EFFECTS OF GOVERNMENT SPENDING ON PRODUCTIVE CAPACITY

EFFETS DES DEPENSES GOUVERNEMENTALES SUR LES CAPACITES PRODUCTIVES

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Abstract
This paper assesses the effect of government spending on productive capacity in Sub-Saharan Africa. Using a sample of 35 sub-Saharan African countries, we estimate a panel data model using the methods of feasible generalized least squares (FGLS) and system generalized moments (GMM-System) over the period 2000-2018. This analysis shows that government spending has a positive and significant effect on the productive capacity of sub-Saharan African countries. This shows that an increase in spending contributes to an increase in productive capacity. Furthermore, our analysis shows that the level of public spending has a positive effect on the economic complexity of sub-Saharan African countries. Indeed, an increase in government spending improves the level of production, and subsequently promotes the diversification of sub-Saharan African economies.
Keywords: Productive capacity, government spending, economic complexity, GMM system
Résumé

Cet article apprécie l'effet des dépenses gouvernementales sur les capacités productives en Afrique Subsaharienne. À partir d'un échantillon de 35 pays d'Afrique subsaharienne, nous estimons un modèle en données de panel par les méthodes des moindres carrés généralisés réalisables (FGLS) et des moments généralisés en système (GMM-Sytème) sur la période 2000-2018. Il en ressort de cette analyse que les dépenses gouvernementales ont un effet positif et significatif sur les capacités productives des pays d'Afrique subsaharienne. Ce qui montre qu'une augmentation des dépenses contribue à l'augmentation des capacités productives. Par ailleurs, notre analyse montre que le niveau des dépenses publiques affecte positivement la complexité économique des pays d'Afrique subsaharienne.

Mots clés : Capacités productives, dépenses gouvernementales, complexité économique, Lewbel-IV, GMM en système.
Classifiction JEL : A10, A14, O40, P47.

Introduction

Can government spending improve the productive capacity of sub-Saharan African countries? This paper seeks to address this concern. Since 2006, much analytical work (not evidence-based studies) has been undertaken on the question of "how to foster productive capacities in developing countries" (See Cornia and Scognamillo, 2016; UNCTAD, 2016, 2020). The United Nations Conference on Trade and Development (UNCTAD) has called for the strengthening of productive capacities in developing countries, and in particular in LDCs (least developed countries), with a view to promoting the structural transformation of economies and sustainable growth and development.

It provided an initial definition of the concept of "productive capacities" in its 2006 report on LDCs, entitled "The Least Developed Countries Report 2006: Developing Productive Capacities" (see UNCTAD, 2006). According to this report, productive capacities are "the productive resources, entrepreneurial capabilities and production linkages that together determine a country's ability to produce goods and services and enable it to grow and develop". This analysis uses the Productive Capacity Index developed by UNCTAD to examine empirically, for the first time, the effect of government spending on capacity. This question has probably not been addressed in the literature because data on countries' performance in terms of productive capacity did not really exist.

The dataset recently released by UNCTAD now allows researchers to conduct analyses of productive capacity to inform policy decisions in both developed and developing countries. Indeed, Hidalgo and Hausmann (2009) show that countries whose economic structures include less complex (low-productivity) products, such as raw materials, wood and textiles, tend to suffer from persistent underdevelopment. According to the latter, economic complexity provides an internationally comparable measure of productive capacities based on the combination of products integrated into a country's economy. The underlying intuition is that an increased capacity to produce a variety of sophisticated products, generally characterised by returns, reflects the amount of productive knowledge within an economy (Hidalgo and Hausmann, 2009; Felipe and al., 2012; Hidalgo, 2021).

In their work, Hausmann and al. (2007) emphasise that well-functioning institutions encourage investment in productive sectors. To this end, authors such as Keynes argued that public spending (government spending or public investment spending) has a knock-on effect on economic growth (Sarwa and al., 2014). In contrast to the latter, the neoclassical view argues that an increase in public spending crowds out private economic activity due to the increasing effect of borrowing (to support public spending) on interest rates (see Mundell, 1963; Fleming, 1962). As for the Ricardian view, public spending has neither a crowding out nor a crowding in effect (Arestis, 2011). Related to these theoretical debates, the empirical literature shows mixed results on the effects of public spending (Facchini and al., 2013).

The government must spend the money collected from taxpayers efficiently in important sectors of the economy, as it is accountable to its citizens. In this context, the concept of efficiency assesses the allocation of resources in a country that develops human capital. Public spending is one of the main pillars of fiscal policy, and in-depth studies of its effects have

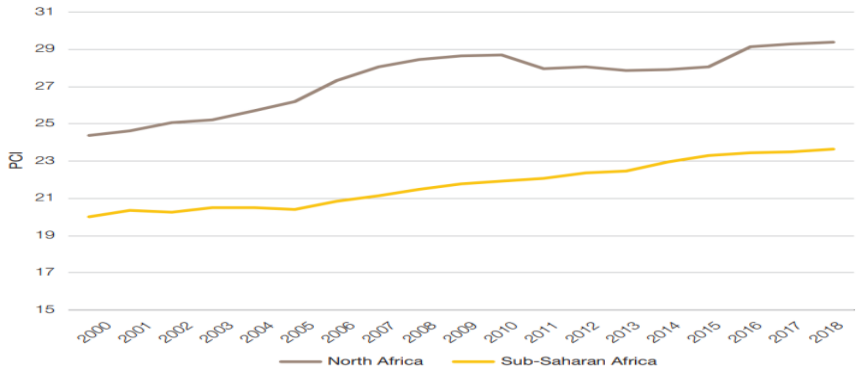
generally produced mixed results (Nguyen and al., 2020). The objective of this study is to analyse the effects of government spending on the development of productive capacity in sub-Saharan countries. The rest of this paper is structured as follows: in the first section we present some stylised facts, followed by a review of the theoretical and empirical literature in the second section. The methodology of this work is presented in the third section. The results are presented in the fourth section of this paper.

1. Some stylised facts

The PCI (Productive Capacity Index) ranking shows that the simple arithmetic mean of the 193 countries is 26.76, and the median value is 27.81. The developed countries of North America, i.e. Canada and the United States, have high scores of 50.51 and 42.30 respectively, followed by the European countries, which have a median score of 41.27. Among developing countries, Latin American countries have the highest median value (32.14), followed by Oceania (31.67), Asia (31.18) and Africa (23.84). These broad regional groupings mask considerable variation. For example, the median score for East Asian economies is 40.00, close to that of developed countries, while the median scores for South Asia and West Asia are 28.48 and 33.94 respectively. Similarly, the median score for North African countries is 29.39, while that for sub-Saharan African countries is 23.63 (UNCTAD, 2020).

Africa's low productive capacity is both a cause and a consequence of the region's persistent socio-economic vulnerabilities to adverse external shocks, although its overall performance masks considerable variations in country-specific performance. The weak productive capacity of these countries weakens their economies and makes them more vulnerable to the vagaries of external shocks (UNCTAD, 2020). The performance gap between North Africa and sub-Saharan Africa is clear (see Figure 1). It can be seen that the productive capacity of North Africa is higher than that of sub-Saharan Africa, as the group average masks considerable intra-regional variation and it is therefore instructive to compare the performance of North Africa with that of sub-Saharan Africa.

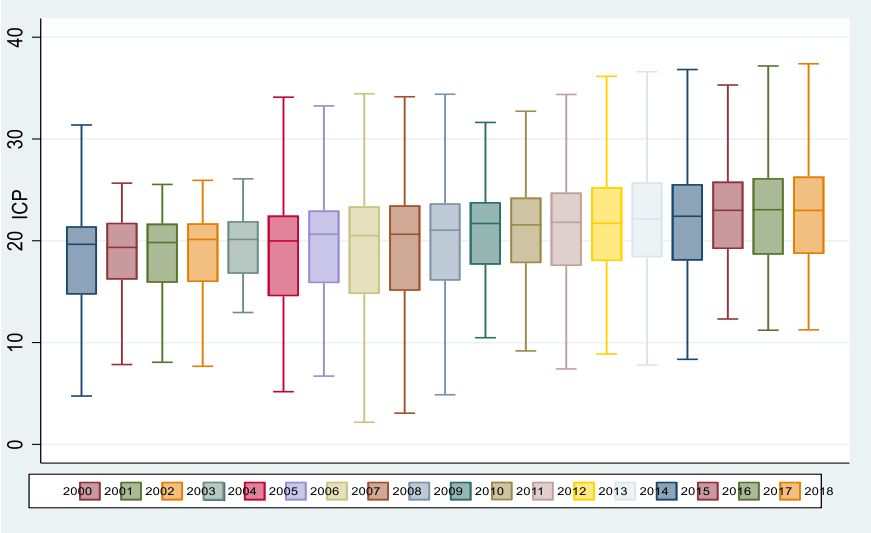
Figure 1: Evolution of the productive capacity index in Africa



Source : UNCTAD (2020)

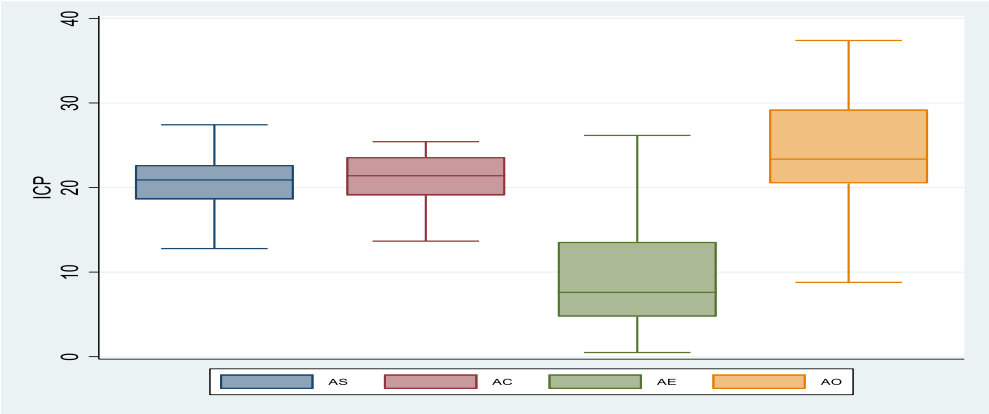
Although Sub-Saharan Africa is the last region in terms of productive capacity performance, it is improving. Figure 2 shows that the level of productive capacity in the region is increasing.

Figure2:Evolution of productive capacities in the Sub-Saharan Africa region



Source : Authors based on UNCTAD data

Figure 3: Comparison of the level of productive capacities within sub-Saharan African sub-regions

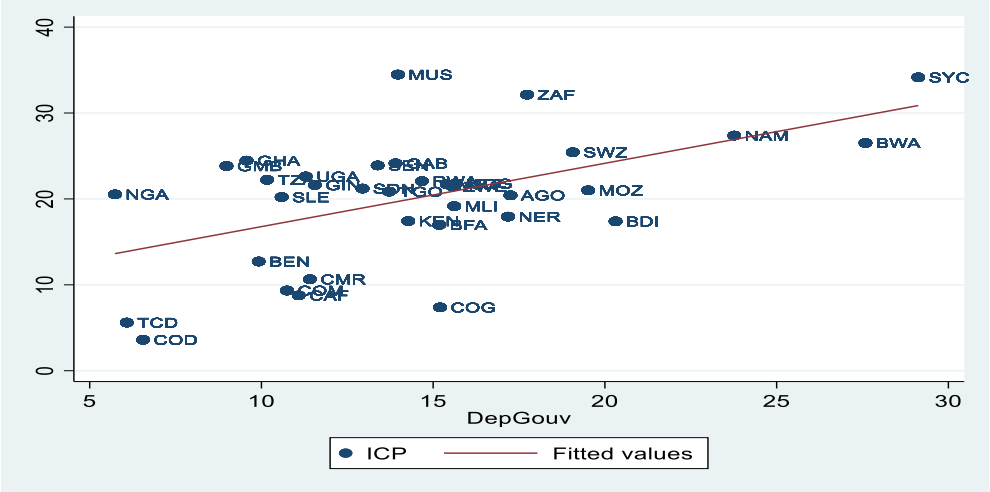


Source : Authors based on UNCTAD data

Although the production capacity of Sub-Saharan African countries is growing, there are differences within the region. The level of productive capacity is highest in West Africa, followed by Central and Southern Africa. However, East Africa has low levels of productive capacities (see Figure 3).

1.1 Correlation between government spending and productive capacity

Figure 4: Graphical correlation between government spending and Productive Capacity



Source : Authors

Figure 4 shows a large clustering of points around the straight line, as the points do not show much dispersion. Figure 4 shows that there is a positive correlation between government expenditure and the level of productive capacity. An increase in government spending is necessary for the development of productive capacities in order to promote inclusive economic growth and achieve sustainable development

2. Effects of government spending on productive capacity: A transmission channel analysis

This section analyses, from a theoretical point of view, the ways in which government spending can affect productive capacities. To this end, it is important to recall that we rely on UNCTAD's (2020) definition of productive capacities. According to the latter, "productive capacities" are considered to be the result of several factors. These factors include: human capital development; physical capital development (energy infrastructure, transport infrastructure; information and communication technology, i.e. ICT); private sector development; institution building; structural change in production and natural resource endowment. Therefore, discussing the effects of government spending on productive capacity involves discussing how each main dimension of this concept is affected by the level of government spending.

Effects of government spending on human capital

Government spending (or public expenditure) on human capital development through education and health in developing countries has attracted the attention of many researchers and development partners because of its essential role in economic growth (Fahimi and al., 2018), individual well-being (Currie, 2009), economic development (Suri and al., 2011) and poverty reduction in general (Okorie Nathan, 2016). Human capital is an intangible asset that workers need to increase their productivity and well-being (Goldin, 2016). The value placed on human capital has led to an increase in the allocation of resources to education and health in African countries (Eggoh and al., 2015; Ogundari and Awokuse, 2018).

Effects of government spending on physical infrastructure

Authors such as Landau (1986) and Barro (1991) have shown that public spending on infrastructure has a negative impact on gross domestic product. Indeed, several recent studies on infrastructure are primarily economic in nature (Breidenbach, 2020; Brugnoli and al., 2018; Chen and Haynes, 2015). In recent years, there has been extensive research on the measurement of transport infrastructure. Maparu and Mazumder (2021) examined the causality between transport infrastructure and urbanisation in India from 1991 to 2011 through road, rail, air and port infrastructure. Wang and al (2020) examined the impact of road and rail transport infrastructure on economic growth in developing countries. Over the last two to three decades, the macroeconomic modelling stream has emerged as an important and widely used approach to examine the economic benefits of transport infrastructure investment (Lakshmanan, 2011).

In terms of energy, the authors have shown that government policies through public spending could play a key role in reducing energy poverty, but little attention has been paid to this factor. Nguyen and Su (2022) attempt to examine the impact of public expenditure on energy poverty in a global sample of 56 developing countries. They show that public spending has a U-shaped effect on energy poverty, implying that increasing public spending can alleviate energy poverty up to a certain level, but after this tipping point, any excessive spending would be detrimental to energy welfare. Several studies have confirmed the existence of the Armey curve in developing countries such as Africa (Whajah and al., 2019), India (Akram and al., 2020) and Brazil (Divino and al., 2020). At the same time, the literature on fuel poverty emphasises that economic growth (higher income levels) reduces fuel poverty (Hills, 2011). Thus, the inverted U-shaped effect of public spending on economic growth, following the Armey curve, may lead to a U-shaped effect of public spending on fuel poverty.

The development of ICT infrastructure plays an important role in disseminating information more quickly and supporting the distribution of development in each region. Through the transfer and use of all kinds of information, from small businesses to large enterprises, ICTs link all the productive sectors of a national economy, increasing their efficiency. At the firm level, intensive use of and investment in ICT accelerate productivity growth (Bloom et al, 2012), leading to output growth (Brynjolfsson and Hitt, 2003). Investment in both ICT and R&D (Research and Development) is strongly linked to productivity and innovation (OECD, 2004; Hall and al, 2013). Nasab and Aghaei (2009), in their research, used a generalised method of moments (GMM) as part of a dynamic panel data approach and applied it to the economy of OPEC member countries over the period 1990-2007.

Effects of government spending on structural change

There is a large body of work on the relationship between public spending and structural change. Li a and al (2019) study the long-term effects of state-historical public spending on structural change in local economies from 1930 to 2000. They find that wartime defence spending led to a sustained reallocation of labour to manufacturing and other non-agricultural sectors in war production centres, contributing to long-term population growth in these areas. Fishback and Cullen (2013) examine the medium-term effects of war spending on local economic development between 1939 and 1958, while (Fishback and Jaworski, 2016) focus on

the longer term from 1960 to 2000. They found that war activity was correlated with faster population growth, but not with per capita income or median house values in local economies.

Effects of government spending on natural resources

According to Souidi and al (2018), natural resources, institutional quality, trade openness and inflation determine public spending in resource-rich countries. In Corden's (1984) Dutch disease theory, the "spending effect" is the first process put forward. According to Dutch disease theory, an abundance of natural resources leads to a depreciation of the real exchange rate (Wijnbergen, 1984; Sache and Warner, 1999; Comunale, 2017). As a result, the industrial sector loses competitiveness. Furthermore, in the Dutch disease theory, the expenditure effect, also known as the spendind effect, is explained by the increase in exports of natural resources, which form the basis of all the country's wealth.

In addition, some empirical studies have examined the general impact of natural resources on the budget. One of the causes of the natural resource curse, according to Atkinson and Hamilton (2003), is the renewal of natural resource rents in public spending. In particular, they explain the resource curse in the public sector by inflating bills according to employees' salaries. Robinson and al (2006) argue that the growth of the public sector has been encouraged by politicians through the expansion of the resource sector. In a similar vein, Stevens (2003) sees subsidies as another aspect of public spending. He argues that the boom in the primary sector often has negative effects on the sector.

Effects of government spending on the private sector

According to some authors, an increase in public spending due to higher public borrowing requirements crowds out private investment, which in turn has a negative impact on economic growth. This is known as the "crowding out" hypothesis. Conversely, other authors believe that any increase in public spending is accompanied by an equal increase in private saving, so that there is no first-order effect on private spending (Barro, 1974). This view suggests that rational agents behaving in this way should regard public spending as irrelevant (the so-called "Ricardian equivalence" theory). These contrasting views have led to a number of empirical studies attempting to assess the impact of public spending on private investment, most of which show mixed results in support of one theory or the other. Furceri and Sousa (2011) analyse the impact of public spending on the private sector, assessing the existence of crowding-out and crowding-in effects. Using a panel of 145 countries from 1960 to 2007, the results suggest that public spending has significant crowding-out effects, negatively affecting both private consumption and investment. Moreover, while the effects do not seem to depend on the different phases of the business cycle, they vary considerably across regions.

Effects of government spending on institutions

Economists also consider the case where the public sector with a financial and institutional role has an effect on a nation's economic growth. According to endogenous growth theory,

public spending can stimulate economic growth through education and medical subsidies as well as social transfers, research and the design of the legal framework; this in turn increases human capital (Romer, 1986; Barro, 1990; López and al, 2011). At the same time, the better institutional quality of a nation will contribute to a better economy by reducing transaction costs and risks (Cohen and al., 1983; Fosu, 2014). Some authors have shown that an increase in public spending and its redistribution towards internal security contributes to the fight against crime and terrorism in a state (Looney, 2002).

3. Methodology

3.1 Model precision

In the absence of a theoretical model on the macroeconomic determinants of productive capacity, we adopt a pragmatic approach by postulating a model specification that links productive capacity indices to a set of macroeconomic factors. In order to determine the effect of government spending on productive capacities in sub-Saharan African countries, we use an empirical model. The specification of the model will be inspired by the work of Gnangnon (2021b) who analysed the effects of development aid on productive capacities developed by UNCTAD. Some control variables are taken from the literature (see Gnangnon, 2021a; UNCTAD, 2020; Shiferaw, 2017; Cornia and Scognamillo, 2016).

Model 1 :

$$\Pr odCap_{it} = \alpha_0 + \alpha_1 \Pr odCap_{it} + \alpha_2 DepGouv_{it} + \alpha_3 PIB/hab_{it} + \alpha_4 Ouver_{it} + \alpha_5 TransMi_{it} + \alpha_6 VulChoc_{it} + \alpha_7 AidCom_{it} + \varepsilon_{it}$$

In Model 1, the main explanatory variable of the model is "***ProdCap***". It measures the level of productive capacity, which can be either total productive capacity or each of its eight components. ***ICP***" is the index of total productive capacity. This variable is expressed as a percentage and varies between 0 and 100. A value of 0 indicates the absence of productive capacity, while a value of 100 indicates a high level of productive capacity. This indicator, which was made available to the public some time ago, has been used in a number of economic and econometric studies (Giombini and al., 2022; Gnangnon, 2021a; Gnangnon, 2021b).

DepGouv is total government expenditure**.** ***GDP/cap*** measures the level of GDP per capita. The variable Ouver measures the degree of openness to foreign trade. ***TransM***i is the total remittances sent by migrants to their countries of origin. The variable ***VulChoc*** is the index of vulnerability to external shocks. This variable takes into account the victims of natural disasters, the instability of agricultural production and the instability of exports of goods and services. The ***AidCom*** variable measures the amount of aid for trade granted to countries. Finally, the model includes the error term ε_{it} which takes into account the other variables not taken into account in the model

Model 2 :

$$\Pr odCap_{it} = \alpha_0 + \alpha_1 \Pr odCap_{it-1} + \alpha_2 DepGouv_{it} + \alpha_3 PIB/hab_{it} + \alpha_4 Ouver_{it} + \alpha_5 TransMi + \alpha_6 VulChoc + \alpha_7 AidCom + \nu_t + \mu_i + \varepsilon_{it}$$

Model 2 includes the lagged dependent variable $ProdCap_{it-1}$. The other explanatory variables remain unchanged. i and t denote a country and a period respectively. The panel data set used to conduct the empirical exercise covers 35 Sub-Saharan African countries and the period runs from 2000-2018. Following its variables, we have ν_t and μ_i that capture time-invariant specificities for each country in the model and ε_{it} represents the normally distributed error term.

3.2 Estimation technique

Although the GMM (method of generalized moments) estimator of the two-stage system is our preferred estimator of model (2), we find it important to gain an initial insight into the effect of government spending on productive capacity by estimating the linear model (1) using standard estimators, namely the feasible generalized least squares (FGLS) estimator. The results obtained from estimating this static version of model (1) using FGLS estimators are shown in Table 3. This method has a special feature. The FGLS estimator makes it possible to correct for heteroscedasticity and autocorrelation problems. It was used as the basic model by Gnangnon (2021b) to assess the effects of aid on productive capacity. As model 1 may suffer from endogeneity problems that the FGLS estimator cannot correct, we will use the GMM method in a system as a robustness method for our basic results.

However, postulating that the level of government spending could influence the level of productive capacity, we opt as a second robustness method for a dynamic panel represented by model 2 which will be estimated by the method of moments whose preferred estimate in empirical analysis is the generalised two-stage system. The difference and system method of moments (GMM) estimator proposed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) are popular methods. However, the system GMM technique has the advantage of solving several endogeneity problemsOne of these problems arises from the presence of the lagged dependent variable as a regressor in the model.

The validity of the GMM estimator of the two-stage system is assessed on the basis of three tests, including the AR (1) test, which is the ArellanoBond test of the presence of first-order serial correlation in the residuals of the level equations; the AR (2) test, which is the ArellanoBond test of the absence of second-order autocorrelation in the residual of the differentiated equation; and Hansen's Sargan test of over-identifying restrictions. The null hypothesis of the latter test is the joint validity of the instruments used in the system of equations. The null hypothesis of this last test is the joint validity of the instruments used in the system of equations. The GMM estimator of the two-stage system is valid for conducting the empirical analysis if the null hypothesis of each of these tests is not rejected (Roodman, 2009).

3.3 Source de données

To verify the effect of government spending on productive capacity, we used secondary data from various databases. The data on the productive capacity index come from UNCTAD (2020). Data on vulnerability to shocks come from the Foundation for International

Development Studies and Research (FERDI). The rest of the variables have been extracted from World Bank data (WDI, 2023).

4. Presentation of results

4.1 Statistical analysis and results of the basic model

In this section, we present the results of the descriptive statistics and the correlation matrix for the variables in the model.

4.1.1 Statistical table and correlation matrix

Table 1 shows that there are no strong fluctuations between the variables. However, we can see that the overall means of our variables are respectively around 20.03 for the variable explaining productive capacity, and 14.415 for the variable explaining government spending. With a standard deviation of 7.658 for the first variable and 5.994 for the second. These results show that the average level of productive capacity in Sub-Saharan African countries is low and below average, at around 20.03. Table 2 analyses the correlation that may exist between different variables in the model. There is a positive correlation at the 1% level between government spending and productive capacity. Similarly, there is a positive correlation between the variables GDP/capita, Trade openness, migrant remittances, and the explained variable productive capacity at the 1% threshold. Aid for trade is positively correlated with productive capacity at the 5% threshold. On the other hand, the shock vulnerability variable is negatively correlated with productive capacity.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ProdCap	664	20.03	7.658	.491	37.389
DepGou	664	14.415	5.994	.952	39.451
PIB/hab	664	8.014	.909	6.444	10.266
Ouver	664	68.174	35.619	1.295	225.023
TransMi	625	2.353	3.014	0	14.521
VulChoc	664	37.936	16.214	2.373	88.173
AidCom	543	6.28	10.456	-2.136	75.686

Source : Authors

Table 2: Correlation

Variables	ProdCap	DepGou	PIB/hab	Ouver	TransMi	VulChoc	AidCom
ProdCap	1.000						
DepGouv	0.476	1.000					
	(0.000)						
PIB/hab	0.590	0.399	1.000				
	(0.000)	(0.000)					
Ouver	0.339	0.452	0.563	1.000			
	(0.000)	(0.000)	(0.000)				
TransMi	0.004	-0.178	-0.173	-0.176	1.000		
	(0.927)	(0.000)	(0.000)	(0.000)			
VulChoc	-0.053	-0.108	-0.340	-0.250	0.284	1.000	
	(0.169)	(0.005)	(0.000)	(0.000)	(0.000)		
AidCom	0.041	-0.183	-0.098	-0.204	-0.033	-0.017	1.000
	(0.339)	(0.000)	(0.022)	(0.000)	(0.446)	(0.700)	

Source: Authors

4.2 Basic model results

Table 3: Effects of public spending on productive capacity: Basic results

Dependent variable: Productive capacities						
	FGLS					
	(1)	(2)	(3)	(4)	(5)	(6)
DepGouv	**0.608*** **	**0.365*** **	**0.398*** **	**0.393*** **	**0.382*** **	**0.375*** **
	(0.044)	(0.041)	(0.043)	(0.043)	(0.043)	(0.044)
PIB/hab		4.014***	4.374***	4.196***	4.463***	4.572***
		(0.272)	(0.307)	(0.303)	(0.309)	(0.319)
Ouver			-0.020**	-0.015*	-0.013	-0.004
			(0.008)	(0.008)	(0.008)	(0.008)
TransMi				0.335***	0.269***	0.351***
				(0.076)	(0.078)	(0.079)
VulChoc					0.053***	0.060***
					(0.015)	(0.015)
AidCom						0.100***
						(0.022)
Constant	11.265***	-17.403***	-19.384***	-18.732***	-22.717***	-24.780***
	(0.681)	(2.032)	(2.171)	(2.205)	(2.459)	(2.551)
Observations	664	664	664	625	625	524
Pays	35	35	35	35	35	35

Source : Authors ; standard deviations are robust *** p<0.01, ** p<0.05, * p<0.1

The results in Table 3 column 6 show that government spending has a positive and significant effect on productive capacity at the 1% level. Similarly, the variables GDP/capita, vulnerability to shock, migrant remittances and aid for trade have a positive and significant effect at the 1% threshold. In contrast to these variables, trade openness is negative but not significant. The next step will be to analyze the robustness of these results in order to consolidate our analysis and identify relevant recommendations.

4.3 Robustness

4.3.1 Robustness of basic model results due to change in estimation technique

In this section, we change the estimation technique. We rewrite model 1 above, introducing the lagged endogenous variable, which gives us model 2 above. This change in estimation technique allows us to deal with the endogeneity problem evoked in model 1. To do this we will apply GMM in System.

Table 4 : Effects of government spending on productive capacities

Dependent variable: Productive capacity						
	GMM-Système					
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
L.ICP	0.983***	0.959***	0.954***	0.959***	0.953***	0.932***
	(0.006)	(0.009)	(0.010)	(0.009)	(0.011)	(0.020)
DepGouv	**0.011***	**0.013***	**0.021***	**0.017** **	**0.020***	**0.030** **
	(0.006)	(0.007)	(0.012)	(0.009)	(0.011)	(0.015)
PIB/hab		0.199***	0.182***	0.192***	0.251***	0.299**

		(0.064)	(0.060)	(0.065)	(0.097)	(0.127)
Ouver			-0.001	-0.001	-0.002	-0.000
			(0.001)	(0.001)	(0.002)	(0.002)
TransMi				0.018*	0.022**	0.030**
				(0.009)	(0.009)	(0.015)
VulChoc					0.001	0.001
					(0.003)	(0.005)
AidCom						0.020**
						(0.010)
Constant	0.474***	-0.665*	-0.430	-0.617*	-1.030	-1.342
	(0.099)	(0.398)	(0.420)	(0.355)	(0.644)	(0.887)
Observations	594	594	489	564	564	467
Number of ID	35	35	35	35	35	35
Intrument	9	34	21	16	31	29
AR(1)	0.0156	0.0158	0.0152	0.0156	0.0159	0.0305
AR(2)	0.173	0.173	0.192	0.246	0.248	0.569
Hansen	0.568	0.465	0.531	0.728	0.259	0.311

Source : Authors ; standard deviations are robust *** p<0.01, ** p<0.05, * p<0.1

4.3.2 Robustness by changing the alternative variable to productive capacity

While average income is a measure of comparative development, economic complexity is developed to build predictions of growth and development patterns based on the availability of productive capacity within an economy. Large productive capacities can sustain growth over long periods because of their ability to produce a diverse range of sophisticated products (Hidalgo and Hausmann, 2009; Felipe and al., 2012). Indeed, there are several other indices for measuring productive capacity, such as Hidalgo and Hausmann (2009); Simoes and Hidalgo (2011) on economic complexity, the International Institute for Management Development and the World Economic Forum on national competitiveness or the United Nations Industrial Development Organization's Competitive Performance of Industry Index (UNCTAD, 2020). However, this study looks at economic complexity as an alternative measure of productive capacity. Given that some countries do not have full data on economic complexity, we use a panel of 25 countries over the period 2005-2018.

We rewrite model 2 as follows and call it model 3:

$$ECI_{it} = \alpha_0 + \alpha_1 ECI_{it\text{-}1} + \alpha_2 DepGouv_{it} + \alpha_3 PIB/hab_{it} + \alpha_4 Ouver_{it} + \alpha_5 TransMi + \alpha_6 VulChoc + \alpha_7 AidCom + \nu_t + \mu_i + \varepsilon_{it}$$

With ECI the economic complexity index, which is an alternative measure of productive capacity. And ECI_{t-1} its lagged variable. The other variables in the model are identical to those in model 2. The results of the estimations of model 3 are presented in table 6.

Table5: Effects of government spending on economic complexity

	Dependent variable: Economic complexity					
	GMM					
	(1)	(2)	(3)	(4)	(5)	(6)
ECI_{t-1}	0.919***	0.790***	0.806***	0.803***	0.782***	0.698***
	(0.020)	(0.045)	(0.015)	(0.020)	(0.121)	(0.104)

DepGouv	**0.004*** **	**0.008***	**0.011*** **	**0.004****	**0.012*** **	**0.017*** **
	(0.001)	(0.005)	(0.003)	(0.002)	(0.002)	(0.003)
PIB/hab		0.013	0.003	0.010	0.014	0.022
		(0.028)	(0.009)	(0.017)	(0.015)	(0.029)
Ouver			-0.001***	-0.001	-0.004*	-0.001
			(0.000)	(0.001)	(0.002)	(0.002)
TransMi				0.005*	0.012**	0.015*
				(0.003)	(0.006)	(0.008)
Vul					-0.004***	-0.004**
					(0.001)	(0.001)
AidCom						0.003**
						(0.001)
Constant	-0.121***	-0.413**	-0.301***	-0.288**	-0.118	-0.528*
	(0.027)	(0.176)	(0.051)	(0.114)	(0.371)	(0.277)
Observations	300	225	225	225	225	270
Number of ID	25	25	25	25	25	24
Instruments	8	9	24	23	24	25
AR(1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AR(2)	0.119	0.128	0.141	0.132	0.200	0.141
Hansen	0.880	0.856	0.328	0.274	0.285	0.326

Source : Authors ; standard deviations are robust *** p<0.01, ** p<0.05, * p<0.1

4.3.3 Interpretation of results

Our basic results in Table 3 obtained using the FGLS estimator show that, overall, there is a positive and significant relationship between productive capacity and the variables government expenditure, GDP per capita, remittances and vulnerability to shocks. In contrast to these variables, economic openness has no effect on productive capacity, but is nevertheless negative.

To consolidate our results from the basic model, we carried out robustness tests using system GMM estimators, the results of which are presented in Tables 4 and 6. We can see that government spending has a positive and significant effect at the 5% threshold on productive capacity (see Table 5). In fact, a 10% increase in government spending improves the level of productive capacity by 0.30% in sub-Saharan African countries. GDP per capita has a positive and significant effect at the 5% threshold. The level of per capita income contributes to the development of productive capacity; this result is identical to that of Gnagon (2021b). The Aid for Trade variable has a positive and significant effect. According to the results in Table 5, a 10% increase in the amount of aid allocated to trade improves the level of productive capacity by 0.20%. These results are in line with those of Gnagon (2021b).

The robustness results obtained with the alternative variable of productive capacity (model 3) are presented in table 5 column 6. It can be seen that government spending has a positive and significant effect at the 1% level. This means that when government spending increases by 10%, the level of economic complexity increases by 0.17%. We can conclude by saying that government spending is favourable to the development of economic complexity. This result is in line with that of Saadi (2020) who used this variable as a control variable to analyse the effects of migrant remittances on economic complexity.

Migrant remittances are positive and significant at the 10% threshold. This shows that the sending of remittances by migrants to their country of origin would contribute to an increase in economic complexity. This is in line with the work of Saadi (2020) who shows that remittances in general and remittances used for investment purposes are positively associated with economic complexity in developing and emerging countries. Similarly, the aid for trade variable is significant and positive at the 5% threshold. Table 5 shows that a 10% increase in aid for trade contributes to a 0.03 improvement in the economic complexity of sub-Saharan African countries. On the other hand, economic vulnerability has a negative and significant effect at the 5% threshold. The level of economic vulnerability in Sub-Saharan African countries does not favour the development of their economic complexity.

Conclusion

The aim of this study was to examine the effects of government spending on productive capacity in sub-Saharan African countries. The empirical investigations carried out, using panel data estimated by the methods of generalised least squares (FGLS) and generalised moments in a system (GMM-System), made it possible to establish several results. This analysis shows that government spending has a positive and significant effect on the productive capacity of sub-Saharan African countries. This shows that an increase in spending contributes to an increase in productive capacity. Furthermore, our analysis shows that the level of public spending has a positive impact on the economic complexity of sub-Saharan African countries. Two main recommendations emerge from this analysis: (i) it is important for the leaders of sub-Saharan African countries to direct their government spending towards productive sectors in order to improve their production capacity and achieve sustained and sustainable growth (ii) the leaders of sub-Saharan African countries must put in place policies to monitor and evaluate spending in different productive sectors in order to make them more effective.

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