ORIGINAL RESEARCH PAPER

Agricultural Economics

ETHNICITY, URBANIZATION AND AGRICULTURAL GROWTH IN BENIN

KEY WORDS: Ethnicity, urbanization, agricultural growth, VAR, Benin.

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ABSTRACT

In order to promote agricultural growth and urbanization of rural areas, ethnicity poses many dysfunctions in land governance concerning the rules, processes and structures mediating decisions on access, use and control of land, as well as the technique of managing conflicting land decisions and interests. The objective of this paper is to analyze the effects of urbanization and ethnicity on agricultural growth in Benin. Using VAR modeling on data covering the period 1995-2019, the results show that agricultural population negatively affects agricultural growth and ethnicity positively and significantly affects agricultural growth. Thus, it would be very interesting to take into account the evolution of agricultural population and ethnicity in the design and implementation of reforms in the agricultural sector in Benin.

INTRODUCTION

In most least developed countries, agriculture is considered the primary source of wealth and the mainstay of the economy. Poverty and malnutrition remain pervasive in the African countryside (Cour, 2007). Indeed, African peasant farmers, whose survival is threatened by the scarcity of natural resources and the stagnation of agricultural yields, have few opportunities for real conversion to other rural or urban activities. Agricultural growth is not sufficiently productive and competitive to cope with the rapid increase in population, resulting in growing agricultural dependence on imports and food aid. The adjustment of supply and demand for agricultural products is becoming increasingly delicate (Court, 2007).

This situation seems to be accentuated by the ethnic movements that have occupied a prominent place on the social and land claims scene in sub-Saharan Africa for several decades. These ethnic movements appear to be indigenous, autochthonous or native depending on the region and the historical period. These, mostly peaceful and / or violent induce and feed the definitions of Arab lands with their multidimensional proposals at once cultural, social, economic and political (Lacroix, 2007 ; Otheguy, 2015). The work of Mesini & Thivet (2014) notified the movements of organizational ethnicisassions that are accompanied by important and revealing changes, starting with semantics.

Indeed, access to land for sustainable agricultural growth and its resources has long been considered secondary, but is now recognized as a major issue, carrying political, economic, social and environmental stakes. Africa is the least urbanized continent, but it is the fastest growing urban continent (Le Roy, 1991 ; Magrin, 2013). Annual urban growth rates are 4.3% per year (Véron, 2006). In 2000, 41.3% of its population lived in cities while the average urbanization rate was 50% worldwide. Between 1950 and 1997, Africa's total population tripled and during the same period, its urban population increased by a factor of 11, i.e., an acceleration of the urbanization rate that is three times higher than that experienced by Europe during the industrial revolution.

In addition, land is a permanent cross-cutting issue when it comes to agriculture, forestry, housing, activities, services, the environment and regional planning. The reconciliation of land uses is a necessity if we want to see sustainable agricultural growth capable of ensuring and guaranteeing food and nutritional security. Since the 1960s, Sub-Saharan Africa has had the highest rate of urbanization in the world, despite being predominantly agricultural (Piermay, 1981).

Agricultural growth is therefore one of the objectives of agricultural policies in sub-Saharan African countries. The Sub-Saharan Africa (SSA) region has a population of more than 950 million, or about 13% of the world's population. By 2050, this share is expected to increase to nearly 22%, or 2.1 billion people. Undernourishment is a long-standing problem and progress on it has been uneven within the region (OECD, 2016). Although it has declined from 33 percent in 1990-92 to 23 percent in 2014-16, the percentage of undernourished people remains the highest in the developing world (FAO, IFAD, and WFP, 2015). With SSA experiencing rapid population growth (2.7 percent per year) over the same period, the absolute number of undernourished people increased by 44 million to 218 million.

In the West African Economic and Monetary Union (WAEMU) zone, agriculture, with very little mechanization, is the only sector at the heart of their economies, which remain very vulnerable to various exogenous shocks and climatic hazards. These countries of the Union are experiencing a gloomy socio-economic situation characterized by persistent poverty, unemployment and food insecurity. Their growth rates remain volatile and far below the levels required to achieve the Sustainable Development Goals (SDGs) (7%). They are among the bottom fifty (50) countries according to the 2013 Human Development Index (HDI) ranking carried out by the United Nations Development Program (UNDP).

In Benin, one of the member countries of the Union, agriculture is the most important sector of the economy and contributes an average of 32.7% to the gross domestic product (GDP), 75% to export earnings, 15% to government revenues and provides about 70% of employment (World Bank, 2018). As a result, it ensures the country's food security. Benin ranks 30th in Africa and 163rd out of 189 in the world according to the Human Development Index (HDI) ranking in 2019. The poverty rate is about 40 percent in 2019 compared to 35.2 percent in 2009. It is noted that in most of Sub-Saharan Africa, agriculture can fuel economic growth, provide investment opportunities for the private sector, and be the main driver of related firms and the rural non-farm economy (World Bank, 2008).

However, agriculture is a critical activity for Benin. More than 7,000,000 Beninese, or just over 70% of the population, derive their livelihood from this sector (NISEA, 2013). Since independence (1960), agricultural development has been at the forefront of economic policies implemented to ensure a strong and sustainable economy. Unfortunately, actions have not matched the declarations. This has kept agriculture in its rudimentary state while the country is experiencing rapid urbanization (47% in 2018) followed by high population growth of over 2.7% per year (DPM, 2018). This rapid urban sprawl is most often observed at the expense of agricultural land and natural resources, leading to land conflicts.

It is therefore interesting to try to understand the effects of ethnicity and urbanization on agricultural growth in Benin.

The particularity of this work is that it has a double interest. First, it attempts to verify the optimistic theory of demography on agriculture by highlighting the ethnic factor that characterizes African countries. Secondly, it will contribute to scientific debates on agricultural development by filling in some of the limitations of the literature on the subject on the one hand, and to help and guide decision-makers in the definition and elaboration of agricultural policies on the other.

Following the introduction, this article is divided into three sections. The first section deals with the literature review. The second section presents the methodological approach adopted. Finally, the third section is devoted to the discussion of the results, and the economic implications of the results are presented in the conclusion.

1. Ethnicity, Urbanization And Agricultural Growth : A Theoretical And Empirical Analysis

Theoretical and empirical work on the link between demographics and agricultural development has placed particular emphasis on the role of urban land, settlement and local market availability as key factors in promoting agriculture (Michel et al., 2011 ; Cour, 2007). Thus, through these positive effects, land security contributes to both the social and economic security of inhabitants and the attractiveness of land markets justifying investment in facilities and development (Michel et al., 2011). In cities south of the Sahara, two major processes are increasingly affecting their land structure: the privatization of public land (or protected land) and the allocation of urbanization resources (development, integration, equipment) to private actors. It is in this context that Hernando de Soto's theses have been widely disseminated and have become, over the last twenty years, the main theoretical and operational instrument for controlling land norms and stimulating development logics based on land. These theses consist of guaranteeing land security for illegal occupants in order to integrate them into the formal market and thus resurrect "dead capital" on the one hand, and formalizing land transactions in order to promote access to the market for land in order to stimulate investments and encourage public or private financing of urbanization on the other (De Soto, 2005 ; Delville, 2005).

These theses quickly showed their low effectiveness (Miranda, 2002), and even their inapplicability (Payne et al., 2009). To explain this failure, we can first mention the complexity of the functions and uses of land : it supports both urban planning policies and the housing economy, and is also the lever of public finance (through taxation or property development). These territories are also those of political distribution and elections, which are major determinants of the redistribution of access to housing and land. In other words, the complexity of urban land tenure is not taken into account by De Soto's simplifying recipe (2005), which assumes a complete overhaul of local land tenure logics and a simplification of forms of ownership, through the digitization of land registers and private property.

The second explanation is that the illegibility of political communities and the inability to bring together metropolitan territories, institutions and political powers, and urban communities (inhabitants, users, voters) (Fourchard, 2007 ; Lorrain, 2011) limit the "capacity" of the actors responsible for implementing titling programs. Indeed, titling programs, developed with the help of external tools and actors (development aid, international cooperation), do not refer to "local" legitimacy, which is essential to establish the legal legitimacy of the land title and its economic value in the framework of a formal land market.

The third point is the historical weight of land tenure problems, which leads to a complex situation and a diversity of land tenure statuses, an overlapping of rights, local legal productions and their framing and fixation with social logics (Soares-Gonçalves, 2010).

The work of Giordano (2001) shows that agrarian reforms are legal instruments that propose to resolve the "agrarian question". In Eastern and Central Europe, regions known for their strong agricultural vocation, they served to "nationalize", or rather to make the territory of a state more ethnically homogeneous. He analyzes the fundamental characteristics of these reforms in Poland, Romania and Yugoslavia, between the two wars, the author explains, how in this country, the procedure of land distribution privileges those who belong to the "titular nation" and discriminates radically and systematically against minority ethnicities. Instead of solving the agrarian question, it has generated social conflicts and interethnic tensions that, in some cases, turn into a quasi-civil war. Similarly, Solari Pita (2013)) explains that the analysis of the transformations of ethnicity over time highlights the relationships between the historical, political and economic conditions of each context and the actions of local social actors.

Adaptation, kinship and legal strategies of resistance during colonization or engagement with current indigenous movements and integration into dominant cultural milieus are part of ethno-genetic processes that oppose traditional essentialist and strategic perspectives on the ethnic subject (Solari Pita, 2013). In West Africa, for example, the work of Akindès (2004) ; Chauveau et al. (2008) ; Colin (2005) ; Losch (2000) ; Losch et al. (2003) show that during the period of relative prosperity in the 1960s-1970s the existence of violence between indigenous Bété and Baoule migrants in the Forest West. Gunya (2017) shows that the land reforms of the 1990s in the former Soviet republics led to the removal of the state monopoly on land ownership, the emergence of a market, and the involvement of local communities.

Land conflicts multiplied in the Forest West throughout this period, the most violent ones no longer pitting only the natives against the Baule, but also against the "northerners" (Burkinabè, and above all, Dioula from the north of the Ivory Coast and neighboring countries). In the western forest regions, this spiral of conflict took on greater proportions, and the frustrations felt by the majority of rural indigenous people, and by young people in particular, served as a vector for the politicization of these tensions. In fact, the rural societies of the Center and the North, with low land resources, and those of the Forest East, a former pioneer front under increasing land pressure, found in the massive phenomenon of the opening up of the "western agrarian frontier", from the 1950s-1960s onwards, an outlet for their own inter-generational and inter-community tensions (Lesourd, 1984).

Urbanization is considered, along with the lack of water resources and desertification, as one of the major causes of the reduction of the cultivable area. This process has accelerated since the 1970s-80s with the rapid growth of the urban population (Abis & Cusi, 2010). The mobilization of agricultural land for the realization of housing infrastructure programs or urban facilities is thus justified, even if some of the rehousing operations undertaken are apparent reasons for the recovery of land with high land value and stem from speculative practices often orchestrated by municipal authorities (Navez-Bouchanine, 2007). Work by Valette et al. (2014) ; François et al. (2013) ; and Benabed et al. (2014) has shown that land tenure status impacts the ability of farmers to negotiate the sale of their land or to refuse it, and thus the fate of agricultural land on the urban periphery. This situation of land reform-driven urbanization negatively impacts agricultural growth.

Similarly, the work of Marie et al. (2013) shows that population growth induces a significant expansion of urban spaces at the expense of rural and agricultural spaces. This scenario

implies competition of activities and uses on the urban periphery. Their work points out that agrarian reforms advocate the principle of preserving high productivity agricultural land. They conclude that urbanization opposes agrarian reforms in some African and Latin American countries. Conflicts between agrarian reforms and urbanization structures have led to declines in agricultural growth in Latin America and India. These different scenarios have shown that agricultural land is threatened by urban pressure. Moreover, the areas opened up to urbanization are only driven by speculative logic instead of responding to real needs. They explain that public policies to eradicate clandestine construction, slums and substandard housing are the starting point for the mobilization of land, which is sometimes excessive and sometimes misused.

Similarly, Valette and Dugué (2017) show that various factors such as public policies in favor of rehousing poor populations, the promotion of privatization of agricultural land rights and more generally economic growth have favored peri-urbanization in the main cities of the Maghreb, notably Meknes in Morocco. They do notify that this urbanization is intensifying to the detriment of land with high agronomic potential despite the laws for the preservation of agricultural land. Speculative processes favor the purchase of land throughout the plain by investors and neo-farmers in both peri-urban and rural areas. The increase in the price of fertile land in peri-urban areas causes the price of land of the same quality in rural areas to rise, thus destroying family farming in Morocco, which is no longer able to compete with investors and large landowners in an increasingly speculative land market. The work of Satterthwaite et al (2010) examines the influences on food and agriculture of an increasingly urbanized world and a decreasing relationship between food producers and food consumers.

These authors point out that urbanization has been supported by the rapid growth of the global economy and the proportion of gross world product and workers in industrial and service enterprises. Globally, agriculture has rapidly responded to the growing demands of the urban population. They note that urbanization is not easy in some regions in Africa and northern countries. This urbanization has often been a source of conflict between primarily agricultural landowners and the state. The evolution of these conflicts is having a huge impact on the agricultural growth of these countries. Tripathi & Rani (2018) instead show that the effect of agricultural productivity is positive on urbanization for a less trade-open economy like India. They suggest the need for further development of agriculture in order to achieve a higher level of urbanization in India on the one hand, but also the adoption of technologies in the agricultural sector focused on rural education on the other. Li et al. (2016) explain the reasons for the rise in social tensions and increase in the number of conflicts in China after a good performance.

The problems of the old urbanization (1978-2014) and the problems not solved by the past policy are at the origin of the new urbanization plan. They explain that tensions have evolved into conflicts that are often the result of untreated social anxiety. They suggest serious attempts to improve governance, which involves: improving multi-level governance and interregional coordination, improving policy transparency and rule of law, adjusting the level of redistribution, and integrating rural and urban areas. Peerzado et al. (2019) show that urbanization is impacting land around the world. They explain that the overlay of land creates a shortage of food and fiber for the growing population and induces socioeconomic and infrastructural problems not only in this megacity, but also in the country.

2. Methodological Framework

To examine the effects of ethnicity and urbanization on agricultural growth in Benin, econometric regressions on time series data covering the period 1995-2019 are conducted. The data used are from secondary sources and come mainly from the FAO statistical yearbooks. The methodology consists in specifying the model and the variables used.

2.1. Specification of the model

In order to analyze the effects of ethnicity and urbanization on agricultural growth, we adopt in this paper a methodological approach based on VAR modeling. Indeed, the criticisms levelled at simultaneous equations (traditional macroeconomic models), which are the strength of VAR modeling, can be summarized in three points and are generally due to Sims (1980), namely: (i) a priori restrictions (the endogenous and exogenous variables are known automatically), (ii) the arbitrary causal structure (the direction of causality between variables is not identified or is poorly identified), and (iii) the inadequate treatment of expectations.

Note that, unlike the simultaneous equation system which suffers from identification problems (impossible to calculate the structural parameters or to estimate the reduced parameters if the model is under-identified), vector autoregressive modelling removes the constraints linked to the identification of the structural equations and is thus less restrictive than the simultaneous equations, thanks to the non-accounting for the assumption of simultaneity of effects between variables and the shifting of all the endogenous variables assumed to be exogenous. However, when the hypothesis of simultaneous effects between variables is not taken into account, the VAR is confused with an a-theoretical model (without economic foundation), which does not present economic reality and is likely to bias economic policy.

The VAR model is based on assumptions about the identification of the equations to be estimated that have no theoretical (economic) basis. This is the major weakness of VAR models, which has been criticized to the extent that it has led to the development of so-called "structural" VAR models, which are a remedy insofar as they make it possible to predict the effects of identified changes (known decisions or policies) in the socio-economic environment. Shocks or innovations are no longer random or unidentified, their origin is known or identified In this VAR modeling, all variables are endogenous and each equation is represented by the regression of a variable on its past and the past of all other variables in the model. A VAR is not intended to describe economic behavior, but simply to reproduce the dynamic interdependencies between all the variables in the model. For Sims (1980), a VAR model provides a framework within which to test for restrictions such as exogeneity, causality, lag shape, structural form or rational expectations.

VAR modeling assumes that the n selected variables of interes *y1, y2,...yn* form a vector Y=(*y1, y2,...yn*) whose dynamic behavior can be described by the following equation :

$$Y_t = \delta^0 + \delta^1 Y_{t-1} + \delta^2 Y_{t-2} + \cdots + \delta^p Y_{t-p} + \varepsilon_t \quad (1)$$

In other words, using, *yi,i=1,...n,* we get:

$$y_{i,t} = \delta_i^0 + \sum_{j=1}^{p} \delta_{i1}^j y_{1,t-j} + \sum_{j=1}^{p} \delta_{i2}^j y_{2,t-j} + \cdots + \sum_{j=1}^{p} \delta_{in}^j y_{n,t-j} + \varepsilon_{i,t} \quad (2)$$

With, $Y_{t-j} = (y_{1,t-j}, y_{2,t-j}, \ldots, y_{n,t-j})$, $\delta^0 = (\delta_1^0, \delta_2^0, \ldots, \delta_n^0)\, n \times 1$ vector of constant terms constants $\varepsilon_t = (\varepsilon_{1,t}, \varepsilon_{2,t}, \ldots, \varepsilon_{n,t})$ a vector of white noise of variance-covariance matrix $V(\varepsilon_t) = \sum of\ size\ n \times n$ et $\delta^1, \delta^2, \ldots, \delta^p$ a sequence of square matrices of size n×n.

Sims (1980) uses the term innovation to describe the residual of each variable in the VAR model in the sense that it is the "new" component that is unpredictable from the past values of that variable. Using the different variables retained namely LGDPAG (log of agricultural growth measured by agricultural

GDP), LNPOPAG (log of agricultural labor force), LNSUPAG (log of sown area), LNINDEX (log of ethnicity rate and LNINVAG (log of agricultural investment) in this paper and focusing on agricultural GDP growth (LNPIBAG), equation (2) can be rewritten as :

$$LNGDPAG_t = \delta^0_{LNPIBAG} + \sum_{j=1}^{p} \delta^j_{LNPIBAG}\, LNGDPAG_{t-j} + \sum_{j=1}^{p} \delta^j_{LNPOPAG}\, LNPOPAG_{t-j} + \sum_{j=1}^{p} \delta^j_{LNSUPAG}\, LNSUPAG_{t-j} + \sum_{j=1}^{p} \delta^j_{LNINDEX}\, LNINDEX_{t-j} + \sum_{j=1}^{p} \delta^j_{LNINVAG}\, LNINVAG_{t-j} + \varepsilon_{LNPIBAG,t} \quad (3)$$

Thus, for the interpretation of the VAR parameter estimation results, only equation (3) is retained in this paper.

2.2 Presentation of the model variables

For the presentation of the variables used in the model, the dependent variable is to be defined first, and then the description of the independent variables will follow. In addition, the units of measurement and the signs are presented. The description of these variables is presented in Table 1.

Table 1 : Definitions of variables and expected signs

Variables	Definition	Source	Unit	Expected Signs
GDPAG	Agricultural GDP	FAO site	Ton	+/-
POPAG	Agricultural labor force	FAO site	Man	+
SUPAG	Agricultural area	FAO site	Hectare	+
INDEX	Ethnicity rate	FAO site	-	+
INVAG	Agricultural investment	FAO site	Billions	+
ε	Error term	-	-	
δ^0	Constant	-	-	
LN	Neperian logarithm	-	-	

Source : Authors, 2022

3. Presentation And Analysis of Results

Here, we present the results of the descriptive statistics and finally present the results of the regressions performed.

3.1 Descriptive statistics

The descriptive statistics for all variables are presented in Table 2. Based on a few variables, this table shows that the average agricultural GDP production in Benin is 22.449 tons. The highest agricultural production is 27.511 tons and the lowest is estimated at 21.192 tons.

Table 2 : Descriptive statistics of the variables

Variables	Moyenne	Ecart type	Minimum	Maximum
LNGDPAG	22,449	1,217	21,192	27,511
LNPOPAG	18,765	0,828	15,133	18,765
LNSUPAG	15,239	0,691	14,739	17,654
LNINDEX	-0,243	0,051	-0,269	-0,065
LNINVAG	27,280	0,522	26,669	28,887
No. of obs.	24			

Source : Authors based on FAO data, 2022

3.2. RESULTS AND DISCUSSION

We present the results by first presenting the unit root and causality tests. Next, we determine the optimal number of lags and finally we proceed to the estimates. The results of the unit root tests are presented in Table 3.

Table 3 : Results of the unit root tests

	Statistic d'ADF	Statistic d'ADF in first difference	Integration order
LNGDPAG	-5,388***		I(0)
LNPOPAG	-4,297**		I(0)
LNSUPAG	-2,244	-3,970**	I(1)
LNINDEX	-2,629	-3,632**	I(1)
LNINVAG	-3,878**		I(0)

Source : Authors based on FAO data, 2022

Mackinnon's critical values are as follows: -5.388 (1%), -4.297(5%) and -3.878 (5%). It can be seen that the ADF test does not reject the existence of a unit root for all the series taken at the level even at the 10% threshold. It can therefore be seen from this table that the LNGDPAG, LNPOPAG and LNINVAG variables are stationary in level (or integrated of order 0). On the other hand, the LNINDEX and LNSUPAG variables are integrated of order 1, i.e. stationary in first difference. For the causality test, this step consists in determining the direction of causality between the different variables. This causality analysis therefore makes it possible to assess the relevance of the probable effects of the variables LNPOPAG, LNINVAG, LNINDEX and LNSUPAG on LNPIBAG. The results of the Granger causality test are shown in the table below.

Inspired by the procedure of Lutz (1994) and Goletti (1994), it took just a number of lags of two to obtain these conclusive results. As for the causality test, the results are presented in Table 4 using the Granger causality test. The content of each cell (ij) gives the value of the probability associated with the null hypothesis test of non-causality. This hypothesis is accepted as soon as the probability is higher than 5% : we then say that variable i does not cause variable j. Conversely, the signs ***, ** and * indicate that variable i causes variable j at the 1%, 5% and 10% threshold respectively.

Table 4 : Results of the Granger causality test

	LNGDPAG	LNPOPAG	LNINDEX	LNINVAG	LNSUPAG
LNGDPAG		0,924	0,055*	0,017**	0,536
LNPOPAG	0,044**		0,122	0,003***	0,388
LNINDEX	0,004**	0,266		0,077*	0,501
LNINVAG	0,003**	0,001***	0,020**		0,086*
LNSUPAG	0,048**	0,680	0,417	0,258	

Source : Authors based on FAO data, 2022

From the results obtained, it emerges from this causality test in the sense of Granger that there is a "feedback effect" between agricultural GDP (LNGDPAG) and the ethnicity index (LNINDEX), between agricultural GDP (LNGDPAG) and agricultural investments (LNINVAG), between the active agricultural population (LNPOPAG) and agricultural investments (LNINVAG), and between the ethnicity index (LNINDEX) and agricultural investments (LNINVAG). On the other hand, there is a unidirectional causality from the active agricultural population (LNPOPAG) to agricultural GDP (LNGDPAG), from the sown agricultural area (LNSUPAG) to agricultural GDP (LNGDPAG) and from agricultural investments (LNINVAG) to the sown agricultural area (LNSUPAG). It can be seen that the growth in agricultural GDP (LNGDPAG) is explained by each of the variables selected, i.e. the ethnicity index (LNINDEX), agricultural investment (LNINVAG), the active agricultural population (LNPOPAG), the ethnicity index (LNINDEX) and the agricultural area sown (LNSUPAG).

To determine the number of lags p of the VAR model, the Akaike (AIC) and Schwartz (SC) information criteria were used. The results obtained are as follow :

Table 5 : Finding the optimal number of lags.

Shift	Akaike (AIC)	Schwartz (SC)
0	-4,505	-4,258
1	-18,538***	-17,057***

Source : Authors based on FAO data, 2022

It can be seen from this table that the optimal lag of the VAR, the one that minimizes the AIC and SC statistics, is p=1. This shift corresponds to the order of the estimated VAR, i.e. VAR

(1). The results of the estimation of the parameters of the VAR (1) model are summarized in Table 6.

Table 6 : Results of the estimation of the VAR parameters (1)

	LNGDPAG	LNPOPAG	D(LNINDEX)	LNINVAG	D(LNSUPAG)
LNGDPAG (-1)	-0,861	-0,458	-0,062	-0,409	-0,467
	(1,765)	(0,391)	(0,061)	(0,439)	(0,470)
	[-0,488]	[-1,172]	[-1,021]	[-0,932]	[-0,995]
LNPOPAG (-1)	-0,975	2,235	0,095	0,699	0,755
	(5,443)	(1,205)	(0,187)	(1,353)	(1,449)
	[-0,179]	[1,856]	[0,507]	[0,517]	[0,521]
	30,003	8,483	0,733	0,699	0,755
	(58,769)	(13,006)	(2,023)	(1,353)	(1,449)
	[0,511]	[0,652]	[0,362]	[0,517]	[0,521]
LNINVAG (-1)	5,737	0,577	0,125	1,726	0,877
	(4,604)	(1,019)	(0,158)	(1,144)	(1,225)
	[1,246]	[0,566]	[0,787]	[1,508]	[0,716]
D(LNSUPAG(-1))	-2,170	-0,382	-0,079	-0,578	-0,391
	(8,630)	(1,910)	(0,297)	(2,145)	(2,297)
	[-0,251]	[-0,200]	[-0,264]	[-0,269]	[-0,170]
C	99,125	-24,419	-3,461	-21,285	-24,953
	(73,337)	(16,229)	(2,524)	(18,230)	(19,520)
	[-1,352]	[-1,505]	[-1,371]	[-1,168]	[-1,278]
R2=0,677 ; R2 adjusted =0,582					

Source : Our estimates

The estimation of the VAR process (1) is reported in the table above. The results for each of the LNGDPAG, LNPOPAG, LNINDEX, LNINVAG, and LNSUPAG equations are reported. However, only the agricultural GDP equation (LNGDPAG) is interpreted given the purpose of this paper. Thus, it is found that agricultural GDP growth (LNPIBAG) depends negatively on the lagged quantities of a period of its own value, the agricultural labor force (LNPOPAG) and the agricultural area sown (LNSUPAG). On the other hand, the variables ethnicity index (LNINDEX) and agricultural investment (LNINVAG) lagged by one period positively explain the growth of agricultural GDP (LNGDPAG).

The various diagnostic tests for the validation of the VAR (1) have been carried out. These include VAR Residual Normality Tests, VAR Residual Portmanteau Tests for Autocorrelations, VAR Residual Serial Correlation LM Tests and VAR Residual Heteroskedasticity Tests (Includes Cross Terms). The results show that the estimated VAR passed the post-estimation tests. The following graphs represent the responses of agricultural GDP growth (LNGDPAG) to shocks to the errors of the variables LNPOPAG, LNINDEX, LNINVAG and LNSUPAG. For each of these variables, the shock corresponds to the standard deviation of its errors. The time horizon of the responses is set at 10 years, assuming that this horizon corresponds to the time needed for the variables to recover their long-term levels. Thus, the response functions of agricultural GDP growth to the impact of a shock on each of the variables is LNPOPAG, LNINDEX, LNINVAG and LNSUPAG are simulated in the Figure (see Appendix).

A positive shock to the agricultural labor force results in a stabilization of agricultural GDP growth in the first four years. The effect becomes positive from the fifth year onwards and accelerates further. Similarly, a positive shock to the ethnicity index results in a stabilization of agricultural GDP growth until the fifth year before starting to grow. Also, a positive shock to agricultural investment, i.e., an expansive agricultural investment policy, results in a stabilization of agricultural GDP growth for the first six years before it begins to decline. Similarly, an increase in the area sown to agriculture does not affect the trajectory of agricultural GDP growth in the first five years. From the sixth year on, the effect becomes negative.

The objective of the decomposition of the variance of the forecast error is to calculate for each of the innovations in the Figure, its contribution to the variance of the error in percentage. The variance decomposition of the forecast error of agricultural GDP growth is shown in Table 7.

Table 7 :Variance decomposition

Period	S.E.	LNGDPAG	LNPOPAG	D(LNINDEX)	LNINVAG	D(LNSUPAG)
1	1,020	100,000	0,000	0,000	0,000	0,000
2	1,321	97,402	0,013	6,915	11,015	0,154
3	1,388	94,987	0,292	6,388	10,996	0,337
4	1,617	92,744	3,655	7,366	10,982	0,252
5	4,154	94,979	4,323	7,129	10,530	0,038

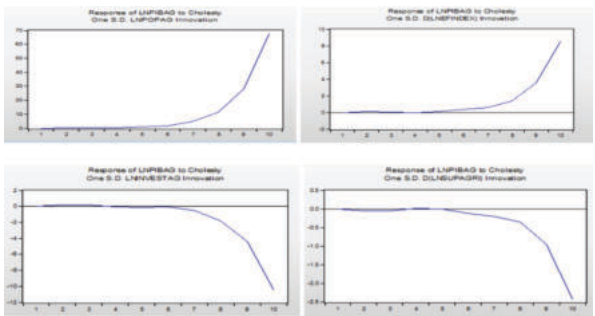
Source : Our estimates

From this table it can be seen that 97% of the variance in the forecast error of agricultural GDP growth is due to its own innovations, 11% to innovations in agricultural investments and 7% to innovations in the ethnicity index. The results thus indicate that shocks to these variables largely determine fluctuations in agricultural GDP growth at all horizons.

CONCLUSION

As in developing countries, the situation of the agricultural sector in Benin is nowadays criticized. Indeed, Benin, through its policy and its various reforms, is working towards agricultural growth in order to improve the living conditions of its population. The objective of this paper is to analyze the effects of ethnicity and urbanization on agricultural growth in Benin using a VAR model covering the period from 1995 to 2019.

The results suggest that agricultural growth, agricultural labor force, ethnicity index and agricultural investment vary over time. Agricultural GDP growth depends negatively on the lagged quantities of its own value, the agricultural labor force, and the agricultural area sown. On the other hand, the variables ethnicity index and one-period lagged agricultural investment explain positively the growth of agricultural GDP. In view of these results, it is urgent that economic policy take into account the evolution of the population, the ethnicity index and urbanization in the design and implementation of reforms in the agricultural sector. It is therefore important to revitalize other sectors of activity that may consume part of the active population in order to avoid labor intensification that often reduces the income of agricultural workers. It is also necessary to work for flexibility in the ethnicity index in order to promote social cohesion. Finally, efficient agricultural investments should be favored to facilitate intensive cultivation due to advanced urbanization in the areas where people live. Agricultural growth supported by adequate agricultural investments and an active agricultural population is a particularly effective means of reducing hunger, malnutrition and food insecurity. For the very poor, a large part of their livelihoods is derived from family farming and related activities.



Source : Our estimates

Figure: Response functions of agricultural GDP following a shock to other variables

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