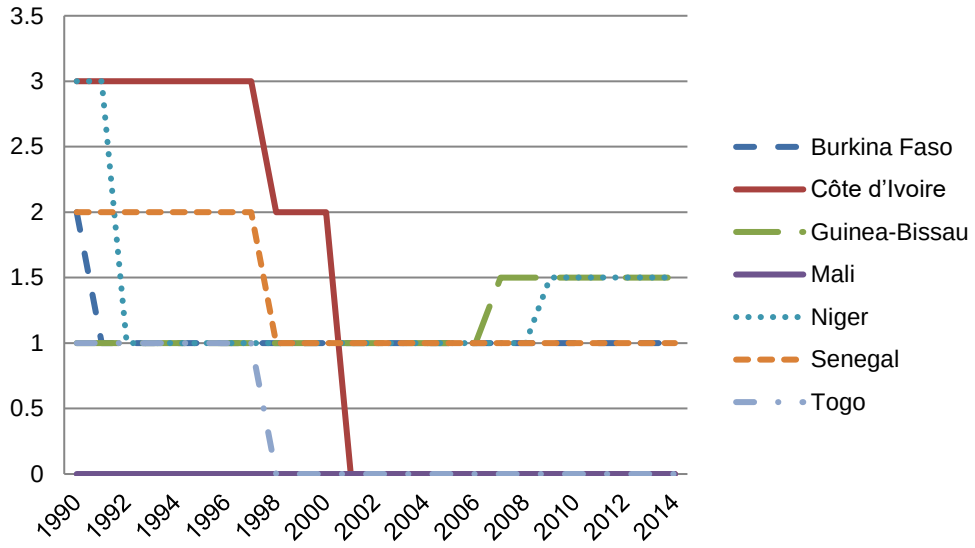

Figure 8. Bureaucracy Quality Indicator (1990-2014)

The low values of the quality and effectiveness of government indicators for the WAEMU countries clearly indicate that the impact of public spending and its components on growth may be undermined by institutional failures. In this subsection, we learn that the quality and effectiveness of governance indicators can be important for the growth performance of countries. Bayraktar and Moreno-Dodson (2015) suggest that governance indicators determine the effects of public spending on growth; countries with better quality of public institutions have more productive public spending. Rajkumar and Swaroop (2008) also show the importance of good governance for effective public spending.

4. Regression analysis using current and capital expenditure classification

In order to better understand the impact of public spending on growth, any empirical analysis must take into account other variables which may affect growth as well. The objective is to draw implications to guide policymakers, to the extent that different public spending allocations may involve dynamic tradeoffs in their impacts on growth.

Public expenditures can affect economic activities through both demand- and supply-side effects (Hemming *et al.* 2002). The size and form of demand-side impacts depend on whether the economy has unused capacities and whether changes in public expenditures are permanent or temporary. If the economy has an excess capacity, higher public spending can increase economic activities directly through the higher demand for goods and services, as well as through its multiplier effects on private consumption. It is suggested that this type of demand-side effects are stronger in developing countries when compared to advanced economies (Schclarek, 2003). If public expenditures are increased beyond the unused capacity of the economy, inflationary pressures are expected in the short term. If such expenditures are permanent, they can lead to expanded capacity of the economy in the longer term.

Government spending can also have a direct effect on aggregate supply. Public expenditures in infrastructure, education, research and development can lead to a higher

productive capacity of the economy. Supply-side effects must be investigated in the medium or long run because it takes time to make such spending productive and observe a sustained increase in growth.

Our analysis focuses first on the short term in order to capture demand-side effects of public spending on growth. Second, we also run medium-term regressions to capture the supply-side effects. Since the medium-term results validate the ones in the short term, we can interpret the second exercise as a robustness check indicating that the effects observed are beyond a demand response.

In the absence of detailed and comparable data on economic classifications of public spending in the WAEMU countries, we focus on its current and capital components. Many different factors can determine the link between public spending and growth. The following subsections discuss the details of the regression analysis.

Data: All WAEMU countries are included in regressions. The regression period is 2000-2013. The time period may change slightly from one country to another depending on data availability at the country level. The main data sources are the African Development Indicators Database, the World Economic Outlook Database, and the World Development Indicators Database. Annual data are used in the empirical analysis, meaning that the focus is on the short-term growth impact of government spending. In Table 5 column (3), we run a medium-term regression using 3-year averages, and show that the results are robust. We cannot run longer-term regressions due to data limitations.

Econometric Methodology: A dynamic panel technique (system GMM) is applied and the results are compared with those obtained with the static panel regressions. Table 5 compares different regression methodologies. The system GMM is preferred since it is quite likely that the right-hand-side variables may not be exogenous, as they can be determined by variables that are not controlled for in the empirical specifications. The system GMM allows for a rigorous treatment of the endogeneity of public spending with respect to growth in order to have more reliable and precise results (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998). More specifically, we use a two-step GMM methodology which requires taking the first differences of the variables. It should be noted that time and fixed-effect dummies are introduced in levels. The introduction of a set of instrumental variables with GMM techniques helps us control for possible endogeneity among regressors. Some examples of papers on public expenditures or its components which use this methodology while running regression specifications are: Afonso and Alegre (2011), Cavalloa and Daude (2011), Bayraktar and Moreno-Dodson (2015), and Gupta *et al.* (2014). In the regressions, the set of instruments consist of lagged values of dependent and independent variables. Only the first lags of the variables are used as instruments due to data limitations. Defining the set of instrumental variables has been always challenging when one uses GMM methodologies in regression analyses. Our set of instruments may not be the most ideal one, but this is the best set of instruments that we can introduce because the availability of government data for the WAEMU countries is scarce. It should also be noted that in the following regression tables, it can be seen that our instruments pass most tests. J-test is for an over-identification problem where H_0: there is no over-identification problem. We fail to reject in each case. For serial correlation z-tests (AR(2)), H_0 is "there is no serial correlation"; and for normality test, H_0 is "normal distribution". We fail to reject H_0 in each test. The only problem is with AR(1) tests. We fail to reject these tests, indicating that the set of instrumental variables is weak. However, after trying alternative sets of instrumental variables, we concluded that it is the best available set of instruments which can be introduced in our analysis. In the following subsections, we show that our main results are robust to alternative specifications and methodologies. While the GMM results refer to a dynamic, multi-year framework, the analysis overall is based on annual data. In the following subsection, alternative regression methodologies are used to demonstrate the robustness of the results.

Empirical Specification: Our working assumption is that the growth rate of countries can be determined by accumulation of private capital (private investment), trade openness, accumulation of human capital, accumulation of public capital (measured by public investment or public capital spending), other public spending items, budget balance, public revenue, and macroeconomic stability (measured by inflation). The empirical specification is shaped based on

this working assumption. As presented in the following subsections, we also test alternative regression specifications and different regression methods to check the robustness and relevance of our empirical results.

Similar to the regression specifications in Bayraktar and Moreno-Dodson (2015), we include fiscal revenues and the overall government budget constraint. Bayraktar and Moreno-Dodson (2015) conclude that public spending can be a significant determinant of growth only when the funds are used for productive purposes. The introduction of the government budget constraint has been essential in similar studies to consider the possible positive effect of public spending on growth while taking into account its sources of financing and their possible negative implications for growth. The empirical specification with the budget constraint avoids bias associated with incomplete specification, ignoring financing options of governments and budget balance (see Kneller *et al.* (1998) and (1999), Bose *et al.* (2007), Benos (2009), and Bayraktar and Moreno-Dodson (2015)). Both the uses and the sources of funds need to be considered together for any meaningful evaluation of the effects of expenditures, taxes, and the overall fiscal balance on growth. When looking at the estimated coefficients of public spending together with fiscal revenue and balance, the net effect of public spending on growth can be seen more clearly.

Due to the inclusion of the budget constraint in the regressions, we excluded some expenditure items named as "other expenditures" (most of them non-classified or classified as "others") to prevent any multi-collinearity problems. In some specifications, total fiscal revenues are disaggregated into tax and non-tax revenues. Grants are also included as part of total revenues because they are very significant in the WAEMU region.

Before running any regression, we conducted the correlation matrix to check for any multi-collinearity problems. Table 2 reports the correlation coefficients. It can be seen that pairwise correlation coefficients are not high enough to cause any multi-collinearity problems.

The basic panel regression equation is defined as:

$$\hat{y}_{it} = b_1\hat{y}_{it-1} + b_2 OPEN_{it} + b_3 HC_{it} + b_4 FR_{it} + b_5 PE_{it} + b_6 FS_{it} + b_7 CPIINF_{it} \quad (1)$$

where:

- *i* is the country index,
- *t* is the year index,
- $\hat{y}$ is the rate of growth of real GDP per capita,
- *OPEN* is the ratio of exports plus imports to GDP [in some regressions, the private investment-to-GDP ratio is used as a control variable instead of the openness ratio],
- *HC* is the human capital index,
- *FR* is the ratio of total fiscal revenues to GDP,
- *PE* is the ratio of public expenditures to GDP,
- *FS* is the ratio of the fiscal balance (deficit or surplus) to GDP,
- *CPIINF* is the inflation rate,
- b_1, b_2, b_3, b_4, b_5, b_6, and b_7 are the coefficients assigned to the independent variables.

Two groups of independent variables are considered in the regression specification: fiscal variables and control variables (non-fiscal determinants of growth). In addition to these variables, country and time effects are included in the regression equation as well. The countries in our dataset have different socioeconomic and institutional backgrounds, and their economic performances are significantly different from each other. Thus, we have introduced country fixed effects in the regression specifications to control for country differences. It should be noted that in the regression specifications country dummies are introduced in levels, not in first difference.

Table 2. Correlation Matrix (annual data)

	1	2	3	4	5	6	7	8	9	10	11	12
Total Expenditure /GDP	1.00											
Current expenditure (% of GDP)	0.30	1.00										
Capital expenditure and net lending (% of GDP)	0.52	-0.06	1.00									
Other expenditure (% of GDP)	0.26	-0.37	-0.29	1.00								
Balance fiscal (% of GDP)	-0.29	-0.27	-0.17	-0.03	1.00							
Total rev./GDP	0.41	0.06	0.39	0.12	0.33	1.00						
Total tax/GDP	0.22	0.48	-0.01	0.12	-0.30	0.23	1.00					
Trade (% of GDP)	0.04	0.37	-0.26	0.08	-0.18	0.04	0.21	1.00				
Inflation, consumer prices (annual %)	-0.02	0.12	0.41	0.06	0.00	-0.12	-0.13	-0.03	1.00			
Gross fixed capital formation, private sector (% of GDP)	0.18	-0.12	0.11	0.30	-0.06	0.24	0.41	0.28	-0.03	1.00		
Gross public fixed capital formation, current prices (% of GDP)	0.49	-0.21	0.15	0.20	-0.07	0.33	0.06	-0.09	-0.20	0.19	1.00	
Total debt outstanding at year-end (% of GDP)	-0.04	0.40	0.31	-0.34	-0.05	-0.18	-0.36	0.00	0.40	-0.33	-0.35	1

The selection of control variables is based on the growth literature and country case studies. The share of exports and imports (trade openness) to GDP and the share of private investment in GDP are considered significant determinants of growth (see Edwards, 1993). Another reason to include private investment in the regression equation is to capture some complementarity effects between private and public investment (see, for example, Ramirez, 1996). Alternative specifications with the share of private investment in total investment and in public investment are tested in the "robustness check" section below. Also, foreign investment can be important for growth (see, for example, Boakye–Gyasi and Li, 2017). But, we did not include in the specification because of the limited significance of such investments in the region. The inflation rate is included as a measure of macroeconomic stability. Human capital is also an important determinant for growth. Following Bose *et al.* (2007) and Barro and Sala-i-Martin (2003), we construct the human capital variable as the weighted sum of the enrollment ratios (%) in primary and secondary schools, and in higher education. The weights are 1 for primary school enrollment ratio, 2 for secondary school and 3 for enrollment in higher education. The weights are approximations to the relative values of three types of education. Finally, in the set of control variables, we also include the lagged value of the dependent variable (growth rate of GDP per capita) to take into account the growth inertia factors.

Regarding the fiscal variables, following the literature, as explained above, the government budget constraint is considered in the specification by including revenues, expenditures, and the fiscal balance together. Since the "other expenditures" category of public expenditures is not included in the regression specification, the inclusion of other budget items does not introduce any multi-collinearity problems. It means that since public expenditures do not include "other expenditures" category, total fiscal revenue plus budget surplus is not equal to total public expenditure.

Total public spending items are classified into two groups: current and capital. Current expenditures are defined to include a) requited payments other than for capital assets or for goods or services to be used in the production of capital assets, and b) unrequited payments for purposes other than permitting the recipients to acquire capital assets, compensating the recipients for damage or destruction of capital assets, or increasing the financial capital of the recipients. Capital expenditures are defined as expenditure for acquisition of land, intangible assets, government stocks, and nonmilitary and nonfinancial assets. Other expenditure are total public expenditure minus current and capital expenditures (excluded from the regression).

In the regression analysis, we consider not only total public spending but also capital and current components separately. In many studies, only the capital spending item has been included, but the inclusion of both components is essential to capture any interaction between them. The rationale for this decision is based on the evidence that some categories of current spending items are indeed critical to ensure the profitability of investments; for example, operations and maintenance expenditures. In addition, it would not be realistic to isolate public investments completely since in many countries capital budgets include de facto, explicitly or implicitly, salaries and current spending items. Given that these current expenses are essential

to ensure the proper functioning of capital goods, their absence may result in a liability for the country in the end, with doubtful effects on growth.

With the current-capital classification of total public spending, the empirical specification becomes:

$$\hat{y}_{it} = b_1\hat{y}_{it-1} + b_2 OPEN_{it} + b_3 HC_{it} + b_4 FR_{it} + b_5 CurrentExp_{it} + b_6 CapitalExp_{it} + b_7 FS_{it} + b_8 CPIINF_{it} \quad (2)$$

where *CurrentExp* is current expenditure in percent of GDP and *CapitalExp* is capital expenditure in percent of GDP.

The estimated coefficients of the regression specification (equations (1) and (2)) are presented in Table 3. In each column, a different set of variables is introduced.

4.1. Regression Analysis with Total Public Expenditure

The estimation results for total public expenditure are given in columns (1) and (2). The regression specification includes public spending and other fiscal variables as a percent of GDP. While in column (1) trade openness is one of the control variables, in column (2) private investment is used instead. The results indicate that the impact of total public expenditure is positive, but statistically significant at the 10 percent level only in the specification given in column (2). When we compare the estimated coefficients of public spending in the specifications with and without private investment, we find that total public spending has a more significant impact on growth when the private sector is considered.

Interestingly, total fiscal revenue has a statistically significant and positive impact on growth, which may reflect the relatively high percentage of grants included under total fiscal revenues. Although it is positive, the total budget balance does not have a significant effect on growth, perhaps indicating that these countries have managed to maintain fiscal stability as a necessary but not sufficient condition for higher growth.

Although the focus of this paper is on the link between public spending and growth, it is also critical to acknowledge the positive and significant effects that both trade openness and private investment have had on growth in the WAEMU countries.

4.2. Regression Analysis with Expenditure Classifications: Current versus Capital

The question that we try to answer in this section is whether the different components of public spending can have varying effects on growth. The classification of public spending considers current versus capital public spending. As it was explained in the literature review section, many related studies show that the capital component of public spending is expected to have a higher impact on growth when compared to the impact of the current component.

The estimated coefficients are presented in columns (3), (4), (5) and (6). The most interesting observation is that while the impact of the capital component on growth is positive and statistically significant, the effect of the current component is consistently negative, but not significant. This could indicate lack of complementarity between current and capital spending, which could be explained by a high percentage of current expenditures allocated to paying interest on debt, and/or to salaries not directly connected to the productivity of investments.

One policy lesson derived from this analysis could be that policy makers in the WAEMU group should focus on ensuring that current expenditures are adequately allocated to support public investments which are shown to have a positive impact on growth. For example, operations and maintenance allocations, during and after the projects are concluded, should be reflected in the budget in order to ensure the sustainability of investments and the creation of capital assets that contribute to growth. This lesson could also be applied to the programs supporting the approval of grants which constitute an important source of fiscal revenue in these countries.

Table 3. Dynamic Panel-GMM Results with Total Public Spending and Its Components (Annual data)

Dependent variable: Growth rate of GDP per capita	1	2	3	4	5	6	7
Constant term	-12.044**	-3.581	-19.034**	-10.131*	-10.964	-1.939	-9.977*
	(-2.03)	(-0.822)	(-2.55)	(-1.752)	(-1.837)*	(-0.431)	(-1.898)
Growth rate of GDP per capita (-1)	-0.098	-0.118	-0.062	-0.069	-0.1	-0.126	-0.165
	(-0.889)	(-1.028)	(-0.512)	(-0.53)	(-0.911)	(-1.104)	(-1.424)
Trade openness (% of GDP)	0.143**	..	0.131**	..	0.144**	..	..
	(2.41)		(2.208)		(2.428)		
Private investment (% of GDP)	..	0.184*	..	0.159*	..	0.146*	0.156**
		(1.763)		(1.659)		(1.794)	(2.103)
Tax revenue (% of GDP)	..	..	0.915**	1.239***	..	..	0.957**
			(2.545)	(2.705)			(2.443)
Other revenue (% of GDP)	..	..	-0.115	-0.081	..	..	0.056
			(-0.685)	(-0.455)			(0.856)
Total fiscal revenue (% of GDP)	0.156*	0.243*	..	..	0.171*	0.157*	..
	(1.659)	(1.636)			(1.743)	(1.875)	
Current public expenditure (% of GDP)	..	..	-0.045	-0.132	-0.101	-0.059	-0.073
			(-0.344)	(-0.74)	(-0.774)	(-0.398)	(-0.473)
Capital public expenditure (% of GDP)	..	..	0.448**	0.373**	0.223*	0.308*	0.311
			(2.495)	(2.23)	(1.874)	(1.931)	(1.493)
Total public expenses (% of GDP)	0.059	0.061*	..	..	..	..	..
	(1.463)	(1.741)					
Budget surplus (% of GDP)	0.002	0.005	0.005	0.004	0.001	0.002	..
	(1.457)	(0.93)	(0.974)	(1.151)	(1.125)	(1.318)	
Total public debt (% of GDP)	..	..	..	..	..	..	-0.01*
							(-1.677)
Inflation - consumer price index	-0.062	0.004	0.033	0.108	-0.059	0.01	0.094
	(-1.021)	(0.076)	(0.481)	(1.313)	(-0.97)	(0.174)	(0.511)
Human Capital Indicator	0.021	0.015	0.016	0.048*	0.015	0.024	0.026
	(0.776)	(0.542)	(0.448)	(1.657)	(0.536)	(0.826)	(0.911)
Dummy for politically unstable countries (Burkina Faso, Cote d'Ivoire and Guinea-Bissau)	..	..	..	..	..	..	..
No. of observations	113	110	102	101	113	110	101
J-statistics	1.84	1.28	2.11	2.06	1.69	1.59	1.79
Arellano-Bond serial correlation test AR(1)	1.06	0.88	0.91	1.03	1.01	0.97	1.07
Arellano-Bond serial correlation test AR(2)	0.47	0.58	0.47	0.75	0.67	0.55	0.82

Note: The estimation method is a dynamic panel - GMM. Annual data are used. t-statistics are given in parenthesis. * indicates 10% significance level, ** indicates 5% significance level, and *** indicates 1% significance level. These significance levels are equal to one minus the probability of rejecting the null hypothesis of zero coefficients. J-test is for overidentification problem where H0: there is no overidentification problem. We fail to reject in each case. For serial correlation z-tests, H0 is "there is no serial correlation"; and for normality test, H_0 is "normal distribution". We fail to reject H0 in each test.

Given that the coefficient of the fiscal balance is not significant for growth, the debt constraint is alternatively introduced as an important measure of fiscal stability in the specification. The level of debt distress is expected to be a significant determinant of growth for the WAEMU countries (see, for example, Fosu, 2010). The higher the debt ratio to GDP, the lower the effect of public spending on growth. The results are presented in Column (7) of Table 3. Indeed, the estimated coefficient of the debt-to-GDP ratio is negative and statistically significant at the 10

percent level. The results show that the remaining coefficients are robust to the inclusion of the debt variable instead of the fiscal balance.

Given that a significant, though in some countries declining, portion of current expenditures corresponds to interests paid on existing external debts, the policy implication of this result is that, debt reduction and debt repayment, which open up an additional fiscal space to invest in productive capital assets, would be conducive to growth. This message also alerts against the increasing use of external borrowing, particularly on non-concessional terms, which is more costly to repay and further limits the existing fiscal space.

As it can be seen in columns (3) and (4), another interesting result is that higher fiscal revenues, including grants, contribute to higher growth rates and this relationship is significant. The policy lesson derived from this result is that, as long as those grants are allocated to productive public spending, they could be conducive to growth. This is an important lesson for donors and multilateral organizations providing grants to the WAEMU countries. This could also indicate that because the fiscal revenue to GDP ratios are relatively low in the region, and mainly dependent on indirect taxes and natural resources, taxes might have not been distortive to economic activities.

As was the case in the previous function specification, both trade openness and private investment are statistically significant determinants of growth for these countries. This indicates that boosting private sector activities and trade exchanges is as important for growth, if not more, as increasing productive public investments.

4.3. Regression Results with Public and Private Fixed Capital Formation

An alternative classification of public spending can be with the inclusion of public fixed capital formation, which is a component of public capital spending that is expected to have a strong impact on growth (see, for example, Agénor *et al.* 2008; Anyanwu, 2014). Public fixed capital formation can be important for many countries, but it becomes a necessary component of growth in developing countries where private investment tends to be more limited and most basic infrastructure may not exist. The importance of infrastructure investment and public capital accumulation in the private production process cannot be denied. For production and transportation, firms require a reasonably good quality of energy sources, communication, roads, and water. Public fixed capital formation in the areas of health and education is also important for technological progress and human capital accumulation. Data limitations on the detailed compositions of public fixed capital formation do not allow us to run regression specifications with infrastructure, health, and education classifications. However, just by introducing total public fixed capital formation in the specification, we can obtain a valuable information about its significance for growth.

In such regression specification, we can also observe possible complementarity between public and private fixed capital formations. This complementarity is expected to be important for relatively capital-poor countries. Any positive changes in public capital may lead to higher private investment due to improvements in the production process (see, for example, Bayraktar and Fofack, 2011).

In the regression specification, we cut public capital expenditures into two components: public fixed capital investment and public other capital expenditures, defined as total public capital expenditure minus public fixed capital investment. All variables are in percent of GDP. We also include private fixed capital formation.

The regression results are presented in Table 4, Column (1). Private fixed capital formation has a positive coefficient and it is significant at the 10 percent level. When compared to the coefficient of private investment, public fixed capital formation has a higher estimated coefficient, indicating a larger impact of such investments on growth. Its significance level is stronger as well at the 5 percent level. Other capital spending items have a positive and significant impact on growth. It means that not only physical capital formation but also other capital spending items are important for growth in the WAEMU region.

Similar to the original results, tax revenue has a positive and unexpectedly significant impact on growth. Other public revenues are not statistically significant determinants of growth.

The current component of public expenditure has a negative, but not statistically significant, coefficient. As before, the level of debt has a negative impact on growth. Inflation enters the equation with a positive but insignificant coefficient, and human capital has a positive and significant coefficient at the 10 percent level.

Table 4. Private and Public Investment

Dependent variable: Growth rate of GDP per capita	(1)	(2)	(3)
Constant term	-9.747**	-9.895**	-3.457
	(-1.998)	(-2.016)	(-0.537)
Growth rate of GDP per capita (-1)	-0.214	-0.21	-0.224
	(-1.582)	(-1.54)	(-1.377)
Private investment (% of GDP)	0.135*	0.128*	0.095*
	(1.914)	(1.859)	(1.641)
Tax revenue (% of GDP)	1.029***	1.069***	0.975***
	(3.157)	(3.198)	(2.997)
Other revenue (% of GDP)	0.063	0.066	0.058
	(0.993)	(1.036)	(0.923)
Current public expenditure (% of GDP)	-0.071	-0.069	-0.041
	(-0.508)	(-0.49)	(-0.292)
Public fixed capital formation (% of GDP)	0.226**	0.233**	0.259**
	(2.48)	(2.485)	(2.348)
Volatility of public fixed capital formation (% of GDP)	..	-0.301**	..
		(-2.096)	
Quality of public fixed capital formation	..	..	12.677*
			(1.782)
Other Capital public expenditure (% of GDP)	0.258*	0.276*	0.259*
	(1.645)	(1.607)	(1.763)
Total public debt (% of GDP)	-0.006*	-0.007	-0.003
	(-1.641)	(-1.504)	(-1.215)
Inflation - consumer price index	0.077	0.075	0.084
	(0.241)	(1.213)	(1.367)
Human Capital Indicator	0.048*	0.052*	0.056*
	(1.625)	(1.702)	(1.878)
No. of observations	107	107	107
J-statistics	1.88	1.86	2.01
Arellano-Bond serial correlation test AR(1)	0.95	1.06	1.22
Arellano-Bond serial correlation test AR(2)	0.67	0.78	0.55

Note: The estimation method is a dynamic panel - GMM. Annual data are used. t-statistics are given in parenthesis. * indicates 10% significance level, ** indicates 5% significance level, and *** indicates 1% significance level. These significance levels are equal to one minus the probability of rejecting the null hypothesis of zero coefficients. J-test is for overidentification problem where H0: there is no overidentification problem. We fail to reject in each case. For serial correlation z-tests, H0 is "there is no serial correlation"; and for normality test, H0 is "normal distribution". We fail to reject H0 in each test.

4.4. Regression Analysis with Volatility and Quality of Public Investment

The results above clearly indicate the importance of both private and public fixed capital formation for growth. It has been shown in the literature that the volatility of public expenditure and/or public investment can also have a significant impact on the growth performance of countries. For example, Museru *et al.* (2014) show the statistical significance of public investment on the growth rate of 26 Sub-Saharan African countries, and that aid effectiveness may have been eroded by volatility in public investment. Following the methods suggested by Museru *et al*. (2014) and Ebeke and Ehrhart (2011), we construct the volatility metrics by calculating the rolling standard deviation of the ratio of public investment to GDP over 2-year overlapping sub-periods.

The results are presented in Table 4 Column (2). The findings show that all variables are robust to the inclusion of the volatility indicator. The volatility measure for public investment has a clear negative and statistically significant impact on growth. This observation indicates that as the volatility of public investment increases, it lowers growth rates. The result is not surprising. Given the economic and statistical significance of public fixed capital formation on growth, any

sharp fluctuations in this component can result in negative consequences for growth, as they increase uncertainty and often prevent continuity.

In addition, when determining the growth performance of countries, another concern is the quality of public investment. The quality of public investment has been calculated according to the methodology suggested by Chakraborty and Dabla-Norris (2009) and Calderon and Serven (2004). This methodology requires the calculation of the first principle component of different indicators of infrastructure quality. In our paper, three indicators of quality in the services of telecommunications (main phone lines per 100 people), power (electricity production per 100 people), and water (access to clean water in percent of total population) are used for the principle component analysis. The coefficient of electricity is 0.11, telecommunication is 0.67 and water is 0.48. The lower values correspond to lower quality. The principal components are then re-indexed with values between 0 and 1, where 1 corresponds to the highest quality.

The results are presented in Table 4 Column (3). The findings clearly show that the quality of public fixed investment matters for growth. The coefficient is positive and significant at the 10 percent level. The result indicates that improvements in the quality of public capital can lead to higher growth rates, as expected (see, for example, Chakraborty and Dabla-Norris, 2009).

4.5. Robustness Check

In this paper, we have employed one of the most commonly used regression techniques for growth specifications: system GMM. Other methods are also suggested in the literature, such as fixed-effect panel regressions and regressions with moving averages for medium- and longer-term analyses. Using longer-term data, we aim to capture supply-side effects of public spending on growth. Public spending on infrastructure, education, and health can significantly affect the production process of the private sector. But such expenditures can be effective mostly in medium and long terms. Thus, inclusion of medium-term analyses is important to understand whether we also observe supply-side effects of public spending.

The results for the robustness check of the regression methodologies are presented in Table 5. In column (1), the GMM results with annual data points are given. The regression specification is taken from Table 4 for comparison purposes. In column (2) regression results with fixed-effect panel OLS are presented. Again, annual data are used in this column. In column (3) 3-year moving average data points are introduced. The purpose is to analyze medium-term effects on public spending and investment on growth. The regression methodology is GMM, as is the case in column (1).

The results presented in columns (1) and (2) are mostly consistent. The main difference is that the lagged value of the growth rate of GDP per capita becomes highly significant in column (2), and the size and the significance level of private investment declines enormously. The size of the coefficient of public fixed capital formation increases and still remains statistically significant in column (2). The debt-to-GDP ratio is no longer statistically significant in column (2).

When we focus on the medium-term effect of public spending on growth in column (3), we notice that the coefficient of private investment declines, but is still statistically significant. On the other hand, the size of the coefficient of public fixed capital formation is almost the same and statistically significant. The significance of debt ratios drops in the medium term. The rest of the coefficients can be considered robust.

Table 5. Robustness Check with Alternative Methodologies

Dependent variable: Growth rate of GDP per capita	GMM with annual data (1)	Fixed-effect panel OLS with annual data (2)	GMM with 3-year moving-average data (3)
Constant term	-9.747**	-3.084*	-1.601
	(-1.998)	(-1.623)	(-0.522)
Growth rate of GDP per capita (-1)	-0.214	0.421***	-0.314
	(-1.582)	(4.333)	(-1.015)
Private investment (% of GDP)	0.135*	0.025	0.034*
	(1.914)	(0.309)	(1.722)
Tax revenue (% of GDP)	1.029***	0.251*	0.775*
	(3.157)	(1.626)	(1.748)
Other revenue (% of GDP)	0.063	0.023	0.008
	(0.993)	(0.423)	(0.128)
Current public expenditure (% of GDP)	-0.071	-0.021	-0.145
	(-0.508)	(-0.243)	(-1.271)
Public fixed capital formation (% of GDP)	0.226**	0.335**	0.261*
	(2.48)	(2.111)	(1.694)
Other Capital public expenditure (% of GDP)	0.258*	0.101	0.127
	(1.645)	(0.678)	(0.761)
Total public debt (% of GDP)	-0.006*	0.001	-0.006
	(-1.641)	(-0.026)	(-0.547)
Inflation - consumer price index	0.077	0.081	0.099
	(0.241)	(1.512)	(0.572)
Human Capital Indicator	0.048*	0.014	0.028
	(1.625)	(1.388)	(1.534)
Adjusted R-squared		0.551	
Goodness of fitness test		9.253	
No. of observations	107	131	91
J-statistics	1.88		1.23
Arellano-Bond serial correlation test AR(1)	0.95		0.72
Arellano-Bond serial correlation test AR(2)	0.67		0.43

Note: t-statistics are given in parenthesis. * indicates 10% significance level, ** indicates 5% significance level, and *** indicates 1% significance level. These significance levels are equal to one minus the probability of rejecting the null hypothesis of zero coefficients. J-test is for overidentification problem where H_0: there is no overidentification problem. We fail to reject in each case. For serial correlation z-tests, H_0 is "there is no serial correlation"; and for normality test, H_0 is "normal distribution". We fail to reject H_0 in each test.

4.6. Alternative Specifications for Robustness Check

In this section, in order to check the robustness of the results, we run alternative regression specifications. Our results indicate a positive and significant linear link between total public spending and growth, and between its capital component and growth. In addition to this link, a nonlinear relationship could also be detected (Grossman, 1988). In alternative specifications, we introduce the squared term of public spending and its components. The results presented in columns (1) and (2) of Table 6 show that, while the significance of the linear term continues, we also identify a statistically significant nonlinear relationship between the squared terms of public expenditures and growth. The estimated coefficient of the squared term of public expenditure is negative and statistically significant (Column (1) of Table 6). It indicates that there are diminishing returns to scale for public expenditures. As the share of public expenditures in GDP increases, it triggers a positive effect on growth, but at a decreasing rate. Similarly, we observe a significant negative estimated coefficient for the squared term of the capital component of public expenditures. The interpretation of this result is the same: the returns on capital expenditures decline over time. The nonlinear term of current expenditures is also negative, but not statistically significant.

Table 6. Robustness Check with Alternative Specifications

Dependent variable: Growth rate of GDP per capita	1	2	3	4	5	6	7	8	9	10
Constant term	-25.691***	-13.074**	-7.964*	-6.072	-3.173*	-10.657*	-11.391*	1.176	-5.251*	-2.616
	(-3.115)	(-2.307)	(-1.624)	(-0.861)	(-1.861)	(-1.595)	(-1.722)	(0.219)	(-1.9)	(-1.206)
Growth rate of GDP per capita (-1)	-0.179	-0.23**	-0.179	-0.173	-0.035	-0.16	-0.165	-0.082	-0.004	-0.082
	(-1.557)	(-2.02)	(-1.497)	(-1.443)	(-0.373)	(-1.253)	(-1.297)	(-0.766)	(-0.04)	(-0.771)
Log of initial GDP per capita (constant US$)	..	..	..	..	..	..	..	-0.641*	..	..
								(-1.718)		
Private investment (% of GDP)	0.268*	0.205*	..	..	0.152*	0.171**	0.174**	0.106**	0.171**	0.192*
	(1.955)	(1.887)			(1.808)	(2.356)	(2.412)	(2.358)	(2.284)	(1.754)
Private investment (% of public investment)	..	..	0.056*	..	..	..	..	..	..	..
			(1.991)							
Private investment (% of total investment)	..	..	..	2.835**	..	..	..	..	..	..
				(2.212)						
Tax revenue (% of GDP)	1.033***	1.004**	1.006***	1.02***	1.023*	..	..	..	..	..
	(2.641)	(2.573)	(2.953)	(2.984)	(1.881)					
Other revenue (% of GDP)	0.131*	0.119	0.102	0.112	0.071	..	..	..	..	..
	(1.868)	(0.706)	(1.415)	(0.978)	(1.564)					
Total fiscal revenue (% of GDP)	..	..	..	..	..	0.123*	0.108*	0.081	0.073	..
						(1.723)	(1.762)	(0.579)	(1.489)	
Total revenues from grants (% of GDP)										-0.069
										(-0.461)
Total public revenues – grants (% of GDP)										0.905*
										(1.757)
Current public expenditure (% of GDP)	..	-0.115	-0.126	-0.146	..	-0.055	..	-0.014	..	-0.03
		(-0.26)	(-0.973)	(-1.04)		(-0.367)		(-0.111)		(-0.237)
(Current public expenditure)^2 (% of GDP)	..	-0.002	..	..	..	..	..	..	..	..
		(-0.107)								
Current public expenditure (% of total public expenditure)	..	..	..	..	-4.833***	..	..	..	..	..
					(-2.693)					
Capital public expenditure (% of GDP)	..	0.388***	..	..	..	0.301**		0.268***		0.412***
		(3.471)				(2.097)		(2.449)		(2.691)
(Capital public expenditure)^2 (% of GDP)	..	-0.118***	..	..	..	..	..	..	..	..
		(-3.081)								
Capital public expenditure (% of total public expenditure)	..	..	..	..	1.045**	..	..	..	..	..
					(2.219)					
Total public expenses (% of GDP)	0.064**	..	..	..	0.086*		0.069*	..	0.377**	..
	(2.261)				(1.926)		(1.733)		(2.053)	
(Total public expenses)^2 (% of GDP)	-0.039**	..	..	..	..	..	..	..	..	..
	(-2.339)									
Positive shocks on total public expenses (pos_{it})	..	..	..	..	..	..	..	..	0.737*	..
									(1.908)	
Negative shocks on total public expenses (neg_{it})	..	..	..	..	..	..	..	..	-0.216*	..
									(-1.745)	
Public fixed capital formation (% of GDP)	..	..	0.255**	0.243*	..	..	..	..	..	..
			(2.399)	(1.835)						
Other Capital public expenditure (% of GDP)	..	..	0.36*	0.375*	..	..	..	..	..	..
			(1.731)	(1.804)						
Budget surplus	0.008	0.002	0.002	0.002	0.002	0.002	.0.001	0.001	0.007	0.005
(% of GDP)	(1.444)	(0.406)	(0.439)	(0.39)	(0.491)	(0.342)	(0.014)	(0.276)	(1.485)	(1.253)
Inflation - consumer price index	-0.081	-0.052	-0.088	-0.003	0.055	-0.048	-0.064	0.031	-0.035	-0.031
	(-1.487)	(-1.221)	(-1.421)	(-0.186)	(1.038)	(-0.505)	(-0.682)	(0.572)	(-0.628)	(-0.553)
Human Capital Indicator	0.024	0.024	0.021	0.017	0.006	0.004	0.002	0.006	0.015**	0.017
	(0.879)	(0.946)	(0.741)	(0.612)	(1.012)	(0.123)	(0.047)	(0.723)	(2.411)	(1.477)
Bureaucracy quality	..	..	..	..	..	1.273**	1.478*	..	..	..
						(2.163)	(1.886)			
No. of observations	101	101	107	107	101	91	91	110	110	110
J-statistics	2.43	2.03	1.94	1.38	1.49	1.31	1.33	1.88	1.87	1.71
Arellano-Bond serial correlation test AR(1)	1.11	1.07	0.96	0.78	1.12	0.81	1.21	1.01	1.31	1.12
Arellano-Bond serial correlation test AR(2)	0.57	0.61	0.67	0.48	0.77	0.58	0.68	0.73	0.57	0.71
Jarque-Bera normality test	1.43	1.15	1.64	1.24	1.25	1.34	1.15	1.25	1.45	1.51

Note: The estimation method is a dynamic panel - GMM. Annual data are used. t-statistics are given in parenthesis. * indicates 10% significance level, ** indicates 5% significance level, and *** indicates 1% significance level. These significance levels are equal to one minus the probability of rejecting the null hypothesis of zero coefficients. J-test is for overidentification problem where H0: there is no overidentification problem. We fail to reject in each case. For serial correlation z-tests, H_0 is "there is no serial correlation"; and for normality test, H_0 is "normal distribution". We fail to reject H_0 in each test.

Our regression results show that both public and private investments are indeed statistically significant determinants of growth. In the regression specifications, we have included

private and public investments as two separate independent variables. It would be also interesting to see whether we observe any complementarity between these two variables. Public investment, especially in infrastructure, can promote private investment. To capture this complementarity effect, in two alternative specifications, the ratio of private investment to public investment and the share of private investment in total investment are introduced as independent variables. As was the case in our initial analysis, the new results support the argument that private investment is important for the growth performance of the WAEMU countries. The estimated coefficients of the new variables are reported in columns (3) and (4) of Table 6. They are positive and significant. These results highlight the critical importance of an increasing share of private investments in total investments for growth. While public investments are essential to support private sector development, growth acceleration would be limited without adequate development of private investment.

In new empirical specifications the current and capital components of public spending are introduced in an alternate way. They are calculated as a share of total public expenditures. We also include the share of total public spending in GDP (Devarajan *et al.* 1996). In column (5) of Table 6, the estimated coefficients of this new specification are reported. While the estimated coefficient of the current component as a share of total spending is negative and highly significant, the coefficient of the capital component is positive and statistically significant. These outcomes support our initial findings: the positive impact of the capital component on growth is very important for the WAEMU countries.

For a robustness check, we also introduced new variables in the regression specification. The quality of institutions and government is one of these variables. In section 3, the importance of the quality of institutions for the WAEMU countries has been discussed. In the literature, there are many studies presenting the importance of the quality of institutions for growth, which is considered a critical factor impacting the effectiveness of public spending to boost growth (see, for example, Acemoglu *et al.* 2003). In the absence of quality institutions, governments may tend to use total or capital expenditures for rent-seeking activities, leading to inefficient spending (Keefer and Knack, 2007; Grigoli and Mills, 2014).

In the main regression specifications of this paper, an indicator of institutional quality has not been included in the set of explanatory variables due to data limitations for the WAEMU countries. Despite the fact that this variable is not available for Benin, given the importance of such indicators for growth, this sub-section includes some regression results with the bureaucracy quality index as a measure of institutional quality. The definition of the index is given in Section 3. It is well suited to capture the quality of institutions because its higher values indicate that public institutions have the strength and expertise to govern without drastic changes in policy or interruptions in government services due to non-professional or technical reasons. As the quality level increases, the risk of countries underperforming declines. This is due to the fact that bureaucracy tends to be more autonomous from political pressures and can make better decisions for the country as a whole. As the bureaucratic quality declines, policy decisions will be more political and the transition of any changes in government will be more drastic and unstable.

The regression results with the bureaucracy quality index are presented in columns (6) and (7) of Table 6. We also tested the importance of the government effectiveness index (defined in Section 3) for growth. Because the continuous government effectiveness series starts in 2002, we had to exclude many data points in the regression analysis. As a result, the estimated coefficients were not comparable to the main regression results. As expected, the estimated coefficient of the bureaucracy quality index is positive and statistically significant (see, for example, Rodrik, 2000). This indicates that in countries with better bureaucracy quality, public spending has a stronger positive effect on growth. The rest of the coefficients are robust to the inclusion of this new variable. In particular, the results show that when the quality of institutions is taken into account, both total public spending and its capital component are statistically significant and have a positive effect on growth.

We are also interested in any convergence towards similar levels of growth within the WAEMU group. Many empirical studies on growth use the logarithm of the initial level of per capita GDP to capture possible convergence effects among different countries. If there is any convergence, lower initial GDP per capita is expected to lead to a higher average growth rate in

the long run. The regression results are reported in column (8) of Table 6. The log of the initial level of GDP per capita is negative and significant at 10 percent levels of significance. Countries with lower initial GDP per capita tend to grow faster. The coefficients of the rest of the variables, including capital and current components of public spending, are robust to the inclusion of GDP per capita. This means that, in the long run, there is statistically significant convergence among the 8 members of the WAEMU group.

We add another interesting regression specification involving both positive and negative shocks of total public spending. See, for example, Dessus and Varoudakis (2013) for the impact of asymmetric shocks in the WAEMU area. With this specification, we can assess whether expansionary and contractionary government spending shocks (due to vulnerability, internal and external factors, such as political events, natural disasters, security issues, global and European crises, etc.) have an asymmetric effect on the economies of the WAEMU countries. The reaction of economic growth to expansionary and contractionary policies is expected to be asymmetric. There can be different reasons for asymmetry effects. For example, if wages and prices are sticky, a contractionary public spending shock may affect output negatively in a lower magnitude than a positive effect created by an expansionary spending shock. Another example of asymmetric effects can be that, when output is close to the full employment level or faces supply constraints (such as lack of adequate production capacity), increasing government spending may not increase output, but the opposite may be true when a decrease in public spending can trigger a negative effect on output. Perceptions and expectations of the public can also be important for asymmetric reactions. If policy changes are perceived as permanent by the public, then the expansionary shock may trigger an increase in growth, but if they are perceived as temporary, then the expansionary shock may not affect growth.

Positive and negative government spending shocks, posit and negit, are introduced in the regression specification to assess the importance of such asymmetric effects. We define the shocks in accordance with the methods suggested by Cover (1992), Kandil (2001), and Berument and Dogan (2004): posit = 0.5 * (εgit + abs(εgit)) and negit = -1 * (εgit - posit). εgit is the residual term created by regressing the log first difference of public spending on the rest of the explanatory variables of our regression model.

The regression result is presented in column (9) of Table 6. We observe asymmetric effects in the response of growth on positive and negative public spending shocks. Positive shocks have a positive significant effect on growth performances of the countries in the WAEMU region, while the estimated coefficient of the negative shocks is negative and significant, but its magnitude is much smaller. In order to test whether the coefficients are indeed statistically different, we run a Wald test statistics with the hypothesis that the magnitude of the positive coefficient of the positive shock is equal to the magnitude of the negative coefficient of the negative shock. We reject the null hypothesis at the 1 percent significance level. This result indicates that the WAEMU economies are still below their growth potential and that there is margin to increase public spending, specially its capital components, only in parallel to improvements in the quality of institutions managing it, in order to ensure a positive effect on growth.

We also run an alternative empirical specification with grants and other public revenues as percent of GDP. Grants can have positive or negative effects on growth (Svensson, 1999). The results are presented in column (10) of Table 6. On one hand, the coefficient of grants is negative but not statistically significant. This can be explained by the fact that countries getting a higher amount of aid in the form of grants generally rely also on domestically generated revenues to finance public spending and have lower growth rates. On the other hand, the estimated coefficient of other revenues (including taxes) is positive and statistically significant, which could be explained by a relatively low tax burden in the region when compared to the other parts of the world and the predominance of consumption taxes in the region, which are less distortive to economic activity than direct taxation. The rest of the variables, including public expenditures, are robust to the introduction of these two types of revenues.

5. Conclusion

This paper empirically demonstrates the importance of public spending volume, composition (current/capital), and quality in determining per capita growth rates in a group of countries belonging to a monetary union. Monetary unions not only help members reach fiscal and price stability, but also introduce significant constraints on how to finance public spending in the absence of country-based monetary policies. In this paper, we try to understand which components of public spending can be more effective on growth so that such member countries facing fiscal and monetary restrictions can allocate their limited resources more efficiently.

The focus of the paper is the WAEMU countries. The regression analysis finds that total public spending has a positive impact on growth for these countries. While the impact of the capital component on growth is positive and statistically significant, the effect of the current component is negative, but not statistically significant. In the regression specifications, the capital component has been further split into two components (public fixed capital investment and public other capital expenditures). The results indicate that not only physical capital formation, but also human capital items, are important for growth in the WAEMU group. In addition, as expected, while public investment volatility has a clear negative and statistically significant impact on growth in the group, the quality of public fixed investment is shown to contribute to enhancing its positive effect on growth.

The findings also support the argument that public budget deficits have not been an important constraint for the impact of government spending on growth in the WAEMU union, reflecting fiscal discipline achievements in the union. However, the results clearly show that the debt-to-GDP ratio has a significant negative impact on growth, indicating that, in addition to adequate fiscal balances, low levels of debt distress should be maintained in order not to jeopardize growth prospects. Furthermore, additional levels of public spending contributing to increasing the debt to GDP ratios beyond certain levels may result in lower GDP per capita growth rates.

Unexpectedly, total fiscal revenue has a significant and positive effect on growth, most likely due to relatively low fiscal revenue to GDP ratios, supplemented by grants. It could also indicate that the current design of tax systems is not distortionary for economic activity, partly because of its heavy reliance on consumption and natural resource related taxes.

In each regression specification, it is observed that the effects of both trade openness and private investment on growth are positive and significant, indicating that public spending alone is not enough to encourage growth and that its positive effects are enhanced in an environment of trade openness and larger private sectors. The regression findings also show that the quality of institutions, measured by the bureaucracy quality index, enhances the positive effect of public spending, especially capital, on growth. The estimated coefficients of fiscal variables are robust to the inclusion of institutional quality in the regression specification. The findings are robust to different regression methodologies, regression specifications, as well as the inclusion of short- and medium-term data.

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