Public Expenditure and Private Sector Investment in WAEMU Countries

By

Okey Mawussé Komlagan Nézan
Faculty of Economics and Management
University of Lomé

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Abstract

This paper seeks to analyse the nature of the relationship between public expenditure and private investment in eight WAEMU countries for the period 1980–2009. Our analysis, using econometric estimations, shows that total public expenditure and its capital component positively and significantly affect private investment. The results also highlight a non-linear quadratic relationship between public spending and private investment. Public spending and its capital component (share of GDP) should be at least 20% and 8.79%, respectively, before having a significant positive effect on private investment. Governments and policy makers should pursue the vast infrastructure policies undertaken these last years in the WAEMU zone and mobilize more resources to finance capital expenditures.

Key words: *Public expenditure, private investment, WAEMU*

1. Introduction

An analysis of the effect of public expenditure on private investment is done within the general framework of analysing the nature of the relationship between the public and the private sector. Despite the role of public spending in growth, as mentioned by Barro (1990), several schools of thought support the idea that economic development and growth could be assured only by limiting the public sector to the smallest possible share (Iossa et al, 2008). In fact, facing the increasing disengagement of the state, the private sector is a powerful engine of growth, a real catalyst for rapid growth (Cowen, 2002). Although often defined as all private enterprises, whose capital is majority owned by individuals or private companies, the private sector is also characterized by the share of private sector investment in GDP (Ruhashyankiko and Yehoue, 2006). For a long time, certain spheres of economic activity were reserved for public authorities: Transport, energy, environmental services, and even education. But today several studies recognize the broadening of private sector activity in various fields such as education, health, security, infrastructure financing, and even solving the liquidity crisis (Cornand, 2002). However, private sector growth cannot be achieved without the support of public authorities through laws, reforms and infrastructure improvement. Thus, since the 1980s, the role of the state paradoxically consists of creating the conditions for its own exit, by eliminating all the administrative barriers likely to hinder the development of business.

The current context of a global economy characterized by the financial crisis due to the loopholes of liberalism, is renewing enquiries into, on the one hand, the role of the public authorities and the place of the private sector in the economy in a country and, on the other hand, the best channel through which the public authorities and the private sector can support growth, especially in developing countries. Hugon (2002) proposes that African countries create a stabilized environment that allows investment risk by favouring the reconstitution of states according to their essential functions; because boosting private sector investments is not in fact possible without a significant commitment of public investment (Hugon, 2002; Viner, 1927; Barro, 1990; Cavallo and Daude, 2011; Wang, 2002).

Within a framework of stimulating private investment, the West African Economic and Monetary Union (WAEMU) Council adopted the "Cotonou Declaration" in April 1997. This is intended to sustainably maintain annual economic growth at a level higher than 5%, thanks to the implementation of measures likely to establish a climate favourable to private investment. However, for WAEMU countries the structure of public expenditure is partly dictated by WAEMU's convergence criteria. The WAEMU countries are subjected to convergence criteria (the first two second-rank criteria) that stipulate that,

the wage bill does not exceed 35% of tax revenue, and public investments financed by internal resources constitute at least 20% of tax revenue. The aim of these multilateral surveillance measures is to encourage governments to reduce their budget deficits. But the first two second-rank criteria mentioned above implicitly reflect the accession of the WAEMU countries to policy measures that advise the reduction of current expenditure and increasing capital spending as a condition for attaining long-term growth. This raises questions about the potential role of these criteria in the weakness of productive publics pending (7.7% of GDP for capital and 15.05% for current expenditure in 2009), and thus to what extent they are responsible for both the low rate and stagnation of private investment in WAEMU countries (9.7% between 1980 and 2009, and 12% in 2009). It is therefore necessary to study the effect of public spending restrictions, and to determine the optimal level of public spending which the WAEMU countries need to meet both the convergence criteria and the objectives of private sector development.

Literature on the relationship between the private and the public sector often notes two effects: The *crowding-in* effect, by which public expenditure through public investment in infrastructure positively affects private sector investment, thus showing the complementarity between the private and the public sector (Cavallo and Daude, 2011; Wang, 2002). In this case the Keynesian mechanisms related to the policies of stimulation of demand are brought to the fore. Other authors (Algan et al, 2002; Nubukpo, 2007) refer to *the crowding-out* effect through which public expenditure, by increasing the tax pressure, provides substitutable goods and services to the private sector and by increasing the upward pressure on wages, would be likely to reduce private investment and job creation (the Ricardian equivalence theorem). The crowding-out effect highlights a relationship of substitution between the private sector and the public sector (Algan et al, 2002).

Most empirical studies, especially those considering WAEMU countries, are focused on the direct relationship between public expenditure or the composition of public expenditure and economic growth, without analysing the channels through which public expenditure affects growth, such as private sector investment (Nubukpo, 2007; Ouattara, 2007). Moreover, few studies test the non-linear relationship between public expenditure and economic performance. The only one to be found that integrates WAEMU countries is that of Devarajan et al (1996). It was also found that most empirical studies were satisfied to determine the nature of the relationship between the public sector and the private sector without establishing the optimal level of public capital, which makes it possible to maintain or reverse the relationship (i.e., without testing the non-linearity of the relationship). It is, therefore, necessary to explore the non-linear relationship between public expenditure and private investment in the WAEMU sub-region in order to make a statement about the relevance of the thresholds set by the convergence criteria (especially the first two second-rank criteria) to which these countries are subjected.

From the aforementioned, several questions emerge: What is the influence of the public sector on the growth of the private sector in WAEMU countries? Is there an optimal level of public expenditure necessary for the emergence of private sector investment in the countries of the region? In short, what is the nature of the relationship between the public sector and the private sector in the WAEMU region?

The principal objective of this study is to analyse the nature of the relationship between public expenditure and private investment in the WAEMU countries. Specifically:

- Analysing the effect of total public expenditure and its components (current expenditure and capital expenditure) on private sector investment.
- Determining the threshold of public capital expenditure and current expenditure from which the effect of public expenditure on private investment is optimal.

To achieve these objectives we test the following hypotheses:

- Public capital expenditure positively affects private investment whereas current public expenditure affects private investment negatively. The latter effect is so weak that total public expenditure exerts a *crowding-in* effect on private sector investment. The analysis of the signs of the coefficients of the various variables capturing the public sector (in the econometric model) will make it possible to determine the nature of the impact of the public sector on the private sector. This causes the emergence of the infrastructures channel, or the "Aschauer hypothesis".
- There exists a threshold beyond which the effects that public expenditure and its components (capital and current) exert on private sector investment are reversed. In other words, there exists a non-linear quadratic relationship between public expenditure and private sector investment in the WAEMU countries.

This study enriches the economic literature on determinants of private sector investment by focusing on the nature of the relationship between public expenditure and private investment. On the one hand, it makes it possible to provide guidelines to WAEMU governments on the level, composition and optimal allocation of the public expenditure necessary for the promotion of a good investment climate. On the other hand, it gives tools to the WAEMU authorities about the choice of the thresholds of the convergence criteria, particularly the first two second-rank criteria.

The rest of the study is organized as follows: In the next section, stylized facts are presented about the evolution of public spending and private investment, and the allocation of public spending in the context of convergence process in WAEMU. Section 3 reviews the theoretical and empirical literature on the relationship between public expenditure and economic performance. In Section 4 the methodological approach is presented. Section 5 presents the results of the econometric estimations of the effects of total public expenditure and its two components (capital expenditure and current expenditure) on private investment. In the last section, a number of conclusions and policy recommendations are given.

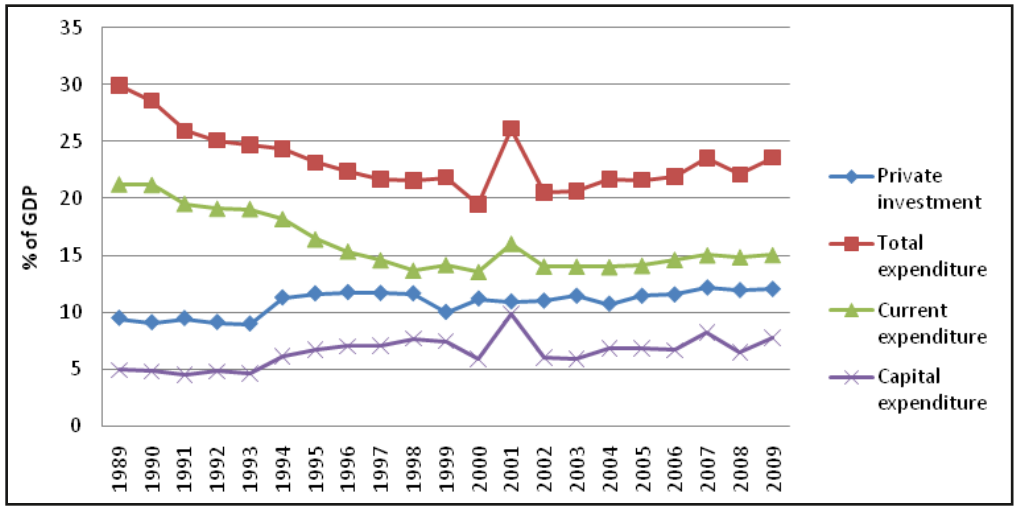
2. Stylized facts

Trend of public spending and private investment in WAEMU countries

According to Esfahani (2000), many developing countries, particularly those with poor institutions, maintained large and inefficient public sectors during the 1980s and 1990s. The share of state enterprises in GDP remained around 14% in low-income economies, it varied between 8% and 10% in medium-income countries, and declined from 9% to 7% in industrialized economies (Esfahani, 2000). African countries are characterized by low private investment rates, although the proportion of private companies exceeds that of state enterprises. During the 1990s, the number of private enterprises, mostly in African countries, was about 75% to 98% of the total number of enterprises (Table A1 in the appendix. The share of gross fixed capital of the private sector in GDP in sub-Saharan Africa was on average 12.1% between 1980 and 1989, 12.6% in 1990 and 1999, and 12.6% between 2000 and 2009 (Africa Development Indicators, 2011). For the countries of the WAEMU, the private investment rate was, on average, 9% between 1990 and 1993, 11.3% between 1994 and 2000, 11.15% between 2003 and 2006, and it rose to 12.1% in 2007 (Figure 1, Table A2 in the appendix). Private investment is low despite the importance of the private sector in the economy. According to Nubukpo (2007), in the short and long term, the variable that seems to have the most significant positive impact on growth in the WAEMU is real private investment. Senegal, Mali, Togo and Burkina Faso had the highest private investment rate during the period 1980–2009: 15.58%; 12.7%; 12.3% and 10.0%, respectively. As shown in Table 1, the lowest private investment rates were realized by Niger (4.5%), Guinea-Bissau (6.3%), Côte d'Ivoire (7.4%) and Benin (8.5%).

The low rate of private investment in WAEMU countries is due to a number of factors that include the weakness of public sector spending and disparities in regulations. In sub-Saharan Africa, the share of gross public sector fixed capital formation was low; it averaged 5.4% between 1980 and 1989, fell to 4.8% between 1990 and 2000, and increased to 5.8% between 2000 and 2009. The share of public consumption expenditure in GDP was, on average, 15.2% between 1980 and 1989, 16.8% between 1990 and 1999, and 14.5% between 2000 and 2006 (Africa Development Indicators, 2011). In 2009 the share of public expenditure in WAEMU's GDP was 23.56% (7.7% for capital expenditure and 15.05% for current expenditure); larger than for the whole of sub-Saharan Africa.

Figure 1: Evolution of public expenditure and private investment in the WAEMU



Source: Author, based on data from BCEAO Statistics Yearbook 2004 and 2008–2009

When the regulations governing the setting up and operation of a business are complex, entrepreneurs give up. The weakness of public sector investment in infrastructure can constitute an obstacle to the activities of the private sector. The governments that spend more on public investment are those of Guinea-Bissau, Burkina Faso, Mali, Niger and Benin, where the average gross general government fixed capital formation (share of GDP in %) during the period 1980–2009 was, respectively 21.1; 9.3; 9.3; 7.9 and 7.8. Less of an effort was made in Côte d'Ivoire, Senegal and Togo, as shown in Table 2. Furthermore, the 2007 and 2008 editions of the annual report of the World Bank on business practice in the world, titled "Doing Business," provided results that showed the sluggishness and slowness of the formal processes of setting up a business in WAEMU countries, and the expense incurred by those who seek to create an individual enterprise, which constitute obstacles to the development of the private sector.

Table 1: Private sector fixed capital formation (share of GDP in %)

	1980–89	1990–99	2000–09	1980–2009
Benin	4.5	8.3	12.8	8.5
Burkina Faso	8.8	10.8	10.4	10.0
Côte d'Ivoire	8.7	6.2	7.3	7.4
Guinea-Bissau	10	7.7	1.1	6.3
Mali	9.9	12.4	15.7	12.7
Niger	**3**	**3.4**	**7.2**	**4.5**
Senegal	**13.7**	**15.4**	**18.2**	**15.8**
Togo	7.8	11.8	17.3	12.3
WAEMU	8.3	9.5	11.25	9.7
Sub-Saharan Africa	14.4	12.4	12.6	13.1

Source: Author's compilations based on Africa Development Indicators 2011

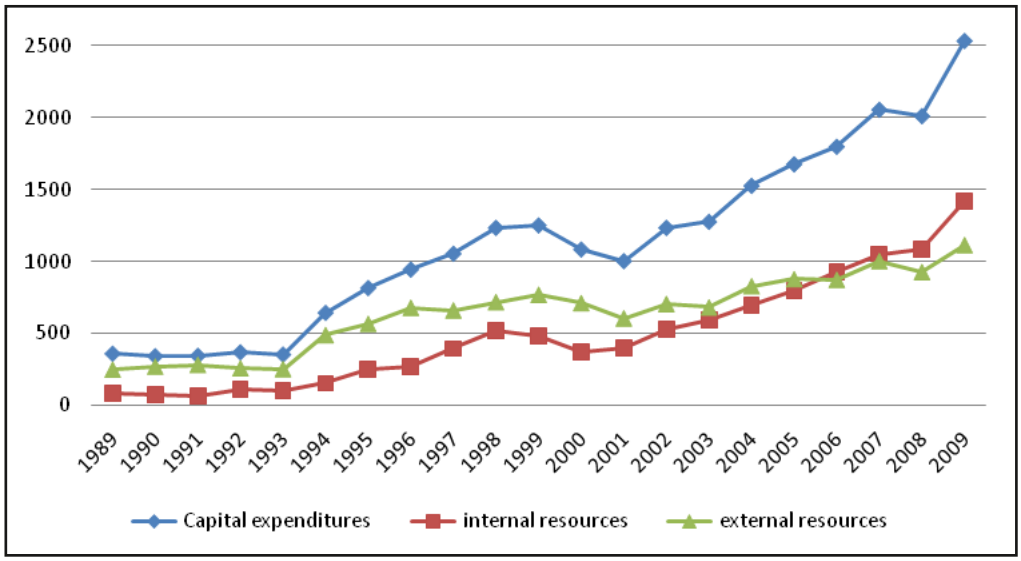
Table 2: Gross general government fixed capital formation (share of GDP in %)

	1980–89	1990–99	2000–09	1980–2009
Benin	9.1	7.5	6.8	7.8
Burkina Faso	10.4	10.5	7	9.3
Côte d'Ivoire	7.1	5.6	2.8	5.2
Guinea-Bissau	33.3	20.2	9.8	21.1
Mali	10.2	10.1	7.7	9.3
Niger	11.2	5.6	7	7.9
Senegal	3.7	4.5	7.9	5.4
Togo	11.2	3.7	3	6.0
WAEMU	12.0	8.5	6.5	9.0
Sub-Saharan Africa	6.1	4.8	5.8	5.6

Source: Author's compilation based on Africa Development Indicators,2011

Over the years current expenditure has been mainly financed by government budget (local resources). Figure 2 presents the capital expenditure and its internal and external financing (in billions of CFA francs).

Figure 2: Capital expenditure and its financing sources in the WAEMU



Source: Author based on data from BCEAO Statistics Yearbook 2004 and 2008-2009

Capital expenditures were mainly financed by external resources in WAEMU in the period before 2006, but from 2006, that was dominated by internal resources. This reversal may be due to the Heavily Indebted Poor Countries (HIPC) programme by the Multilateral Debt Relief Initiative (MDRI), which will enable the country to have more resources. Debt relief initiatives for poor countries by the World Bank and the IMF were established to minimise the effects of debt on the economic development of these countries. Five of the eight WAEMU countries (Benin, Burkina Faso, Mali, Niger and Senegal) completed the HIPC Initiative in the firt phase in1999. By the end of 2006, all

these countries were also eligible for the Multilateral Debt Relief Initiative (MDRI).[1] The completion point was reached in Togo in November 2008. This debt forgiveness is a contribution to the financing of development and should allow all those countries that have reached the completion point to receive a 100% cancellation of debt owed to the IMF, World Bank and African Development Bank (AfDB).

WAEMU's convergence criteria and the problem of allocating public expenditure

Some studies in the economic literature show that the factors that can influence the structure of public expenditure are corruption and the political system. The budgetary choice can vary according to not just the qualitative characteristics of the political system, but also the level of perception of corruption in the country. In addition to the overall size of the budget, corruption during the budgetary process also influences the allocation of expenditure in the various sections of the budget. Empirical studies show that corruption reduces the budgeted running and maintenance expenditure, increases military expenditure, and reduces the education and health expenditure. The choice of expenditure also depends on the system of signing government contracts in the country. Government contracts are prevalent in the sectors that absorb most of the public capital expenditure such as energy, defence, public works, and communication and transport (Moschovis, 2010).

However, for WAEMU countries, the structure of public expenditure is partly dictated by WAEMU's convergence (the first two second-rank) criteria), which stipulate that:

- The wage bill does not exceed 35% of the tax revenue. Only three countries — Mali, Niger and Senegal — adhered to this criterion between 2008 and 2009.
- Public investments financed on internal resources should reach at least 20% of tax revenue. Only three countries — Côte d'Ivoire, Guinea-Bissau and Togo — did not comply with this criterion between 2008 and 2009 while Benin, Burkina Faso, Mali, Niger and Senegal complied.

These criteria that encourage capital expenditure and discourage current expenditure (salaries and wages, transfers and grants) have positive and negative implications. The positive implication is that expenditure in infrastructure will make it possible to meet needs such as transport, communication, water and electricity and those of public services (health and education) in the region. This results in an increase in the movements of people, goods and services, the rapid increase in the population and urbanization, and an increased regional economic integration. Energy, road, railway and telecommunication infrastructure can, in particular, facilitate trade and the division of labour, stimulate competition in the markets, favour a more efficient distribution of economic activities between regions and countries, contribute to the dissemination of technologies and the adoption of new organizational practices, or offer access to new resources. All these elements are favourable to the activities of the private sector.

The negative consequences of these criteria are that countries will tend to reduce their current expenditure, leading to a reduction in the wage bill and reduced military expenditure (security). Although this reduces the spending burden of the states, it partly explains the low level of salaries reflected in the Guaranteed Inter-professional Minimum

Wage, SMIG (in spite of the efforts aimed at raising the SMIG, one notices that the levels of the minimum wage in 2007 are CFA Franc 36.607 per month in Côte d'Ivoire and CFA F 36.174 in Senegal. Niger and Togo have the lowest levels of CFA Francs 18.899 and CFA Francs 13.757 per month, respectively; see Table A3 in the appendix). Moreover, corruption, low recruitment in the public sector, unemployment and low levels of financing of security could be responsible for the reduction in the capacity for private investment in WAEMU countries. WAEMU countries need to raise the level of the SMIG and carry out recruitment in the civil service to reduce unemployment. There are thus questions about the optimality of the thresholds set by the WAEMU convergence criteria. There is also the question of knowing what is the effect of each one of these two components of public expenditure (capital and current), which would it be necessary to decrease or increase, and in what proportion this needs to happen to satisfy both the convergence criteria and the development objectives of the private sector. It is important to find indisputable data concerning the optimal size of the state administration and its influence on private investment.

The IMF (2011) shows that fiscal convergence within the Union could remain difficult. The multilateral framework established by the Treaty of WAEMU in 1994 to ensure fiscal discipline has not kept its promises. A high percentage of members do not actually meet the convergence criteria (Table A4 in the appendix). But there are good reasons to believe that WAEMU countries have similar technologies. The similarity of the WAEMU economies is because they have almost the same production and trade structure. The countries in WAEMU have low levels of income and industrialization, low mechanization of agriculture, and exports consist mainly (about 60% of total exports) of agricultural commodities (cocoa, coffee, cotton and fish) and mining (gold, oil and phosphate), while imports consist of industrial products.

3. Literature review

Theoretical approaches to the relationship between public expenditure and private investment

The relationship between public expenditure and private investment is ambiguous. Various types of relationship between the public sector and the private sector are identified below. Substitutability or complementarity refers to the crowding-in effector the crowding-out effect. The non-linear relationship under discussion refers to Laffer's curve.

Crowding-out effect and its mechanisms

According to the crowding-out effect hypothesis, public expenditure has a negative effect on private investment, thus establishing a substitutability relationship between the public sector and the private sector. This effect operates through several mechanisms such as an increase in the interest rate, the reduction of the amount of available savings, the rise of taxes and duties, the increase in public wages, the fall of profits, the reduction of credit to the private sector and the weakness of institutions that might follow an increase in public expenditure.

Public expenditure involves a rise of the interest rate that discourages private investment. The rise in public expenditure increases inflationary pressures, which cause a rise in the short and long-term interest rate and slows down private demand, which harms investment and growth. In addition, the rise in the amount of public expenditure is manifested by a budget deficit, which is financed either by the flotation of a loan, or by recourse to a central bank advance. The issuing of loans, through movements of interest rate, is likely to modify private agents' demand for currency as this issue affects the savings of these same agents. In the case of the issuing of loans, there appears a phenomenon of financial crowding-out with respect to private economic agents. The development of public loans is a determining factor in the rise of the interest rate, which discourages the demand for liquidity on the part of private agents and investment initiatives. Moreover, by resorting to the available funds in the economy, the state considerably reduces the level of the available money supply to private agents for their productive activities (Dramani and Laye 2008). In other words, this causes restricted access to finances, thereby reducing the financing of private investment (Cavallo and Daude, 2011).

Public expenditure financed by taxes discourages private investment (Nubukpo, 2007). The increase in public expenditure has a negative effect on investment if

enterprises anticipate that it will result in increased taxes and that the spillover effects are low. If investment depends on anticipated profitability, it depends negatively on anticipated future taxes, and one can directly obtain anti-Keynesian effect: Investment is a decreasing function of current public expenditure. There is also the fact that the rise in public wages leads to upwards pressure on private sector wages, leading to a fall in profit of investments: Profit is higher when workers accept low wages, but the rise in public expenditure (current) allows a specific increase in wages. The crowding-out effect also acts through the production by the public sector of goods substitutable to the private sector, or activities competing with those of the private sector (Algan et al, 2002; Nubukpo, 2007). In addition, the quality of institutions is a channel because the weakness of institutions may lead to the inefficiency of public expenditure that is in turn less profitable for the private sector (Cavallo and Daude, 2011).

Crowding-in effect and its mechanisms

According to the crowding-in effect hypothesis, public expenditure has a positive effect on private investment and thus translates to a relationship of complementarity between the public and the private sector. This effect operates through various channels such as infrastructure, the improvement of marginal productivity, education, health and security. Public expenditure, by financing the infrastructure, leads to an increase in the marginal productivity of private capital and an increase in the rate of return of the private sector (Cavallo and Daude, 2011; Wang, 2002). According to Wang (2002), there are two symmetrical hypotheses, the first (public-infrastructure-spilling hypothesis) assumes that externalities shift the infrastructure sector to the private sector, and the second (private-production-spilling hypothesis) assumes the opposite trajectory.

According to the public-infrastructure-spilling hypothesis, public investments, in particular in infrastructure, are theoretically regarded as having varied effects on the economy. Public capital has positive and significant effects on the private sector's production and capital productivity and formation. The services provided by public capital are assumed to enter both directly and indirectly into the private production process, and thus increase the private sector's productivity. Public capital and private capital are thus assumed to be in q-complementarity (the concept of q-complementarity and substitutability refers to the effect of the quantity of a resource on the marginal production of another resource). In other words, public investments can have a crowding-in effect on private sector investment by increasing the rate of return of private capital (Wang, 2002).

Construction infrastructure generally contributes to the rest of the economy through several channels. On the one hand, it is considered to produce an effect similar to the inter-industrial input-output link. For example, a highway or railway construction project will create a domino effect for industries upstream by providing an impetus to real estate, the steel industry and private construction. Besides, several private production activities will indirectly benefit from the highways and railways through better transport of goods and services at lower costs.

According to the private-production-spilling hypothesis, it is also postulated in agreement with Eisner (1991) and Holtz-Eakin (1994) that the growth of public sector infrastructure would be stimulated by the growth of the private sector. As the private

sector develops, its demand for public infrastructure and services increases. This demand is satisfied by an expansion of investments in public infrastructure. In other words, the demand for public infrastructure services forces the infrastructure sector to increase. A positive externality thus transits from the private infrastructure production sector, which depends on public capital.

In addition, Cavallo and Daude (2011) present a simple theoretical model which has two channels through which public investment can affect private sector investment. Public investment increases the productivity of private capital and leads to a potential crowding-in effect on private sector investment. In addition, the weakness of institutions and limited access to financing could decrease the positive effects of public investment projects and crowd out private sector investment.

Concerning the effect of public consumption expenditure (or current expenditure), Furceri and Sousa (2009) point out that two theories predict different effects that public expenditure can have on investment. The standard model of real cycles asserts that an increase in public consumption will have a positive effect on investment: An increase in public consumption leads to an increase in employment which, when it is sufficiently persistent, leads to an increase in the return on capital and, consequently, can trigger an increase in investment. Conversely, the standard IS-LM model predicts that investment should drop in response to a positive public expenditure shock: An increase in public expenditure (if it is not accompanied by an accommodating increase in money supply) leads to an increase in the interest rate, which in return will result in a reduction of investment.

It is necessary to add that public military consumption expenditure affects security, reduces uncertainties and crime, and creates favourable conditions for private enterprise. Thus, for Atesoglu (2004) there is a positive cointegration between military expenditure and private investment and, consequently, the anticipated rise in defence expenditure during the first decade of the 21st Century should have promoted private sector investment and thus capital accumulation.

The ambiguity of the effect of public expenditure is also noted by Angeletos and Panousi (2009) who introduce uncertainty into the analysis and study the effect of public expenditure in a neo-classic model with an incomplete market. They show that there are two opposite effects of public expenditure on private investment: The familiar channel of opportunity cost which tends to encourage investment, whereas the wealth channel tends to discourage investment. Alesina and Perotti (1995) show that a reduction in public expenditure could have strong positive effects on investment. This comes from the fact that investment strongly depends on companies' profits; the budgetary reduction increases the share of profit in value added by decreasing that of wages.

Algan et al (2002) present three channels through which the effects of public expenditure pass, and approach the question in terms of public employment in relation to private employment.

1. Public employment through justice, the police or public infrastructures can have a positive influence on the productivity of private employment. It is a situation where the public sector produces goods that are not substitutable for those produced by the private sector. The creation of public jobs, by having a positive externality on the

productivity of private employment, makes the latter more profitable and can thus favour their creation. On the other hand, if the public sector produces goods that are substitutable for those of the private sector, an expansion of public employment decreases the profitability of private employment and thus slows down their creation. Thus, public employment should have a crowding-out effect on private employment, which is all the more important as the goods produced by the public sector are substitutable for those of the private sector.

2. The creation of public jobs improves the prospects for the unemployed. There emerges an upward trend in wages that can result in the disappearance of some private jobs (Holmlund, 1997). Moreover, if job-hunting cannot be done simultaneously in the public sector and the private sector, a rise of the relative wages of the public sector compared with that of the private sector attracts new workers to the public sector and thus increases the crowding-out of private employment. A corollary is that "good" public employment (offering high wages and good working conditions) should crowd out more private jobs than "bad" public jobs (offering lower wages and less good conditions of work). Consequently, the creation of public jobs is likely to exert an upward influence on the unemployment rate since the revenues paid in the public sector are large.

3. The financing of the creation of public jobs (through the increase or the redeployment of public expenditure) is likely to be distorting and can thus have negative effects on the productivity of and the private sector's demand for labour.

The ambiguity of the nature of the relationship between public expenditure and private sector investment can be grasped through the possibility of the existence of a non-linear relation, i.e., public expenditure has a crowding-in effect up to a given threshold from where it starts to have a crowding-out effect, and vice versa.

Linear relationship versus non-linear relationship between public spending and economic perfomance

At the end of the 1970s, Laffer's curve demonstrated that public revenue drawn from direct taxation obeys a kind of normal law, i.e., beyond a certain tax rate the public revenue drawn from income tax decreases in spite of the increase in the tax rate because the most wealthy decide to work less. This theory shows from another viewpoint that public expenditure and growth are positively linked when public expenditure is below its optimal amount and quality, and negatively when they are above and not correlated when the public authorities provide the optimal amount of services (Nubukpo, 2007).

Barro (1990) and Devarajan et al (1996) have explicitly taken into account the possibility of a non-linear relationship between fiscal policy and growth in the non-linear approach of endogenous growth models. The questions raised in Devarajan et al (1996) concern the impact of public expenditure and its components, and the possibility of reaching an "optimal" level of military expenditure (in terms of impact on economic growth) proposed by non-linear endogenous growth models. The authors start from the

following stance: Productive expenditure can be positively associated with growth when its share in the budget is low, but this relationship turns negative when the share gets large. Because as the share keeps rising, decreasing returns to scale set in and, eventually, the relationship between the two variables turns negative. This relationship has been empirically studied by Devarajan et al (1996) and Hermes and Lensink (2001) through the introduction of the squared values of total public expenditure such as those of its components into the equations to be estimated. The existence of a linear relationship between public shares and private investment can be described as follows:

- Investment in infrastructure can only become effective at a given point (Hermes and Lensink, 2001).
- Defence expenditure is associated with positive consequences as the defence industry involves many research and development activities.
- Education and health services stimulate investment and growth through accumulation factors; beyond a given point the increase in public expenditure for these factors can delay investment and growth since their operation starts to become inefficient. Thus, there is an optimal level of expenditure allocated to these education and health factors.
- The distortionary effect of taxes on private investment starts to be felt only after taxes have reached a minimal level. This refers to the famous Laffer's curve.
- The central government needs a certain number of civil servants to efficiently provide public services. The efficiency of public services begins decreasing after the optimal number of civil servants is reached. This assumes that there is an optimal number of civil servants and, therefore, a level of public expenditure in wages associated with the efficiency of public services.

Aschauer (2000) developed a model that brings to the fore the existence of a non-linear relationship between public capital and economic growth, such that a permanent increase in the public capital ratio produces a permanent increase in growth – but only if the marginal product of public capital exceeds the marginal product of private capital after tax. It is important to take account of this prediction of non-linearity between public capital and growth when carrying out empirical studies.

The effect of an increase in public investments on economic growth is also assumed to depend on the relative marginal productivity of private versus capital public. In a neo-classic configuration, an increase in public investments (compared with private investment expenditure) will increase or lower the rate of economic growth according to whether the marginal product of public capital respectively exceeds or is exceeded by the marginal product of private capital.

The empirical results of Aschauer (2000) show that (i) the relationship between public capital and economic growth is non-linear, (ii) the public capital's stock of maximization of growth is about 60% to 80% (ratio of public to private capital) larger than the stock of private (material) capital; and (iii) permanent changes in public capital are associated with permanent changes in economic growth. For the USA, d'Agostino (2011) finds that the non-linearity hypothesis is unverified for the relationship between public non-

military consumption expenditure and economic growth showing that this component is not a good proxy for productive public expenditure.

Empirical studies on relationship between private investment and public expenditure

Concerning the empirical results, the studies by Blejer and Khan (1984) led to an important result: The level of private sector investment was positively influenced by the trend of the level of public investment in infrastructure. Greene and Villanueva (1991) interpreted this relationship as a long-term complementarity and a short-term substitutability between public investment and private investment, in the sense that a short-term increase in public sector investment seems to crowd out private sector investment.

Aschauer (1989) and Erenburg (1993) examined at an aggregate level the impact of public infrastructure on private sector investment and showed a positive correlation. Aschauer (1989) assumed an overall technology of the Cobb-Douglas type, where production is the fruit of the private sector's usual contributions of capital and labour, supplemented by the public sector's equipment or infrastructure. In the case of the United States, he arrived at the conclusion that infrastructure has a very marked positive effect on the total productivity of the factors (TPF) of the private sector; this is what has been called "the Aschauer hypothesis", confirmed by Munnel (1990).

Algan et al (2002) studied 17 OECD countries during the period 1960–2001. The empirical investigations suggest that the creation of one public job destroys approximately 1.5 private jobs, increases the number of the unemployed by 0.3, and slightly decreases participation in the labour market. On the one hand, the crowding-out effect is larger in countries where the public sector's production is highly substitutable to that of the private sector and where, on the other hand, the secure incomes in the public sector are high.

For developing countries: Some empirical studies[2] on the subject have confirmed the idea that the effect would depend on the degree of complementarity or substitutability between public sector investment and private sector investment (Khan and Reinhart, 1990; Gupta et al, 2005). For Nigeria, Ilusanya and Oyebade (2008) show that the multiplication and development of private educational institutions[3] are due to certain difficulties facing the state and federal universities: The social structure, because the demand for places is permanently higher than the supply, the successive reforms of government policy, the fall of the budget allocated to higher education, and the increase in strikes and confrontations related to religious sectarianism. These factors have presented major development opportunities for private universities.

The conclusions of the empirical studies have not been unanimous on the favourable effect of public expenditure on economic performance. Devarajan et al (1996) were among the first authors to develop the concepts of productive public expenditure and unproductive public expenditure. Devarajan et al (1996) consider the effect of the growth of capital and of the components of public expenditure separately. They found a negative (positive) and significant relationship between the component of capital public expenditure (current expenditure) and the real per capita GDP of growth for 43 countries over the period 1970–1990.

According to Gregoriou and Ghosh (2009), the homogeneous panel hypothesis of

Devarajan et al (1996) is not likely to hold in reality, because countries are not unanimous in their points of view on the role of public expenditure in growth. The importance attached to capital and current expenditure, as well as the commitment to viable long-term capital projects instead of recurring expenditure such as salaries and wages, grants and retirement regimes, vary by country. Thus Gregoriou and Ghosh (2009) take account of heterogeneity and model at the level of each country the effects of the average levels of capital expenditure and current expenditure. This makes it possible to effectively capture the basic variations in the parameters of the model, which clearly show that for countries like Brazil and Thailand, capital expenditure has a rather negative and significant effect, while current expenditure has a positive role to play in the determination of long-term growth. In addition, for countries like Sudan and Zimbabwe, neither capital nor current expenditure has a substantial impact on growth. Gupta et al (2005) assess the effect of fiscal consolidation and the composition of public expenditure on economic growth for 39 low-income countries over the period 1990–2000. Their results show that countries where public expenditure is concentrated on wages tend to have a low growth rate, and those that allocate a high share to capital and non-wage goods and services have a rapid expansion of output. Thus, protecting capital expenditure during tax adjustment leads to high growth, whereas the reduction of the wage bill is not harmful for growth in low-income countries.

Cavallo and Daude (2011) use the panel data of 116 developing countries over the period 1980–2006 to analyse the effect of public capital on the private capital. They find that, on average, the crowding-out effect dominates. In addition, they note that this crowding-out effect is mitigated (or even reversed) in countries equipped with better institutions (where the marginal productivity of public investment is higher in theory) and which are open to international trade, and where financial flows such as financing constraints are less.

For the WAEMU, Ouattara (2007) studies the respective roles of the various "productive" and "non-productive" components of public sector expenditure in the economy of the WAEMU countries through an econometric analysis aimed at capturing the effects of relative factorial marginal productivity and/or externalities on the long-term rate of economic growth. The analysis shows that public capital expenditure has a positive relative factorial productivity effect, whereas public consumption expenditure does not show any effect on growth. The study thus confirmed the productive contribution of public infrastructure to GDP growth in WAEMU.

Nubukpo (2007) reveals that public consumption expenditure has a globally negative short and long-term impact on the growth of the WAEMU economy: In the short term, this negative impact is significant in Côte d'Ivoire, Mali, Niger, Senegal and Togo. In the long term, the negative impact of public consumption expenditure on growth is significant in Benin, Mali and Niger. Public investment expenditure has a positive impact, primarily in the long term, on the growth of the WAEMU economy: the impact appeared positive and significant in the long term in Burkina Faso, Côte d'Ivoire, Senegal and Togo. Nevertheless, in the short term, the positive impact of public investment on growth appeared significant only in Benin and Burkina Faso.

Although the current analysis does not include the direct effect of public expenditure on growth, it helps to understand how public expenditure as well as its composition can affect macroeconomic indicators, including private investment.

Dramani and Laye (2008) analyse the determinants of private investment in Senegal.

They show that public expenditure had a marked incidence on private sector investment and slightly significantly on growth. The "low" causality can be explained by the fact that investments in infrastructure, health and education attracted renewed attention around the middle of the 1990s. Their results strengthen the conviction that there is a retroactive loop between public investment and private sector investment.

For Lazonick (2007), entrepreneurship (an essential component of the private sector) often has functions that are substitutable with those of government, but in the long term, the government's support to private sector development is vital. The development of the private sector in fragile countries is hindered not only by the structures which promote the unproductive and destructive forms of entrepreneurship, but also by the reduction of the government's capacity to support the development of the private sector.

In summary, studies analysed the non-linear relationship between public spending and growth without addressing this relationship in terms of private investment (Barro, 1990; Devarajanet al, 1996; Aschauer, 2000; d'Agostino, 2011; Ouattara, 2007). Those who analyse the relationship between public spending and private investment are limited only to the test of the linear relationship (Aschauer, 1989; Erenburg, 1993; Cavallo and Daude, 2011; Dramani and Laye, 2008), except for Hermes and Lensink (2001) and Fosu et al (2011).

This study focuses on the WAEMU zone, which is in full dynamic of convergence, and whose member countries have similarities in terms of agricultural production, industrial structure and composition of exports. This partly justifies the use of panel data. The focus is on the public sector through public expenditure, and on the private sector through private investment. In addition, explanatory variables are included;the square of public spending that highlights the existence of an optimal level of public spending and a non-linear relationship.

4. Methodological approach

A theoretical model is presented that will allow for the derivation of an estimable equation for the countries of the WAEMU zone.

The theoretical model

For the analysis of the effect of public spending on private investment, the theoretical framework of Bajo-Rubio and Sosvilla-Rivero (1993) is taken, in which public services lead to externalities and lower production costs. Private sector production is directly affected by the services provided by public infrastructure that are often approximated by the public capital stock (Bajo-Rubio and Sosvilla-Rivero, 1993).

Thus we begin the analysis by considering an aggregate production function of the private sector in which public capital is included as a production factor.

$$Y = AF(K, KG, N) \tag{1}$$

Where Y is the level of private output, A is an index of technological advancement, K the stock of private capital, KG the stock of public capital, and N the labour factor.

For reasons of simplicity, a Cobb-Douglas form of technology is employed.

$$Y = AK^{\alpha_1} KG^{\alpha_2} N^{\alpha_3} \tag{2}$$

By applying the logarithm to Equation 2 and by indicating with small letters the log of their corresponding capital letter we obtain:

$$y = a + \alpha_1 k + \alpha_2 kg + \alpha_3 n \tag{3}$$

According to Aschauer (1989), there are two possibilities:

1. On the one hand, the F (.) function in Equation 1 is at constant return to scale compared to private inputs. In other words, increasing return in the three inputs (i.e $\alpha_1 + \alpha_3 = 1$, et $\alpha_1 + \alpha_2 + \alpha_3 > 1$ and respectively)

   thus Equation 3 becomes

$$(y-k) = a + \alpha_2 kg + \alpha_3 (n-k) \tag{4}$$

2. On the other hand, the F (.) function is at constant return in the three inputs, this implies an increasing return in private inputs (i.e. $\alpha_1 + \alpha_2 + \alpha_3 = 1$ and $\alpha_1 + \alpha_2 < 1$ respectively)
   Equation 3 becomes:

$$(y-k) = a + \alpha_2 (kg-k) + \alpha_3 (n-k) \tag{5}$$

Note that Equations 4 and 5 can be combined in the following general specification:

$$(y-k) = a + \alpha_1' k + \alpha_2 (kg-k) + \alpha_3 (n-k) \tag{6}$$

Where $\alpha_1' = \alpha_1 + \alpha_3 - 1$

When Equation 6 is the basis of an empirical analysis, if the coefficient estimated of α_2 is positive and statistically significant then the stock of public capital is productive and the accumulation of capital by the government will improve the productivity of private capital.

When α_1' is not significantly different from zero, the increasing return to scale hypothesis in relation to the three inputs will not be rejected, then Equation 4 is the most appropriate for the analysis. On the other hand, if the estimated coefficient of α_1' is not significantly different from that with the opposite sign of α_2 (i.e., $\alpha_1' = -\alpha_2$), then the constant return to scale hypothesis in the three inputs will not be rejected, then Equation 5 will be the equation to be estimated.

Theory suggests that an additional term is introduced, which is the rate of the capacity of utilization in logarithm cu whose coefficient is assumed to be positive (this is not done in this study due to the difficulty to find proxy for cu). The general form of the equation is:

$$\left(y-k\right)_t = \beta_0 + \beta_1 k_t + \beta_2 kg + \beta_3 \left(n-k\right)_t + \beta_4 cu_t + \varepsilon_t \tag{7}$$

ε_t is the term of error

Furthermore, according to neoclassical analysis, the investment decision is made by comparing the marginal productivity of capital at the interest rate (which is the price of capital obtained by the interaction of supply and demand for loanable funds). Private Investment (*INVPRIV*) is therefore a function of the productivity of capital and the real interest rate: *INVPRIV=f(y-k, i)*.

From this framework, the private investment function is derived that depends on the productivity of private capital $\left(y-k\right)_t$ and interest rate *i*. This model is then extended by introducing the square of public spending to highlight the non-linear relationship. The WAEMU zone is in dynamic convergence, member countries have similarities in the means of agricultural production, the industrial fabric and the composition of exports, which partly justifies the treatment of econometric panel data. The choice to carry out the analysis on the WAEMU countries is also justified by several factors: On the one hand, these countries have many similar characteristics and belong to the same geographical region. In addition,WAEMU countries are subjected to the same convergence criteria that can have effects on the structure of their public expenditure and, as an indirect result, their economic performance.

Model adopted

Based on the theoretical framework presented above and the structure of WAEMU economies,an empirical model is considered in which private investment depends on public spending and a number of control variables. In this study, the share of expenditure in GDP is used, as well as the ratio of GDP of most of the variables. This has the advantage of strengthening the stationarity of ratio samples. After preliminary econometric tests (unit root test), the following equations are estimated:

$$INVPRIV_{it} = \alpha_0 + \alpha_1 depub_{it} + \beta' X_{it} + \varepsilon_{it} \quad (8)$$

$$INVPRIV_{it} = \alpha_0 + \alpha_1 depub_{it} + \alpha_2 depubsq_{it} + \beta' X_{it} + \varepsilon_{it} \quad (9)$$

$i = 1, 2$ …….8 indicates the countries; $t =$ the period (1980-2009); ε is the error term. Equation 8 is the linear specification and Equation 9 the quadratic specification. In these equations we expect $\alpha_1 > 0$, and $\alpha_2 < 0$ (condition of the existence of possible threshold: maximum).

In the econometric treatments, public expenditure is decomposed into public capital expenditure and public current expenditure to analyse the exact effect of each one of these components on gross private capital formation (*composition effect*). This decomposition makes it possible to identify the best channel through which public expenditure can affect the private sector or growth.

The private investment equation becomes:

$$INVPRIV_{it} = \beta_0 + \beta_1 decap_{it} + \beta_2 decur_{it} + \beta' X_{it} + \varepsilon_{it} \quad (10)$$

$$INVPRIV_{it} = \beta_0 + \beta_1 decap_{it} + \beta_2 decur_{it} + \beta_3 decapsq_{it} + \beta_4 decursq_{it} + \beta' X_{it} + \varepsilon_{it} \quad (11)$$

Equation 10 is the linear specification and Equation 11 the quadratic specification. In these equations, $\beta_1 > 0$ and $\beta_3 < 0$ show the existence of a (maximum) threshold of capital expenditure; $\beta_2 < 0$; and $\beta_4 > 0$ show the existence of a (minimum) threshold of current expenditure.

Definition variables

INVPRIV = Gross fixed capital of the private sector (ratio of GDP). It represents private sector investment.

depub = global public expenditure (ratio of GDP). Public services lead to externalities that positively affect private investment.

decur = Public current expenditure (ratio of GDP). This variable captures recurrent public expenditure. The upward pressure on wages could reduce the profits of companies and private investment. It is supposed to have a negative sign on gross private capital.

decap = Government capital spending (ratio of GDP). This variable captures public investment. It represents the investment of public enterprises and thus plays a conflicting role on private investment decisions (Blejer and Khan, 1984). But for Cavallo and Daude (2011), public investment raises the marginal productivity of private capital and leads to the potential crowding-in of private investment. Furthermore, public investment in infrastructure has a very strong positive effect on total factor productivity in the private sector (Aschauer Hypothesis). Due to unavailability of data for all countries over the period considered in this study, we cannot use disaggregated data on public investment (such as investments in road infrastructure, electricity).

depubsq, decursq, decapsq = respectively, total public expenditure squared, public current expenditure squared and public capital

expenditure squared. Their coefficients are supposed to have an opposite sign to the value of variables not squared. They are introduced into the equations to reveal the non-linearity of functions and the existence of an optimal point beyond which the variables, public investment, government current expenditure and capital expenditure, can produce adverse effects on the dependent variable (Hermes and Lensink, 2001; Devarajan et al, 1996). By considering a set of 43 countries, Devarajan et al (1996) show in a growth model that current public expenditure positively and significantly affects the per capita growth rate, whereas the public capital expenditure affects the growth rate negatively and significantly. However, by considering only 21 developed countries they find results that conform to the standard assumption; thus the public capital expenditure coefficient is positive and statistically significant, and current public expenditure is negative and statistically significant.

X = (growth rate, FDI, interest rate, Polity2) is the vector of control variables.

growthrate = GDP per capita growth (annual percentage). Many authors find that economic growth is a key determinant of investment,recognizing the positive impact of domestic demand on domestic investment (Morrissey and Udomkerdmongkol 2012). Furthermore, according to Jongwanich and Kohpaiboon (2008), private investment tends to positively respond to output growth in both the short and long run.

FDI = Foreign direct investment net is assumed to have a positive effect on private investment. FDI has several positive effects which include productivity gains, technology transfers, and the introduction of new processes, managerial skills and know-how in the domestic market (Alfaro et al, 2004).

interestrate = real interest rate. This is a proxy for the cost of financing, as private investment is a decreasing function of its cost. According to neo-classical theory, high interest rates discourage investment by raising the user cost of capital, while private investment is negatively related to interest rate. Its coefficient is assumed to be negative.

Polity2 = Political governance index Polity2 (the democracy index Polity2 from POLITY IV; this database offers long sample of data on the quality of institutions for all countries. This is a combined index of democracy and autocracy, ranging from -10 (strongly autocratic) to +10 (strongly democratic). It is a proxy for institutional quality and political uncertainty. According to Cavallo and Daude (2011), weak institutions crowd out private investment. Furthermore Morrissey and Udomkerdmongkol (2012) show that total private investment is higher under favourable regimes (good governance). The expected sign of its coefficient is positive.

It would also be useful to include credit to the private sector as an explanatory variable in the empirical model. Although it is important to assess the effect of financial development on private investment, its introduction in the model will not allow us to capture the net effect of the cost of capital (interest rate) due to the presence of the quantity of credit and the cost of credit. Uncertainty can be explicitly introduced in our analysis by using inflation volatility. As there is a convergence criterion to assure stability in the union that fixes the rate of inflation, using inflation volatility as a proxy of uncertainty may skew the results. The analysis is limited to the political uncertainty captured by the variable polity2.

Econometric treatment

A panel data estimation of the ordinary least squares fixed effects model and the random effects model is adopted. The fixed effects model allows the correlation of the individual unobserved effects with the variables of the model. The random effects model hypothesis assumes that there is no correlation between the individual effects and the other regressors. The fixed effects models is restrictive in terms of degree of freedom while the random effects model approach can raise the problem of non-convergence because of the correlation between the variables and the random effect (Greene, 2005). The Hausman specification test makes it possible to test orthogonality between the random effects and the regressor in order to retain the necessary model. The Breusch–Pagan Lagrange multiplier test (with a probability of less than zero) tests the existence and the significance of random effects at the 1% level, the Hausman test (with a probability greater than 10%) implies the non-correlation of these effects with other variables in the model. The use of panel data for this study is justified by the homogeneity of the countries in question (because they are subjected to the same monetary and budgetary rules). Moreover, the temporal dimension of our data (short) does not allow for good results with a country-by-country estimation. We will first do a panel unit root test.

Data Sources

Our data cover a panel of the eight WAEMU countries (Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo. Guinea-Bissau is the most recent to join the union) and cover the period 1980-2009. These data are from Africa Development Indicators 2011. They are complemented by those available from BCEAO Statistics Yearbook 2004 and 2008-2009 and African Economic Outlook (www.africaneconomicoutlook.org). Table 3 summarizes the variable description and the sources.

Table 3: Description of variables

Abbreviation	Description and measure	Sources
FDI	Foreign direct investment: share in GDP (%)	*Africa Development Indicators 2011*
growth rate	GDP per capita growth (annual %)	
interest rate	Real interest rate(%)	
INVPRIN	Private sector investment: share in GDP (%)	*Africa Development Indicators 2011*
Depub	Total public expenditure: share in GDP (%)	BCEAO,
Decur	Public current expenditure: share in GDP (%)	*African Economic Outlook*
Decap	Public capital expenditure: share in GDP (%)	(www.africaneconomicoutlook.org)
polity2	Democracy index *Polity2, (-10) to (10)*	POLITY IV database

Source: Author's compilation

Descriptive Statistics

The results in Table 4 constitute the summary statistics of the data, and show that private sector investment as percentage of GDP is very low, averaging just 9.793% during the period 1980-2009. On average, public current expenditure is larger than public capital expenditure.

Table 4: Summary statistics of variables 1980–2009

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
INVPRIV	240	9.793	4.85	0.5	23.984
Depub	240	22.622	7.719	9.4	51.818
Decur	240	13.968	4.611	6.4	29.4
Decap	240	8.654	5.833	1.4	39.1
FDI	240	1.214	1.619	-2.1	13.7
Interestrate	240	1.153	14.133	-96	40.2
Growthrate	240	-0.08	4.965	-29.6	15.3
polity2	240	-1.208	5.732	-9	8

Source: Author's compilation

Panel unit root test

The traditional Augmented Dickey-Fuller (ADF) test for unit root suffers from low capacity to reject the null stationarity hypothesis of the series, especially in short- period data. Thus, the recent literature shows that panel stationarity tests are more powerful than those based on individual time series. Among the recently developed tests, we have the LLC unit root test of Levin et al (2002); IPS of Im et al (2003), Maddala and Wu's test (1999), and those by Choi (2001), Hardi (2000) and Breitung (2000). In this study, we use the test of Im et al (2003), and that of Levin et al (2002). Note that the panel unit root test of Levin et al (2002) assumes a homogeneous autoregression root unit. Under the alternative hypothesis, the autoregression coefficient is the same for all individuals for the LLC test, whereas Im et al (2003) assume a heterogeneous root unit. The alternative hypothesis assumes the presence of a subset of individuals whose variable of interest follows a stationary process. The results of the panel tests of Levin et al (2002) and of Im et al (2003) (Table 5) reveal that all the variables are at a stationary level and thus integrated by order zero. The level stationarity of all the variables enables us to proceed with the estimation of the panel fixed effects and random effects models.

Table 5: Panel unit root test results

Variable	Im-Pesaran-Shin test		Levin-Lin-Chu test		Integration order
	no trend	with trend	no trend	with trend	
INVPRIV	-2.067 (0.033)	-2.706 (0.023)	-0.340 (0.000)	-0.493 (0.000)	I(0)
depub	-2.481 (0.001)	-2.906 (0.006)	-0.263 (0.000)	-0.406 (0.000)	I(0)
decur	-2.234 (0.013)	-2.459 (0.173)	-0.173 (0.003)	-0.250 (0.012)	I(0)
decap	-2.201 (0.017)	-2.579 (0.090)	-0.198 (0.081)	-0.417 (0.011)	I(0)
FDI	-3.049 (0.000)	-3.028 (0.002)	-0.587 (0.000)	-0.589 (0.001)	I(0)
interestrate	-4.466 (0.000)	-6.226 (0.000)	-0.793 (0.000)	-0.796 (0.000)	I(0)
growthrate	-6.226 (0.000)	-6.375 (0.000)	-1.078 (0.000)	-1.122 (0.000)	I(0)
polity2	-2.077 (0.042)	-2.433 (0.195)	-0.203 (0.014)	-0.316 (0.033)	I(0)

Note: T-bar is reported for the Im-Pesaran-Shin test and coefficient is reported for Levin-Lin-Chu test.
(.) P-value
Source: Author's compilation

5. Results of econometric estimations

The results of the econometric estimations are presented as follows: Table 6 for the results of the linear specification, and those of the non-linear (quadratic) specification are detailed in Table 7.

Linear specification

For each specification we carry out estimations of the fixed effects and the random effects model. The results are similar for both the fixed effects and the random effects model in all the linear specifications, while the fixed effects model results present the highest R-squared. We therefore continue with the fixed effects model's results.

The regression results of the linear specifications of private investment model are presented in Table 6. The results suggest that global public spending affects positively and significantly private investment in WAEMU countries. Other factors such as FDI, real interest rate and governance are also determinants for private investment in this zone. On the contrary, government current expenditures have a negative sign and are not statistically significant in these estimate equations.

The coefficient of global public spending was positive, as expected, and was statistically significant at the 1% level. The positive relationship between global public expenditure and private investment reflects the crowding-in (level) effect of public spending on private investment very well, or in other words the complementarity between the public and private sector in the WAEMU zone. A 10% increase in global public expenditure leads to a 1.13% increase in the private investment rate. The significance of the global expenditure does not assure that all the components of public expenditure are affected to the same magnitude and direction as private investment. So it is important to know what component of spending affect more private investment. Considering the effect of the various components of public spending (the composition effect), the results indicate that:

First, as expected, capital expenditure affects private investment positively and significantly. This result is in line with the Aschauer hypothesis theory, but our results do not corroborate those of Cavallo and Daude (2011) who found a negative and significant impact on public investment of the private investment rate, and Devarajan et al (1996) who found that the relationship between the capital component of public spending and per capita growth is negative and significant. We attribute these contrasting results to the country sample used and the reality of the WAEMU zone. Our results show that a 10% increase in public capital leads to a 2.25% increase in the private investment rate.

There thus exists a complementarity between public investment and private investment in WAEMU countries. According to the degree of development and integration of WAEMU countries, the marginal productivity of public capital is high. Countries are meeting infrastructure needs (transport, communication, water and electricity) and public services (health and education), therefore, additional energy, road, railway and telecommunication infrastructures can facilitate trade and the division of labour, stimulate competition in the markets, and favour a more efficient distribution of economic activities. We also deduce that capital expenditure is responsible for the significance of the global expenditure (because of the magnitude and the sign of its coefficient), as postulated in our first hypothesis (H1).

Table 6: Linear model of private investment

	1-FE	2-RE	3-FE	4-RE
FDI	0.7617	0.7602	0.6845	0.6896
	(5.60)***	(5.60)***	(5.00)***	(5.03)***
Interestrate	-0.0307	-0.0290	-0.0109	-0.0107
	(1.94)*	(1.84)*	(0.64)	(0.62)
Growthrate	0.0258	0.0276	0.0039	0.0079
	(0.60)	(0.64)	(0.09)	(0.18)
polity2	0.1800	0.1784	0.2074	0.2027
	(3.83)***	(3.83)***	(4.38)***	(4.30)***
Depub	0.1130	0.1065		
	(2.80)***	(2.68)***		
Decap			0.2251	0.2078
			(3.97)***	(3.71)***
Decur			-0.0106	-0.0076
			(0.18)	(0.13)
_cons	6.5670	6.7130	7.4255	7.5221
	(7.04)***	(4.07)***	(7.66)***	(4.60)***
R2	0.24	0.012	0.26	0.07
N	240	240	240	240
Hausman Test:chi2	2.05		9.73	
Hausman, Prob>chi2	0.842		0.136	
Breusch and Pagan LM Test	chi2(1) = 731.67		chi2(1) = 572.92	
	Prob > chi2 = 0.000		Prob > chi2 = 0.000	

* p<0.1; ** p<0.05; *** p<0.01
1-FE fixed effects RE random effects 2-(.) Absolute value of t statistics in parentheses

Second, current expenditure is not significant in this linear specification (furthermore the sign of its coefficient in the estimated model is negative). There are two reasons for this non-significance: First, there are good indications that it comes from the low size of current expenditure of some countries. We must recognize that public current expenditure is relatively low compared with the needs of countries; it was about 21.27% of GDP in 1989, but represented only 15.05% of GDP in 2009 (Graph 1,Table A2 in the appendix). It was, on average, 13.97% of GDP (Table 4) over the period considered. Moreover, in terms of employment, according to the main results of the 1-2-3 survey in the member

states of WAEMU, the share of public employment is low, only 8% of employed work in the public sector, which invalidates the myth of a bloated public sector. The second explanation of the non-significance of public current expenditure is poor management and inefficient use of these expenditures by governments, for example, through the recruitment of unskilled workers for some positions (along ethnic or political lines, for instance), which affects the quality of current expenditure. These are the issues surrounding the influence of the quality of governance on the effectiveness and efficiency of public spending.

Significance of non-linear specification

The regression results of the non-linear quadratic specifications of private investment model are presented in Table 7. The results suggest there is a non-linear quadratic relationship between public spending and private investment. The significance of the quadratic terms capturing non-linearity (coefficients of expenditure squared) leads us to conclude that the non-linear specification is more relevant for the analysis of the nature of the relationship.

In the estimated equation presented in Table 7 column 1, the coefficient of total public expenditure is negative and significant (a 10% increase in total government spending leads to a decrease of 3.29% in the private investment rate when in the downward phase of the private investment curve, or downward-sloping part) and the coefficient of the squared value of total public expenditure is significant and has positive signs. Although these results reveal a non-linear relationship between global public spending and private investment and the existence of an optimal threshold, the signs of the coefficient are not those expected in Equation 9, and the nature of the optimum is not what was expected. Total expenditure appears to be in a U-curved relationship with private investment (instead of an inverted U-curved relationship postulated by our hypothesis). Our results show that there is a threshold of expenditure beyond which there is a reversal effect of total expenditure on private investment. Private investment therefore attains its optimum (minimum here) when the share of total expenditure in GDP is around 20%. The threshold is obtained by setting the first derivative equal to zero:

$$\frac{\partial INVPRIV}{\partial depub} = -0.3290+2*(0.0081)*depub = 0$$

,

$$\text{hence, } depub^{*} = \frac{-0.3290}{2*(0.0081)} = 20.308642 \approx 20$$

Beyond this threshold of 20% (upward sloping part) an additional increase of the total expenditure increases private investment. In other words, public spending (share of GDP) should be at least 20% before having an overall positive effect on private investment. Positive externalities of public spending become effective only after public expenditure

has reached a minimum level.

In the non-linear model the coefficient of total capital expenditure is negative and significant; the coefficient of the squared value of capital expenditure is significant and has positive signs. Here again, the signs are not as expected, and the results highlight the non-linear quadratic relationship between capital expenditure and private investment. The investment rate therefore reaches its optimum (minimum) when the share of capital expenditure in GDP is about 8.79 %;(-(-0.2989)/(2*0.017)). Public capital expenditure appears to be in a U-curved relationship with private investment. This result is in line with Hermes and Lensink (2001). Thus our results support the view that capital expenditure (investment in infrastructure) becomes effective only after a certain point, due to the fact that it is usually associated with large (positive) externalities.

The coefficient of the squared value of current expenditure is not statistically significant showing that there is not a non-relationship between current expenditure and private investment. The linear relationship is more relevant. This is in line with the results obtained by Devarajan et al (1996) who found that the linear relationship between current expenditure and economic growth gives a better fit. Furthermore, the non-significance of current expenditure in both the linear and the non-linear specification does not mean that current expenditure is not relevant to private investment. This non-signification can also be due to the interaction of the opposite effects of different components of government current expenditure (salaries versus maintenance operations).

It appears that private investment is lowest when the share of total expenditure in GDP is 20% (8.79% for capital expenditure). The distribution of expenditure may conform to the rule that at least 43.29% of total expenditure (i.e., 8.79117647/20.308642) will be allocated to capital expenditure (infrastructure funding) and the remaining expenditure will be allocated to current expenditure. It has to be pointed out here that our threshold may not correspond to the threshold determined by analyses using general equilibrium models and therefore should be viewed with caution. It is also not necessarily the optimal level and allocation of public spending for any particular country at any particular time, which is likely to depend on that country's individual circumstances. However, these results give us some idea of the optimal composition of public spending.

Table 8 shows that the thresholds found in this study are slightly different from those of Devarajan et al (1996) who found a non-linear U-inverted relationship between public capital and economic growth. In fact, Devarajan et al (1996) show that, considering the non-linear model with public capital, the growth function reaches a maximum when the share of capital expenditure in total expenditure is 18%. The choice or nature of the dependant variable is probably the reason for the difference in our results and those of Devarajan et al (1996) and Fosu et al (2011) who used the per capita real GDP growth rate as dependant variable.

Another issue is related to the financing of public spending. Financing is not a constraint in reaching the threshold level of public spending because of the following reasons: The Heavily Indebted Poor Countries (HIPC) initiative completed by the Multilateral Debt Relief Initiative (MDRI) will enable a country to have more resources. Jeanneney and Tapsoba (2011) show that during the period 1994–2004 the UEMOA states had the ability to borrow in their regional financial market and the assumption of a credit constraint imposing on the restrictive fiscal policy is implausible. The bond issue is expected to prevent the use of state funding of commercial banks, and thus the risk of crowding out the private sector.

Table 7: Non-linear model of private investment

	1-FE	2-RE	3-FE	4-RE
FDI	0.6879	0.6879	0.7041	0.7657
	(5.11)***	(5.13)***	(5.31)***	(4.06)***
Interestrate	-0.0388	-0.0374	-0.0048	0.0000
	(2.48)**	(2.41)**	(0.29)	(0.00)
Growthrate	0.0112	0.0128	-0.0087	0.1151
	(0.26)	(0.30)	(0.21)	(1.98)**
polity2	0.1857	0.1848	0.2221	0.2061
	(4.04)***	(4.06)***	(4.88)***	(3.74)***
Depub	-0.3290	-0.3251		
	(2.42)**	(2.40)**		
Depubsq	0.0081	0.0079		
	(3.39)***	(3.35)***		
Decap			-0.2989	-0.6966
			(2.50)**	(4.65)***
Decur			-0.0626	0.3422
			(0.25)	(0.99)
Decapsq			0.0170	0.0196
			(4.88)***	(4.17)***
Decursq			0.0030	-0.0055
			(0.39)	(0.52)
_cons	12.0543	12.0508	10.1666	9.4207
	(6.49)***	(4.88)***	(4.92)***	(3.31)***
R^2	0.27	0.07	0.33	0.05
N	240	240	240	240
Hausman Test:chi2	3.85		151.37	
Hausman, Prob>chi2	0.697		0.000	
Breusch and Pagan LM Test	chi2(1) = 748.1		chi2(1) = 590.8	
	Prob > chi2 = 0.000		Prob > chi2 = 0.000	

* p<0.1; ** p<0.05; *** p<0.01

1-FE fixed effects RE random effects 2-(.) Absolute value of t statistics in parentheses

Table 8: Previousthresholds of public spending

	Devarajan et al (1996)	Hermes and Lensink (2001)	Fosu et al (2011)
	Per capita real GDP growth rate	Private investment	GDP per capita growth rate
Total expenditure	-	-	-
Capital expenditure /public investment	**18%** of total expenditure (maximum)	**5.4%** of GPD (minimum) *	Between **9.0%** an **10%** of GDP (maximum)
Current expenditure	-	**5.38%** of GDP (maximum wages and salaries)**	-

* Table 6: (-(-0,206)/(2*0,019))

** Table 6: (-(1,13)/(2*(-0,105)))

Source: Author's compilation

Although there still is the possibility of debt, one must certainly consider the issue of debt sustainability. There are ways to expand the formal sector to generate sufficient internal resources (large tax base) hidden in the informal sector. Countries could finance public spending because they have not reached the level of tax burden yet. In brief, it is desirable to undertake measures aimed at expanding the formal sector to generate sufficient domestic fiscal resources (large tax base) hidden in the informal sector, and to think about the financing of a toll road that will provide more resources to finance expenditures without a debt burden.

Private investment and other variables

Foreign direct investment, the real interest rate and the governance indicator polity2 are also statistically significant in the private investment equation. In contrast, they are not statistically significant.

Foreign direct investment positively affects private investment, as expected. An increase of 10% increases the investment rate by 3.6% for all the specifications. Foreign direct investment thus exerts a crowding-in effect on private investment in WAEMU countries. These results are in line with the intuition of Alfaro et al (2004), but do not corroborate the empirical findings of Morrissey and Udomkerdmongkol (2012) that show that FDI appears to ‘‘crowd out” domestic private investment in developing countries.

The real interest rate affects significantly and negatively private investment. This highlights an indirect channel through which public spending (financed by borrowing) may affect private investment. An increase of 10% in the interest rate leads to a decline in the private investment rate of between 4% and 5%, regardless of the model specification. This negative relationship between interest rates and investment was found by Greene and Villanueva (1991) and is in line with neoclassical theory. Another explanation is that public sector borrowing from domestic banks in order to finance public investment can crowd out the private sector through a rise in the interest rate. Fortunately the WAEMU countries have various alternatives for public investment finance,as mentioned above.

Democratic governance affects private investment positively. A 10% increase in the democracy index polity2 leads to an increase in

the private investment ratio by 1.8%. Moving from an autocratic state to a democratic state is profitable for private sector investment. This result is in line with the prediction of Cavallo and Daude (2011), and the empirical findings of Morrissey and Udomkerdmongkol (2012). Furthermore, other non-economic and institutional factors (such as corruption and civil war), and their interaction with public spending may affect private investment in different ways.

6. Conclusion and policy implications

Private sector development has increasingly become of concern to policymakers in recent years, considering its undeniable role as the engine of growth. According to Nubukpo (2007), in both the short- and long-term, the variable that appears to have the most significant positive impact on growth in WAEMU is real private investment. This work aimed to analyse the nature of the relationship between the public and the private sector by focusing on the effect of total public expenditure and its two components (capital and current expenditure) on private investment in a panel of eight WAEMU countries over the period 1980–2009. Our analysis shows that:

- Total public expenditure and its capital component affect private investment positively and significantly when we consider the linear relationship. A 10% increase in global public expenditure leads to a 1.13% increase in the private investment rate. A 10% increase in public capital leads to a 2.25% increase in the private investment rate.
- Current expenditure is not significant in both the linear and the non-linear specifications.
- The results highlight a non-linear quadratic relationship between public spending and private investment. Total public expenditure and its capital components affect private investment positively and significantly, reflecting the complementarity between the public and the private sector, but this positive relationship only comes into effect after attaining a certain threshold of public spending.
- The optimal thresholds of public expenditure are as follows: Public spending and its capital component (share of GDP) should be at least 20% and 8.79%, respectively, before having a positive effect on private investment.
- It appears that private investment is lowest when the share of total expenditure in GDP is 20 % (8.79% for capital expenditure). The distribution of expenditure may follow the rule that at least 43.29% of total expenditure will be allocated to capital expenditure (infrastructure funding) and the remainder will be allocated to current expenditure.
- Our results suggest that other factors, including foreign direct investment, real the interest rate and good governance, fundamentally determine the private investment rate.

The policy recommendations are:

- Governments and policymakers should pursue the vast infrastructure policies undertaken these past years in the WAEMU zone. This will result in crowding-in private investment.
- Making good the allocation of public resources, and controlling civil servants and current expenditure will reduce misuse and increase the effectiveness of public (current) expenditure.
- Undertaking measures aimed at expanding the formal sector to attract sufficient domestic fiscal resources (large tax base) hidden in the informal sector, and thinking about the financing of a toll road will provide more resources to finance expenditures without a debt burden.
- Strengthening good governance will make public spending more productive and more profitable for the private sector.
- Finally, the results suggest that further studies on the effect of public spending could explore the possibility of a non-linear relationship between public spending and economic performance.

Notes

1. Benin reached completion under the HIPC Initiative in March 2003 and received debt relief under the Multilateral Debt Relief Initiative (MDRI) in January 2006. Mali reached completion under the enhanced HIPC Initiative in March 2003, and received debt relief under the MDRI in January 2006. Burkina Faso reached completion under the HIPC initiative in April 2002 and received debt relief under the MDRI in January 2006. Niger reached completion under the enhanced HIPC initiative in April 2004 and received debt relief under the MDRI in January 2006. Senegal reached completion under the enhanced HIPC initiative in April 2004 and received debt relief under the MDRI in January 2006. In Togo the decision point under the HIPC Initiative was met (https://www.imf.org/external/np/exr/facts/hipc.htm) in November 2008. Only two countries in the UEMOA (Côte d'Ivoire and Guinea Bissau) have not yet benefited from the HIPC initiative (IMF, 2011).

2. Public investment would stimulate private investment in Pakistan and in Zimbabwe. Other studies show that public investment would crowd out private investment, for example in Chile, Colombia, Ghana and Mexico (Dramani and Laye, 2008).

3. Private university education has developed at a consistent pace, moving from three establishments in 1990 to 24 in 2006.

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Appendix

Table A1: Number of private enterprises and percentage in total number of enterprises

	Burkina		Senegal	
Year	Number	%	Number	%
1990	101	74.81	1093	95.54
1991	129	79.14	1158	95.86
1992	139	79.89	984	96.28
1993	136	79.07	1114	96.62
1994	177	83.89	1132	96.5
1995	185	84.47	1213	97.2
1996	190	86.76	1370	97.44
1997	196	88.67	1372	98.21

Source: Author's computation based on data from Afristat

Table A2: Private investment and public expenditure in the WAEMU

Year	INVPRIV	DEPTOT	DEPCOUR	DEPCAP	Internal resources	External resources
1989	9.47	29.88	21.27	4.89	84.5	245.6
1990	9.09	28.52	21.22	4.79	71.5	266.7
1991	9.46	25.89	19.56	4.46	62.8	278.1
1992	9.11	25.07	19.13	4.76	110.7	255.3
1993	8.97	24.69	19.11	4.61	100.5	249.6
1994	11.26	24.32	18.22	6.10	153.5	486.1
1995	11.62	23.12	16.44	6.68	248.6	563.8
1996	11.73	22.39	15.37	7.01	265.4	675.4
1997	11.65	21.67	14.60	7.06	393.5	657.5
1998	11.62	21.55	13.69	7.69	515.6	715
1999	9.99	21.82	14.18	7.45	481.6	765.7
2000	11.17	19.45	13.57	5.88	372	707.7
2001	10.91	26.11	16.04	9.89	397.7	601.7
2002	10.98	20.53	14.05	6.01	528.5	701.9
2003	11.41	20.59	14.04	5.92	594.1	678.5
2004	10.72	21.65	14.00	6.80	697.2	825.3
2005	11.40	21.59	14.12	6.82	797.4	874.6
2006	11.52	21.90	14.64	6.66	924.8	869.7
2007	12.13	23.52	15.04	8.20	1 051.30	999.9
2008	11.90	22.08	14.87	6.45	1 083.40	923.7
2009	12.00	23.56	15.05	7.77	1 418.20	1 111.10

Source: Author, based on data from BCEAO Statistics Yearbook 2004 and 2008–2009

Table A3: Level of wages: Guaranteed Inter-professional Minimum Wage (SMIG)

Date	Benin	Burkina Faso	CI	Mali	Niger	Senegal	Togo
1982 – 1 July	51.75	114	191.4	49.92	109.02	152.04	72
1990 –1 January	81.21	130.69	191.4	67.22	109.02	201.6	79.36
1995 – 31 December	81.21	143.76	212	84.02	109.02	201.6	79.37
2001 – 31 December	126.48	143.76	212	84.02	109.02	209.1	79.37
2005 – 31 December	168.75	179.52	228.79	172.05	118.12	226.09	85.98
2006 – 31 December (*)	27 000	28 723	36 607	28 460	18 899	36 174	13757
2010	182.5	190.4			177.2	209.1	

Notes: Hourly rates for industrial skilled workers ; weekly 40-hour work regime, single zone [Au régime des 40 heures hebdomadaire de travail, Zone unique]
*CFA Franc/month

Source: Author, based on data from BCEAO Statistics Yearbook 2004 and 2008–2009

Table A4: Total non-observations of the criteria

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Benin	5	5	3	4	4	3	4	4	3	3
Burkina Faso	5	4	4	5	5	4	6	6	6	6
Côte d'Ivoire	7	7	6	6	6	6	7	6	6	6
Guinea-Bissau	8	8	8	7	5	5	6	7	7	7
Mali	4	2	3	5	4	3	5	4	4	4
Niger	4	3	3	3	4	3	5	4	4	4
Senegal	2	2	3	3	3	2	4	4	4	4
Togo	6	4	6	6	4	4	5	5	5	5

Sources: UEMOA; BCEAO; and IMF (2011)