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AGRICULTURAL PRODUCTIVITY IN ECOWAS REGION: DOES GOVERNANCE MATTER?

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Abstract

The role of agricultural productivity in reducing poverty in developing countries is largely highlighted in the economic literature. The main objective of this paper is to determine the role of governance in agricultural productivity in the ECOWAS zone and other factors influencing the agricultural productivity of this zone. Specifically, the aim is to: (i) Establish a sense of the existing relationship between agricultural productivity and governance (corruption) in the ECOWAS area and quantify this relationship; (ii) Identify in general the factors affecting agricultural productivity in the ECOWAS area. In order to achieve the objectives set, a random effects model was used on panel data. The random effects model confirmed by the significance of the Breusch-Pagan test indicates that corruption has a negative and significant effect on agricultural labor productivity in the ECOWAS area at 0.10%. On the other hand, the gross domestic product, capital factor, temperature and precipitation have a positive and significant effect of 0.33%, 0.08%, 0.09% and 1.56% respectively on the productivity of agricultural labor within ECOWAS.

Keywords: Agricultural productivity, Governance, Panel data, ECOWAS

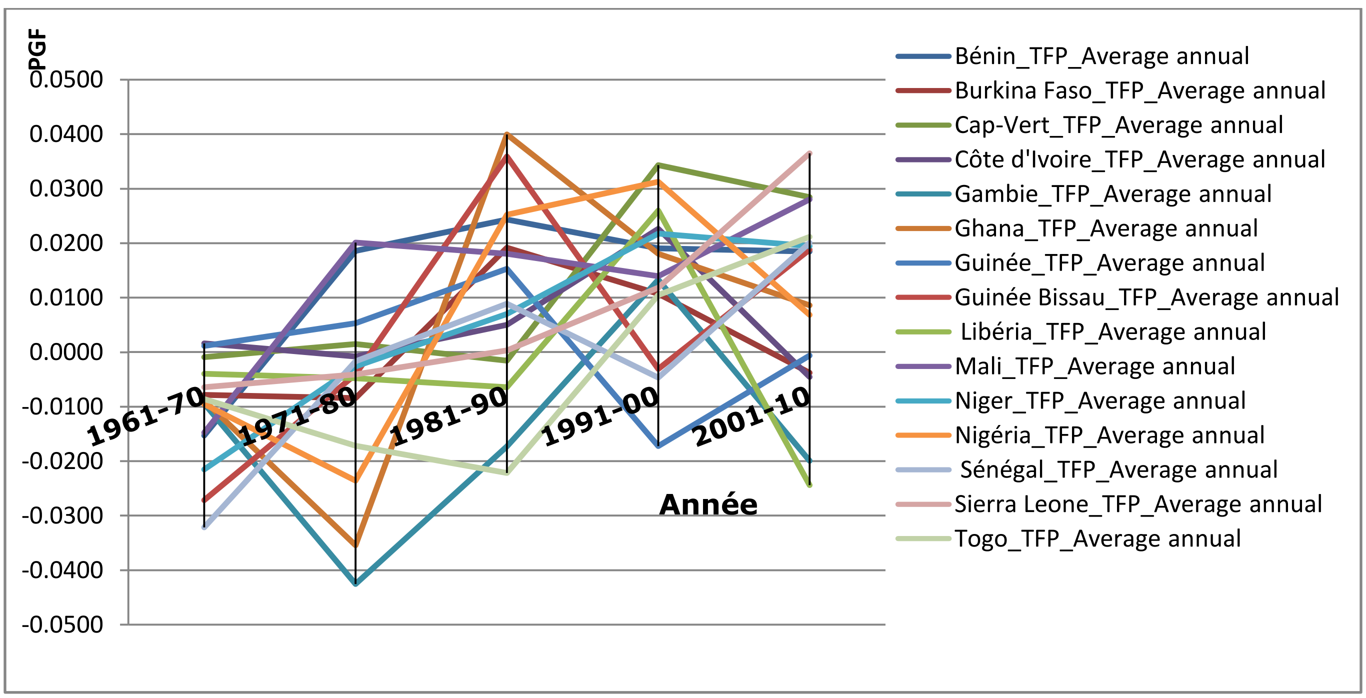
INTRODUCTION

The role of agricultural productivity in reducing poverty underlined by various authors (Wamba 2009; Matsuyama 1992) and various institutions reveals the importance attached to agriculture. As an illustration, according to the World Bank, agricultural growth has two to four times more effective impact on increasing the income of the poor. It also represents a third of gross domestic product (GDP) and three-quarters of employment in Sub-Saharan Africa. According to the same source, it is a way of improving living processes 78% of poor people living in rural areas of the planet.

Also in July 2003, the Maputo Declaration stipulated under the New Partnership for Africa's Development (NEPAD), African countries including ECOWAS had to devote 10% of their national budget to the revitalization and improvement of the productivity of their agricultural sector. More than ten years later, this detailed plan for development of African agriculture including ECOWAS, which was supposed to help these African countries to achieve an agricultural growth rate of 6% per year, is struggling to be respected, with agricultural productivity still very low, this, despite numerous initiatives and commitments made in recent years, both at continental, regional, countries (A. Diallo, and K. Mbaye BB Thiaw, 2013).

In the ECOWAS zone, agricultural productivity has evolved irregularly since the 1961-2010 (see below chart the evolution of the average annual growth in total factor productivity). The first two decades of 1961-1980, the average annual growth of total factor productivity of the different countries in the region experienced mostly negative trend. This trend will be reversed slightly until the early 81-2010 with an average annual growth of the total productivity of the factors positively majority, however not reaching 0.05. This trend factor productivity of countries in the area although little glistening could be achieved with the various plans for agriculture in each country and sometimes at the regional level.

Figure 1: Evolution of the rate of total factor productivity in annual Average



Source: Author by World Bank data (Agricultural TFP individual countries 2015)

This brief presentation above of the evolution of agricultural productivity of the ECOWAS zone suggests a fundamental question, that of why agricultural productivity in the ECOWAS zone is still weak.

According to the regional agricultural policy in West Africa "ECOWAP," the period from 1980 to 2005 has experienced an increase in average yields of only 42%. This increase in yields was originally only 30% of agricultural supply. Also, compared to the world level, productivity per hectare of the majority of productions are lowest. Furthermore, the most used inputs as improved seeds, fertilizers, agricultural machines are only rarely used. However, the unsolved question is whether these factors are sufficiently available before their uses are very low? Or rather, the budget allocated for the acquisition of these factors is not actually used for that purpose and that is what has led to the unavailability of such factors as their low use.

Also, the basic research question of this paper is to determine the role of governance in agricultural productivity in the ECOWAS zone and other factors that may influence this productivity.

Several studies have highlighted certain factors as explanatory elements of low agricultural productivity in West Africa. In its work, Kouassi (2009), mentioned that the environmental degradation, high population growth, locust attacks, the poor performance of economies are factors that contributed to lower productivity in West Africa. Several other studies on the topic around the world have highlighted several other factors explaining the weakness of agricultural productivity (Block 2010; Fuglie 2013; Wang and Ball 2014; Mishra 2010; Kamei 2013). Also, this study seeks to determine the fundamental role of factors such as corruption and government effectiveness (both governance factors) in explaining agricultural productivity of ECOWAS.

Indeed, fungibility (diversion of resources from their primary objectives) or the use of resources allocated to the agricultural sector for other purposes could have an impact on the expected output (decline in productivity) of the agricultural sector.

The relevance of this research is justified by the key role of the agricultural sector by improving its productivity in food security, the improvement of trade and population lives in conditions of poor countries and especially those in the ECOWAS area. With a contribution of 35% to regional GDP, covering 80 % of the food needs of the region, 16.3% of regional exports, Agriculture ECOWAS zone occupy a place of choice in the fight against poverty.

As general objective of this paper, it is to analyze the role of governance in agricultural productivity in the ECOWAS zone. Specifically, these are: (i) Establish the direction of the relationship between agricultural productivity and governance (corruption and government effectiveness) in the ECOWAS zone and quantify this relationship; (ii) Determine general factors that affect agricultural productivity in the ECOWAS zone.

To achieve our objectives, two hypotheses are proposed in the context of this study are:
(i) There is a positive relationship between agricultural productivity and governance (corruption and government effectiveness) in the ECOWAS area (improved governance leads to improved agricultural productivity);
(ii) Factors such as the growth of capital stock (captured by the number of tractors per hectare), the agricultural labor force, and improved climatic conditions lead to increased agricultural productivity.

MACROECONOMIC BACKGROUND OF WEST AFRICAN COUNTRIES

Some results of the common agricultural policy of the ECOWAS zone - CAADP

The implementation of the Comprehensive African Agricultural Development Program (CAADP) provided some gains in agricultural production for the ECOWAS region. These gains can be as follows, in terms of cereal production, rising by 59% between 2000 and 2012. The biggest increase is in rice (+ 95%) and maize (+130%). However, if there is an increase in production, the improvement in yields is not significant. It should be noted that the improvement in production presented above is mainly due to the increase in cultivated areas. The only exception that can be made concerns only rice and maize. In the years 2000 and 2010, the increase in paddy rice production could be explained by a 71% increase in yields (annual growth of 2.9% over the period).

Moreover, if the rate of demand follows a geometric sequence, the supply only progresses in an arithmetic way. Otherwise, demand is growing faster than supply, resulting in dependence on food imports, which have increased considerably in recent years, notably for certain commodities such as cereals, milk and meat.

Clearly, under the dual effects of the increase in import volumes and import prices, the agri-food trade balance of the ECOWAS zone balanced at the time of the Ecowap adoption showed a deficit of about 3 billion over the period from 2008 to 2011.

As regards intra-Community trade, they have increased in recent years between the different countries in the Community. Of an average market value of more than 200billion CFA F livestock is at the top of the agro-pastoral trade in the area. Nigeria, the main producer and consumer of the area, followed by Ghana and Ivory Coast, concentrate a large part of agricultural trade. However, this dynamic of intra-Community exchange is slowed down by national strategies of the different countries of the zone which want to be self-sufficient. By way of example, in the livestock sector, all the coastal countries that now source from the major Sahelian breeding countries have national self-sufficiency objectives.

As for food security, it has improved. The availability of calories per capita has greatly improved in West Africa, exceeding in the majority of countries the threshold of 2500 Kcal/day/inhab. The rate of undernourishment declined from, say, between 2005 and 2015, from 16% to 7.5% in Benin, from 40% to 22% in Sierra Leone, from 26% to 21% in Burkina Faso or from 23% to 10% % in Senegal. However, despite this progress, food and nutrition insecurity remains particularly high in West Africa. Under nutrition still exceeds the world average (11%) in many countries. Nearly 40% of children under 5 are affected by stunted growth and 12% by acute malnutrition. Household poverty is the major cause of this insecurity. Nearly 55% of the West African population lives on less than 1.25 USD/day. One of the major problems also remains the lack of investment in family farming. According to a study by the Roppa, the RBM Apess, 20% of the credit allocated to the economic sectors is destined for agriculture of which only 2% for the family farms. These brief results of the Comprehensive African Agricultural Development Program (CAADP) of the ECOWAS zone that evolve into a saw tooth lead us to analyze the different productivities of the zone.

Evolution of agricultural productivity in the ECOWAS zone

Evolving irregularly for some countries in the ECOWAS zone and weakly to other countries in the same zone, agricultural productivity ECOWAS area is indexed by various strategic analyzes as the result of structural problems and inadequate policies in different countries of the area. Compared to other regional unions of the world where a higher yield is driving gains in production, agricultural yields ECOWAS area are well below global benchmarks. As an illustration, over the period 1980 to 2009, the sown grain to increase by 3.9% while the yield rose by only 1% less. In line with the first illustration, the same result is applicable to other types of crops (excluding maize) where productivity has not increased substantially, or sometimes it is stagnated. Also, do we see that the area of productivity differs depending on the types of crops.

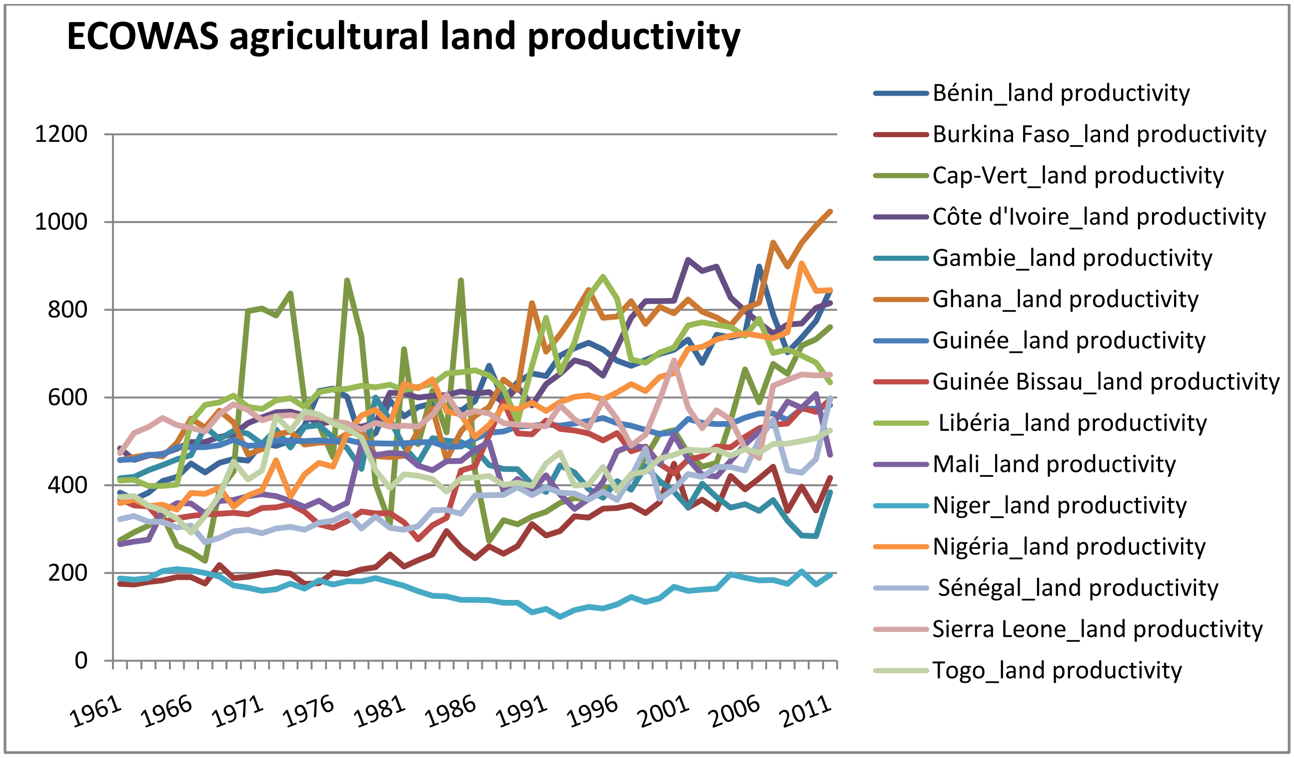
Regarding agricultural productivity of the factors of the area, we pay special attention to the partial productivity of factors, namely: (i) agricultural productivity of the land; (ii) agricultural labor productivity and (iii) agricultural productivity of capital.

Defined as total agricultural output reported cropland, the observation made by different analysis reveals that the productivity of land in the ECOWAS zone is still low and is short of the international standards. However, its growth rate is above the growth rate of other African regions (excluding Central Africa). Over the period 1980 to 2010 , it was 2.3 in West Africa against 1.4 in North Africa and 2.6 in Central Africa (Benin et al ., 2011).

Also, structural adjustment programs and the devaluation of the 90 pacemakers were periods of producers in the area have increased the arable land mainly cash crops and leading to a rapid improvement in productivity. Also, note that agricultural growth in the ECOWAS region was based on the expansion of arable land and not on improving yields.

The graph below illustrates the evolution of agricultural land productivity in different countries of ECOWAS area.

Figure 2: Evolution of agricultural productivity of the land factor



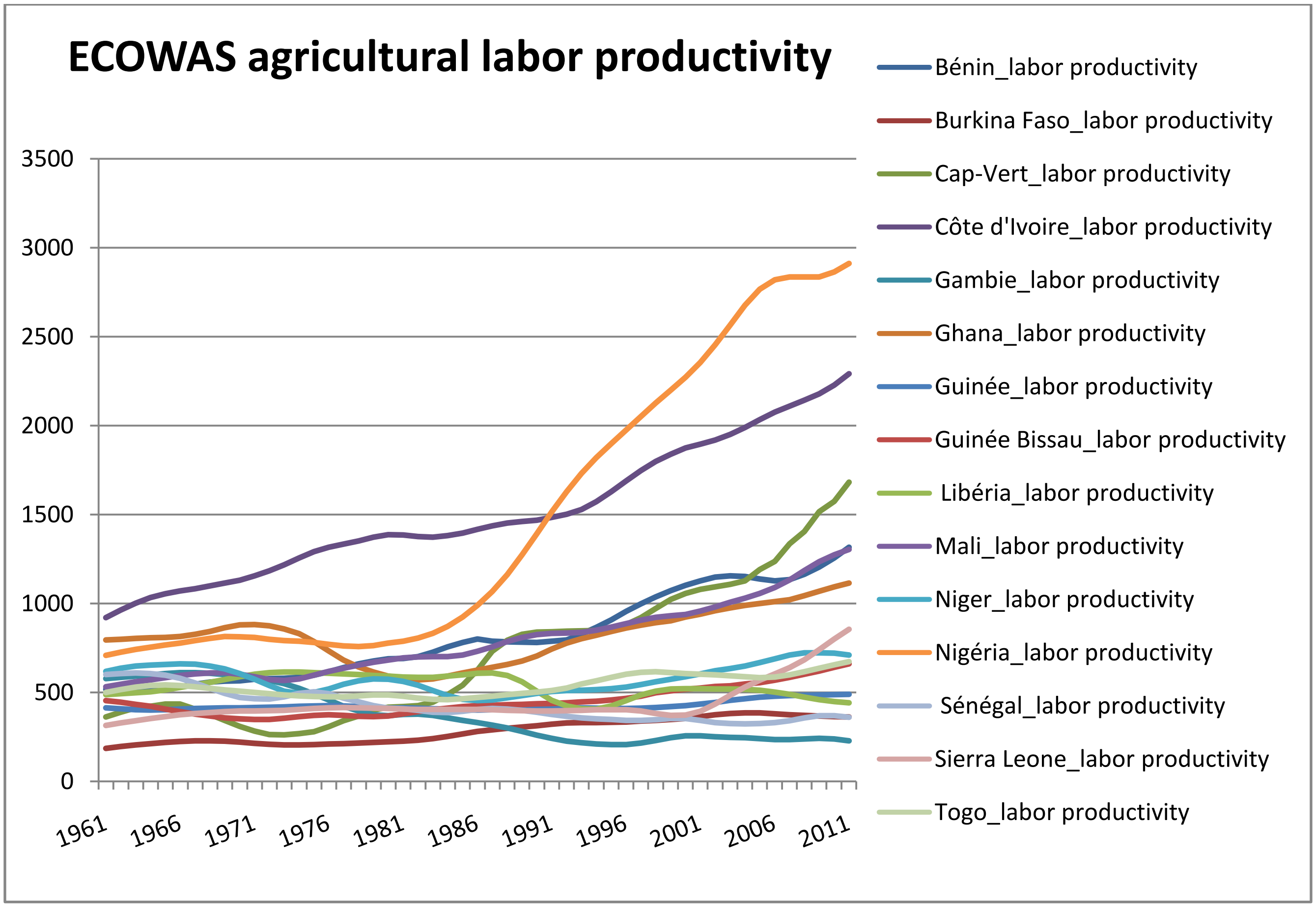
Source: Author by World Bank data (Agricultural TFP individual countries, 2015)

This representation shows that with the exception of Ghana, Nigeria and Senegal which display a more or less constant improvement of agricultural productivity of the land, the other countries in the region face high variability (variation in tooth Saw) this productivity.

Regarding agricultural labor productivity is defined as the ratio of total agricultural production and agricultural labor. Also, compared to other African regions, agricultural labor productivity in the West African region has evolved timidly. Over the period 1980 to 2010, it was 0.9 in West Africa against 2.7 in North Africa and 1.6 in Central Africa (Benin et al., 2011).

The parameters responsible for improving the productivity of the land seems justified the poor performance of the region in terms of agricultural labor productivity. Also, SAP and devaluations 90s behind the change in the relative prices seem to be behind the low growth rate of labor productivity in the area. The graph below illustrates the evolution of agricultural land productivity in different countries of ECOWAS area.

Figure 3: Evolution of agricultural productivity Labor factor



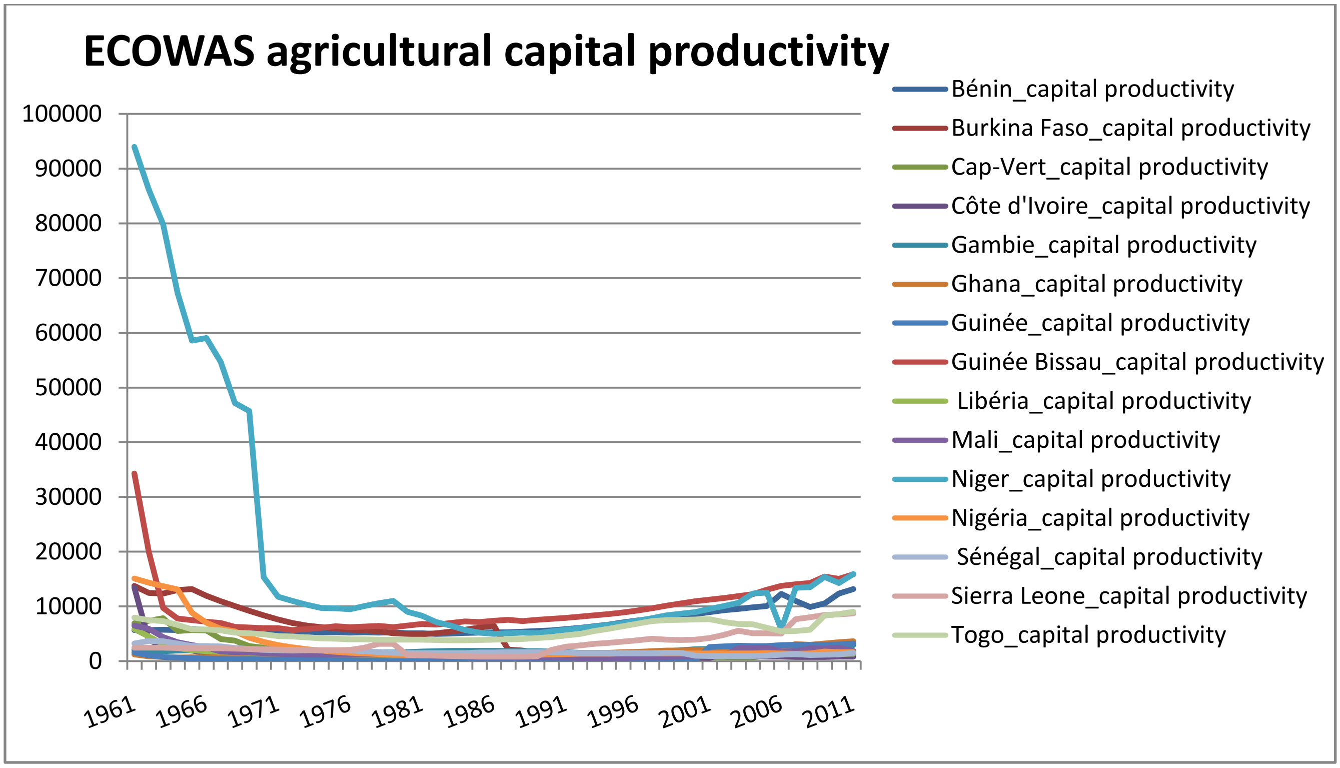
Source: Author by World Bank data (Agricultural TFP individual countries, 2015)

The above graph showing changes in the labor productivity of agricultural labor in different countries of the area shows that with the exception of Nigeria and Ivory Coast that displays a clear evolution of that productivity, this productivity for other countries experiencing a steady downward trend and even for some countries like Gambia.

In relation to agricultural productivity of capital, in addition to countries such as Benin, Ghana and Sierra Leone that have experienced rising productivity in recent years, other countries in the ECOWAS zone experienced agricultural productivity of capital down on period 1961-2011.

The graph below illustrates the evolution of agricultural productivity of capital from different countries in the ECOWAS zone.

Figure 4: Evolution of agricultural productivity factor of Capital



Source: Author by World Bank data (Agricultural TFP individual countries, 2015)

Following the presentation of the evolution of different productivity, the overall representation does not reflect the reality of the whole area; actually saw the difference from one country to another. Also, the average productivity of a country to another in some cultures can vary up to 5 times for a given factor. However, trying to understand the reason for this state of affairs and drawing on best practice from other regions, noticed the differences between countries in terms of productivity can be addressed through appropriate measures.

Also, following the presentation of the analysis on the evolution of different productivity as partial total that we are interested in the state of governance in the ECOWAS area to see what relationship there might be between evolution of factor productivity and the state of governance in the area.

Evolution factors of governance adopted in the ECOWAS zone (corruption)

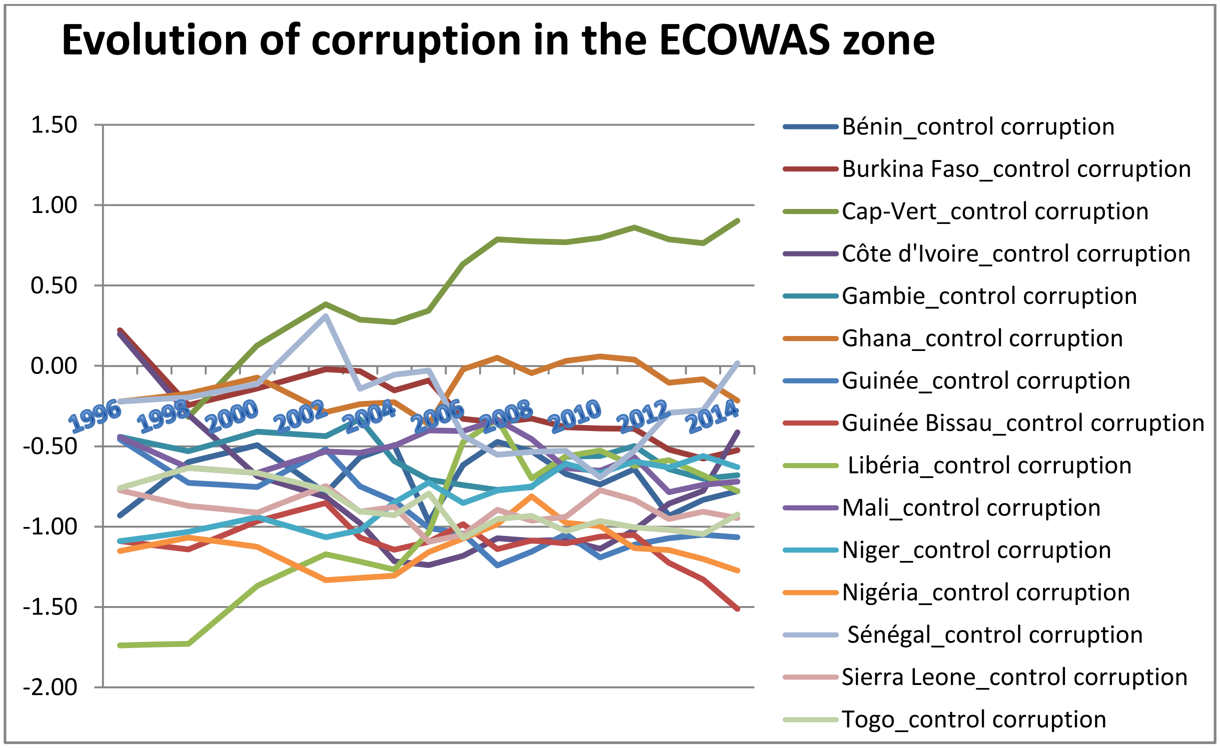
Governance includes the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the ability of government to effectively formulate and implement sound policies; and the respect of citizens and state for institutions that govern economic and social interactions among them.

There are several parameters of governance but here we retain only corruption which we think relevant for our study.

The values of these indicators are expressed on a scale of [-2.5 +2.5]. The closer the score is to +2.5, the better the country in terms of governance and vice versa. Indicators of governance: expressed on a scale of [-2.5 +2.5] where -2.5 means very poor governance and +2.5 very good governance.

Figure (5) with the evolution of the control of corruption factor in the various ECOWAS countries shows that control in those countries is negative with the exception of Cape Verde , where this control has experienced a positive trend from the year 2001.

Figure 5: Evolution of the corruption factor in the ECOWAS zone



Source: Author by Kaufmann Daniel, Aart Kraay and Massimo Mastruzzi (2010). "The Worldwide Governance Indicators: Methodology and Analytical Issues"

LITERATURE REVIEW

Studies that have addressed the underlying factors of agricultural productivity are many and can be categorized in two (02) levels, firstly, those referring to factors related to the structure of the agricultural sector (agricultural labor, fertilizers, size of arable land, agricultural machinery, soil quality, etc) and those referring to external factors that influenced the productivity (infrastructure, environmental, climatic factors, vocational training, the education, macroeconomic factors, etc).

To these two categories may be added, the studies carried out to determine the efficiency in the use of factors in agriculture. However, remember that in practice it is difficult to use only the first or second order factors because of the importance and influence of these two categories of factors in explaining agricultural productivity.

Also the literature uses the combination of the two groups of factors with special emphasis on one factor based on the objective of the study. Rarely in the literature are the factors of the first group or the second group only employees. Also, most of the available studies consider both the first group of factors is to say, those referring to the structure of the agricultural sector (agricultural labor, fertilizers, size farmland, agricultural machinery, soil quality, etc) and the second group of factors.

However, in the literature, it is rare to have studies that referred to the role of institutions and especially the aspects of governance in agricultural productivity, some recent studies have explored this area. The recent study that focused on the role of institutions refers to that Fulginiti, Perrin and Yu (2004). According to the findings of their studies, the former British colonies have experienced higher rates of growth of total factor productivity, while the former Portuguese colonies experienced lower rates. They also found negative effects for political conflicts and wars , and the positive effects arising from political rights and civil liberties. This study was conducted in 41 countries in Sub -Saharan Africa over the period 1960-1999 through a Fourier production frontier semi- nonparametric.

Also, no study, at least to our knowledge in the ECOWAS zone has had to take into account the parameters of governance as factors that explained agricultural productivity. Also, this last finding is the foundation, the objective of our study, that is to say, analyzing the parameters of governance in explaining the level of productivity in the ECOWAS zone.

Through literature, the results of studies available show the contribution of each factor to different degrees in explaining agricultural productivity.

Relative to the first group identified by reference to the initial factors of the agricultural sector as factors behind the sector's productivity, mention may be made of the work of Alabi and Imahe (2005) on the Nigerian case. In their work, the authors led to the findings that factors such as the distribution of arable land, the rain medium, fertilizer use, the value of imports, agricultural expenditure in capital and loans from commercial banks agricultural sector are explanatory elements of agricultural productivity in Nigeria. Other studies have reached similar conclusions sometimes and sometimes to various conclusions (Owuor 2000).

Polyzos and Arabatzis (2006), working on the productivity of labor in agriculture in 51 prefectures of Greece found that cultivated farmland factors related to the number of workers in the sector (some persons per hectare), irrigated farmland , weather conditions and the level of training and education of the agricultural population significantly determine the productivity of labor. In addition, for this study, if the author said in the paper does not meet collinearity problem, but did not explain how this was done given its econometric model that has a linear combination of the added value Agricultural related to the agricultural population (dependent variable) and the agricultural population (explanatory variable). A similar study was conducted in Kenya by Evenson and Mwabu (2001). These authors sought to determine the impact of training and monitoring project which was implemented in Kenya on agricultural productivity of the country, taking into account other determinants of agricultural production. The findings of this study show that there is a high incidence of training and monitoring when control a number of parameters such as farm management capacity. However, these authors found that the effect of education on farm productivity is certainly positive but statistically insignificant. Regarding the role of the education factor on agricultural productivity, many studies in several countries have revolved around this element with different results depending on the estimates used techniques (Reimers and Klasen 2015; Vollrath 2007; Alene and Manyong 2006).

As for the third category of studies on the determination of efficiency in the use of factors in agriculture, several studies carried on different countries have shown that the change in total factor productivity is sometimes more attributable to changes in efficiency that technological change and sometimes more due to technological change and the evolution of efficiency taking into account also cultured products (Ajetomobi 2012; Ajetomobi and Odeniyi 2011; Ajetomobi 2009; Kannan 2011). Also, sometimes the determinants of agricultural productivity can vary from one region to another (Owuor 2000).

As noted above , all covered literature, various factors (land , fertilizers , irrigation , tractors , education , training , weather conditions , etc ...) have been the subject of studies by way of items that can be explained in agricultural productivity, however, the finding reported not taking into account the factors of governance (including corruption) in explaining the level of agricultural productivity. Also, this is the gap that our study will attempt to fill in studying the role of governance in explaining the level of agricultural productivity in the ECOWAS region.

METHODOLOGY

Theoretical Framework

In order to rule on the empirical specification to use, re-visitation of the theoretical approach is made. Also, agricultural productivity is defined as the reported agricultural production to levels of inputs used. Generally up to establish the relationship existed between agricultural productivity and its explanatory factors, both approaches are often used, it is the Cobb- Douglas production function developed by Paul Douglas and Charles Cobb in 1928 in their study on the theory of marginal productivity and Translog function (Transcendental Logarithm) said flexible production function is a generalization of the Cobb -Douglas function. These two models are set forth in order to adopt a reflecting part of the study.

The production function developed in the work of Cobb -Douglas (1928) is widely used to establish the relationship that may exist between agricultural productivity and its determinants due to its simplified form (Polyzos and Arabatzis , 2006; Valerio , 2014) .

The general shape of this function is specified as follows:

$y = A \cdot \prod_i x_i^{ai} \; ou A, a_i > 0$ ……………………………………………………..……(1)

Where, the index i represents the factors of production.

The linearization of this general shape gives the following configuration:

$\ln(y) = \ln(A) + \sum_i a_i \cdot \ln(x_i)$ ……………………………………………..……(2)

However, for a production function of two factors, the general shape retention can be specified as follows:

$Y = AK^{\alpha} L^{\beta}$ …………………………………………………………………………(3)

Where Y is output ; A is a factor of the economy dimension; K is the amount of capital used ; L, the amount of labor used ; α the share of production that pays K and β the share of production that pays L, with α + β = 1 .

In carrying out the linearization of the function (3), we obtain:

$\ln Y = \ln A + \alpha lnK + \beta \ln L$ ………………………………………..……………… (4)

Nevertheless, although the Cobb-Douglas function is heavily used in the studies, restrictive assumptions (unit elasticity of substitution between factors, constant returns to scale) on which it is based are the limits of this function.

Furthermore, the Translog function which is a generalized form of the Cobb Douglass function does not require any particular form of production structure. Which one is often used, was defined by Christensen, Jorgenson and Lau in 1971.

It is as follows:

$\text{Ln}\, y = \beta_0 + \sum_i \beta_i \ln(x^i) + \sum_i \sum_j \beta_{ij} \ln(x^i) \ln(x^j)$………………………………………(5)

With y as production; x^i, as production factors.

Rather used by several authors (Heyer and al ., 2004; Ajetomobi , 2012) , the Translog function has some shortcomings including the fact that it is only an approximation of a production function at a given point and not the direct expression of the production function , which limits the scope of the results. Similarly , while the production function satisfies certain regularity conditions (the positivity of marginal productivity of factors of diminishing returns , convexity of isoquants , clean elasticities negative factors) , they cannot be met in full for a flexible form (production function Translog) at risk of losing its flexible nature .

Also, following the presentation of these two theoretical approaches, Cobb Douglas production function is retained in the context of this study, because despite its restrictive assumptions, it seems to be more appropriate because of its simplified form. This same function was used earlier by several authors before to determine the factors influencing productivity (Block 2010; Hayami and Ruttan 1985; Fulginiti and Perrin 1998).

Consequently, the Solow model (1957), took into account factors such as land, labor and capital with the specification of the agricultural production function as follows:

$$Y_t = A_t f(K_t, L_t, N_t)$$

With, Y_t agricultural production in the agricultural sector in the year t, K_t, L_t, N_t, represent respectively, the capital factor , the Labor factor and factor land used in agriculture sector in period t. Also, A_t means the level of the technology commonly called the Solow residual or total factor productivity. It is assumed that the production function is based on constant returns to scale .

Recall that can be used in total way (TFP) or partial (partial productivity), the limited availability of data justifies the use of more and more in the literature of the partial factor productivity such as capital, labor and land.

However most of these studies, as outlined in the literature review, were not considered institutional aspects specially governance as a factor explaining agricultural productivity, which is the gap that we identified in the literature and we will try to fill through this study. Indeed we assume that corruption in the agricultural sector that can manifest as fertilizer shortage, inadequate tractors, quality seed failure, low implementation of irrigation projects (own corruption indicators in the study defined in the agricultural sector) and low government effectiveness (quality indicator of public policy which the agricultural policy and their implementation) may have effects on agricultural productivity. Also, the above factors are identified as transmission channels of governance to agricultural productivity. Cobb Douglas production function will be changed to increase recovery and governance factors to determine the role of these factors on agricultural productivity in the ECOWAS zone. Also, the main contribution of this study is the inclusion of factors of governance (corruption specifically) in explaining the level of agricultural productivity in the ECOWAS zone.

Empirical specification

Generally, productivity is the ratio between production and staff factors. Also, total factor productivity is the total production related to the total value of the factors, or as it is tough to associate the value of inputs, the approach developed in the literature is the use of partial factor productivity. Accordingly, the partial factor productivity is the ratio of total output and the value of a factor. However this approach has shortcomings, because, in relation to the total production value of a factor, it is as if this were the only factor that is used for production, however, there are other factors, which constitute a limitation of this approach.

According to the theoretical review which allowed to rule on the Cobb-Douglass function, the production function can be written as follows:

$$Q = f(x_1, x_2, x_3, \dots\dots, x_n)$$

With, $Q$the production et $x_1, x_2, x_3, \dots\dots, x_n$ the factors production.

Also partial factor productivity can be written as follows:

$$PPF = \frac{Q}{x_i}$$

By retaining the equation (4) and in line with the work of Ajetomobi (2012), Polyzos and Arabatzis (2006), estimating our equations are written as follows:

$$PPFT_{it} = \alpha_0 + \alpha_1 PIBH_{it} + \alpha_2 K_{it} + \alpha_3 L_{it} + \alpha_4 Temp_{it} + \alpha_5 Qplu_{it} + \alpha_6 corr_{it} + u_{it} + \varepsilon_{it} \quad (1)$$
$$PPFL_{it} = \beta_0 + \beta_1 PIBH_{it} + \beta_2 K_{it} + \beta_3 Temp_{it} + \beta_4 Qplu_{it} + \beta_5 corr_{it} + u_{it} + \varepsilon_{it} \quad (2)$$
$$PPFK_{it} = \delta_0 + \delta_1 PIBH_{it} + \delta_2 L_{it} + \delta_3 Temp_{it} + \delta_4 Qplu_{it} + \delta_5 corr_{it} + u_{it} + \varepsilon_{it} \quad (3)$$
$$PIBH_{it} = \gamma_0 + \gamma_1 PPFT_{it} + \gamma_2 PPFL_{it} + \gamma_3 PPFK_{it} + \gamma_4 corr_{it} + u_{it} + \varepsilon_{it} \quad (4)$$

Model variables

$PPFT_{it}$: Land factor Partial productivity

$PPFL_{it}$: Labor factor Partial productivity, (gross Agricultural Production divided by number of persons economically active in agriculture, +15 yrs, male+female).

$PPFK_{it}$: Capital factor Partial productivity

$PIBH_{it}$: Gross Domestic Product per Capitaexcluding agricultural value added.

K_{it} :Capital in the agricultural sector, given the problem of unavailability of data, is captured by the stock of agricultural machinery (the total stock of agricultural machinery in "tractor equivalence of 40 metric power, aggregation of the number of two-wheeled tractors, Four-wheeled tractors and combine harvesters. Data are from FAO).

T_{it} : The area of cultivated farmland

L_{it} : Agricultural Labor

$Temp_{it}$: Represents the temperature that is factors for sensing climate aspects

$Qplu$: Represents the quantity of rain

$corr_{it}$: Represents corruption in public sector

α_0, β_0, δ_0, γ_0 represent the constant terms

ε_{it}, the error term and μ_{it} : specific effect.

To check the preponderance of one of the partial productivities in relation to the others, we have studied the correlation between the various partial productivities and the GDP on the one hand and on the other the correlation between the corruption and the various partial productivities. From the results, relations are unequivocal; there is a strong positive relationship (0.4723) between GDP and the partial productivity of the labor factor in relation to the relation between GDP and other partial productivities. Similarly, there is a strong negative relationship (-0.0149) between corruption and the partial productivity of the labor factor in relation to the relationship between corruption and other partial productivities. This leads us to retain the partial productivity of the labor factor as preponderant in relation to other productivities, thus leading to the latter equation (5) to be estimated for this paper:

$$\boldsymbol{PPFL_{it} = \beta_0 + \beta_1 PIBH_{it} + \beta_2 K_{it} + \beta_3 Temp_{it} + \beta_4 Qplu_{it} + \beta_5 corr_{it} + u_{it} + \varepsilon_{it}} \quad (5)$$

Expected signs

Variables	Signes attendus
$PIBH_{it}$	+
K_{it}	+
L_{it}	+
$Temp_{it}$	+
$Qplu_{it}$	+
$corr_{it}$	-

Data sources

The data used for the estimates come mainly from the World Bank database (world development indicators 2015 and Agricultural TFP individual countries 2015). Concerning data on good governance, we used the database of Freedom House 2015 and KKM 2010. The study will cover the 15 countries of ECOWAS: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Nigeria, Niger, Senegal, Sierra Leone and Togo. Also, the period covered by this study runs from 1961 to 2011. This period laps is justify by the fact of availability of data. It should also be noted that most of the zone countries are confronted with the problems of statistics available and therefore difficult to have statistics at country level individually, which leads us to refer to Statistics from the World Bank and other international sources.

ANALYSIS AND FINDINGS

Descriptive statistics

For example, according to the results of Table 1 (Average and standard deviation) below, the average GDP per capita in the ECOWAS area is US $ 406,2995 and the average GDP per capita Countries of the ECOWAS area is US $ 392,9853. The average of the Partial Productivity of the Labor factor is 676.9436 in the ECOWAS area with a minimum of 186.3159 and a maximum of 2912.615. Regarding corruption, the average in the ECOWAS area is -0.6281676. The results of all variables are shown in the table below.

Table 1: Means and standard deviations

Variables		Obs	Moyenne	Ecart - type	Min	Max
prod_labor	Overall	N = 765	676.9436	448.6656	186.3159	2912.615
	Between	n= 15		368.6997	283.8256	1509.045
	Within	T = 51		272.5029	-80.26701	2123.319
Pib	Overall	N = 765	406.2995	392.9853	50.10304	3801.45
	Between	n= 15		233.092	225.2772	1077.441
	Within	T = 51		321.9648	-264.6975	3130.308
Capital	Overall	N = 765	1632.593	3658.435	2	24835.88
	Between	n= 15		3064.432	16.22512	11806.8
	Within	T = 51		2146.62	-9658.908	14661.67
Corruption	Overall	N = 765	- 0.6281676	0.4791595	-1.740032	0.8614963
	Between	n= 15		0.4484094	-1.531134	-0.0058888
	Within	T = 51		0.2041616	-1.634193	0.570969
Temprature	Overall	N = 765	26.88671	1.395176	22.39278	29.6415
	Between	n= 15		1.380701	23.06053	28.49648
	Within	T = 51		0.4061287	25.6188	28.20653
Precipitation	Overall	N = 765	95.65034	55.77628	8.897032	256.9465
	Between	n= 15		56.38092	14.51319	208.0455
	Within	T = 51		11.84155	51.57468	155.9597

Source: Author, construction from Kaufmann Daniel, Aart Kraay and Massimo Mastruzzi (2010) database. "The Worldwide Governance Indicators: Methodology and Analytical Issues" and the world bank database ((WDI 2015).

From Table 2 below (Correlation between variables), the results indicate a negative correlation between Partial Labor Productivity and Corruption Factor. Thus, there is a positive correlation between the partial productivity of the labor factor, GDP and capital with a significance of 5%.

Table 2: Correlation between variables

Variables	prod_lab	Pib	Capital	Corrup	Temp	Precipit
prod_lab	1.0000					
Pib	0.4723*	1.0000				
	(0.0000)					
Capital	0.7578*	0.2217*	1.0000			
	(0.0000)	(0.0000)				
Corrup	-0.0149	0.3543*	-0.1250*	1.0000		
	(0.6809)	(0.0000)	(0.0005)			
Temp	-0.0335	-0.2767*	0.0538	0.0350	1.0000	
	(0.3548)	(0.0000)	(0.1372)	(0.3338)		
Precipitat	-0.0524	-0.1610*	0.0187	-0.4342*	-0.2687*	1.0000
	(0.1477)	(0.0000)	(0.6057)	(0.0000)	(0.0000)	

Source: Author, construction from Kaufmann Daniel, Aart Kraay and Massimo Mastruzzi (2010) database. "The Worldwide Governance Indicators: Methodology and Analytical Issues" and the world bank database ((WDI 2015).

* : indique la significativité au seuil de 5%.

Model Estimation

Following the stationarity tests of LLC by Levin et al (2002), the fixed effects and random effects models were used. However, the Hausman test is used to discrete the two models in order to retain the most appropriate. Also, the probability of the Hausman test greater than 10% leads to the rejection of the fixed effects model. In addition, the Breusch Pagan test is applied to test the significance of random effects.

In addition, the homoskedasticity and correlation test are also verified. As far as the homoscedasticity test is concerned, it is a question of seeing whether the error variance of each individual is constant, otherwise if for each individual i, $\sigma^2 = \sigma^2$ for all t. The new dimension of panel's data is to ensure that the variance is the same for all individuals: $\sigma^2 = \sigma^2$ for all i.

In relation to the correlation, it is also a question of checking that there is no correlation of the errors between the individuals and of verifying that the errors are not autocorrelated for each individual.

DISCUSSIONS

In accordance with equation (5) and in order to detect the effects of the governance captured by the corruption variable on the partial productivity of the labor factor, the fixed effects and random effects models were used. The hausman test (probability> 10%) did not retain the fixed effects model but the Breusch-Pagan test (probability <5%) confirmed the significance of a random effects model. Thus, the applied heteroskedasticity test indicates the rejection of the alternative hypothesis of heteroskedasticity and the acceptance of the null hypothesis of homoskedasticity with a p-value greater than 5% for The F statistic. In relation to the correlation test, the autocorrelation test of Wooldrigde (2002) presented in Stata Journal (2003), Vol. 3, No. 2, is used. It also indicates the rejection of the alternative hypothesis that is the autocorrelation hypothesis and the acceptance of the null hypothesis that the absence of autocorrelation with a p-value greater than 5% for the statistic F.

Also according to the expected signs, estimates show that Gross Domestic Product, Capital, Temperature and Precipitation have a positive and significant sign and the corruption factor has a negative and significant sign.

Table 3. Estimated results: Partial Labor Factor Productivity

prod_labor	Pib	Capital	Corrup	Temp	Precipitat
Coef	0.3322559***	0.081018***	-0.10286***	0.09659***	1.567051***
	(0.000)	(0.000)	(0.010)	(0.073)	(0.000)
R^2			0.5571		

*** significance at 1%; ** significance at the 5%; * Significance at 1%

According to estimates of the random effects model, agricultural labor productivity is explained at 55.71% by the model variables. Also, the results show a negative and significant contribution of corruption on the productivity of agricultural labor. Corruption would have a significant and negative impact on agricultural labor productivity in the ECOWAS area at 0.10%. These findings on the effect of corruption on the productivity of agricultural labor in ECOWAS approximate those of Fink (2002) who finds that corruption affects agricultural development through its effects on the possession and use Land availability, credit availability, quality of supply, water allocation, product standard and certification, marketing and agribusiness development. For their part, Slangen et al. (2008) point to incentives as a good institutional environment without which farmers are less interested in how their agricultural operations affect the future quality of land and soils. The rule of law is important for agricultural performance because if there is no law or enforcement of laws or even no government to protect against people who steal and divert resources for agricultural production, producers may be discouraged by this state of affairs and will no longer be motivated to produce. Thus, all individuals in this society would reasonably have the intention of choosing flight as the easiest way of economic activity. Engaging in productive activity would not be their best answer (Duncan and Pollard 2002).

Indeed, corruption occurs in the allocation of government subsidy credits. Corruption leads to the supply of agricultural inputs of bad quality and high prices. Water allocation and irrigation facilities are often to the advantage of the regions and lobbying that provides more rent to politicians. It also intervenes in product certification procedures in agricultural transport licenses and thus affects agribusiness. Donor-funded projects can often face the lack of transparency, accountability, awareness and attention, prevention of corruption, and lack of implementation of targets because there are controls.

For Lio and Liu (2008), given the same quantities of agricultural inputs, the same levels of education, and the same climatic conditions, a country with better governance can generate more agricultural income. In addition, it has been found that better governance not only directly supports agricultural productivity (which is, given the same quantities of capital stock and land, an agricultural worker in a country with better governance will produce more) , But also indirectly enhances agricultural productivity through the accumulation of agricultural capital.

In relation to factors, gross domestic product, capital, temperature and precipitation, the results indicate a positive and significant contribution of 0.33%, 0.08%, 0.09% and 1.56% respectively on agricultural labor productivity within ECOWAS. These results confirm the work of Polyzos and Arabatzis (2006) who find that the determinants of agricultural productivity can be two (02) factor categories. The first category relating to the structure of the agricultural enterprise comprises all productive inputs of human capital and fixed capital, technology, returns to scale, etc. The second category includes factors relating to land, natural environment, geographical position of land, climatic conditions, agricultural infrastructure. According to Zioganas (1999), climate change affects crop types and the overall profitability of agricultural areas. Good climatic conditions combined with irrigation facilities create favorable conditions for increased agricultural yield. Most of the empirical studies visited have resulted in the results of government spending on research and education, irrigation, climatic conditions, fertilizer use, and so on. Have a positive and significant effect on the productivity of agricultural labor (Kannan 2011, Huffman and Evenson 1993, Ramaila and al. 2011.

CONCLUSION

The main objective of this paper is to determine the role of governance in agricultural productivity in the ECOWAS zone as well as other factors influencing the agricultural productivity of this zone. As a result, estimates of the random effects model have shown that corruption negatively affects labor productivity in a negative way. However, factors such as gross domestic product, physical capital, temperature and precipitation have positive and significant effects on agricultural labor productivity. As far as corruption is concerned, its effect could be through channels such as the allocation of government subsidy credits to farmers, provision of agricultural inputs, water allocation and irrigation facilities, and Financing of agricultural projects. The corruption effect on these important factors for the development of the agricultural sector could cause the disincentive of workers in the agricultural sector and consequently act on their productivity. However, economic implications such as the fight against corruption in all its forms in the agricultural sector must be a golden rule and the intensification of support to the sector through the allocation both financial (grants) and material (agricultural inputs) must be a priority. In addition, an effort must be made at the level of each country to respect the Maputo Declaration (July 2003) within the framework of the New Partnership for Africa's Development (NEPAD) on the allocation of 10% of their national budget for the revitalization and improvement of the productivity of their agricultural sector.

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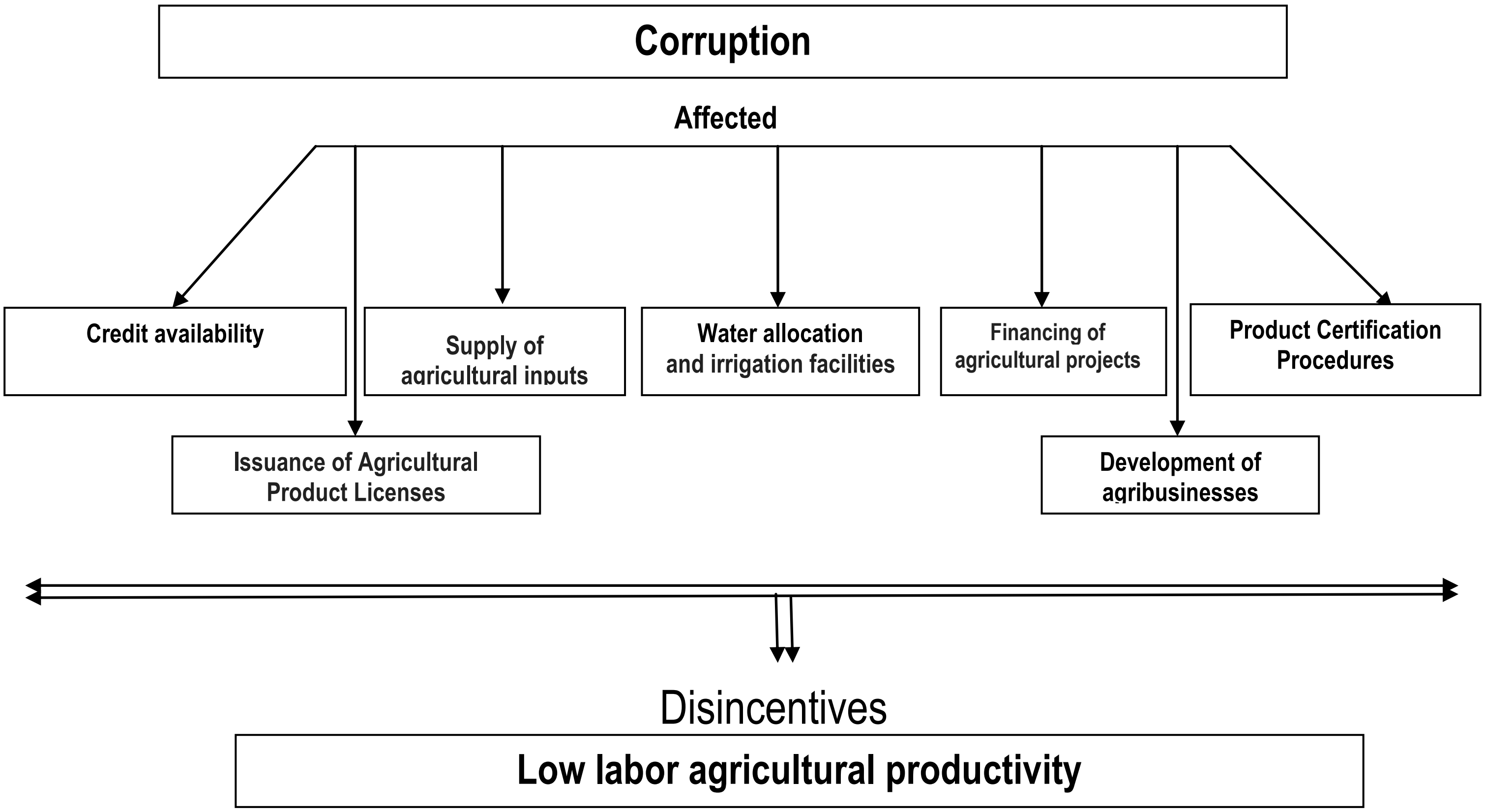
APPENDICES

Appendix 1 : Transmission channel of corruption to low productivity



Source: Author, construction from the work of Fink (2002)

Appendix 2 : Descriptive statistics (Means and standard deviation)

Variable		Mean	Std. Dev.	Min	Max	Observations
prod_l~r	overall	676.9436	448.6656	186.3159	2912.615	N = 765
	between		368.6997	283.8256	1509.045	n = 15
	within		272.5029	-80.26701	2123.319	T = 51
pib	overall	406.2995	392.9853	50.10304	3801.45	N = 765
	between		233.092	225.2772	1077.441	n = 15
	within		321.9648	-264.6975	3130.308	T = 51
capital	overall	1632.593	3658.435	2	24835.88	N = 765
	between		3064.432	16.22512	11806.8	n = 15
	within		2146.62	-9658.908	14661.67	T = 51
tempra~e	overall	26.88671	1.395176	22.39278	29.6415	N = 765
	between		1.380701	23.06053	28.49648	n = 15
	within		.4061287	25.6188	28.20653	T = 51
prcipi~n	overall	95.65034	55.77628	8.897032	256.9465	N = 765
	between		56.38092	14.51319	208.0455	n = 15
	within		11.84155	51.57468	155.9597	T = 51
corrup~n	overall	-.6281676	.4791595	-1.740032	.8614963	N = 765
	between		.4484094	-1.531134	-.0058888	n = 15
	within		.2041616	-1.634193	.570969	T = 51

Appendix 3 : Descriptive statistics (Correlation between the variables)

	prod_l~r	pib	capital	corrup~n	tempra~e	prcipi~n
prod_labor	1.0000					
pib	0.4723*	1.0000				
	0.0000					
capital	0.7578*	0.2217*	1.0000			
	0.0000	0.0000				
corruption	-0.0149	0.3543*	-0.1250*	1.0000		
	0.6809	0.0000	0.0005			
temprature	-0.0335	-0.2767*	0.0538	0.0350	1.0000	
	0.3548	0.0000	0.1372	0.3338		
prcipitation	-0.0524	-0.1610*	0.0187	-0.4342*	-0.2687*	1.0000
	0.1477	0.0000	0.6057	0.0000	0.0000	

Appendix 4 : Unit root test in panel

Variables	Statistics	Intégration order
prod_terre	-26.4081 (0.0000)***	I(1)
prod_labor	-5.0528 (0.0000)***	I(1)
prod_capital	-11.9145 (0.0000)***	I(0)
pib	-17.3371 (0.0000)***	I(1)
capital	-7.4106 (0.0000)***	I(1)
labor	-16.9063 (0.0000)***	I(2)
prcipitation	-2.2556 (0.0120)***	I(0)
temprature	-29.3586 (0.0000)***	I(1)
corruption	-5.1550 (0.0000)***	I(1)

Appendix 5 : Estimation of random effects model

```
Random-effects GLS regression               Number of obs      =       765
Group variable: codepays                    Number of groups   =        15

R-sq:  within  = 0.7194                     Obs per group: min =        51
       between = 0.5571                                    avg =      51.0
       overall = 0.6169                                    max =        51

                                            Wald chi2(5)       =   1928.45
corr(u_i, X)   = 0 (assumed)                Prob > chi2        =    0.0000
```

prod_labor	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
pib	.3322559	.0183393	18.12	0.000	.2963115	.3682004
capital	.081018	.0025984	31.18	0.000	.0759253	.0861107
temprature	.09659	13.43789	1.79	0.073	-2.241202	50.43438
prcipitation	1.567051	.4199814	3.73	0.000	.743902	2.390199
corruption	- .10286	26.49729	-2.57	0.010	-120.0366	-16.16913
_cons	-430.8682	368.9371	-1.17	0.243	-1153.972	292.2352
sigma_u	249.52955					
sigma_e	146.13626					
rho	.74461133	(fraction of variance due to u_i)				

Appendix 6 : Breusch Pagan test results

```
Breusch and Pagan Lagrangian multiplier test for random effects

        prod_labor[codepays,t] = Xb + u[codepays] + e[codepays,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
              prod_la~r  |   201300.8       448.6656
                      e  |   21355.81       146.1363
                      u  |      62265       249.5296

        Test:   Var(u) = 0
                             chibar2(01) =  8273.88
                          Prob > chibar2 =   0.0000
```

Appendix 7 : Autocorrelation test

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      14) =      2.227
           Prob > F =      0.1578
```