Technical Efficiency of Tax Revenue Collection Zones in Benin

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Abstract:- All government bodies, the Directorate General of Taxesis made up of offices responsible for various tasks. Those of the DGI are responsible for processing tax returns nationwide. These offices behave like DMUs, with the aim of maximizing production in terms of processed tax return documents, taking into account the resources allocated to them. This paper uses the DEA methodology (output-oriented model) to determine the technical efficiency of tax collection offices in the various communes of Benin. The results show that tax collection offices in the communes of Cotnou, Sèmé-Kpodji, Tanguieta and Dassa are hyper-efficient, while others score less than one. Truncated Tobit regression was used to characterize the environmental factors that explain this efficiency. Total population has a positive and significant effect on the technical efficiency of collection points. On the other hand, density, income, ethnic diversity and proximity to neighboring borders were not significant. The hyper-efficient DMUs must train the weak ones in order to standardize technical efficiency throughout Benin.

Keywords:- *DMUs, Technical Efficiency, DEA, Collection areas.*

I. INTRODUCTION

The collection system of an economy is defined as a set of regulations, laws, and collection devices specific to that nation. In each nation, the management of the tax system is entrusted to the general tax administration, which ensures the organization of the tax structure, the distribution of tasks in different areas, and the allocation of devices necessary for a better mobilization of tax revenues. In developing countries, the structure is divided into different organizations, such as decentralized organization and unified organization. (Bodin, 2012). In several countries, the concept was further developed by creating services for medium-sized enterprises and specialized services for small taxpayers. In this type of organization, each service (including central services and each operational service) remains organized on a functional basis. (Bodin, 2012).This segmentation allows for improvements in terms of efficiency and effectiveness of the tax administration. (Bodin, 2012).

The multidisciplinary theory of organizations defines the framework within which any organization operates to produce better results (Milgrom Robert, 1997). In the context of our study, we invoke the systemic school, whose main founders are Norbert Wiener (1940-1950), Stafford Beer, and Herbert S. (1950-1960). Norbert Wiener's systemic theory, known as cybernetics, is an interdisciplinary approach that studies complex systems and the processes of communication and control that govern them. Stafford Beer's systemic theory, also known as Beer's cybernetics, is an approach that aims to understand and model complex organizational systems. The system combines inputs to produce outputs under the influence of environmental factors.

Within the framework of the General Directorate of Taxes, the inputs of the declarative tax system are the electronic equipment (computers), the number of employees, the geographical space occupied(Sanjel, 2012) by the different collection zones, etc. The combination of these inputs allows for the processing of tax declaration documents resulting in the production of tax revenues (output). An imbalance in the factors of production constitutes a hindrance to the performance of the system.

The functioning of an organization, whether it is a public service or a firm (Deprins, 1983), requires the concept of efficiency, which necessitates an understanding of the inputs that go into the production of a finished product called output (Deprins, 1983). Several empirical studies have evaluated the efficiency of firms, public or quasi-public services, while determining the environmental factors that hinder the proper functioning of these organizations in order to propose appropriate reorganization measures for better results.

Deprins (1983)studied the efficiency of the public service (the Belgian postal service) by considering the post offices as firms. He conducted this study using the Farrell 1957 method and found that the post offices were efficient in both cases he analyzed. Porcher & al.,(2018)used the DEA method to determine the efficiency scores of the French water public service in order to evaluate the capacity of public services to minimize inputs in terms of revenue to produce a maximum amount of water. The results of their estimations show that the water production services are difficult to manage. Thus, environmental variables allow for an improvement in efficiency scores of 0.1 on average compared to 0.059 identified by the Belgian postal service (Deprins, 1983)

In the search for water production, (Benito & al., 2019)also used the DEA methodology to analyze the efficiency of the drinking water supply service in small municipalities. Once efficiency indicators were determined, these authors evaluated the determinants of efficiency on a sample of Spanish municipalities with less than 5000 inhabitants in 2014. The estimation results show that population density and citizens' income level have a negative and significant impact on drinking water supply. Studies by (Fong, 2015;Wade et al., 2014 ; Byrnes et al., 2010 ;Walter et al., 2009) have also addressed the efficiency of public water supply services.

In Senegal, Ngom(2007)quantified the technical efficiency score of industrial enterprises, and in continuation of his work, he determined the successive factors affecting their degree of efficiency. Data from the World Bank's Enterprise Survey (2014), covering 601 Senegalese companies distributed in 4 regions (Dakar, Thiès, Kaolack, and Saint-Louis) and only concerning the manufacturing sector, were applied to the data analysis (DEA).

Other studies have been conducted in the agricultural sector (Maurice, 2021 ;Ndiaye, 2018), while others have been carried out in the financial sector (Aydın & al.,2019; Bamba, 2020 ; Keita, 2004). However, such an analysis has not yet been performed on revenue collection zones located in Benin. This paper contributes to the literature by determining the efficiency of revenue collection zones in Benin and the factors that characterize this efficiency in order to propose a better organizational procedure for tax administration that maximizes its tax collection efforts.

The mode of organization of work in the General Directorates of Taxes differs from one country to another and this generates different expected results. However, there is a general framework for the collection of tax revenues defined by tax law (Sanjel, 2012). In Benin, in accordance with the provisions of Article 20 of Decree No. 2021-307 of June 2021 on the attribution, organization and functioning of the Ministry of Economy and Finance, the General Directorate of Taxes is competent in the collection of direct taxes and similar taxes; indirect taxes and similar taxes with the exception of those payable on export and import; registration duties and stamps or similar taxes (DGI of Benin, 2023).

In order to carry out its mission effectively, which includes determining the tax base, controlling and liquidating all taxes, duties, fines and penalties of all kinds provided for or to be provided for by laws and regulations for the benefit of the State and local authorities, etc., the General Directorate of Taxes is implementing tax administration reforms to modernize its structure, thus reorganizing the traditional collection system. Ambitious for a modern and efficient administration serving users, the GDT adopts a strategic orientation plan(Repport,GDT 2021) regarding the creation of the taxpayer service unit (quality of reception, internal and external communication); the decentralization of financial statement certification (a procedure that takes at least two weeks); the simplification of the procedure for issuing tax certificates (extension of the validity period); the implementation of tele-procedures (e-filing, e-payment) etc.

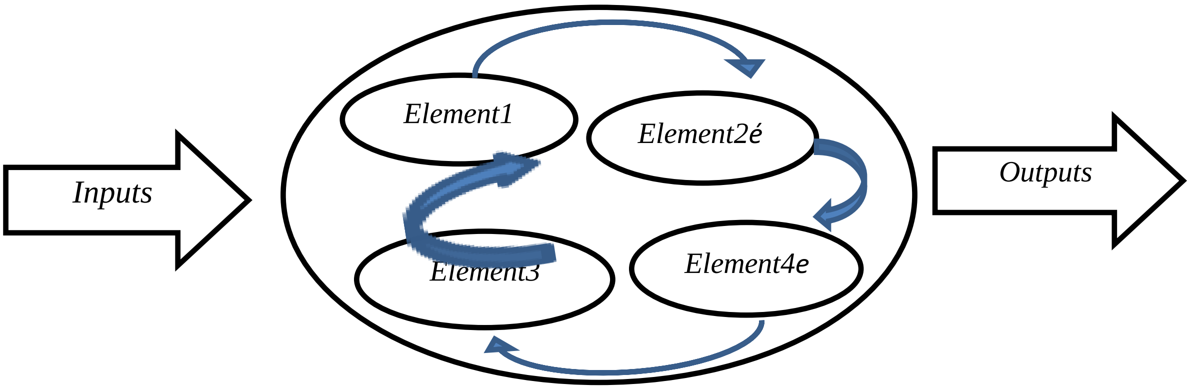
In the context of e-filing, the GDI offices in each collection zone benefit from electronic equipment such as computers, internet connection, personnel, and geographical space for installation in each collection zone in Benin. These allocated resources allow for the processing of tax declaration documents generating tax revenue. In the year-end report for 2022(Rapport GDT, 2022) from the General Directorate of Taxes, the revenues mobilized amount to 1,694,261.3 million FCFA, representing a collection rate of 103.2.It is also noted an increase of 250,218.7 million CFA francs compared to the achievements of the year 2021 which stood at 1, 444,042.6 million CFA francs, resulting in a growth rate of 17.3.Despite the increase in tax revenues mobilized from the Benin declarative system, the International Monetary Fund's work shows that the tax revenue to GDP ratio remains low compared to the required norm, at 11% (Rapport GDT, 2022).

This low tax revenue to GDP ratio observed despite the declarative system leads us to question the technical efficiency of the collection zones in mobilizing tax revenues. In this regard, we mainly question the efficiency scores of each tax collection zone distributed throughout the territory of Benin, given a collection commitment that does not maximize tax revenues. The research question is as follows: What is the level of technical efficiency of each tax collection zone and what are the determinants of the technical efficiency of these collection offices? The general objective of this study is to determine the technical efficiency scores for each collection office and the factors characterizing this efficiency.

II. ORGANIZATION THEORY

A. *Norbert Wiener's systems approach*

Norbert Wiener's systems theory, known as cybernetics, is an interdisciplinary approach to the study of complex systems and the communication and control processes that govern them. Wiener developed this theory in the 1940s and 1950s, drawing inspiration from Claude Shannon's work on information theory. According to Wiener, a system can be defined as a set of interconnected elements that interact with each other and with their environment. These elements can be people, machines, living organisms, organizations and so on. Systems theory aims to understand how these elements interact and coordinate to achieve a common goal. Systems theory uses modeling tools. It establishes a coherent link between the elements that make up a system. All these interacting elements are limited by a boundary.



Graph 1: Inputs – Outputs

- **Produced by the author:** In the context of the IMB, the systems approach enables us to understand how the various parts of the organization are interdependent, and how they can be optimized to achieve set objectives. This involves taking into account interactions between different departments, communication processes, information flows and feedback mechanisms.

B. Theoretical approach establishing the link between the tax collection system and revenue mobilization

In view of the systemic approach of organization theory and the theoretical framework of tax administration organization, the objective of mobilizing tax revenues is likely to be hindered by the poor organization of the tax administration system. Thus, the organization of the tax administration can reduce the mobilization of tax revenues in several ways:

- **Lack of coordination:** If the different divisions or departments of the tax administration do not work closely together, this can result in gaps in collecting the information and data necessary to properly assess tax revenues. This can lead to errors and omissions in calculating taxes owed, which reduces tax revenues.(Cottarelli, 2011;OCDE, 2022; Claude & Carcenac, 2020 ;Rachel & al, 2020).
- **Lack of human and technical resources:** If the tax administration does not have adequate human and technical resources, it may struggle to effectively perform tasks related to tax collection. This can lead to delays in processing tax returns and refunds, as well as difficulties in identifying and pursuing tax evaders. These shortcomings can result in a decrease in tax revenue mobilization.(Etrang, 2014; Claude & Carcenac, 2020)
- **Complexity of the tax system:** If the tax system is too complex, it can make it difficult for taxpayers to understand their tax obligations and correctly fill out their returns. This can lead to errors and omissions in calculating taxes owed, which reduces tax revenue. Additionally, excessive complexity can also encourage tax fraud, as it is easier for fraudsters to exploit loopholes in the system.(Moummi, 2012 ; Rapport GBM, 2019; Rapport CESE, 2019).
- **Corruption and poor governance:** If the tax administration is corrupt or poorly managed, it can lead to abuses of power, embezzlement of funds, and fraudulent practices. This can reduce tax revenues, as a portion of the funds collected may be diverted or lost due to corruption(Chambas et al., 2007; Mauro, 2004; 1995; Myrdal, 1968).

To improve tax revenue mobilization, it is important to establish an efficient organizational structure for the tax administration. This can include implementing mechanisms for coordination between different divisions, allocating adequate human and technical resources, simplifying the tax system, and combating corruption and poor governance. (Rachel & al, 2020).

C. Empirical work on the technical efficiency of public administrations and the factors characterizing this efficiency

Given that the objective of this paper is to determine the level of efficiency of tax collection offices, taking into account the human resources and technologies they have to process tax-related documents, we present empirical work on the efficiency of public services. Over time, we present the factors characterizing these efficiencies.

(Porcher & al., 2018)use the DEA method to determine the efficiency scores of the French public water service in order to evaluate the ability of public services to minimize inputs in terms of revenue to produce a maximum quantity of water. The results of their estimations show that the services in charge of water production are difficult to manage. Thus, environmental variables allow for an improvement in efficiency scores of 0.1 on average compared to 0.059 generated by the public utility. Still in water production research (Benito & al., 2019)also use the DEA methodology to analyze the efficiency of the drinking water supply service in small municipalities. Once the efficiency indicators have been determined, these authors assess the determinants of efficiency on a sample of Spanish municipalities with fewer than 5,000 inhabitants in 2014. The results show that population density and citizens' income levels have a significant negative impact on drinking water supply.

To determine the efficiency of 45 internationally known airlines in financial, operational and marketing terms, (Aydın & al.,2019)use the DEA method. The results of their estimations show that 21 airlines are efficient among the 45. Thus, Norwegian Airlines, Vietnam Airlines, Thai Airways emerge as the super-efficient companies in terms of overall satisfaction, with the respective main assets liquidity, employees and fleet, and finally employees and customers. Based on relative priorities, Vietnam Airlines is the best-performing airline, followed by Norwegian Airlines.

As for the estimation of the productivity of the Colombian education system, (Prior & al., 2022), use the Malmquist-Luenberger meta-border index to measure the evolution of the productivity of 4587 schools comprising public and differentiated private schools that all participated in the Saber 11 standardized test between 2014 and 2017 in subjects such as mathematics, reading, science, social and civic sciences and English. The results obtained express inefficiency in both sectors. This is characterized by a change in best practice. There are also significant differences between departments. Moreover, before the change in practices, private schools outperformed public schools. In their model, these authors use electronic equipment, number of teachers, etc. as input variables.

Two actors are involved in the procurement process: companies and public bodies.Andrews & Entwistle (2015)evaluates the relationship between commitment to public-private partnerships, management capacity and productive efficiency for a set of English companies. The results of the SLO estimations show ! that only governments with very strong management capacity are able to achieve productive efficiency gains from public-private partnerships. In their model, the authors use population, population density and ethnic diversity as explanatory variables for efficiency. The first two variables are found to be significant.

With the aim of establishing a clear relationship between modes of public service delivery and local government efficiency, (Cuadrado-ballesteros, 2013)develop a study to analyze the effect of functional decentralization and outsourcing processes on the efficiency of local public services. To this end, they use data on 129 Spanish municipalities with more than 10,000 inhabitants covering the period 1999 to 2007. Using DEA's estimation method to determine upstream efficiency scores, linear regression revealed that both modes of public service provision (functional decentralization and outsourcing) have a negative impact on the efficiency of local public services. Outsourcing has a negative impact on local government efficiency.

The inputs used in these authors' models come from pioneering work (Teresa & al., 2010), and represent personnel costs, expenditure on current goods and services, and current transfers. Outputs are the number of economic activities, land area, population density, etc.

To assess the cost-effectiveness of 108 large Italian municipalities and to study the extent to which municipal efficiency is also associated with administrative efficiency, (Storto, 2016)uses the DEA estimation method to calculate efficiency scores using 6 inputs and 2 outputs. The results reveal that there are significant inefficiencies of scale in a number of municipalities, but, unexpectedly, a large proportion of these inefficiencies are related to the quality of public services.

The measurement of productivity and efficiency of activities in the construction sector is examined in Sweden by (Landin & Öberg, 2014) . For the author, understanding past and present productivity levels is necessary to boost emerging development and increase the efficiency of the construction industry. For his study, he uses survey data from groups of expert practitioners. Performance indicators were studied for each type of construction to determine the most appropriate factors. The model designed to measure the efficiency of office buildings and multi-family housing is one that relates the efficiency of new developments to the output/input ratio at aggregate level. The estimation results show that efficiency can only be improved through innovations in terms of processes and product formulation.

With the aim of measuring the technical efficiency of farm households growing traditional vegetables in Tanzania,Srinivasulu & al. (2015)uses the stochastic frontier production function CobbDouglas, applied to primary survey data from 181 households growing traditional vegetables in five regions (Arusha, Tanga, Morogoro, Dodoma and Dar es Salaam) of Tanzania. The estimation results show that the overall average technical efficiency is 67%. This means that at this state of technology, a farm can improve its production by 27% with a better combination of resources, knowing that the average farmer in the sample reaches the technical efficiency level of the most efficient counterpart.

The GlobalMalmquistLuenberger (GML) world benchmark index was used by (Wu & Qian, 2018)to measure total factor productivity (TFP), which the author decomposes into technological and efficiency changes. The estimation results show that technological progress and efficiency improvements are the main drivers of TFP acceleration.

To determine the technical efficiency of vegetable farms in a multi-species system (cocoa, rubber, palm oil) in the Southwest Cameroon region. And subsequently define the determinants of these efficiency scores,(Djoumessi, 2017)uses the DEA model and finds the following results: technical efficiency scores under the constant returns to scale assumption range from 0.124 to 1, with an average of 0.6633. Whereas technical efficiency scores under the variable returns to scale hypothesis range from 0.228 to 1, with a pure technical efficiency mean of 0.77. Scale technical efficiency scores range from 0.425 to 1, with an average of 0.8425. Thus, the majority of farms are not sub-optimally sized. In this sense, the total technical efficiency level expresses that the majority of farmers (79%) are improving production volumes within the constraints of available resources. As for farm characteristics, only the extension service variable significantly influences farmers' technical efficiency.

Section 2 : Empirical analysis of the tax collection and revenue mobilization system in Benin's tax collection areas.

III. RESEARCH METHODOLOGY

A. *Choice of variables, data sources and expected sign*

To analyze this chapter, we collected our data from the Directorate General of Taxesof Benin (DGT), in terms of inputs and outputs: Tax revenue collected, electronic equipment, manpower in terms of staff numbers. Environmental variables are provided by INsta. The data are in cross section and cover the year 2021. We define our variables as follows:

➢ *Output:*

- **Tax revenue mobilized by collection zone**: This is production in terms of tax revenue mobilized by collection zone.

➢ *Inputs:*

- **Electronic equipment:** This is the physical capital, in terms of resources available to communal tax collection offices, expressed in number of computers.(Huguenin, 2013).
- **Labor:** This is the labor factor, defined in terms of the number of employees in charge of processing tax returns.(Aydın, al., 2020).
- **Surface area:** This is the physical capital, in terms of land resources, occupied by communal tax collection offices, expressed in square kilometers (km)**.**(Cuadrado-Ballesteros, & al., 2013;Huguenin, 2013).
- **Dependent variable for the analysis of efficiency determinants :**
- **Pure Technical Efficiency:** This is the dependent variable, representing the DMUs' efficiency score, and is determined by the output-oriented DEA method**.**(Andrews & Entwistle, 2010; 2015;lo Storto, 2016;Benito & al., 2019 ; Andrews & Entwistle 2010 ; Lannier & Porcher, 2014) .
- **Independent variables for analyzing the determinants of efficiency :**
- **Total population:** This is the total number of people living in the collection area. It has a mixed effect on technical efficiency(Andrews & Entwistle, 2010; 2015;lo Storto, 2016;Benito & al., 2019 ; Andrews & Entwistle 2010;Lannier & Porcher, 2014)
- **Ethnic diversity: the number of languages spoken in the office area. It has a mixed effect on technical efficiency.**(Andrews & Entwistle, 2010; 2015 ;Andrews & Entwistle, 2015;Andrews & Entwistle, 2010).
- **Proximity to a neighboring economy:** the distance separating the known location from the border of a neighboring economy. Measured in Kilometers (Km), it has a positive effect on technical efficiency**.**(Cuadrado-Ballesteros & al., 2013).
- **Commune area:** the total surface area of the commune,measured in hectares. It has a mixed effect on technical efficiency(Andrews & Entwistle, 2010;2015)
- **Pluriactivity rate:** the rate represents the weight of economic activities carried out in the collection area. It has a mixed effect on technical efficiency**.**
- **Rainfall:** Rainfall represents the quantitative change in precipitation, its nature and distribution, such as rain, snow, sleet and fog. It is measured in millimeters. It has a mixed effect on technical efficiency.

B. *The estimation model*

We adopt the DEA method to measure the technical efficiency of tax collection areas given the thesis objective and the small number of collection area available to DGI Benin and the reliability of data from DGI over a period. The DEA method is defined as a mathematical programming technique for comparing organizational or decision-making units.(Benito & al., 2019).Moreover, this method is well suited to a multi-output/multi-input or mono-output/multi-input production study, as in our case. It does not impose any functional link hypothesis between inputs and outputs ((Tsou & Huang 2010 ;Charnes,1978 ;Ray,2004).

Nevertheless, in order to ensure a robust result for efficiency score estimates, it is necessary to detect outliers and process them. (Bogetoft &al.,2011, ; Latruffe, & al., 2012). Several authors have proposed different methods for detecting and processing outliers. The geometric method based on calculating the proportion of the geometric volume of data subsets was proposed by (Andrews & Pregibon 1978). The authors compare the proportion of a subset of data obtained by deleting certain observations to the volume of subsets of data. The ratio of proportions is used to determine outliers. Although this method is sophisticated, it does not eliminate outliers in the case of a single output (Wilson, 2012).

This is why the latter proposes the geometric method for multiple outputs.According to(Simar, 2003),this method is costly and does not take into account the problem's frontier. In 2002, Tayor and Francis group proposed a non-parametric efficiency estimator that is robust to outliers. This method is based on the concept of a minimum input or maximum out function, but cannot be applied to large observations. The alternative method is that of Tan et al 2010, based on indices constructed on the basis of weights applied to observations as each is sequentially tested for efficiency. In Florence Nicoleu's book entitled "Dealing with missing values and outliers", the author suggests four ways of dealing with outliers:

- do nothing (in the case of small outliers)
- use only records for which the data are complete
- use a reweighting method
- impute a value (deterministic methods (mean, ratio, regression)
- Stochastic or random methods (random hot-deck, nearest neighbor)

In the context of our thesis, we ignore outliers, given our relatively small sample of only 26 observations, and with reference to the box plots, which show a minority of outliers per variable. According to Florence Nicoleu, this method requires no prior model specification, and is limited to very small samples and a single output.

In the second stage of our methodology, we estimate efficiency scores using the DEA method with Win4Deap2 software, under the assumption of variable returns to scale with multiple steps. Our estimation is output-oriented, as the objective here is to produce the maximum possible tax revenue (output). To obtain the best DEA efficiency estimator, we recommend the use of VRS (Simar & Wilson 1999; Spottiswoode & al., 2000 ; Cuadrado-Ballesteros et al. 2013). In this paper, we use a single output and three inputs, with a reduced sample of 26 observations and the objective of output maximization, we apply the VRS output-oriented DEA method. To this end, we solve the following programs:

- *VRS Model(Charnes & al.,1978), Output-oriented*

- Primalequation

$$Min \sum_{i=1}^{m} v_i x_{ik} - c_k \quad (1)$$

Constrained

$$\begin{cases} \sum_{i=1}^{m} v_i x_{ij} - \sum_{r=1}^{s} u_r x_{rj} - c_k \geq 0 \;\; j = 1, \dots, n \\ \sum_{r=1}^{s} u_r y_{rk} = 1 \\ u_r, v_i > 0 \quad \forall\, r = 1, \dots, s; i = 1, \dots, m \end{cases} \quad (2)$$

- *VRS Model(Charnes & al.,1978) , Output Oriented*

- Dual equation

$$Max\ \emptyset_k \qquad (3)$$

Constrained

$$\begin{cases} \emptyset_k y_{rk} - \sum_{j=i}^{n} \lambda_j y_{rj} \;\; \leq 0 \qquad r = 1, \dots, s \\ x_{ik} - \sum_{j=1}^{n} \lambda_i x_{ij} \geq 0 \; i = 1, \dots, m \\ \sum_{j=1}^{n} \lambda_i = 1 \\ \lambda_i \geq 0 \qquad \forall j = 1, \dots, n \end{cases} \quad (4)$$

Our model takes slacks into account, which modifies the dual equation and renders it as follows:

- *VRS Model(Charnes & al.,1978), input Oriented*

- Dual equationwith slacks

$$Max\ \emptyset_k\ \varepsilon \sum_{r=1}^{s} S_r + \varepsilon \sum_{i=1}^{m} S_i \quad (5)$$

Constrained

$$\begin{cases} \emptyset_k y_{rk} - \sum_{j=i}^{n} \lambda_j y_{rj} + S_r = 0 \qquad r = 1, \dots, s \\ x_{ik} - \sum_{j=1}^{n} \lambda_j x_{ij} - S_i \;\; = \; 0 \quad i = 1, \dots, m \\ \sum_{j=1}^{n} \lambda_i = 1 \\ \lambda_j, S_r, S_i \geq 0 \qquad \forall j = 1, \dots, n; r = 1, \dots, s; i = 1, \dots, m \end{cases} \quad (6)$$

$y_{rk}$the output r produced by DMU k
$x_{ik}$the input i producedby DMU k
u_r,is the weighting of output r
$v_i$is theweighting of input i
$s$the number of output
$m$the number of input
$n$the number of DMUs making up the sample
$\frac{1}{\emptyset_k}$is the technical efficiency of DMU k
$\lambda_j$represents the weight assigned to outputs and inputsS_r slacks output
$S_i$slacks input
εan archimedian value representing the smallest positive real number greater than 0

The DMU is said be efficient if $\frac{1}{\emptyset_k} = 1$and slacks $S_r, S_i = 0 \forall\, r = 1, \dots, s; i = 1, \dots, m$
Le modèle de DEA ne nécessite point la représentation spécifique d'une forme fonctionnelle.

The DEA model does not require the specific representation of a functional form.

In the third and final step of the methodology, we perform a post estimation analysis of the efficiency scores. This analysis evaluates the effect of experimental variables on the efficiency scores of tax-collecting zones in Benin. For this purpose, some use the MOC estimation method.(Benito & al., 2019; Hoff, 2007), while others use Tobit regression, (McDonald, 2009).According toHoff, (2007).the ordinary least squares method yields robust estimators for the efficiency score regression compared to the Tobit regression. In this estimation, we use both estimation methods to ensure the robustness of our results.

Technical efficiency lies between 0 and 1(Farrel,, 1957), (Farrel, 1957), so the truncated Tobit regression function can be used to assess the effects of environmental variables on the technical efficiency of collection areas in Benin. In the present regression, the truncated values expressing the efficiency of collection areas are not taken into account, but the non-truncated values expressing technical inefficiency are. To this end, truncated probit regression is used to characterize the observed inefficiency. The Tobit regression model is formally represented as follows:

$$\begin{cases} Y_t^* = si\ y_t^* = X_t\,\theta + \varepsilon_t \geq 0 \\ Y_t y_t \quad if\ not \end{cases} \qquad (7)$$

Where θ is a vector of parameters, y_t^* the latent variable which is not always observable, it is observable for its value above or below a certain threshold, $y_t = y_t^*$.In the present regression, observable y_t is less than or equal to 1; X is the set of environmental variables. The estimation procedure most commonly used today is maximum likelihood, whose model is represented as:

$$l(\theta, \sigma^2) = \underset{t:y_i=0}{\pi}\left[1 - \emptyset\left(\frac{x_t\theta}{\sigma}\right)\right] \underset{t:y_i \geq 0}{\pi} \frac{1}{\sigma}\emptyset\left(\frac{y_t - X_t\,\theta}{\sigma}\right) \qquad (8)$$

With log likelihood equal to:

$$\log l(\theta, \sigma^2) = \sum_{t:y_i=0} \log\left[1 - \emptyset\left(\frac{x_t\theta}{\sigma}\right)\right] - N_1 log\left(\sigma\sqrt{2\pi}\right) - \frac{1}{2\sigma^2} \underset{t:y_i \geq 0}{\sum}(y_t - X_t\,\theta) \qquad (9)$$

N_1being the number of observations
Referring to the specific model of efficiency regression on environmental variables in (Benito & al., 2019), we specify our model as follows:

$$EFFICIENCY_i = \beta_0 + \beta_1 DenPop_i + \beta_2 TotPop_i + \beta_3 EstDiv_i + \beta_4 PluRate_i + \varepsilon_i \qquad (10)$$

IV. PRESENTATION AND ANALYSIS OF RESULTS

A. Descriptive statistics for inputs and outputs

Table 1 : Descriptive statistics for inputs and output

Input/outputs	N	Minimum	Maximum	Mean	Variance
Tax_Revenue	26	0.0458	642	25.8	126
Electronic_Equip	26	3	96	11.96	319.478
Labor	26	4	130	17.5	595.06
Surface area	26	80	455	206.54	11944.658

Made by the author: DGI Benin data; NB: tax revenue data in billions of CFA francs.

Tax collection zones as a whole collect an average of 25.8 billion CFA francs in tax revenue, with a maximum of 642 billion CFA francs and a minimum of 0.0458 billion CFA francs.

The minimum of electronic equipment available to a collection zone is 3, and the maximum is 96, depending on the needs of the commune. The Human Resources Department offers an average of 11.92 pieces of electronic equipment per collection office.

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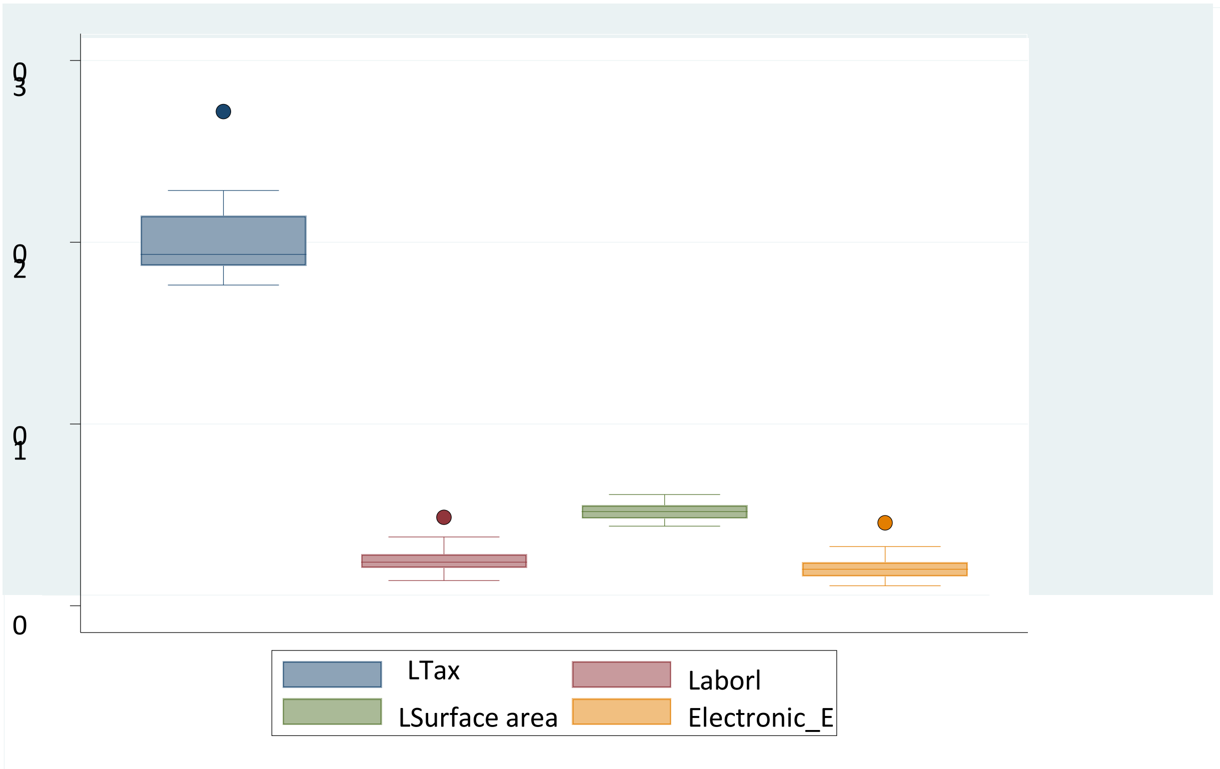
In terms of manpower, each collection zone has an average of 18 staff in charge of verifying and processing declared taxes. Each office can have a minimum of 4 and a maximum of 130 employees. The average surface area occupied by each collection zone is 206.54 square meters, with a minimum of 80 square meters and a maximum of 455 square meters.

Table 2: Descriptive statistics for the effectiveness score and its characteristics

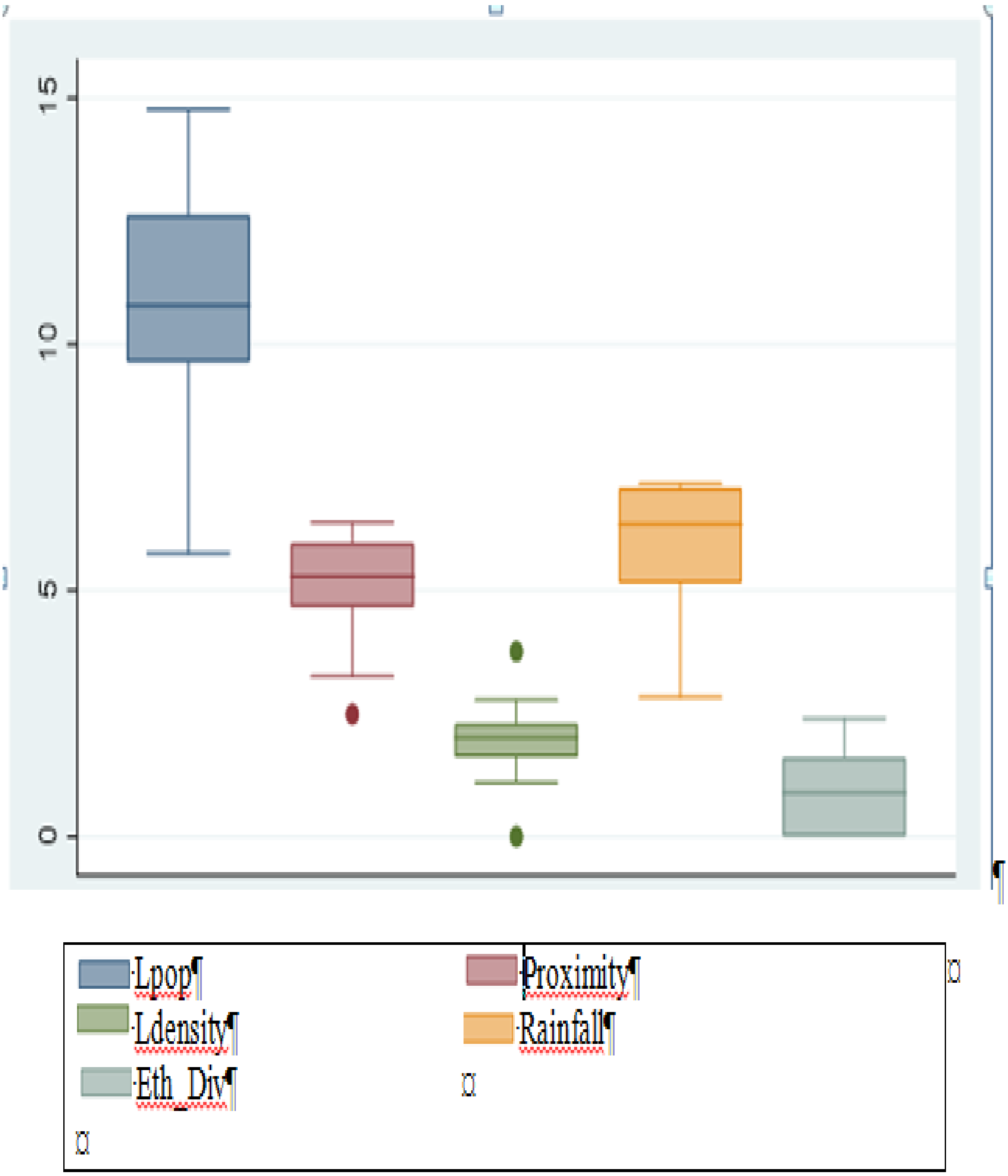
Variables	Obs	Mean	Std. dev.	Min	Max
Eff_Scor	26	.8878077	.071576	.746	1
Pop	26	231266.2	252047.9	51247	1214249
Den_pop	26	827.3077	1894.846	14	8595
Plu_Rate	26	65.40769	8.604832	47.5	79
Scol_Rate	26	38.77692	13.95247	13.8	61
Eth_Div	26	3.423077	2.802471	1	11
Rainfall	26	632.4654	492.0248	61.4	1300
Proximity	26	239.0423	179.1781	12	584
Urb_Rate	26	51.87038	24.30934	15.24	100

Realized by the author : Data INstaD Benin

B. Variable whisker box for outlier detection



Graph 2: Variable whisker box: output- inputs



Graph 3: Moustache box for environmental variables

Both for production factors and environmental variables, outliers are under-represented. Model estimation therefore runs the risk of outlier bias. We therefore estimate our functional model using the DEA estimation method.

C. *Interpretation of results*

Table 3: Estimate results for DEA method

Code	Firms	Scores d'efficacité			Firm_Peers	Output_Project	Inputs_Slacks		
		crste	vrste	scale			(1)	(2)	(3)
1	Cotonou	1.000	1.000	1.000 -	1	27.188	0.000	0.000	0.000
2	Porto-Novo	0.855	0.988	0.866 drs	1 17 23	22.699	0.429	0.000	0.000
3	Djougou	0.802	0.864	0.928 drs	17 1	22.925	0.087	0.056	0.000
4	Natitingou	0.866	0.996	0.870 drs	23 17 5	20.138	0.771	0.000	0.000
5	Tanguiéta	1.000	1.000	1.000 -	5	19.031	0.000	0.000	0.000
6	Abomey-Calavi	0.852	0.932	0.914 drs	17 1	24.510	0.319	0.097	0.000
7	Ouidah	0.846	0.910	0.930 drs	17 1 23	23.590	0.038	0.000	0.000
8	Allada	0.864	0.936	0.923 drs	23 25	20.512	0.136	0.000	0.421
9	Banikoara	0.760	0.812	0.936 drs	21 17 1	21.972	0.000	0.183	0.000
10	Bembèrèkè	0.986	0.986	1.000 -	5	19.031	0.256	0.223	0.000
11	Nikki	0.876	0.876	1.000 -	21 1	20.606	0.000	0.636	0.304
12	N'dalli	0.882	0.898	0.981 drs	17 21	20.227	0.000	0.241	0.000
13	Kandi	0.847	0.888	0.954 drs	17 1 21	21.927	0.000	0.019	0.000
14	Parakou 1	0.887	0.985	0.900 drs	23 1 17	22.279	0.159	0.000	0.000
15	Cime-Borgou	0.898	0.996	0.901 drs	23 1 17	21.695	0.093	0.000	0.000
16	Malanville	0.883	0.884	1.000 -	1 21	20.516	0.000	0.548	0.521
17	Lokossa	0.958	1.000	0.958 drs	17	21.131	0.000	0.000	0.000
18	AplahouéAzoè	0.857	0.899	0.953 drs	17	21.131	0.034	0.636	0.000
19	Comè	0.746	0.892	0.836 drs	23 17 5	20.958	0.961	0.000	0.000
20	Pobè	0.944	0.967	0.976 drs	17 21	20.429	0.000	0.292	0.000
21	Sèmè-Podji	1.000	1.000	1.000 -	21	19.607	0.000	0.000	0.000
22	Abomey	0.855	0.890	0.961 drs	23 17 1 21	21.394	0.000	0.000	0.000
23	Bohicon	0.911	1.000	0.911 drs	23	21.555	0.000	0.000	0.000
24	Covè	0.900	0.900	1.000 -	21	19.607	0.000	0.606	0.336
25	Dassa	1.000	1.000	1.000 -	25	19.043	0.000	0.000	0.000
26	Savè	0.808	0.820	0.986 drs	17 1 21	22.667	0.000	0.045	0.000
	mean	0.888	0.935	0.949					

V. ESTIMATE RESULTS

The results of the DEA estimation method show that the most efficient tax collection areas are mainly those of Sèmé-Kpodji, Cotonou, Tanguieta and Dassa. This means that these tax collection zones suffer neither from a management problem nor from a size problem. The input resources at their disposal enable them to collect as much revenue as possible. Among the other inefficient tax collection areas, some are size efficient and others are management efficient. Thus, on the one hand, we have the tax collection zones of Lokossa and Bohicon, which have pure technical efficiency but suffer from a small size problem, as their scale efficiency is slightly less than 1. On the other hand, the collection zones of Bembèrèkè, Nikki, Malanville and Covè suffer rather from a small management problem, but manage with pure technical efficiency. Under the assumption of variable returns to scale, our results show that all tax collection zones have diminishing returns to scale. This means that: when inputs are doubled, the revenue collected does not increase by the same amount doubled, but rather less than proportionally to the increase in inputs. Economically, it makes sense for tax collection areas to use a constant return to scale, if they can't adopt the best, increasing return.

Even if the Bembèrèkè, Nikki, Malanville, and covè tax collection offices respectively reduce occupied area and labor by (0.256, 0.223); labor and equipment by (0.636, 0. 304); labor and equipment by (0.548, 0.521); labor and equipment by (0.606, 0.336), they will produce the full optimal tax revenue, thus improving their level of scale efficiency. The least inefficient collection zone is Covè, with a score of 0.74. To be efficient, it needs to copy the collection strategy of the Bohicon, Lokossa and Tanguiéta zones. Overall, the results show that the tax collection zones are not weakly inefficient in terms of collection, as no DMUs have an inefficiency score below 0.5. The results also show that the tax collection system implemented in the collection zones generates an average tax revenue loss of 12%.

Tax officials are determined to do their job well. To this end, good management, cooperation and encouragement from the Ministry of Finance will ensure better mobilization of tax revenues.

Before determining the effects of environmental variables on the technical efficiency of tax collection offices, the variables are tested for correlation.

Table 4 : Correlation test of variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Plu_Rate	1.0000						
Lpop	-0.2461	1.0000					
Ldensity	-0.3681	0.3378	1.0000				
Number_district	0.3616	-0.0274	-0.7876	1.0000			
Lproximity	0.1409	-0.3204	-0.4548	0.1689	1.0000		
Esti_Div	-0.1483	0.5288	-0.1086	0.3569	0.0136	0.2021	1.0000

Result at ofCorrelation test: In line with the work of (Kennedy, 2008), the results of the correlation test do not provide coefficients of significance greater than 0.80 or less than - 0.8. Thus, the variables are not correlated two by two, which raises the hypothesis of bias in the model parameters.

Table 5: Result of truncated Tobit regression

Variables Eff_Scor	Tobit Regression				
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
LPop	.0209808 (.014183)	.0247017 (.0150479)	.0328699* (.0148404)	.0333182* (.0161427)	.0209089 (.013406)
LDen_Pop	.002452 (.0080839)	.0040106 (.0090164)	.0038255 (.009181)	.0052553 (.0129868)	.0111135 (.0075548)
Eth_Div	-.0078108*** (.0019184)	-.0090052*** (.0023336)	-.0089972*** (.0027317)	-.0089961*** (.0027663)	-.000407*** (.0027438)*
Plu_Rate	.0009405 (.0010621)	.0014462 (.0009949)	.0019034 (.0011813)	.0019424* (.0011639)	.0036404** (.0011168) *
Proximity		.0001104 (.0000692)	.0001339* (.0000748)	.0001391* (.0000828)	.0001139*** (.0000587)
Rainfall			-.0000242 (.0000239)	-.0000256* (.0000237)	-.000026 (.0000228)
Urb_Rate				-.0001056 (.0006216)	.0014073 (.0006802)
Scol_Rate	.	.		.	-.0117276 (.0036966)*
_cons	.592968*** (.1577199)	.458098** (.2087898)	.3392671 (.216911)	.3286414 (.2421213)	.317939* (.1879167)
/sigma	.0549747*** (.0119665)	.0528504*** (.0113842)	.05195*** (.010740)	.0519208*** (.0106698)	.0455471*** (.0107786)
Prob>Chi2	0.0017	0.0080	0.0053	0.0089	0.000
WaldChi2	17.23	15.64	12.41	12.37	109
Logpseudolik	33.54	34.4100	34.7533	34.700	34.900
Numbr_Obs	22	22	22	22	22

Source: Estimation results

Note: ***= significant at 1%, **= significant at 5%,*= significant at 10%.

The t-statistics are shown in brackets.

Population density has a positive and significant impact u 1% threshold on the production inefficiency of tax collection areas (DMUs). This result corroborates with the work of (Benito & al., 2019 ; Andrews & Entwistle 2010;Lannier & Porcher, 2014)but disagrees with the work of (Andrews & Entwistle, 2010; 2015) ; lo Storto, 2016). The total population of the collection area has a positive, non-significant effect on DMU inefficiency. This means that increasing population improves DMU productivity. This result corroborates the work of(Andrews & Entwistle,; 2015).

As for ethnic diversity, it is significant and negatively affects the inefficiency of DMUs. The work of (Andrews & Entwistle, 2010; 2015)also finds a negative effect, however (Andrews & Entwistle, 2015)finds significance and(Andrews & Entwistle, 2010), non-significance. Proximity to a neighboring economy that is likely to capture the externality effect of economic activities with neighboring borders is insignificant with a positive sign. This result is in line with that of (Cuadrado-Ballesteros & al., 2013). To test the robustness of our estimation, we opt for the method of adding variables to the specified model. In this way, the results remained rosbusts as the signs of all environmental variables remained unchanged for all 5 estimations.

Table 6 : Ols regression

Eff_Score (Var.Denp)	Coef(1)	Coef(2)	Coef(3)	Coef((4)	Coef(5)
LDen_Pop	-.255238 (-0.43)	-.00879 (-0.01)	-.060307 (-0.08)	-.105772 (-0.12)	-.142435 (-0.15)
LPop	0.427954 (2.54)***	0.45309 (2.71)***	0.442907 (2.50)***	4.538221 (2.23)***	4.49422 (2.16)**
EthnDiv	-.0.6032 (-1.19)	-.606761 (-1.22)	-.598287 (-1.14)	-.629153 (-1.11)	-.657476 (-1.04)
PluRateé		.1996684 (1.30)	1.492007 (-1.14)	1.475274 (0.55)	1.489412 (0.54)
Proximity			.2579922 (0.19)	.1702759 (0.10)	.2329304 (0.13)
Rainfall				.000612 (0.25)	.0006249 (0.25)
Number_district					-.038658 (-0.18)
_cons	45.8293 (2.51)*	39.0386 (3.97)**	37.970 (1.56)***	37.40178 (1.64)	37.9493 (1.62)
Prob>F	0.0243	0.0393	0.0368	0.0289	0.0580
R^2	0.4982	0.5215	0.5481	0.6804	0.7964
Number_of Observation	26	26	26	26	26

Source: Estimation results
Note: ***= significant at 1%, **= significant at 5%,*= significant at 10%.
The t-statistics are shown in brackets.

Population density has a positive and insignificant impact on the production efficiency of tax collection offices (DMUs). This result corroborates with the work of (Andrews & Entwistle, 2010; 2015;lo Storto, 2016)but disagrees with the work of (Benito & al., 2019; Andrews & Entwistle 2010;Lannier & Porcher, 2014).

The total population of the municipality has a positive and significant effect at the 1% threshold on the efficiency of DMUs. This means that increasing population improves DMU productivity. This result corroborates with the work of (Andrews & Entwistle 2015). As for ethnic diversity, it is insignificant and negatively affects DMU efficiency. The work of (Andrews & Entwistle, 2010; 2015)also finds a negative effect, nevertheless(Andrews & Entwistle, 2015)finds significance and (Andrews & Entwistle, 2010), non-significance. Proximity to a neighboring economy that is likely to capture the effect of the externality of economic activities with neighboring borders is insignificant with a positive sign. This result is in line with that of(Cuadrado-Ballesteros & al., 2013).

VI. ROBUSTNESS TEST

To test the robustness of our results, we incorporated the number of districts per collection zone, proximity to neighboring borders and rainfall. The results show that these variables are not significant, and the results for the other variables remain unchanged. Only the population variable is significant at 1% for all 5 estimation series. In addition, our estimation is made with the robust option, so that the t statistic can correct for heteroskedasticity using the white method.

VII. CONCLUSION

Like all government bodies, the Directorate General of Taxes is made up of offices responsible for various tasks. Those of the DGT are responsible for tax collection throughout the nation. These offices act as DMUs, with the aim of maximizing tax revenue generation within the resources allocated to them. In carrying out their various tasks, some offices may appear inefficient, thus slowing down the efforts of others. The primary objective of this paper is to identify inefficient DMUs. This paper uses the DEA methodology (output-oriented model) to determine the technical efficiency of Benin's tax collection zones. The results show that the tax collection areas of Cotonou, Sèmé-Kpodji, Tanguieta and Dassa are efficient, while others have an efficiency score of less than 1.Truncated Tobit regression was used to characterize the environmental factors that explain the technical inefficiency of collection areas. Total population, density, income and proximity to neighboring borders are not significant, but positively affect the technical efficiency of collection areas. Ethnic diversity, on the other hand, had a significant negative impact on technical inefficiency. The collection system implemented in the zones generates an average loss of 12% of tax revenue. The efficient DMUs must train the weak ones in order to standardize technical efficiency throughout Benin.

In contrast to existing empirical reviews, with regard to the effect of environmental variables on the effectiveness of DMUs, we question new variables such as: the number of districts per collection zone, proximity to neighboring borders and rainfall. However, the number of observations in your sample is very small for the robustness of a determinant study. This would have adversely affected the results obtained. Our contribution is an economic analysis of the efficiency of tax collection areas. Unlike recent work that deals with taxation at national level, we are interested in individual collection units. This aspect has not yet been addressed in the main literature in the case of the Directorate General of Taxes.

- Tax collection areas must unquestionably work as a group, so that efficient areas can drag inefficient ones towards performance. To achieve this, we need to :
- Organize periodic workshops to disseminate new monitoring techniques and share knowledge;
- Regularly assign agents to consolidate the sharing of knowledge between them;
- Provide agents with the resources to travel to taxpayers and encourage them to declare their taxable income on time;
- Train agents in sophisticated digitalization methods such as: Yellow Box CRM, to bring together the entire tax collection team in all communes; WEDO, to energize meetings, monitor tasks as a team and establish chehlist templates for efficient reorganization of the tax structure.

REFERENCES

[1]. Andrews, D. F., & Pregibon, D. (1978). Finding the Outliers that Matter. *Journal of the Royal Statistical Society: Series B (Methodological)*, *40*(1), 85–93. https://doi.org/10.1111/j.2517-6161.1978.tb01652.x

[2]. Andrews, R., & Entwistle, T. (2010). Does cross-sectoral partnership deliver? An empirical exploration of public service effectiveness, efficiency, and equity. *Journal of Public Administration Research and Theory*, *20*(3), 679–701. https://doi.org/10.1093/jopart/mup045

[3]. Andrews, R., & Entwistle, T. (2015). *Public–private partnerships, management capacity and public service efficiency*. *43*(2), 273–290.

[4]. Aydın, U., Karadayi, M. A., & Ülengin, F. (2020). How efficient airways act as role models and in what dimensions? A superefficiency DEA model enhanced by social network analysis. *Journal of Air Transport Management*, *82*(September), 101725. https://doi.org/10.1016/j.jairtraman.2019.101725

[5]. Aydın, U., Melis, K., & Ülengin, F. (2019). Journal of Air Transport Management How efficient airways act as role models and in what dimensions ? A superefficiency DEA model enhanced by social network analysis. *Journal of Air Transport Management*, *May*, 101725. https://doi.org/10.1016/j.jairtraman.2019.101725

[6]. Balaguer-Coll, M. T., Prior, D., & Tortosa-Ausina, E. (2010). Decentralization and efficiency of local government. *Annals of Regional Science*, *45*(3), 571–601. https://doi.org/10.1007/s00168-009-0286-7

[7]. Bamba, L. N. (2020). *Structure et efficacité du Secteur Financier Ivoirien*. *December 2011*.

[8]. Benito, B., Faura, Ú., Guillamón, M. D., & Ríos, A. M. (2019a). The efficiency of public services in small municipalities: The case of drinking water supply. *Cities*, *93*(April), 95–103. https://doi.org/10.1016/j.cities.2019.04.016

[9]. Benito, B., Faura, Ú., Guillamón, M., & Ríos, A. (2019b). *The e ffi ciency of public services in small municipalities : The case of drinking water supply*. *93*(November 2018), 95–103. https://doi.org/10.1016/j.cities.2019.04.016

[10]. Bodin, J. P. (2012). Modernisation de l'administration fiscale dans les pays en développement: Impact de la TVA. *Revue d'Economie Du Developpement*, *26*(3), 83–103. https://doi.org/10.3917/edd.263.0083

[11]. BOGETOFT, Peter, OTTO, Lars, BOGETOFT, Peter, et al. (2011). *Data envelopment analysis DEA. Benchmarking with Dea, Sfa, and R*,. 81-113.

[12]. Byrnes, J., Crase, L., Dollery, B., & Villano, R. (2010). The relative economic efficiency of urban water utilities in regional New South Wales and Victoria. *Resource and Energy Economics*, *32*(3), 439–455. https://doi.org/10.1016/j.reseneeco.2009.08.001

[13]. Carcenac, N. C. ;Thierry. (2020). *RAPPORT D ' INFORMATION*.

[14]. Cese, R. (2019). *Un Système Fiscal, pilier pour le Nouveau Modèle de Développement*.

[15]. Chambas, G., Brun, J., & Graziosi, G. R. (2007). *La mobilisation de ressources propres locales en Afrique*. 26–29.

[16]. Charnes, A. (1978). *Measuring the efficiency of decision making units*. *2*, 429–444.

[17]. Cottarelli, C. (2011). *Mobilisation des recettes dans les pays en développement* (pp. 1980–2009). FONDS MONETAIRE INTERNATIONAL Mobilisation.

[18]. Cuadrado-ballesteros, B. (2013). Effect of modes of public services delivery on the ef fi ciency of local governments : A two-stage approach. *Utilities Policy*, *26*, 23–35. https://doi.org/10.1016/j.jup.2013.04.005

[19]. Cuadrado-Ballesteros, B., García-Sánchez, I. M., & Prado-Lorenzo, J. M. (2013). Effect of modes of public services delivery on the efficiency of local governments: A two-stage approach. *Utilities Policy*, *26*, 23–35. https://doi.org/10.1016/j.jup.2013.04.005

[20]. Deprins, D. (1983). Estimation de frontiere et mesure d ' efficacite : approches descriptive et econometrique f. *JorbeL-Belgian Journal of Opérations Recherche, Statistics and Computer Science*, *23*, 19–62.

[21]. DGI, R. (2022). *Rapport de fin d'annee 2022*.

[22]. Djoumessi, F. (2017). *Munich Personal RePEc Archive Understanding Variation in Smallholder Efficiency Levels in Vegetable Farms within Forest Based System Farming in Southwest Cameroon*. *79371*.

[23]. Etrang, A. (2014). *Renforcer les recettes fiscales locales pour financer le développement urbain en Afrique*.

[24]. *Fardapaper-Measuring-the-efficiency-of-decision-making-units.pdf*. (n.d.).

[25]. Farrel, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society.Series A., General,120(3)*, 253–281.

[26]. Fong, K. (2015). Exploring and analysing sources of technical ef fi ciency in water supply services : Some evidence from Southeast Asian public water utilities. *Water Resources and Economics*, *9*, 23–44. https://doi.org/10.1016/j.wre.2014.11.002

[27]. GBM, R. (2019). *Étude sur la fiscalité en Afrique de l'Ouest*.

[28]. GDI, R. (2020). *Principale reormes fiscales relatives à l'amelioration du climat des affaires au Bénin*.

[29]. Huguenin, J. (2013). *Data Envelopment Analysis (DEA) Un guide pédagogique à l ' intention des décideurs Chaire Finances publiques* (Vol. 41, Issue 0).

[30]. Keita, A. D. et I. (2004). *Effet des differente reformes du secteur financier sur kes reations entre institutions bancaire et institutions non bancaie: concurence ou complémentarité*.

[31]. Landin, A., & Öberg, M. (2014). *Productivity and Efficiency in the Development of the Swedish Construction Sector*. *June*, 307–318.

[32]. Lannier, A. Le, & Porcher, S. (2014). Efficiency in the public and private French water utilities: prospects for benchmarking. *Applied Economics*, *46*(5), 556–572. https://doi.org/10.1080/00036846.2013.857002

[33]. Latruffe, L., Fogarasi, J., & Desjeux, Y. (2012). Efficiency, productivity and technology comparison for farms in Central and Western Europe: The case of field crop and dairy farming in Hungary and France. *Economic Systems*, *36*(2), 264–278. https://doi.org/10.1016/j.ecosys.2011.07.002

[34]. lo Storto, C. (2016). The trade-off between cost efficiency and public service quality: A non-parametric frontier analysis of Italian major municipalities. *Cities*, *51*, 52–63. https://doi.org/10.1016/j.cities.2015.11.028

[35]. Maurice, F. À. (2021). *Analyse De L ' efficacité Technique Des Exploitations Agricoles Familiales À Maurice Malick Ndiaye*. *September*. https://doi.org/10.19044/esj.2018.v14n9p143

[36]. Mauro, P. (1995). Corruption and Growth. *Quarterly Journal of Economics,110*(No. 3), 681–712.

[37]. Mauro, P. (2004). *The Persistence of Corruption and Slow Economic Growth*. *51*(1), 1–18.

[38]. May, E., Spottiswoode, S., & Faith, L. (2000). The correlation of the gradient of Shannon entropy and anomalous cognition: Toward an AC sensory system. *Journal of Scientific Exploration*, *14*(1), 53–72. http://www.lfr.org/LFR/csl/library/jseGradSCorrelation.pdf

[39]. Moummi, A. (2012). La Mobilisation des Ressources Fiscales et son impact sur les Niveaux de Vie des Ménages : Cas du Niger. *Banque Africain de Développement, Working Paper Series*, *165*.

[40]. Myrdal, G. (1968). No Title. *The Asian Drama. Harmondsworth: The Penguin Press*.

[41]. Ndiaye, M. (2018). *Analyse De L ' efficacité Technique Des Exploitations Agricoles Familiales À Maurice*. *14*(9), 143–160. https://doi.org/10.19044/esj.2018.v14n9p143

[42]. Ngom, A. (2007). *Les déterminants de l'efficacité technique des entreprises industrielles sénégalaises : une analyse par la méthode « Data Envelopement Analysis » (DEA)*. 1–21.

[43]. OCDE, F. M. (2022). *La lutte contre l'évasion fiscale des entreprises multinationales en Mongolie*.

[44]. Porcher, S., Organisationnels, C., Gestion, P., Porcher, S., Paris, H. E. C., & Durand, M. R. (2018). *Choix Organisationnels et Performance des Services Publics To cite this version : HAL Id : tel-01964301 Université Paris 1 Panthéon-Sorbonne Institut d ' Administration des Entreprises de Paris Choix Organisationnels et Performance des Services Publics pa*.

[45]. Prior, D., Arbona, A., & Gim, V. (2022). *Socio-Economic Planning Sciences Efficiency and quality in Colombian education : An application of the metafrontier Malmquist-Luenberger productivity index*. *79*. https://doi.org/10.1016/j.seps.2021.101122

[46]. Rachel Ruamps, Romain Ragot, E. N. et C. G., & MEF/DGT. (2020). *Appui à une meilleure mobilisation des ressources intérieures dans les économies en développement*.

[47]. Ray, S. C. (2004). *Data envelopment analysis: theory and techniques for economics and operations research.* Cambridge university press,.

[48]. Sanjel. (2012). *CHAPTER – I*.

[49]. Simar, L. (2003). Detecting outliers in frontier models: A simple approach. *Journal of Productivity Analysis*, *20*(3), 391–424. https://doi.org/10.1023/A:1027308001925

[50]. Simar, L., & Wilson, P. W. (1999). Estimating and bootstrapping Malmquist indices. *European Journal of Operational Research*, *115*(3), 459–471. https://doi.org/10.1016/S0377-2217(97)00450-5

[51]. Srinivasulu, R., Victor, A.-S., Daniel, K. K., Richard, M., Dannie, R., Magesa, A. M., Silivesta, S., & Radegunda, F. K. (2015). Technical efficiency of traditional African vegetable production: A case study of smallholders in Tanzania. *Journal of Development and Agricultural Economics*, *7*(3), 92–99. https://doi.org/10.5897/jdae2014.0606

[52]. Storto, C. (2016). The trade-off between cost ef fi ciency and public service quality : A non-parametric frontier analysis of Italian major municipalities. *JCIT*, *51*, 52–63. https://doi.org/10.1016/j.cities.2015.11.028

[53]. Taylor, P., Wilson, P. W., & Wilson, P. W. (2012). *Detecting Outliers in Deterministic Nonparametric Frontier Models With Multiple Outputs. February 2015*, 37–41. https://doi.org/10.1080/07350015.1993.10509959

ISSN No:-2456-2165

[54]. Tsou, C., & Huang, D. (2010). On some methods for performance ranking and correspondence analysis in the DEA context. *European Journal of Operational Research*, *203*(3), 771–783. https://doi.org/10.1016/j.ejor.2009.09.010

[55]. Wade, N. G., Hoyt, W. T., Kidwell, J. E. M., & Worthington, E. L. (2014). *Efficacy of Psychotherapeutic Interventions to Promote Forgiveness : A Meta-Analysis*. *82*(1), 154–170. https://doi.org/10.1037/a0035268

[56]. Walter, M., Cullmann, A., Hirschhausen, C. Von, Wand, R., & Zschille, M. (2009). Quo vadis efficiency analysis of water distribution ? A comparative literature review. *Utilities Policy*, *17*(3–4), 225–232. https://doi.org/10.1016/j.jup.2009.05.002

[57]. Wu, J., & Qian, J. (2018). *Economic Growth Efficiency and Productivity Constrained by Government Debts*. 1338–1359. https://doi.org/10.4236/me.2018.97086