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Digitalization and Efficiency of the Beninese Tax Administration

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Abstract:- This paper aims to assess the effectiveness of the Beninese tax administration in the context of digitalization. Specifically, it seeks to determine the efficiency levels of various tax centers and evaluate the impact of digitalization on the efficiency of the Beninese tax administration. Using monthly panel data spanning from 2017 to 2023, a DEA model is employed to calculate efficiency scores. Subsequently, a censored Tobit model is utilized to examine the effect of digitalization on the efficiency of tax centers in Benin. The findings reveal average efficiency scores of 77.80%, 76.79%, 72.01%, 62.72%, 58.56%, 56.11%, and 46.16% for CIME Atlantique, CIME Ouémé Plateau, CIME Borgou Alibori, CIME Zou Collines, DGE, CIME Littoral1, and CIME Littoral 2, respectively. Moreover, digitalization, tax population, and additional taxes resulting from documentary audits positively influence the efficiency of tax centers. Conversely, the number of staff, the agent's directory, staff expenses, and the coverage rate of general accounting audits negatively affect the efficiency of tax centers. Decision-makers must prioritize enhancing the efficiency of tax administrations, expanding the tax base, and ensuring comprehensive tax control coverage to fully capitalize on the benefits of digitalization.

Keywords:- *Digitalization; Tax efficiency; DEA; LBD; TCME.*

I. INTRODUCTION

Adequate mobilization of tax revenues constitutes a significant concern in developing countries for achieving sustainable development goals, necessitating expanded public expenditures. The fundamental reason is associated with the lack of access to external resources. Therefore, having an efficient tax system is essential to avoid severe budget deficits. Thus, understanding the determinants of tax revenue mobilization efficiency presents a crucial challenge for developing countries to prevent compromising economies' ability to create wealth as per the Laffer curve.

The motto of the Beninese tax administration is "Equity Integrity Efficiency." Efficiency within the administration is always at the forefront of economic analysis through studies and research. Few studies have been conducted to examine information technologies in terms of online income declaration, online tax registration, and online tax payment at the tax administration level concerning tax productivity, planning, and implementation, depicting a gap in the literature. Harrison & Nahashon (2015) studied the effects of online tax systems in terms of online income declaration, online tax registration, and online tax remittance, but their work was based on tax compliance.

For a tax administration, measuring efficiency is an essential tool as it enables decision-makers to determine the extent to which the tax administration utilizes resources to achieve its objectives. Two potential implications for future production expansions could be drawn from efficiency measurement exercises. First, efficiency assessment can be used as a basis for reallocating resources from units or business processes with low marginal returns to those with relatively high marginal returns. Second, inefficiencies may indicate that available resources have not been used most productively; therefore, further exploration of ways to improve productive efficiency is warranted.

The evaluation of the effectiveness of public sector institutions within the framework of growth theory is rare in the literature. Examples of this limited research line can be found in the works of Bartel & Harrison (2005); Dombi et al. (2018); Ehrlich et al. (1994). This scarcity could be related to the conceptual problems generally encountered in measuring public sector efficiency, especially difficulties in quantifying the appropriate measure of production.

In this context, the question arises: What is the efficiency of tax centers in Benin? To answer this question, this paper aims to examine the efficiency of seven tax centers in Benin. Specifically, i) Determine the efficiency level of these different tax centers. ii) Assess the influence of digitalization on the efficiency of these centers.

This paper's interest lies in several aspects. Empirically, this research fills gaps in the literature on the link between digitalization and the efficiency of the Beninese tax administration. Conceptually, it allows for the comparison of the efficiency of different tax centers, and it identifies the channels through which digitalization can affect tax administration efficiency. On the policy front, our findings will enhance policymakers' understanding of instruments that could be used to improve tax administration efficiency.

The remainder of this paper is organized into three parts. The first part presents the literature review. The methodological approach is outlined in the second part. The

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third part discusses the obtained results, followed by a conclusion.

II. LITTERATURE REVIEW

In economic analysis, a significant portion of the literature focuses on studying the determinants of the effectiveness of tax revenue mobilization. In this regard, a considerable part of this literature revolves around the conventional factors influencing countries' fiscal performance. These studies have indicated that variables such as Gross Domestic Product (GDP), per capita income, trade openness, the share of money supply in GDP, and the performance of various sectors are the primary conventional factors explaining the evolution of countries' tax efforts (Asongu et al., 2021; Mihóková et al., 2018).

In general, digitalization is employed to enhance the transparency and credibility of public administration and to combat various forms of corruption (Hajic et al., 2009), owing to the broad range of digital opportunities offered by Information and Communication Technologies (ICTs) (Adam, 2020).

Specifically, literature concerning the use of ICTs in the context of taxation exclusively focuses on the digitization of tax procedures and supports the argument that the level of tax compliance improves by simplifying tax procedures, electronic tax filing systems, and tax payments (Khalil & Sidani, 2020; Night & Bananuka, 2020; Tjen & Evans, 2017). In this context, Meimon (2014) demonstrated that tax revenues could be positively affected by tax system reform. Additionally, Khalil & Sidani (2020) stated that tax evasion would decrease in countries with more effective governance and tax systems in terms of tax collection and expenditure of tax revenues. Furthermore, an efficient tax system can provide a compact regulatory framework and institutional foundations that can minimize tax evasion (Tjen & Evans, 2017).

However, the localization of business activities benefiting from remote services via the internet is consequently complex. It is easy for a digital company to declare its activities in countries with the most favorable regulations, especially concerning taxation but also data management (Charrié & Janin, 2015).

Digitalization can lead to the misreporting of figures, resulting in incorrect tax calculations by the taxpayer. It can also incur a high cost of maintaining ICT facilities. Similarly, Oseni (2015) estimated that the use of ICTs could be catastrophic if used negligently by both taxpayers and tax administrators, as scammers and hackers can take advantage of system inadequacies.

These theoretical controversies surrounding the effect of digitalization on the fiscal system's performance have spurred empirical research. This literature demonstrates that there is controversy regarding the determinants of tax administration efficiency.

III. DATA AND METHODOLOGY

A. Model Specification

The determination of the efficiency of tax administration falls within the broader framework of evaluating countries' fiscal performance. In economic literature, several approaches are used to determine fiscal efficiency (tax effort), which is the ratio between a country's actual tax revenues and its tax capacity (Minh et al., 2012; Khwaja & Iyer, 2014).

The choice of an efficiency estimation method is based on the analysis of certain elements advanced by Jacobs et al. (2006) to compare Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) methods. Through the criteria set forth by these authors, we judge that the DEA method is more suitable for determining tax administration efficiencies due to several important elements, namely: a) the existence of multiple inputs and outputs for tax administration production; b) the production technology is difficult to model; c) it is particularly suitable for a small sample size (Djellal et al., 2013). This choice is further justified by referring to the study of Buleca & Mura (2014), which shows that data envelopment analysis seems to be an appropriate methodological tool also in the case of quantifying the efficiency of public administration, particularly for assessing the technical efficiency of production units based on input and output size. Quantifying performance is possible not only for private economic entities, financial institutions, medical establishments, commercial establishments, but also for public sector organizations, including subjects of public administration. The inputs and outputs evaluated using DEA could be included in the type of multi-criteria decision-making.

Thus, DEA for a panel of tax centers in Benin can be expressed as follows:

$$ET_k = \frac{\sum_{r=1}^{s} U_r Y_{rk}}{\sum_{i=1}^{m} V_i X_{ik}}$$

$$\text{Avec } (0 < ET_k \leq 1) \quad (1)$$

Where $\boldsymbol{ETk}$ is the productive efficiency of production unit k using m inputs to produce s outputs; Yrk is the quantity of output r produced by production unit k; Xik is the quantity of input i consumed by production unit k; Ur and Vi are the respective weights of output r and input i; n is the number of production units to be evaluated; m and s are the respective numbers of inputs and outputs.

The use of the DEA approach aims to estimate the ratio between the weighted sum of outputs and the weighted sum of inputs for each production unit under study. However, each decision-making unit will seek to maximize, and if it manages to reach the frontier, the value of the ratio will be equal to one, and conversely, the value will be less than one.

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The productive efficiency of unit k will be maximized under two constraints, namely: 1) the weights applied to the outputs and inputs of production unit k cannot generate an efficiency score greater than 1 when applied to each decision-making unit in the set. 2) The weights applied to the outputs and inputs are strictly positive.

The following mathematical program is used to determine the efficiency of each production unit:

$$\text{MAX} \frac{\sum_{r=1}^{s} U_r Y_{rk}}{\sum_{i=1}^{m} V_i X_{ik}}$$

$$\text{S/C} \begin{cases} \frac{\sum_{r=1}^{s} U_r Y_{rk}}{\sum_{i=1}^{m} V_i X_{ik}} \leq 1 \\ U_r, V_i \geq 0 \\ r = 1, \ldots . s; i = 1, \ldots m \; et \; j = 1, \ldots n \end{cases} \quad (2)$$

B. Determinants Estimation Method

In the literature concerning the determination of explanatory factors for the efficiency scores of production units, some authors argue that econometric models such as Tobit, probit, and logit are suitable for second-stage estimation for analyzing the determinants of production unit efficiency (Alinsato & Alakonon, 2021; Djiogap & Song, 2016; Kirigia & Asbu, 2013; Ramalho et al., 2010; McDonald, 2009). In this regard, Afonso and Aubyn (2011) demonstrated that based on a set of assumptions regarding the data generation process and distribution, disturbance terms can be distributed. Therefore, it is not clear whether the results of bootstrap estimations are necessarily more reliable than the results of the Tobit model even if the results of the latter are potentially biased. Through empirical verification, they found that normal censored Tobit results and bootstrap algorithms yielded very similar results. Thus, to study the explanatory factors of the fiscal efficiency scores of tax centers in Benin, we adopt the Tobit regression model because the efficiency scores determined by the DEA method in the first stage range between 0 and 1.

The model is presented as follows:

$$ET_k = \begin{cases} \beta_j X_k + U_k \; ; si \; ET^* > 1 \\ 0 \; sinon \end{cases} \quad (3)$$

ET is the efficiency score, and X_k is the vector of determinants. This model is suitable for studying the determinants of efficiency according to McCarty & Yaisawang (1993) because the efficiency scores are censored.

C. Presentation of the Variables

In the context of this study, our data concern seven tax centers in Benin over the period from 2017 to 2022, namely: DGE, CIME LITTORAL 1, CIME LITTORAL 2, CIME ATLANTIQUE, CIME OUEME-PLATEAU, CIME BORGOU-ALIBORI, and CIME ZOU-COLLINES. The variables used in this study for determining efficiency fall into two categories: inputs and output. For the output, we have defined an indicator Recmens (Monthly Revenue), which represents the amount of monthly revenue collected. As for the inputs, we have five variables: Eff_pers (Personnel Size), Pop_fisc (Taxpayer Population), Depens_pers (Personnel Expenses), Nbre_eses_agent (Average Number of Enterprises per Administrator), and Tcouv_contr (Coverage Rate of Controls).

Their selection is based on the literature, particularly on the performance sub-indicators selected by Nguyen et al. (2020) in their study of the efficiency of the tax administration of 44 countries. These variables are sourced from the Directorate General of Taxes.

Table 1: Description of Variables

Variables	Description	Source
Monthly revenues (Rec_mens)	Output	DGI
Personnel count (eff_pers)	Input	DGI
Taxpayer population (pop_fisc)	Input	DGI
Personnel expenses (depens_pers)	Input	DGI
Number of businesses per manager (nbre_ese_agent)	Input	DGI
Rate of coverage for document review (tcouvcontr_csp)	Input	DGI
Rate of coverage for spot checks (tcouvcontr_cp)	Input	DGI
Rate of coverage for general accounting verification (tcouvcontr_vgc)	Input	DGI
Additional taxes following document review (emis_csp)	Déterminants	DGI
Additional taxes following spot checks (emis_cp)	Déterminants	DGI
Additional taxes following general accounting verification (emis_vgc)	Déterminants	DGI

Authors 2024, Author based on DGI data

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IV. RESULTS AND DISCUSSIONS

A. Descriptive Analysis

Table 2 provides the descriptive statistics of the variables used for the DEA model and sociodemographic variables for analyzing the determinants of technical efficiency. The sample comprises 588 monthly data points from the Directorate General of Taxes. The primary descriptive statistics of the inputs and output for each center over the examined period are presented in Table 2.

Table 2 Descriptive Statistics of Model Variables. Source: Author 2024

	Mean	Standard deviation	Minimum	Maximum
Variables in the DEA Model	6.56e+09	1.53e+10	2.69e+07	8.99e+10
Monthly Revenue	715.2551	473.216	156	2426
Taxpayer Population	17.87245	12.9429	3	50
Personnel Size	50.5806	17.96522	21.21739	128.3529
Portfolio per Administrator	0.4710884	0.4995884	0	1
Digitalization	0.0136868	0.0206364	0	0.116911
Coverage Rate for Document Checks	2.44e+08	5.13e+08	0	4.41e+09
Complementary Taxes from Document Checks	3.23e+07	7.45e+07	0	6.10e+08
Complementary Taxes from Spot Checks	5.45e+08	1.14e+09	0	6.26e+09
Complementary Taxes from General Verification	3203439	4266920	510000	2.66e+07
Personnel Expenses	588			

Sources: Author (2024)

B. Estimation f Efficiency Scores

Table 3 presents the scores of productive efficiency of the tax administration. On average over the study period, the efficiency score was 64.31% concerning the productive efficiency of the seven tax centers studied. This indicates that there are still opportunities for improving the production of public goods and services in these centers without increasing the means of production. Indeed, the seven centers could increase their respective revenues by 35.69% without recruiting additional staff, increasing personnel expenses, or expanding the tax base. Therefore, we can conclude that the Beninese tax administration is not operating at 100% of its productive efficiency.

Comparing the average efficiency of each center over the period, CIME Atl is the most efficient center with an average score of 77.80%, followed by CIME OP (76.79%), then CIME BA (72.01%), followed respectively by CIME ZC (62.72%) and DGE (58.56%), while the other centers CIME LIT1 (56.11%) and CIME LIT2 (46.16%) are ranked sixth and seventh, respectively. This indicates that CIME LIT2 is less efficient than the other centers.

Table 3 Efficiency Scores. Source: Author 2024

YEARS	CIME ATL	CIME LIT1	CIME BA	CIME LIT2	CIME OP	CIME ZC	DGE	MEAN PER YEAR
2017	0,8171	0,5158	0,6412	0,7523	0,5152	0,5709	0,6907	0,6433
2018	0,8300	0,7580	0,7836	0,7945	0,7534	0,5782	0,5628	0,7229
2019	0,8525	0,6619	0,8591	0,6542	0,8485	0,5278	0,5239	0,7040
2020	0,7804	0,3010	0,6461	0,1483	0,8276	0,6507	0,5134	0,5525
2021	0,7873	0,4750	0,6681	0,2113	0,8467	0,7088	0,4547	0,5931
2022	0,6764	0,4844	0,6977	0,4063	0,8277	0,7115	0,6184	0,6318
2023	0,7025	0,7318	0,7452	0,2641	0,7565	0,6424	0,7353	0,6540
Moy 2017-2023	0,7780	0,5611	0,7201	0,4616	0,7679	0,6272	0,5856	0,6431

Sources: Author (2024)

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Table 4 shows that the efficiency scores of each center are not constant and do not follow a regular trend over the entire study period. The period of digitalization implementation reveals lower efficiency scores than before digitalization. At the same time, the annual revenues during the post-digitalization period have doubled or even tripled compared to the pre-digitalization period. This demonstrates that digitalization has increased the level of productive efficiency of the tax administration. Some factors could explain the evolution of center efficiencies.

Table 4: Efficiency Scores of Tax Centers before and after Digitalization

		DGE	CIME ATL	CIME BA	CIME LIT1	CIME LIT2	CIME OP	CIME ZC
Before digitalization	Mean Efficiency Scores	0,6268	0,8332	0,7613	0,6452	0,7337	0,7693	0,6246
	Average Annual Revenue	329 341 166 282	3 197 444 000	1 911 582 243	23 474 154 519	8 190 128 405	3 265 115 972	1 347 792 114
After digitalization	Mean Efficiency Scores	0,5609	0,7367	0,6892	0,4981	0,2575	0,7607	0,6424
	Average Annual Revenue	546 933 073 900	9 299 842 477	3 360 342 276	35 499 480 615	25 972 990 087	7 243 449 960	3 211 237 712

Sources: Author (2024)

C. Results of Estimation of Determinants of Tax Efficiencies

To determine the influence of socioeconomic variables on efficiency scores, we adopt the following functional model: $scores it$ = (pop_fiscit; eff_persit; depens_persit; nbre_ses_agentit; tcouvcontr_cspit; tcouvcontr_cpit; tcouvcontr_vgcit; emis_cspit; emis_cpit; emis_vgc) emis_csp, emis_cp, and emis_vgc are respectively the amounts of additional taxes following documentary audits, spot checks, and general accounting audits in the centers. They come from the Directorate General of Taxes (DGI).

Table 4 presents the results of the Tobit model estimation in panel data. To assess the statistical foundation of the efficiency scores calculated by the DEA method, we proceeded with a second-stage estimation to identify the exogenous factors influencing the efficiency scores.

The maximum likelihood estimation of the Tobit model on the productive efficiency of the studied tax administration gives us the results in Table 3.

The coefficients of the variables, personnel size, staff directory, personnel expenses, and the coverage rate of general accounting audits are negatively significant. This result shows that an increase in staff size, leading to an increase in personnel expenses, does not allow for an increase in the productive efficiency of the tax administration. These results are consistent with those of authors Abdoul-Akim Wandaogo (2022).

Furthermore, the higher the additional taxes following general accounting audits, the more the productive efficiency of the tax administration deteriorates. This surprising result is consistent with the perception of Arthur Laffer (1980), according to which the positive relationship between the growth rate of taxation and the growth of state revenues would reverse when the tax rate becomes too high.

The sign of the coefficients of the variables population size, and additional taxes following documentary audits is significant and has a positive effect on the efficiency scores of the centers. This result indicates that digitalization, broadening the tax base, and good coverage of documentary audits lead to high efficiency in the tax administration.

Moreover, digitalization improves the level of efficiency of the tax administration. This result is consistent with that of authors Olaoye & Kehinde (2017).

Table 5: Estimation Results of Efficiency Determinants

efficiency	Coef.	Std.Err.	t	P>|t|	[95% Conf. Interval]	
pop_fisc	.0000557	.0000325	-1.71	0.087*	-.0001196	8.16e-06
eff_pers	-.003217	.0016597	-1.94	0.053*	-.0064799	.0000458
n_ese_agent	-.0038117	.0008034	-4.74	0.000***	-.0053911	-.0022323
digit	.0432379	.024813	1.74	0.082*	-.0055423	.0920181
Tauxdecouverturedesvérificat	-1.33607	.5820273	-2.30	0.022**	-2.480285	-.1918552
lEmissionscsp	.0193282	.0106508	1.81	0.070*	-.0016103	.0402667
lEmissionscp	-.0054188	.006171	-0.88	0.380	-.0175504**	.0067128

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lEmissionsvgc	.009146	.0093975	0.97	0.331	-.0093286	.0276205
ldep_pers	-.0567811	.0096263	-5.90	0.000***	-.0757056	-.0378566
_cons	1.338114	.2880049	4.65	0.000***	.7719218	1.904307
var(e.efficiency)	.0277953	.0019437	.0242252	.0318915		

Sources: Author (2024), ***, **, and * Indicate Significance at the 1%, 5%, and 10% Levels, Respectively.

V. CONCLUSION

In this study, we examined the productive efficiency of the tax administration in Benin. To better understand this concept, we first studied the efficiency of seven tax centers: the Directorate General of Taxes (DGE), CIME LITTORAL 1, CIME LITTORAL 2, CIME ATLANTIQUE, CIME OUEME-PLATEAU, CIME BORGOU-ALIBORI, and CIME ZOU-COLLINES.

To evaluate the productive efficiency of the tax administration in Benin, we used the Data Envelopment Analysis (DEA) method. The estimation of scores shows us that the average efficiency of the tax administration is 64.31%, indicating that there are still opportunities for improvement in the production of the studied centers without increasing the means of production.

Furthermore, we used the Tobit model to regress the scores of productive efficiency on factors, including additional taxes related to documentary audits and general accounting audits. The results show that variables such as personnel size, staff directory, personnel expenses, and the coverage rate of general accounting audits negatively and significantly influence the efficiency scores of the centers. Meanwhile, variables such as digitalization, population size, and additional taxes following documentary audits have a positive and significant effect on efficiency scores.

Therefore, the Beninese tax administration must implement measures to manage its database effectively and to establish quality control measures for businesses, to ensure the imposition of "healthy" supplementary taxes and enhance its productive efficiency.

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