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Public Spending and Growth in an Economic and Monetary Union: The Case of West Africa

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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 the per capita growth rates of the West Africa Economic and Monetary Union (WAEMU) countries, which have been fluctuating and remain relatively low 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 is consistently 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 in the WAEMU group. 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 results with country effects indicate that, at the individual country level, capital public expenditures are clearly much more relevant in explaining growth changes than current expenditures. The findings are robust to different regression methodologies, as well as the inclusion of short- and medium-term data.

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Public Spending and Growth in an Economic and Monetary Union: The Case of West Africa*

Blanca Moreno-Dodson[2] and Nihal Bayraktar[3]

1. Introduction

The West African Economic and Monetary Union (WAEMU)[4] 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 increasing economic and fiscal potential.

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 their currency union, with the CFA Franc pegged to the Euro as the common currency, the use of monetary and exchange rate policy as macroeconomic tools at the individual country level is not possible; therefore, the role of fiscal policy, and especially the composition of their public spending, are critical determinants of growth and development.

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

In this paper, we try to explain how public spending volume, composition and quality are linked to the per capita growth rates of the WAEMU countries. Section 2 summarizes literature. In section 3, data and graphical analysis are presented. In section 3a, growth rates in the union are investigated. Section 3b provides data information on total public spending, which includes capital spending, and presents their trends in comparison with the growth paths observed during the last decades. Section 3c focuses on the analysis of the current and capital categories of public spending, separately and jointly, and their links to growth rates in the union. Section 3d analyzes public spending on education and health, and its effect on growth by contributing to building human capital. Section 3e considers several indicators of governance, and effectiveness and quality of institutions, as determinants affecting the link between public spending and growth. 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.

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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, 1995, for the literature review on the relationship between growth, government expenditure, and taxes). In recent years, there is some convergence in terms of the importance of public expenditure on growth. But, the results still change across countries, or from one data sample to another.

Conflicting empirical results on the link between public spending and growth start in the literature of the 1990s. On the one hand, Barro (1991), using cross-country analysis with 98 developing countries for the period of 1960-1985, finds that public consumption is negatively correlated with growth, while public investment does not have a significant impact on economic development. On the other hand, another prominent study by Grossman (1990), using a sample with 48 developed and developing countries, shows that government spending can have both positive and negative impacts on growth rates; he, however, concludes that the positive effect dominates. Similarly, Levine and Renelt (1992) find a negative relationship between government consumption and growth for 119 developed and developing countries during the period of 1974 to 1989, but they find a clear positive relationship between public investment and growth.

Recent studies still continue to find conflicting results. Schaltegger and Torgler (2006) find that large public spending contributes to lower growth in high-income countries. Folster and Henrekson (2001) present that, as the econometric problems are addressed, the relationship between government size and economic growth gets more robust. In an empirical study, Park (2006) tests, with a set of countries combining both developed and developing countries, whether the combination of lower taxes with productive public investment improves growth and whether higher taxes and current government spending contribute to lower growth. He cannot find any robust results. 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. Raminez (2004) and 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 the empirical studies, using empirical specifications or estimation methods similar to the one used in this paper are investigated, we continue observing 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.[5]

[5] Acosta-Ormaechea and Morozumi (2013) show that public capital, relative to current, spending, appears to be associated with higher growth. Ghosh and Gregoriou (2008) and Benos (2009), using GMM for panel datasets, also consider the revenue side of the budget constraint, as well as the budget balance. Using European Union countries, Benos (2009) shows that reallocating government expenditure, especially toward infrastructure and human capital, can improve growth, while, in contrast, Ghosh and Gregoriou (2008), for a group of developing countries, show that the current component of public spending increases growth while the capital component influences it negatively. Gregoriou and Ghosh (2009) support their initial findings. Similarly, Devarajan, Swaroop, and Zou (1996), using data from 43 developing countries over 20 years, show that an increase in the share of current expenditure in total expenditure has positive and statistically significant growth effects. By contrast, the link between the capital

While most empirical studies in the literature use a heterogeneous sample of countries to study the link between growth and government spending, 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.

In this paper, we use a similar setting and similar methodologies, and study the link between growth and public spending with its different components. However, the group of countries included in our study is different. The focus is specifically on WAEMU countries, which can be considered a relatively homogenous group of countries. This way we can understand how the link between growth and public spending work 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[6], but in our best knowledge, our paper is the only empirical study attempting to systematically investigate the relationship between growth and government spending, specifically for WAEMU countries. Despite the fact that data limitations constitute a challenge, we can still introduce many different types of possible regression specifications and estimation techniques to better understand the link between public expenditure and growth.

component of public expenditure and growth is negative. They conclude that seemingly productive expenditures (capital), when used in excess, could become unproductive.

[6] For example, Dessus, Diaz-Sanchez, and Varoudakis (2014) study pro-cyclicality of public investment; Dore and Masson (2002) investigate budgetary convergence in the WAEMU; Hitaj and Onder (2013) study fiscal discipline in WAEMU.

3. Data Analysis

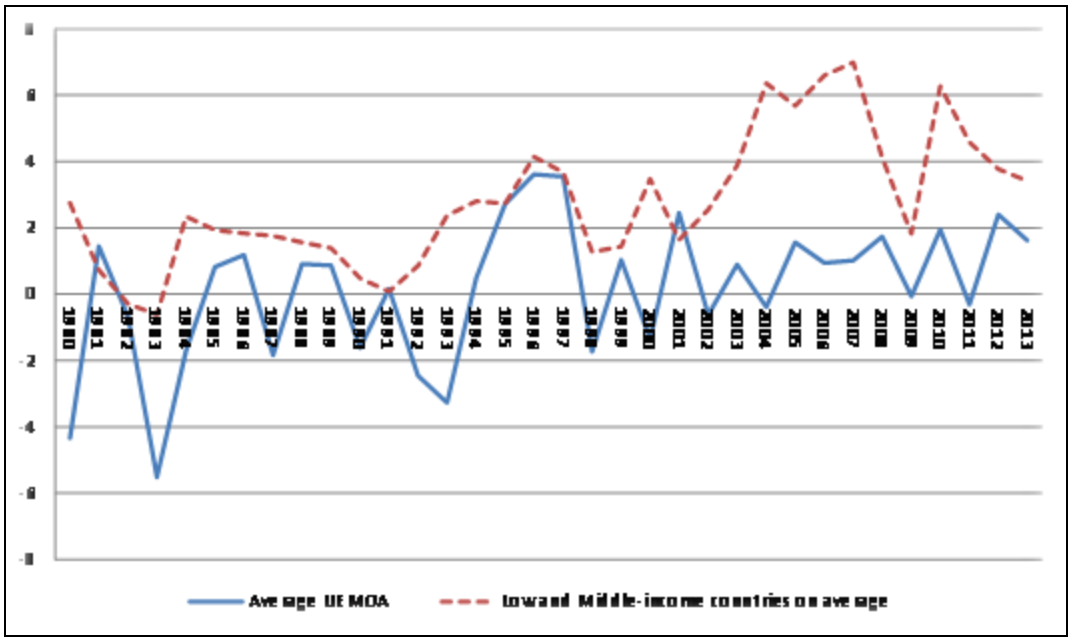
In this section, we investigate the growth performance of the WAEMU countries and the links between public spending and growth. We also consider different components of public spending. The data analysis also include the investigation of related variables such as quality of governance in the WAEMU group.

Analysis of growth rates in the WAEMU group

As can be observed in Figure 1 below, 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 or so. Figure 1 presents the time-trend of the average GDP per capita growth rate in the region and, for comparison purposes, in low- and middle-income countries, in which the WAEMU countries are included as well, between 1980 and 2013. The average value of the GDP per capita growth rate in the region is choppy around the zero line. Also, the trend is volatile as sharp declines and increases are observed almost every other two year period. However, the average in each year is close to the zero line.

When we compare the growth rate of the region with the average growth rates in low- and middle-income countries, it can be seen that the GDP per capita growth rates in the WAEMU are almost always below the growth rates of the comparator group of countries. In addition, while their average per capita growth rates jumped in the first half of the 2000s, we do not observe such improvements for the WAEMU group.

Figure 1
GDP per capita (% growth)



Source: Authors' calculation based on the WDI Database

Table 1 compares the GDP level and growth rates of the WAEMU group with the SSA region and with the group of low- and middle-income countries, between 1980 and 2013. The average growth rate of the WAEMU countries is very close to the SSA average. But, the latter is nearly 1.5 percentage points lower than the one observed in low- and middle-income countries, making the gap between the growth rates in the WAEMU and the rest of the developing countries close to 2.5 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, thereby lowering the average for the WAEMU region.

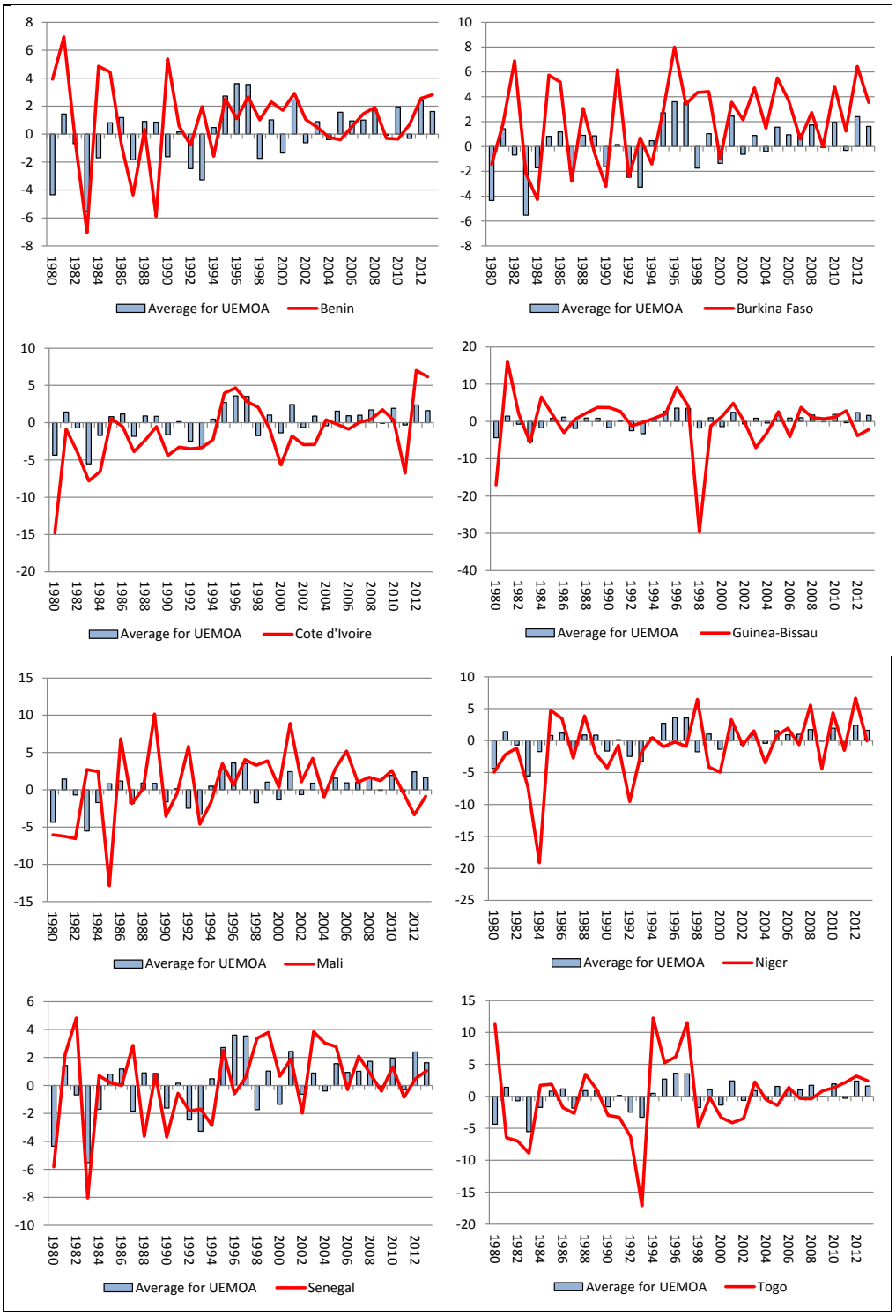
Table 1
GDP Growth and Growth Per Capita Rates (averages 1980-2013)

	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 UEMOA	**2.98**	**520**	**0.16**
Sub-Saharan Africa	**3.03**	**841**	**0.27**
Low & middle income	**4.49**	**1452**	**2.77**

Source: Authors' calculation based on the WDI Database

Figure 2 presents the time trend for the growth rate of GDP per capita in each individual country for the period between 1980 and 2013. The average growth rate for the WAEMU countries is included as well. 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, reflecting often unrelated shocks and political events specific to each country. The growth rates of the individual countries do not follow average rates for the region.

Figure 2
WAEMU Countries: GDP per capita (% growth)

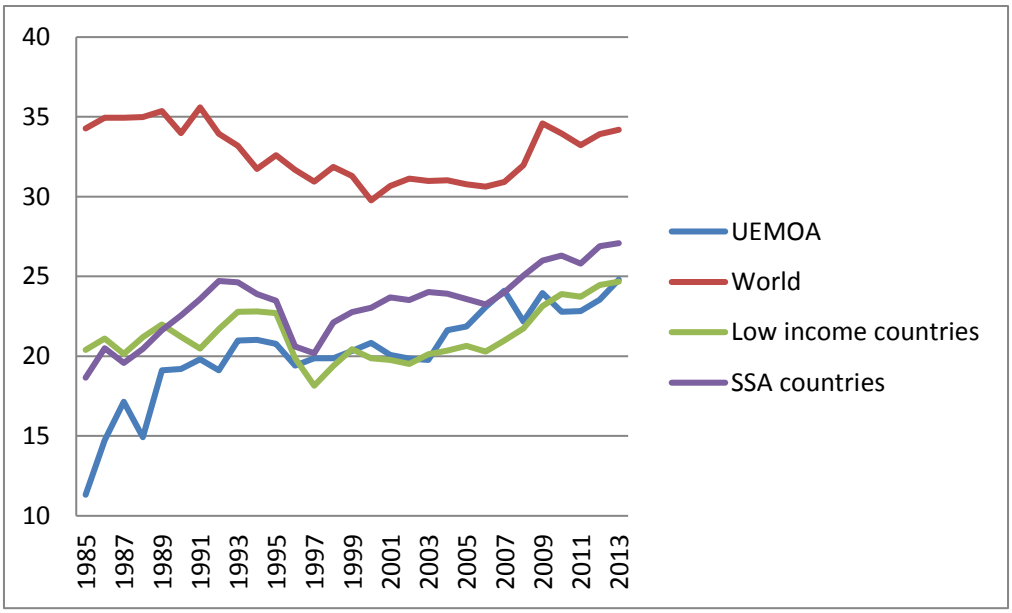


Source: Authors' calculation based on the WDI Database

Analysis of total public spending and public capital formation in WAEMU countries

A priori, the level of public spending, including capital items, could be an important determinant of the growth rates in the group (see, for example, Agénor, Bayraktar, and El Aynaoui, 2008). The share of general government[7] total expenditure in GDP increased almost continuously in the WAEMU countries between 1985 and 2013, as demonstrated in Figure 3. This increase was impressive between 1985 and 1993[8], during which time 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 ratio of public expenditures to GDP, which was approximately 10 percentage points higher (Figure 3).

Figure 3
General government total expenditure (% of GDP)



Source: Authors' calculation based on the WEO Database

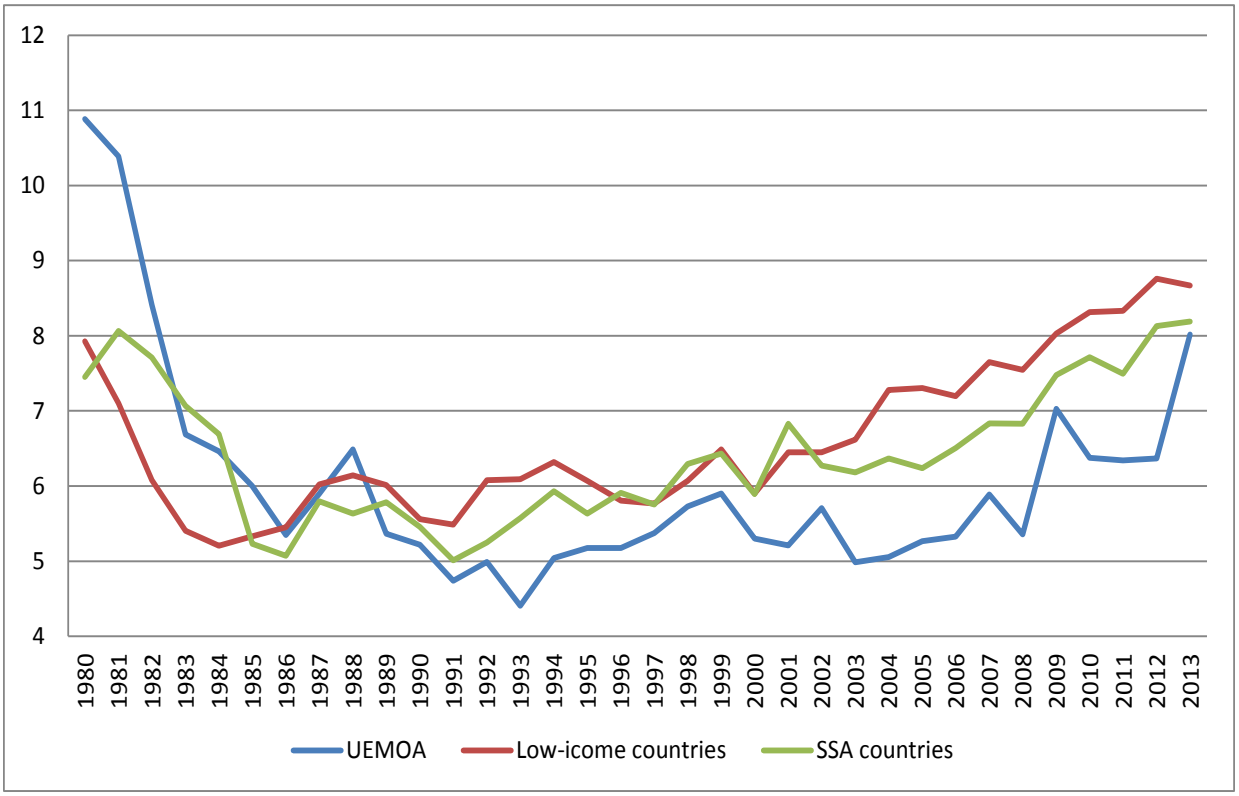
Gross public fixed capital formation is an important component of total government spending.[9] This component includes those investments in infrastructure which are considered essential for private sector activity and, as a result, for higher growth rates (Bayraktar and Fofack 2011). The shares of gross public fixed capital formation, as a percentage of GDP are relatively low on average for the WAEMU countries. For all these countries, the average time trend of the variable is presented in Figure 4. The share is low, but it has been increasing in recent years, from 4 percent of GDP in 1994 to 8 percent of GDP in 2013. Despite

[7] Data on general government includes central and subnational level data.
[8] This was the decade preceding the CFA Franc devaluation in 1994.
[9] Public investment covers gross outlays by the public sector on additions to its fixed domestic assets.

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 WAEMU countries are compared with other low-income countries and SSA countries, Figure 4 presents similar trends. But the average value of the share of public fixed capital in GDP is lowest for the WAEMU countries.

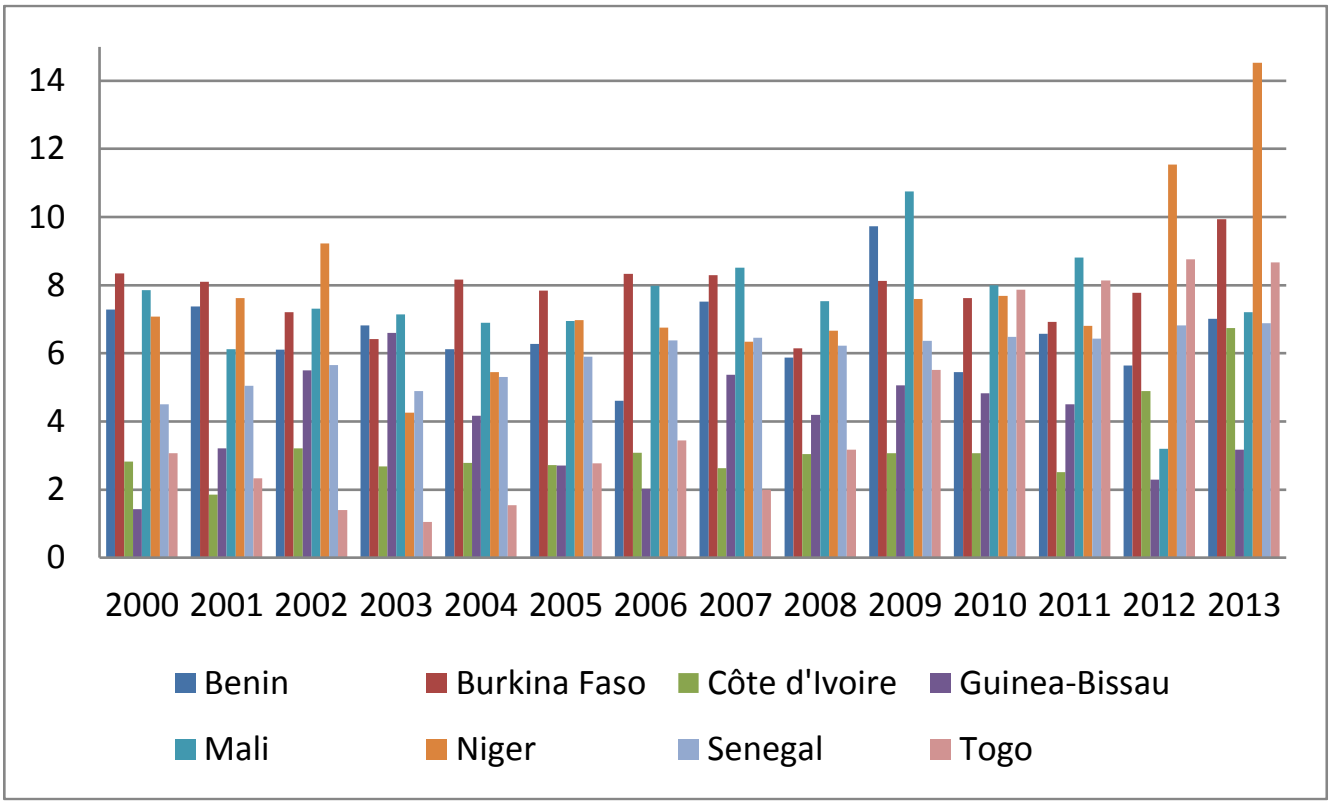
Figure 4
Average gross fixed public capital formation (% of GDP)



Source: Authors' calculation based on the World Economic Outlook Database

Figure 5 shows that the share of gross public fixed capital formation varies significantly across WAEMU countries. Almost all countries have had a higher share in recent years. Burkina Faso and Niger have two of the highest shares in the group. While the value has increased significantly for Mali during the period, it remains low in Cote d'Ivoire, except for over the last two years.

Figure 5
WAEMU: Gross fixed public capital formation (% of GDP*)*

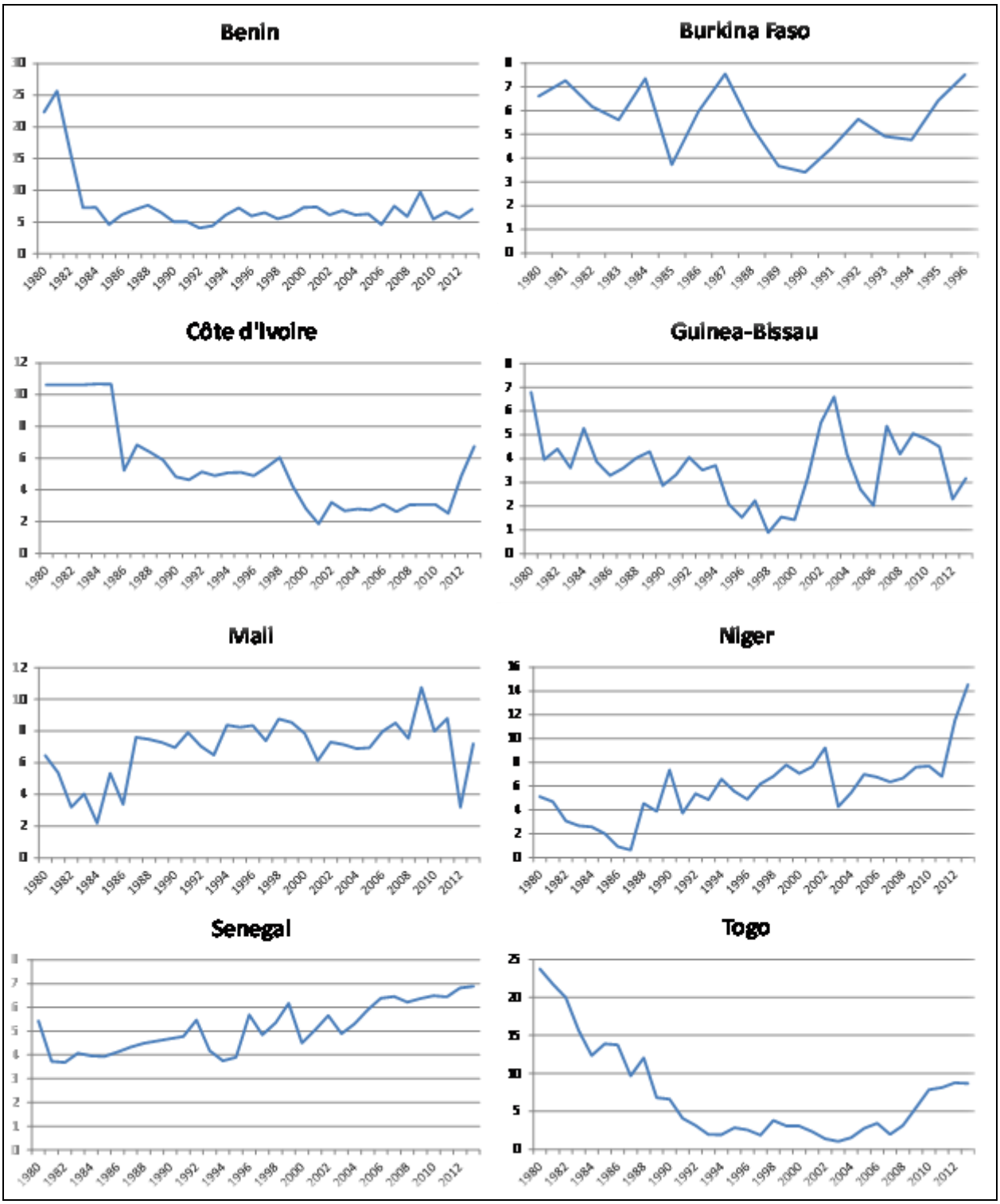


Source: Authors' calculation based on the World Economic Outlook Database

Figure 6 presents the longer-term trend of the share of gross public fixed capital formation in GDP for the WAEMU countries which reflects government infrastructure investments. Both Senegal and Niger exhibit an increasing trend. In Guinea-Bissau, the share of public capital formation fluctuates significantly with sharp increases and drops. Burkina Faso shows a similar trend with almost 4 percentage-point ups and downs. At some point in time, Mali had around 8 percent public capital formation in percent of GDP, but it declined quickly to 3.5 percent in 2012.[10] After a deep drop in the first half of the 1980s, Benin continues to have one of the lowest values in the group, around 7 percent throughout the years. Similar to Benin, Togo also faced a sudden drop in the 1980s, with the rate remaining around 3 percent of GDP during the 1990s and 2000s, and increasing to 8 percent after 2008. A similar U-shaped trend is observed for Cote d'Ivoire. Both Togo and Cote d'Ivoire have been affected by political instability during the last decade or so, and have recently started to increase their share, which may be a sign of a more stable climate for infrastructure financing, especially in Cote d'Ivoire.

[10] This decrease reflects lower amounts of ODA available during the last years.

Figure 6
WAEMU - Gross fixed public capital formation (% of GDP)



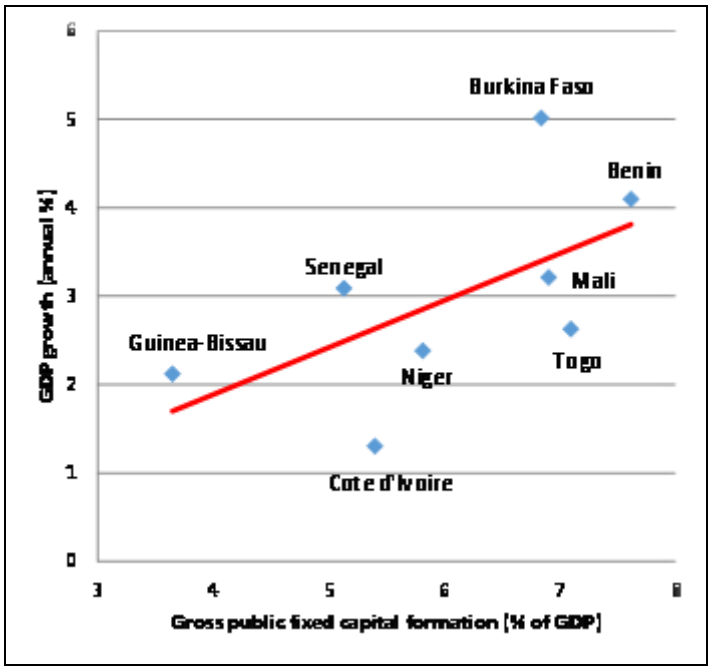
Source: Authors' calculation based on the World Economic Outlook Database

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, Bayraktar, and El Aynaoui, 2008).[11] We can see the evolution of these variables in Figures 7 and 8 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 presented in red 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. Despite the fact that the country has almost 5 percent public investment, Cote d'Ivoire has the lowest average growth rates 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, that are contributing to this result.

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 specification. This link is also specified in our working assumption.

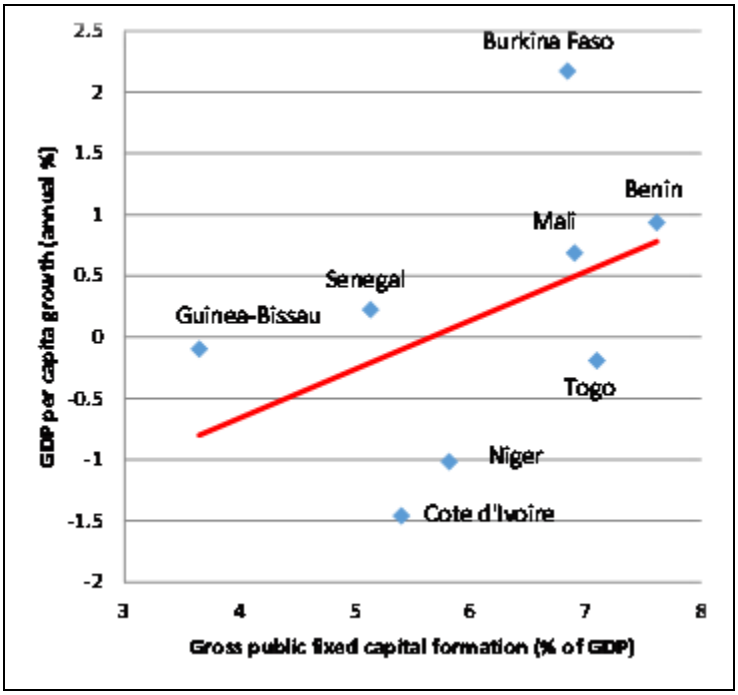
Figure 7
WAEMU- Gross fixed public capital formation and Growth (averages 1980-2013)



Source: Authors' calculation based on the World Economic Outlook Database

[11] It should be noted that the statistical and graphical analyses in this and the following section do not indicate any causality between the variables. Unfortunately, we cannot run formal causality tests since we do not have long enough time series. A simple comparison of trends is presented in this section to give an idea of their evolution. The regression analysis presented in the next section is necessary to understand the link among different variables, after controlling for all other possible determinants.

Figure 8
WAEMU- Gross fixed public capital formation and Per Capita Growth
(Averages 1980-2013)



Source: Authors' calculation based on the World Economic Outlook Database

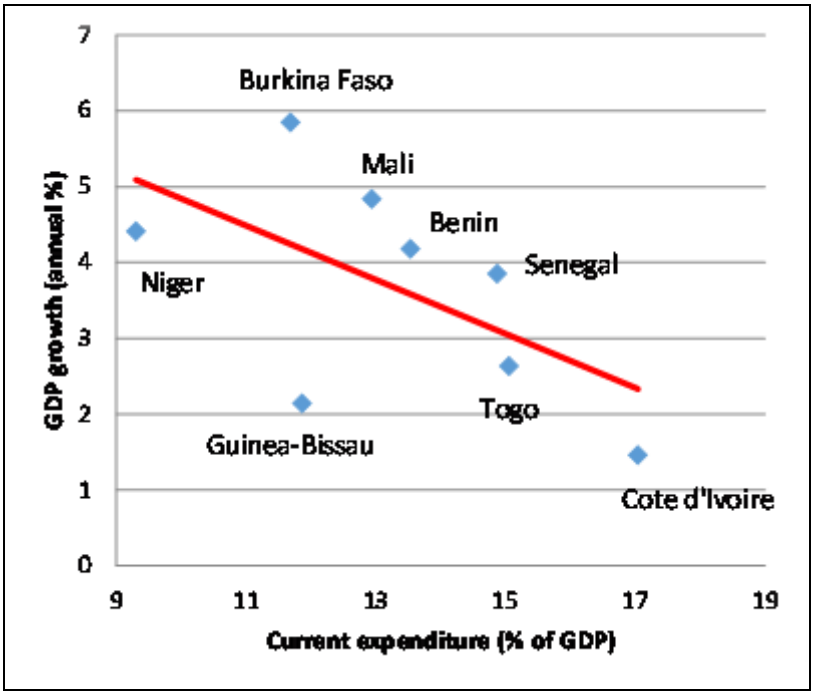
Analysis of current and capital classification of public spending

Based on data availability for comparative purposes, the classification of public spending into capital and current components is chosen as an indicator of the priorities of the governments of the union. The average values of capital and current components are calculated for the period of 2000-2013.[12] Current expenditures are defined to include requited payments other than for capital assets or for goods or services to be used in the production of capital assets, and 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 expenditures for the acquisition of land, intangible assets, government stocks, and nonmilitary and nonfinancial assets.[13]

[12] The data source is the World Bank's African Development Indicators.
[13] 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 9 presents a comparison of trends for the average growth rate and the current component of public spending, Figure 10 shows the same comparison with the capital component. We observe a similar evolution for the former and the opposite for the latter. The figures include simply linear trends. As can be seen in Figure 9, Niger has the lowest average current spending[14], and its growth performance is relatively good. 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 9
GDP Growth Rates and Current Public Expenditure (averages 2000-2013)



Source: Authors' calculation based on the African Development Indicators Database

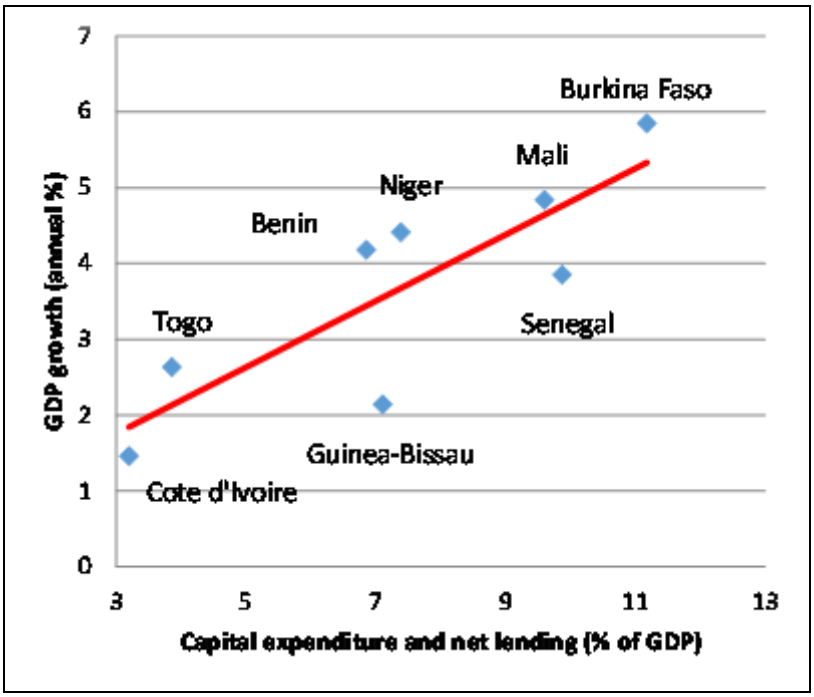
The results in Figure 10 show almost the reverse ordering of countries when compared to the results in Figure 9. Cote d'Ivoire appears in the left-hand corner of the figure with the lowest growth rate and lowest capital spending. On the other hand, Burkina Faso has the highest capital expenditure and 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

[14] 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 no contribute to growth (see, for example, Fosu, 2010). However, this results has to be interpreted in consideration of other factors, as indicated in the next sections.

the same capital spending ratios as Guinea-Bissau, their growth rates are almost 2.5 percentage points higher.

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 empirical specification and working assumption.

Figure 10
GDP Growth Rates and Capital Public Expenditure (averages 2000-2013)



Source: Authors' calculation based on the African Development Indicators Database

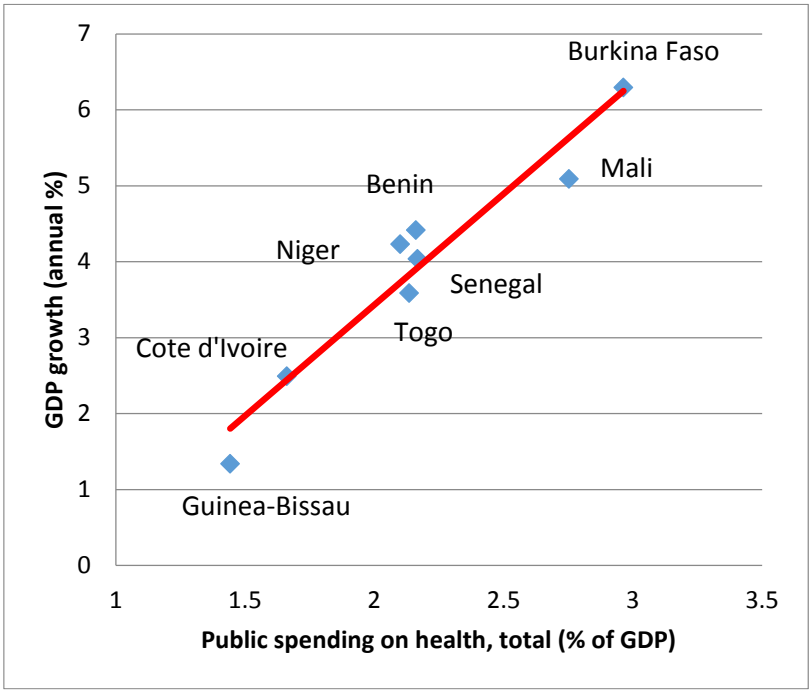
Analysis of Public Education and Health Spending and Growth

A priori, public spending on health and education are considered as two of the most important public expenditure items which can promote growth significantly, as they are strongly linked to human capital accumulation (see, for example, Bloom, Canning, and Sevilla, 2004; Ajakaiye and Kimenyi, 2011). Without educated and healthy people, it is almost impossible to have an adequate labor force and productive jobs; and in their absence, growth rates cannot increase at desired rates. It must be noted, however, that education is considered one of the longest-term investments (Ajakaiye and Kimenyi, 2011). Sometimes it may take decades to see the expected effects on growth. In addition, education public spending does not always reach its beneficiaries and/or its quality may not be good enough to affect growth. In this section a simple comparison between growth rates and health and education public expenditures is presented. We observe a similar evolution of the growth rates and public health spending in the WAEMU.

Figure **11** presents the average growth rates and health spending over the period of 1995 to 2012. The trend line is added in red in

Figure **11**. Burkina Faso has the highest growth rate and the highest share of health spending. Guinea-Bissau figures at the other end of the trend line. It has the lowest growth rate for the period and the lowest ratio of public spending on health.

Figure 11
GDP Growth Rates and Public Expenditure on Health (averages 1995-2012)



Source: Authors' calculation based on the African Development Indicators Database

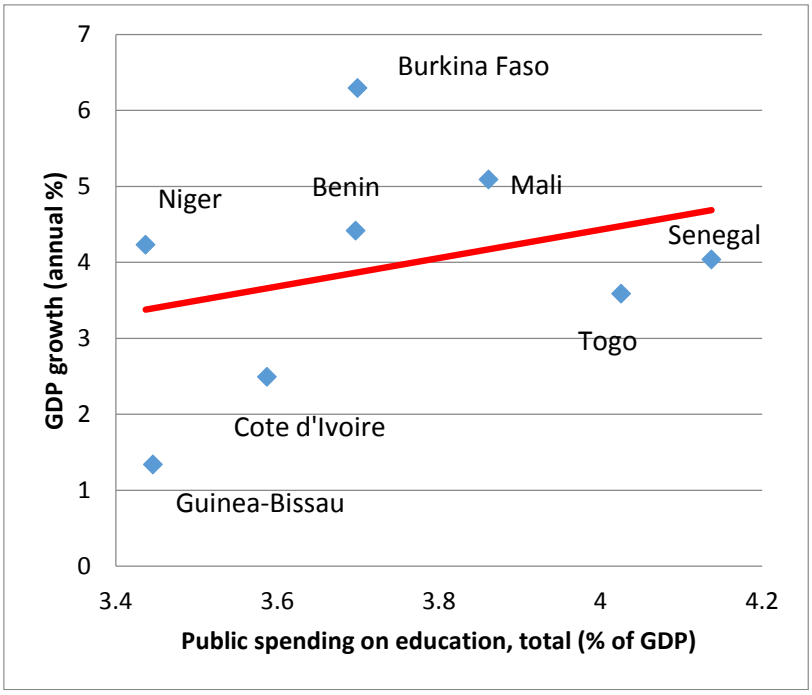
The trends of the growth rates and the shares of education spending diverge greatly by country.

Figure **12** presents the average data points for growth and the share of education spending in GDP for the period of 1995 to 2011. Burkina Faso has the highest GDP growth rates in the group, but its education spending, as a percent of GDP, is close to the average value. Niger and Guinea-Bissau have the same level of public spending on education, but their growth performances are different. In conclusion, it cannot be said that public spending on education and growth rates have evolved at similar paces.

These trends indicate that education and health spending are likely important for growth. Unfortunately, due to data limitations we could not include health and education public spending in our empirical specification. However, we include human capital accumulation, which is considered as the outcome of

health and education public spending, in the regression specification and the working assumption of the empirical model.

Figure 12
GDP per capita and Public Expenditure on Education (averages 1995-2011)



Source: Authors' calculation based on the African Development Indicators Database

Analysis of Governance Effectiveness and the Quality of Institutions

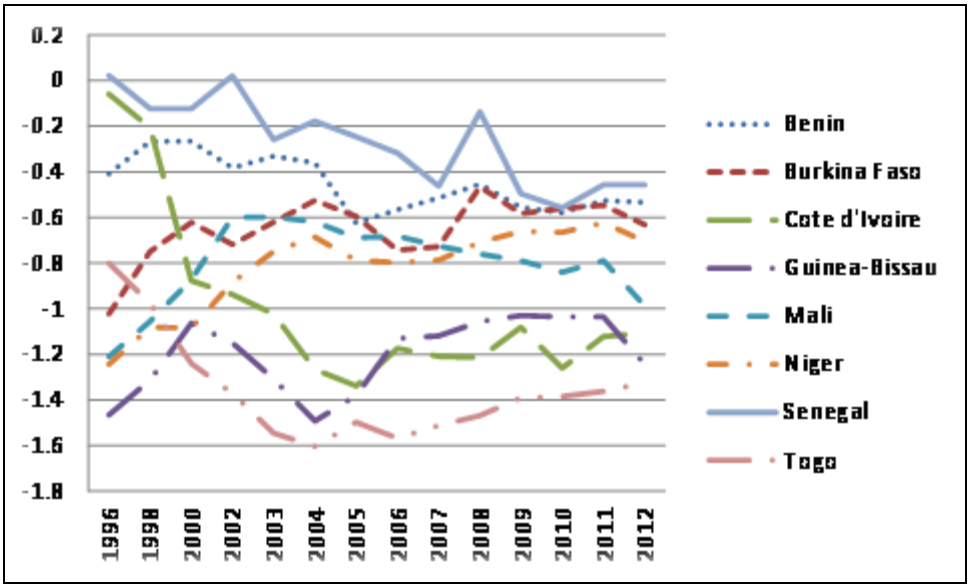
Improvements in the quality and effectiveness of government institutions are essential ingredients of a balanced economic development process. Without solid institutions and good governance, public spending can be easily wasted. In this section, two measures of the quality and effectiveness of institutions and governance for the WAEMU countries are investigated.

One of the indicators is government effectiveness, taken from the World Bank's Worldwide Governance Indicators Database. It captures perceptions of the quality of public services, the quality of the civil service and its degree of independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. The range of the estimated indicator is between +2.5 and -2.5. Figure 13 shows the time trend of government effectiveness for each WAEMU country.

All the values are negative, except one data point in 1996 for Senegal which shows the highest government effectiveness indicator, but with a declining trend. Benin has the second highest indicator, but it is declining

as well. Burkina Faso's government effectiveness has slightly improved throughout the period, but still the process is not smooth, as significant fluctuations are observed. The sharpest drop in government effectiveness is found in Cote d'Ivoire. The value declined from zero to -1.3 between 1996 and 2005, then remained almost stable around -1.2. Niger and Mali have an inverted U-shaped trend. For these two countries government effectiveness improved until 2002; then it started declining. In the group, Togo has the lowest indicator value. It dropped from -0.8 to -1.6 between 1996 and 2004. After that, it started increasing again, but this increase was not enough to raise the value of its government effectiveness above the value of any other country in the group.

Figure 13
Government Effectiveness Indicator (1996-2012)



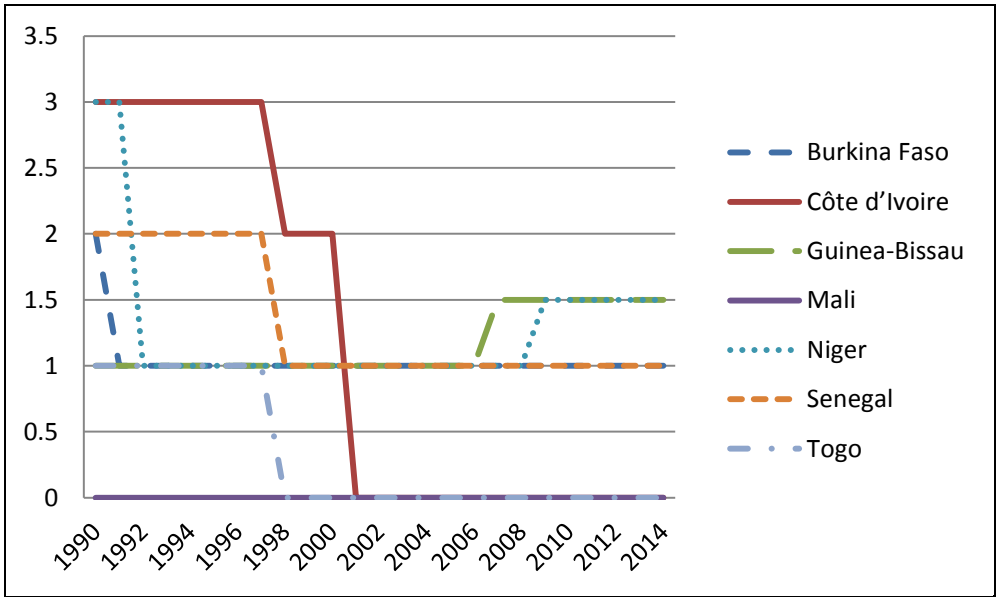
Source: Authors' calculation based on the Worldwide Governance Indicators Database

The second indicator measuring the quality of institutions is the bureaucracy quality indicator. 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.[15]

[15] 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 14 presents the time trend of this indicator for 7 WAEMU countries for the period of 1990 to 2014.[16] When compared to the values in Figure 11, we again observe the same 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 from 3 to zero between 1990 and 2001 and stayed at the zero level after that. Senegal dropped 1 point from 2 to 1 between 1990 and 1998; then it stays at 1 point throughout the period. In recent years, only the indicators for Niger and Guinea-Bissau have improved very slightly, moving from the 1 point range to the 1.5 points range.

Figure 14
Bureaucracy Quality Indicator (1990-2014)



Source: Authors' calculation based on the ICRG Database

Another set of indicators measuring the quality of government is reported by the World Bank: Country Policy and Institutional Assessment (CPIA). Four of these indicators can be relevant for the WAEMU countries:

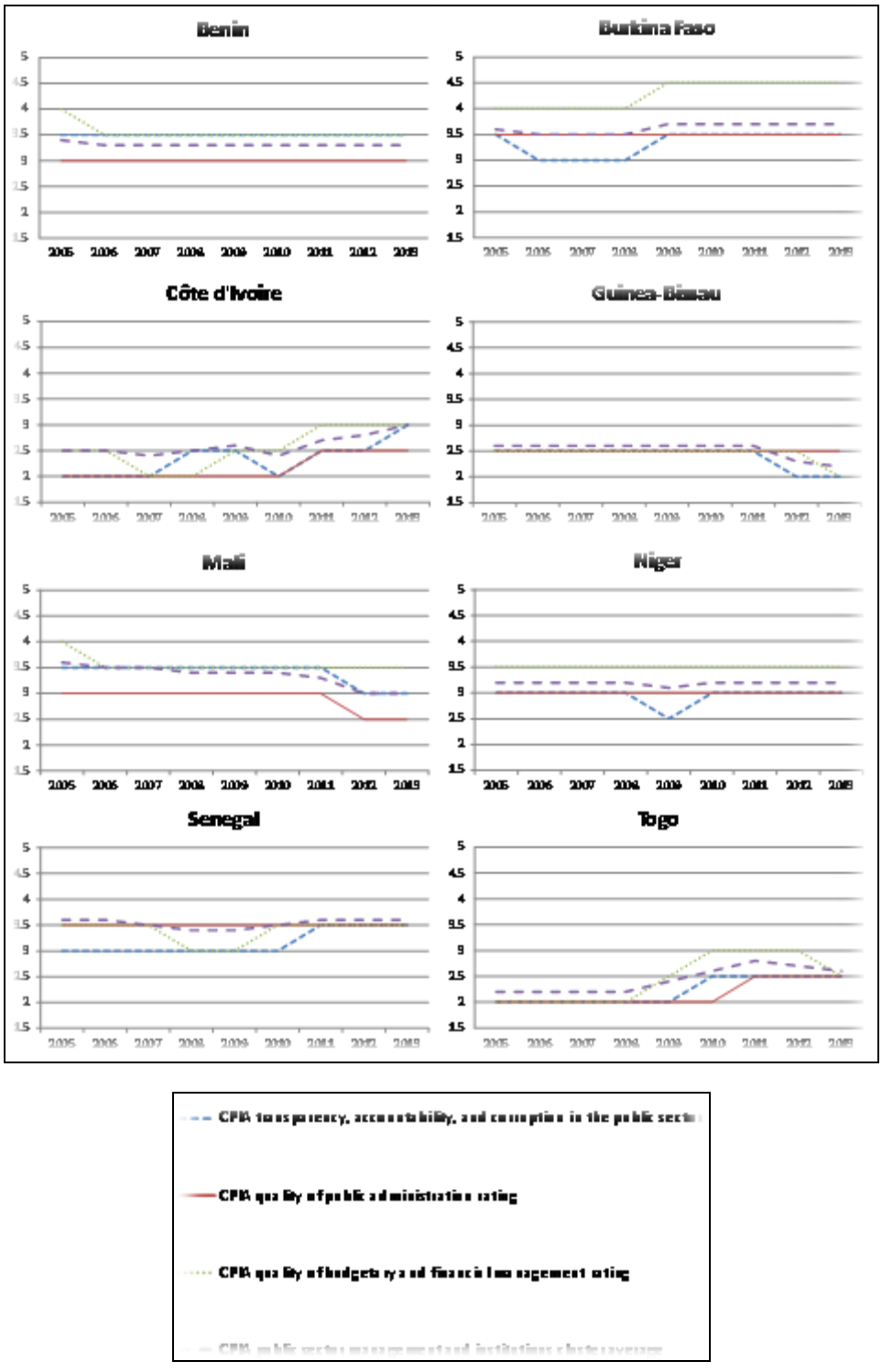
- CPIA transparency, accountability, and corruption in the public sector rating (1=low to 6=high): Transparency, accountability, and corruption in the public sector assess the extent to which the executive can be held accountable for its use of funds and for the results of its actions by the electorate and by the legislature and judiciary, and the extent to which public employees within the executive are required to account for administrative decisions, use of resources, and results obtained. The three main dimensions assessed here are the accountability of the executive to oversee institutions and of public employees for their performance, access of civil society to information on public affairs, and state capture by narrow vested interests.

[16] Benin is excluded due to the lack of data.

- CPIA quality of public administration rating (1=low to 6=high): Quality of public administration assesses the extent to which civilian central government staff is structured to design and implement government policy and deliver services effectively.
- CPIA quality of budgetary and financial management rating (1=low to 6=high): Quality of budgetary and financial management assesses the extent to which there is a comprehensive and credible budget linked to policy priorities, effective financial management systems, and timely and accurate accounting and fiscal reporting, including timely and audited public accounts.
- CPIA public sector management and institutions cluster average (1=low to 6=high): The public sector management and institutions cluster includes property rights and rule-based governance, quality of budgetary and financial management, efficiency of revenue mobilization, quality of public administration, and transparency, accountability, and corruption in the public sector.

Figure 15 reports the level of these 4 CPIA indicators for each WAEMU country. Like the other indicators measuring governance quality, the countries of the union have low scores for the 4 CPIA indicators. Benin and Burkina Faso have the highest institutional CPIA scores on average, while Togo and Guinea-Bissau have the lowest values. It should be noted that while the scores have been improving in recent years for Togo, they have been declining in Guinea-Bissau. Similarly, Mali also faces downward-moving scores. Cote d'Ivoire presents a clear, upward sloping trend of all CPIA indicators. Taking the year 2013 values into account, the CPIA quality of budgetary and financial management rating is the highest in Burkina Faso (score = 4.5) and the lowest in Guinea-Bissau (score = 2). CPIA public sector management and institutions cluster average is again highest in Burkina Faso (score = 3.7) and lowest in Guinea-Bissau (score = 2.2). In the union, Burkina Faso (score = 3.5) and Senegal (score = 3.5) have the highest score for the CPIA quality of public administration rating, while Cote d'Ivoire, Guinea-Bissau, Mali, and Togo have the lowest scores (score = 2.5 for each). While the highest scores for CPIA transparency, accountability, and corruption in the public sector are found in Benin, Burkina Faso, and Senegal (score = 3.5). Guinea-Bissau has the lowest score (score = 2).

Figure 15
WAEMU- Selected CPIA (2005-2013)



Source: Authors' calculation based on the World Bank's World Development Indicators

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. The empirical observations in this section show that the quality and effectiveness of governance indicators can be important for the growth performance of countries[17]

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 both through demand- and supply-side effects (Hemming, Kell, and Mahfouz, 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 can lead to 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 WAEMU countries[18], we focus on its current and capital components.

In this section, we run panel regressions using a dynamic GMM technique. This technique controls for endogeneity[19] of the dependent variable, vis-à-vis the independent variables, and also among regressors.

[17] Similarly, in a paper investigating the link between growth and public spending, Bayraktar and Moreno-Dodson (2015) suggest that governance indicators affect the effects of public spending on growth; countries with better quality of public institutions have more productive public spending. Rajkumar and Swaroop (2008) show the importance of good governance for effective public spending.

[18] Currently data limitations prevent us from studying such classifications. But as data become more available, we are planning to introduce these classifications in the future versions of the paper.

[19] As growth rates increase, it is also possible that the share of public spending to GDP goes up as well.

While the GMM results refer to a dynamic, multi-year framework, the analysis overall is based on annual data.

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[20]. 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.[21]

Econometric Methodology: The dynamic panel technique (system GMM) is applied and the results are compared with those obtained with the static panel regressions.[22] This technique is preferred since it is quite likely that the right-hand-side variables may not be exogenous, as they can be determined by each other, by growth rate, or by other variables that are not controlled for in the empirical specifications. Therefore, it is used to allow for a rigorous treatment of the endogeneity of public spending with respect to growth in order to have more reliable and precise results.[23] More specifically, we use a two-step GMM methodology which requires taking the first differences of the variables.[24] Since a set of instrumental variables is introduced with the GMM technique, it helps us control for possible endogeneity among regressors. [25] 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.[26] In the following sub-section, alternative regression methodologies are used to demonstrate the robustness of the results.

Empirical Specification: Our working assumption is 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

[20] The time period may change slightly from one country to another depending on data availability at the country level.
[21] 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.
[22] Table 5 compares different regression methodologies.
[23] Arellano and Bond, (1991), Arellano and Bover (1995), Blundell and Bond (1998).
[24] It should be noted that time and fixed-effect dummies are introduced in levels.
[25] Some examples of papers on public expenditures or its components which use this methodology while running regression specifications are: Ghosh and Gregoriou (2008), Afonso and Alegre (2011), Cavalloa and Daude (2011), Bayraktar and Moreno-Dodson (2015), and Gupta, Kangur, Papageorgiou, and Wane (2014).
[26] Defining the set of instrumental variables has been always challenging when one uses GMM methodologies in regression analysis. 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 be also 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 H0: there is no over-identification problem. We fail to reject in each case. For serial correlation z-tests (AR(2)), H0 is "there is no serial correlation"; and for normality test, H0 is "normal distribution". We fail to reject H0 in each test. We fail to reject AR(1) tests, indicating that the set of instrumental variables is weak. But, 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.

subsections, we also test alternative regression specifications and various methods to check the robustness and relevance of our empirical results.

Similar to the regression specifications in Bayraktar and Moreno-Dodson (2015)[27], we include fiscal revenues and the overall government budget constraint. Introducing the government budget constraint has been essential in similar studies to separate 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 including the budget constraint avoids biases associated with incomplete specification ignoring financing options of governments and budget balance, in line with other recent papers in the literature.[28] 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 as they are very significant in the WAEMU region.[29]

Before running any regressions, we conducted the correlation matrix to check for any multi-collinearity problems.

[27] 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.
[28] See Kneller et al. (1998) and (1999), Bose et al. (2007), Ghosh and Gregoriou (2008), Benos (2009), and Bayraktar and Moreno-Dodson (2015).
[29] In future regression analysis, we are planning to introduce a distinction between public revenue from grants and other public revenues, including taxes.

Table 2 reports the correlation coefficients. It can be seen that pairwise correlation coefficients are not high enough to cause any multi-collinearity problems.

Table 2
Correlation Matrix (annual data)

	Total Expenditure /GDP	Current expenditure (% of GDP)	Capital expenditure and net lending (% of GDP)	Other expenditure (% of GDP)	Balance fiscal (% of GDP)	Total reve/GDP	Total tax/GDP	Trade (% of GDP)	Inflation, consumer prices (annual %)	Gross fixed capital formation, private sector (% of GDP)	Gross public fixed capital formation, current prices (%ofGDP)	Total debt outstanding at year-end (% of GDP)
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 reve/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 (%ofGDP)	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

Source: Authors' calculations

The basic panel regression equation is defined as:

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

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***, or non-fiscal determinants of growth. In addition to these variables, country[30] and time effects are included in the regression equation as well.[31]

The selection of ***control variables*** was based on the growth literature and the country case studies. The share of exports and imports (trade openness) to GDP and the share of private investment in GDP are considered as 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).[32] The inflation rate is included as a measure of macroeconomic stability. Human capital is also an important determinant for growth. Following Bose, Haque, and Osborn (2007) and Barro and Sala-i-Martin (2003), we construct the human capital variable as the weighted sum of the enrolment ratios (%) in primary and secondary schools, and in higher education. The weights are 1 for primary school enrolment ratio, 2 for secondary school and 3 for enrolment in higher education. The weights are approximations to the relative values of three types of education. Finally, we also include the lagged value of the dependent variable (growth rate of GDP per capita) to take into account 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.[33]

Total public spending items are classified into two groups: current and capital.[34]

> **Current expenditure:** Current expenditures are defined to include requited payments other than for capital assets or for goods or services to be used in the production of capital assets, and 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.

[30] 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 regression specifications country dummies are introduced in levels, not in first difference.

[31] In the future, with longer time series it would be possible to separate the group of conflict-affected countries (Cote d'Ivoire, Guinea-Bissau, and Togo) from the remaining countries. Inclusion of group dummies for these two groups of countries could be another interesting addition to the regression specification.

[32] Alternative specifications with the share of private investment in total investment and in public investment are tested in the "robustness check" section below.

[33] Since the "other expenditures" component of public expenditures is not included in the regression specification, the inclusion of other budget item does not introduce any multi-collinearity problem. Since public expenditures do not include "other expenditures", total fiscal revenue plus budget surplus is not equal to total public expenditure.

[34] The capital and current components of public spending for the WAEMU countries are only publically available in the World Bank's African Development Indicators Database. They are not reported in any IMF sources or other data sources. In the African Development Indicators Database, the source of the data is given as "country economists". Unfortunately, there are no formal definitions for each country in the African Development Indicators database. Thus, we have used the general definitions of current and capital expenditures (IMF definitions).

Capital expenditure: Capital expenditures are defined as expenditure for acquisition of land, intangible assets, government stocks, and nonmilitary and nonfinancial assets.

Other Expenditure: Total public expenditure minus current and capital expenditures (excluded from the regression).

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

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

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

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

Regression Analysis:

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

Regression Analysis with Total Public Expenditure

The estimation results for total public expenditure are given in columns (3) and (4). The regression specification includes public spending and other fiscal variables as percent of GDP. In column (3) trade openness is one of the control variables. In column (4) private investment is used, instead of trade openness. 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 (4). 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.[35] The total budget balance does not have a significant effect on growth, although it is positive, perhaps indicating that these

[35] In similar analyses in other countries, less dependent on grants, the coefficient of fiscal revenue is usually negative and statically significant.

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.

Regression Analysis with Expenditure Classifications: Current versus Capital

The question 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 current component.

The estimated coefficients are presented in columns (1), (2), (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.

Given that the coefficient of the fiscal balance is not significant for growth, the debt constraint is introduced in the specification as an alternative, and more significant measure of fiscal stability. 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 less effect public spending will have 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.

Since a significant, though in some countries declining, portion of current expenditures corresponds to interests paid on existing external debts, the other strong policy message that follows is that debt reduction and debt repayment, which open up 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 (1) and (2), 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 WAEMU countries. This could also indicate that the fiscal revenue to GDP ratios are relatively low, and mainly dependent on indirect taxes and natural resources, which have not been distortive to economic activity.

As it 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 activity and trade exchanges is as important for growth, if not more, as increasing productive public investments.

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	-19.034 (-2.55)**	-10.131 (-1.752)*	-12.044 (-2.03)**	-3.581 (-0.822)	-10.964 (-1.837)*	-1.939 (-0.431)	-9.977 (-1.898)*
Growth rate of GDP per capita (-1)	-0.062 (-0.512)	-0.069 (-0.53)	-0.098 (-0.889)	-0.118 (-1.028)	-0.1 (-0.911)	-0.126 (-1.104)	-0.165 (-1.424)
Trade openness (% of GDP)	0.131 (2.208)**	..	0.143 (2.41)**	..	0.144 (2.428)**	..	..
Private investment (% of GDP)	..	0.159 (1.659)*	..	0.184 (1.763)*	..	0.146 (1.794)*	0.156 (2.103)**
Tax revenue (% of GDP)	0.915 (2.545)**	1.239 (2.705)***	..	..	..	..	0.957 (2.443)**
Other revenue (% of GDP)	-0.115 (-0.685)	-0.081 (-0.455)	..	..	..	..	0.056 (0.856)
Total fiscal revenue (% of GDP)	..	..	0.156 (1.659)*	0.243 (1.636)*	0.171 (1.743)*	0.157 (1.875)*	..
Current public expenditure (% of GDP)	-0.045 (-0.344)	-0.132 (-0.74)	..	..	-0.101 (-0.774)	-0.059 (-0.398)	-0.073 (-0.473)
Capital public expenditure (% of GDP)	0.448 (2.495)**	0.373 (2.23)**	..	..	0.223 (1.874)*	0.308 (1.931)*	0.311 (1.493)
Total public expenses (% of GDP)	..	..	0.059 (1.463)	0.061 (1.741)*	..	..	..
Budget surplus (% of GDP)	0.005 (0.974)	0.004 (1.151)	0.002 (1.457)	0.005 (0.93)	0.001 (1.125)	0.002 (1.318)	..
Total public debt (% of GDP)	..	..	..	..	..	..	-0.01 (-1.677)*
Inflation - consumer price index	0.033 (0.481)	0.108 (1.313)	-0.062 (-1.021)	0.004 (0.076)	-0.059 (-0.97)	0.01 (0.174)	0.094 (0.511)
Human Capital Indicator	0.016 (0.448)	0.048 (1.657)*	0.021 (0.776)	0.015 (0.542)	0.015 (0.536)	0.024 (0.826)	0.026 (0.911)
Dummy for politically unstable countries (Burkina Faso, Cote d'Ivoire and Guinea-Bissau)	..	..	..	..	..	..	..
No. of observations	102	101	113	110	113	110	101
J-statistics	2.11	2.06	1.84	1.28	1.69	1.59	1.79
Arellano-Bond serial correlation test AR(1)	0.91	1.03	1.06	0.88	1.01	0.97	1.07
Arellano-Bond serial correlation test AR(2)	0.47	0.75	0.47	0.58	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, H0 is "normal distribution". We fail to reject H0 in each test.

Regression Results with Public and Private Fixed Capital Formation

An alternative classification of public spending is possible including public fixed capital formation, which is a component of public capital spending expected to have a strong impact on growth (see, for example, Agénor, Bayraktar, and El Aynaoui, 2008). 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 the most basic infrastructure may not exist. The importance of, especially infrastructure investment and 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 valuable information about its significance for growth.

In such regression specification, we can also observe possible complementarity between public and private fixed capital formation. 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.[36] 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 capital fixed 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, positive 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 tax 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.

[36] When we include public fixed capital investment (a component of total capital expenditure) in some regression specifications, we cannot include total capital expenditure at the same time since public fixed capital investment is a component of total capital expenditure. Thus, we had to include only the remaining component of total capital expenditures after subtracting public fixed investment in these regression specifications.

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.[37] Following the methods suggested by Museru, Toerien, and Gossel (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).[38] 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 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 applied for 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).

[37] For example, Museru, Toerien, and Gossel (2014) show the statistical significance of public investment on the growth rate of 26 Sub-Saharan African countries. Their findings state that aid effectiveness may have been eroded by volatility in public investment.

[38] In Table 3, we have shown that trade openness is very important for growth. In the remaining regression analysis, we have dropped this variable because we wanted to focus more broadly on private investment.

Table 4
Private and Public Investment

Dependent variable: Growth rate of GDP per capita			
	(1)	**(2)**	**(3)**
Constant term	-9.747 (-1.998)**	-9.895 (-2.016)**	-3.457 (-0.537)
Growth rate of GDP per capita (-1)	-0.214 (-1.582)	-0.21 (-1.54)	-0.224 (-1.377)
Private investment (% of GDP)	0.135 (1.914)*	0.128 (1.859)*	0.095 (1.641)*
Tax revenue (% of GDP)	1.029 (3.157)***	1.069 (3.198)***	0.975 (2.997)***
Other revenue (% of GDP)	0.063 (0.993)	0.066 (1.036)	0.058 (0.923)
Current public expenditure (% of GDP)	-0.071 (-0.508)	-0.069 (-0.49)	-0.041 (-0.292)
Public fixed capital formation (% of GDP)	0.226 (2.48)**	0.233 (2.485)**	0.259 (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 (1.645)*	0.276 (1.607)*	0.259 (1.763)*
Total public debt (% of GDP)	-0.006 (-1.641)*	-0.007 (-1.504)	-0.003 (-1.215)
Inflation - consumer price index	0.077 (0.241)	0.075 (1.213)	0.084 (1.367)
Human Capital Indicator	0.048 (1.625)*	0.052 (1.702)*	0.056 (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.

Robustness Check

In this paper we have employed one of the most commonly used regression techniques for growth specifications: the system GMM. Other methods or data organization are also suggested in the literature, such as fixed-effect panel regressions and regressions with moving averages for medium- and longer-term analysis.[39] 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 the medium and long terms. Thus, inclusion of medium-term analysis is important to understand whether we also observe supply-side effects of public spending.

The results for the robustness check of the regression methodologies and data organization 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 column (1) and column (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 it 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.

We also 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 terms of public spending and its components. The results presented in

Table **6** in columns (1) and (2) 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. It means that, 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

[39] In papers investigating the impact of public investment or capital on growth, Khan and Kumar (1997) and Dessus and Herrera (2000) suggest two-stage least squares and simultaneous equations models, successively, to deal with a possible endogeneity problem. Due to data limitations, we cannot use these methods in this paper.

components of public expenditures. The interpretation is the same: as the share of capital expenditures in percent of GDP increases, there is a positive effect on growth as well, but at a decreasing rate. This means that the returns on capital expenditures decline over time. The nonlinear term of current expenditures is negative, but not statistically significant.

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 (-1.998)**	-3.084 (-1.623)*	-1.601 (-0.522)
Growth rate of GDP per capita (-1)	-0.214 (-1.582)	0.421 (4.333)***	-0.314 (-1.015)
Private investment (% of GDP)	0.135 (1.914)*	0.025 (0.309)	0.034 (1.722)*
Tax revenue (% of GDP)	1.029 (3.157)***	0.251 (1.626)*	0.775 (1.748)*
Other revenue (% of GDP)	0.063 (0.993)	0.023 (0.423)	0.008 (0.128)
Current public expenditure (% of GDP)	-0.071 (-0.508)	-0.021 (-0.243)	-0.145 (-1.271)
Public fixed capital formation (% of GDP)	0.226 (2.48)**	0.335 (2.111)**	0.261 (1.694)*
Other Capital public expenditure (% of GDP)	0.258 (1.645)*	0.101 (0.678)	0.127 (0.761)
Total public debt (% of GDP)	-0.006 (-1.641)*	0.001 (-0.026)	-0.006 (-0.547)
Inflation - consumer price index	0.077 (0.241)	0.081 (1.512)	0.099 (0.572)
Human Capital Indicator	0.048 (1.625)*	0.014 (1.388)	0.028 (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 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.

Our regression results show that both public and private investment are indeed statistically significant determinants of growth. In 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 that an increasing share of private investments in total investments can have for growth. While public investments are essential to support private sector development, growth acceleration, without adequate development of private investment, would be limited.

Alternative Specifications for Robustness Check

In this section, in order to check the robustness of the results, the current and capital components of public spending are introduced in an alternative way. They are calculated as a share of total public expenditures. We also include the share of total public spending in GDP (Devarajan, Swaroop, and Zou, 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 (see, for example, Acemoglu, Johnson, Robinson, and Thaicharoen, 2003), which is considered a critical factor impacting the effectiveness of public spending to boost growth. 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).

Table 6
Robustness Check with Alternative Specifications

Table 6: 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)	(8)	(9)	(10)
Constant term	-25.691 (-3.115)***	-13.074 (-2.307)**	-7.964 (-1.624)*	-6.072 (-0.861)	-3.173 (-1.861)*	-10.657 (-1.595)*	-11.391 (-1.722)*	1.176 (0.219)	-5.251 (-1.9)*	-2.616 (-1.206)
Growth rate of GDP per capita (-1)	-0.179 (-1.557)	-0.23 (-2.02)**	-0.179 (-1.497)	-0.173 (-1.443)	-0.035 (-0.373)	-0.16 (-1.253)	-0.165 (-1.297)	-0.082 (-0.766)	-0.004 (-0.04)	-0.082 (-0.771)
Log of initial GDP per capita (constant US$)	..	..	..	..	..	..	..	-0.641 (-1.718)*	..	..
Log of GDP per capita (constant US$) (-1)	..	..	..	..	..	..	..	..	..	..
Private investment (% of GDP)	0.268 (1.955)*	0.205 (1.887)*	..	..	0.152 (1.808)*	0.171 (2.356)**	0.174 (2.412)**	0.106 (2.358)**	0.171 (2.284)**	0.192 (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 (2.641)***	1.004 (2.573)**	1.006 (2.953)***	1.02 (2.984)***	1.023 (1.881)*	..	..	..	..	..
Other revenue (% of GDP)	0.131 (1.868)*	0.119 (0.706)	0.102 (1.415)	0.112 (0.978)	0.071 (1.564)	..	..	..	..	..
Total fiscal revenue (% of GDP)	..	..	..	..	..	0.123 (1.723)*	0.108 (1.762)*	0.081 (0.579)	0.073 (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 (-0.26)	-0.126 (-0.973)	-0.146 (-1.04)	..	-0.055 (-0.367)	..	-0.014 (-0.111)	..	-0.03 (-0.237)
$(\text{Current public expenditure})^2$ (% of GDP)	..	-0.002 (-0.107)	..	..	..	..	..	..	..	..
Current public expenditure (% of total public expenditure)	..	..	..	..	-4.833 (-2.693)***	..	..	..	..	..
Capital public expenditure (% of GDP)	..	0.388 (3.471)***	..	..	..	0.301 (2.097)**		0.268 (2.449)***		0.412 (2.691)***
$(\text{Capital public expenditure})^2$ (% of GDP)	..	-0.118 (-3.081)***	..	..	..	..	..	..	..	..
Capital public expenditure (% of total public expenditure)	..	..	..	..	1.045 (2.219)**	..	..	..	..	..
Total public expenses (% of GDP)	0.064 (2.261)**	..	..	..	0.086 (1.926)*		0.069 (1.733)*	..	0.377 (2.053)**	..
$(\text{Total public expenses})^2$ (% 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 (2.399)**	0.243 (1.835)*	..	..	..	..	..	..
Other Capital public expenditure (% of GDP)	..	..	0.36 (1.731)*	0.375 (1.804)*	..	..	..	..	..	..
Budget surplus (% of GDP)	0.008 (1.444)	0.002 (0.406)	0.002 (0.439)	0.002 (0.39)	0.002 (0.491)	0.002 (0.342)	.0.001 (0.014)	0.001 (0.276)	0.007 (1.485)	0.005 (1.253)
Inflation - consumer price index	-0.081 (-1.487)	-0.052 (-1.221)	-0.088 (-1.421)	-0.003 (-0.186)	0.055 (1.038)	-0.048 (-0.505)	-0.064 (-0.682)	0.031 (0.572)	-0.035 (-0.628)	-0.031 (-0.553)
Human Capital Indicator	0.024 (0.879)	0.024 (0.946)	0.021 (0.741)	0.017 (0.612)	0.006 (1.012)	0.004 (0.123)	0.002 (0.047)	0.006 (0.723)	0.015 (2.411)**	0.017 (1.477)
Bureucracy quality	..	..	..	..	..	1.273 (2.163)**	1.478 (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, H0 is "there is no serial correlation"; and for normality test, H0 is "normal distribution". We fail to reject H0 in each test.

In the main regression specifications of this paper, an indicator of institutional quality was not included in the set of explanatory variables due to data limitations for the WAEMU countries.[40] Given the importance of such an indicator 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 7. It is well suited to capture the quality of institutions because a high level means that the 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.

This measure is especially important for the WAEMU countries, as concluded in a recent regional study conducted by the World Bank, "*Boosting Capital Budget Execution in WAEMU Member States for Development Impact (An Integration Approach to Procurement and Public Financial Management)"*[41], which indicates that "… the technical capacities of the agencies involved and general institutional arrangements also affect performance of the budget."

The regression results with the bureaucracy quality index are presented in columns (6) and (7) of

Table **6**.[42, 43] 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 more 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 (in our case, bureaucracy quality) 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 the 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 try and capture convergence effects among different countries. Lower initial GDP will 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

[40] The available measures either do not have long enough data series or not available at all for some WAEMU countries.
[41] World Bank project led by Renaud Seligmann (April 2014).
[42] We also tested the importance of the government effectiveness index (defined in Section 3e) 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. Thus, they are not reported here, but available upon request.
[43] It should be noted that this variable is not included in the main regression specifications because it is not available for Benin.

GDP per capita. This means that, in the long run, there is statistically significant convergence among the 8 countries in the WAEMU group.

Finally, given the observed asymmetry of shocks in the sub-region, we add another interesting regression specification involving both positive and negative shocks of total public spending.[44] With this specification, we can assess whether expansionary and contractionary government spending shocks (due to vulnerability factors, internal and external, such as political events, natural disasters, security issues, global and European crises, etc.) have an asymmetric effect on the WAEMU countries. The reaction of economic growth to expansionary and contractionary policies is expected to be different and asymmetric as well (see Dessus and Varoudakis, 2013). 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 lesser magnitude than the 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, pos_{it} and neg_{it}, are introduced in the regression specification to assess the importance of asymmetric effects. We define the shocks in accordance with the methods suggested by Cover (1992), Kandil (2001), and Berument and Dogan (2004): $pos_{it} = 0.5 * (\varepsilon g_{it} + abs(\varepsilon g_{it}))$ and $neg_{it} = -1 * (\varepsilon g_{it} - pos_{it})$. εg_{it} 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 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 coefficient of the positive shock is equal to the negative coefficient of the negative term. We reject the null hypothesis at the 1 percent significance level. This result could indicate 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.

Grants can have positive or negative effects on growth (Svensson, 1999). We run an alternative empirical specification with grants and other public revenues both as percent of GDP. The results are presented in column (10) of Table 6. The results show that the coefficient of grants is negative but not statistically significant. This can be explained by the fact that countries getting higher amount of aid in the form of grants generally rely also on domestically generated revenues to finance public spending. On the other hand, the estimated coefficient of other revenues (including taxes) is positive and statistically significant,

[44] See, for example, Dessus and Varoudakis (2013) for the impact of asymmetric shocks in the WAEMU area.

which could be explained by the predominance of consumption taxes which are less distortive to economic activity than direct taxation and, overall, a relatively low tax burden in the region comparing to other parts of the world. The rest of the variables, including public expenditures, are robust to the introduction of these two types of revenues.

Regression Results with Country Effects

The results reported in the previous sections are obtained by pooling all data information for each country without taking into account any country-specific effects. Since it is expected that the effects of current and capital public expenditures on growth may vary per country, in this section the growth equation is estimated including country-specific interactive terms. This approach is particularly useful here, given that the sample of countries is relatively small. Due to constraints related to degrees of freedom, however, the country-specific effects are estimated one by one for the current and capital components. In this section, the estimation technique is again GMM.

Table 7 reports the results using annual data. The interactive dummy variables are constructed, for instance, for current expenditure in Benin, as follows:

Interactive dummy for current expenditure in Benin = } 1*current expenditure if the country is Benin

It should be noted that a separate interactive dummy variable was not introduced for Guinea-Bissau[45] to prevent the perfect multicollinearity problem. [46] The results for Guinea Bissau, which is expected to be an outlier anyway, are therefore captured by the difference between the coefficient of the original variable in the regression and the country-specific coefficients.

Column (1) of Table 7 reports the regression results from Table 3 without country effects for comparison purposes. Since private investment is considered significant for growth, the empirical specification includes this variable (see, for example, Khan and Kumar, 1997). In Table 7, while column (2) reports the interactive variables for the current component of public spending for each country, the interactive variables for capital components are presented in column (3). In column (4), the estimated coefficients with total spending are reported.

When we check the current spending variables in column (2) of Table 7, one can see that the estimated coefficients of the interactive country dummies for Burkina Faso, Cote d'Ivoire, and Togo are positive and statistically significant at the 10 percent level. These results indicate that for Burkina Faso, Cote d'Ivoire, and Togo, current expenditures are as essential as capital expenditures for economic growth. The coefficient of the interactive term for Senegal is statistically significant at the 10 percent level, but is unexpectedly negative. The value of the coefficient is highest for Cote d'Ivoire and Togo, indicating that economic public expenditure has the strongest effect on growth in these two countries. The rest of the coefficients are positive

[45] Guinea-Bissau was chosen as it can be an outlier in the group.
[46] One country must be dropped, because the original variable appears as well in the equation; otherwise, there would be perfect collinearity among regressors.

or negative, but not statistically significant. These outcomes imply that current expenditures do not seem to exert any effect on economic growth for this set of countries.

The results with the interactive dummy for capital public expenditure, as reported in column (3) of Table 7, suggest that these expenditures also have a positive impact on growth for each country except for Benin and Cote d'Ivoire. The coefficients are positive and statistically significant for other countries. Their significance level is 10 percent for Mali, Senegal, and Togo, and 5 percent for Burkina Faso and Niger. These results confirm that capital expenditures are essential for economic growth in several of the sample countries, especially for Burkina Faso and Niger.

For Burkina Faso, both current and capital components are statistically significant determinants of growth. However, the impact of current expenditures appears to be less than the impact of capital expenditures, as measured by the size of the estimated coefficients of both variables for this country.

Overall, as expected, it can be concluded that at the country level capital public expenditures are clearly much more relevant in explaining growth changes than current expenditures.

When we check the country-level interactive dummies for total spending in column (4) of Table 7, we see that the coefficients are highly significant at the 5 percent level for Burkina-Faso and Cote d'Ivoire. The significance level of the same coefficients drops to 10 percent for Mali, Niger, and Togo. It is not statistically significant for the remaining countries. It is unexpectedly negative for Senegal, but not statistically significant.

It is important to notice that in the regression results with country effects, the coefficients of the other variables do not change with respect to the results presented in the previous section (see Table 3).

Table 7
Composition of Spending and Country Effects (annual data)

Dependent variable: Growth rate of GDP per capita				
	(1)	(2)	(3)	(4)
Constant term	-10.131 (-1.752)*	-18.68 (-2.347)**	-5.414 (-0.881)	-13.381 (-2.581)**
Growth rate of GDP per capita (-1)	-0.069 (-0.53)	-0.097 (-0.814)	-0.064 (-0.47)	-0.281 (-1.372)
Private fixed capital formation (% of GDP)	0.159 (1.659)*	0.209 (1.81)*	0.179 (1.847)*	0.105 (1.837)*
Tax revenue (% of GDP)	1.239 (2.705)***	0.607 (1.903)*	0.411 (1.881)*	0.644 (2.161)**
Other revenue (% of GDP)	-0.081 (-0.455)	0.112 (0.617)	0.07 (0.372)	0.152 (1.232)
Current public expenditure (% of GDP)	-0.132 (-0.74)	0.221 (0.114)	0.09 (0.612)	..
Capital public expenditure (% of GDP)	0.373 (2.23)**	0.448 (1.835)*	0.359 (1.741)*	..
Total government expenditure (% of GDP)	..	..	..	0.041 (1.739)*
Budget surplus (% of GDP)	0.004 (1.151)	0.001 (0.174)	0.002 (0.37)	-0.001 (-0.237)
Inflation - consumer price index	0.108 (1.313)	-0.321 (-2.006)**	-0.253 (-1.511)	-0.187 (-1.268)
Human Capital Indicator	0.048 (1.657)*	0.014 (0.425)	0.043 (1.647)*	0.011 (0.437)
Benin-Current public expenditure (% of GDP)	..	-0.033 (-0.058)	..	..
Burkina Faso-Current public expenditure (% of GDP)	..	0.109 (1.781)*	..	..
Cote d'Ivoire-Current public expenditure (% of GDP)	..	1.886 (1.981)*	..	..
Mali-Current public expenditure (% of GDP)	..	0.047 (0.051)	..	..
Niger-Current public expenditure (% of GDP)	..	0.287 (1.039)	..	..
Senegal-Current public expenditure (% of GDP)	..	-1.021 (-1.671)*	..	..
Togo-Current public expenditure (% of GDP)	..	0.448 (1.707)*	..	..
Benin-capital public expenditure (% of GDP)	..	..	0.899 (1.544)	..
Burkina Faso-capital public expenditure (% of GDP)	..	..	0.343 (2.374)**	..
Cote d'Ivoire-capital public expenditure (% of GDP)	..	..	0.477 (1.521)	..
Mali-capital public expenditure (% of GDP)	..	..	0.186 (1.878)*	..
Niger-capital public expenditure (% of GDP)	..	..	0.733 (2.141)**	..
Senegal-capital public expenditure (% of GDP)	..	..	0.336 (1.815)*	..
Togo-capital public expenditure (% of GDP)	..	..	0.364 (1.884)*	..
Benin-total public expenditure (% of GDP)	..	..	..	0.357 (1.515)
Burkina Faso-total public expenditure (% of GDP)	..	..	..	0.416 (2.035)**
Cote d'Ivoire-total public expenditure (% of GDP)	..	..	..	1.321 (1.951)**
Mali-total public expenditure (% of GDP)	..	..	..	0.212 (1.682)*
Niger-total public expenditure (% of GDP)	..	..	..	0.151 (1.878)*
Senegal-total public expenditure (% of GDP)	..	..	..	-0.246 (-0.699)
Togo-total public expenditure (% of GDP)	..	..	..	0.547 (1.685)*
No. of observations	101	101	101	117
J-statistics	2.06	1.85	1.91	2.01
Arellano-Bond serial correlation test AR(1)	1.03	0.88	0.96	1.11
Arellano-Bond serial correlation test AR(2)	0.75	0.67	0.48	0.81
Jarque-Bera normality test	1.15	1.25	1.54	1.34

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. The country interactive terms are presented for current and capital spending separately.

5. Conclusion

This paper demonstrates empirically the importance of public spending volume, composition (current/capital), and quality in determining per capita growth rates in the WAEMU countries. The regression analysis finds that total public spending has an impact on growth. 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 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, public investment volatility has a clear negative and statistically significant impact on growth in the group, while the quality of public fixed investment is shown to contribute to enhancing its positive effect on growth. 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 to measure the quality of public investments. The results clearly indicate that improvements in the quality of public capital can lead to higher growth rates.

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, which contribute to increasing the debt to GDP ratios beyond certain levels (to be determined country by country) 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. The regression findings also indicate 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 regression results with country effects confirm that at the country level capital public expenditures are clearly much more relevant in explaining growth changes than current expenditures. The findings are robust to different regression methodologies as well as the inclusion of short- and medium-term data.

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