mathematics

Article

Efficiency and Competitiveness of the Equatorial Guinean Financial Sector

Tito Ondo Ela-Medja and Pilar Alberca *

Faculty of Economics and Business Administration, Department of Business and Accounting, Universidad Nacional de Educación a Distancia (UNED), Paseo Senda del Rey, 11, 28040 Madrid, Spain
* Correspondence: palberca@cee.uned.es

Abstract: The private sector, in order to function properly, needs financing from the national financial sector, and so the efficiency and competitiveness of said financial sector arouse the interest of many researchers, who perform analyses in order to provide authorities and decision makers with relevant information for the decision-making process and the design of their financial policies. This study contributes to this line of research, analyzing both technical and economic efficiency (allocative and cost efficiency) in the financial sector, focusing on banks, using a sample of Equatorial Guinean firms during the period of 2013–2019. Furthermore, the competitiveness of the financial sector is also analyzed. Knowing how efficient and competitive the financial sector is could answer many of the questions that arise when regulating the national business sector. To carry out this analysis, parametric approaches such as stochastic frontiers and non-parametric techniques such as data envelopment analysis are used, as well as different competitiveness indicators (Boone, Panzar–Rosse). During the research, it is found that the banking sector, which represents the financial sector of the country, operates with low levels of technical efficiency: the Cobb–Douglas production function and the trans-logarithmic production function showed similar average efficiency results. Regarding competitiveness, the financial sector operates under monopolistic competition. Therefore, much remains to be achieved to improve the efficiency and competitiveness of the financial sector for the development of Equatorial Guinea. It is the responsibility of economic agents to provide a good business climate in the country and guarantee perfect competition in the financial market to promote national development.

Keywords: competitiveness and efficiency; financial sector; frontier methodologies; stochastic frontier approach; data envelopment analysis; Boone indicator; Panzar–Rosse H statistic

MSC: 90-00

Citation: Ela-Medja, T.O.; Alberca, P. Efficiency and Competitiveness of the Equatorial Guinean Financial Sector. *Mathematics* **2023**, *11*, 241. https://doi.org/10.3390/math11010241

Academic Editors: Adriana Davidescu, Friedrich Schneider and Maria C. Mariani

Received: 22 November 2022
Revised: 22 December 2022
Accepted: 30 December 2022
Published: 3 January 2023

1. Introduction

The current changing trends in the business environment require, as an essential condition, the parallel evolution of production systems with the aim of guaranteeing the competitiveness and sustainability of national and international economies in the future. For this to happen, companies have to operate with maximum efficiency, as this is the only way to optimize their economic resources to guarantee competitiveness and, therefore, their sustainability, taking into account the threats related to the current environment [1]. In this context, it is essential to analyze the issue of company efficiency, since the private sector is the engine of development and economic growth in nations today [2]. Bearing in mind that this private sector is financed by the financial system, it is extremely important to analyze the efficiency with which financial systems operate to provide financial services, both to individuals and to legal entities [3,4].

Reforms and economic liberalization in the financial sector have been promoted by different international organizations as World Bank and International Monetary Fund.

However, the previous academic literature shows mixed evidence on the impact of reforms and economic liberalization on the competitiveness of the financial sector. There are studies that document the greater vulnerability of financial systems [5,6], while another alternative line of research considers that liberalization and financial reforms improve the competitiveness of the financial sector and the banking subsector. This line of research argues that reforms have a positive impact on the mobilization of savings and allocative efficiency, as well as a positive impact on economic growth [7–10].

Therefore, the mixed evidence in the academic literature and the lack of unanimity among previous studies on the effects of financial reforms call for more research. In-depth studies are needed to analyze the impact of reforms on the competitiveness and efficiency of the banking sector. It is also important to examine the factors that could impact economic growth. This paper delves into this line of research by analyzing efficiency and competitiveness in the empirical context of the banking sector in Equatorial Guinea (E.G.). It is extremely important to remember that much of the success of economies today depends on the performance of their private sectors—that is, those that offer favorable efficiency results and tend to be more competitive and guarantee greater sustainability for their citizens. An important question is how these private sectors are financed. Additionally, the governments of the most industrialized countries cannot finance their economies in their entirety to guarantee the well-being of their citizens; instead, some of the responsibility belongs to the private sector, and the private sector, in turn, sources the majority of its financing in national and international financial systems.

It should be noted that the economic and financial crisis that began in 2007 has worsened since the outbreak of the coronavirus pandemic at the end of 2019, having its worst impacts in underdeveloped countries, due to their poor or non-existent production for the market [11]. This is the case in Equatorial Guinea (E.G.), which, depending on imports from other countries, is impacted by any phenomenon that affects its supplier countries. To curb this vulnerability, the country must have a sufficiently efficient and competent business sector, which can also guarantee the well-being of its citizens [4]. For this to happen, the financial sector must be efficient and competitive enough to serve as the engine of national development. To overcome the limitations of the scarce literature and previous works on the financial sector in the economic context of E.G., the main objective of this study is to analyze the degree of efficiency with which the financial sector of E.G. works, as well as its degree of competitiveness, and its possible relationship with financial stability in the country.

The methodological design of this study includes several stages of modeling to evaluate efficiency and competitiveness in the E.G. financial sector. The final sample of this study deals with the commercial banks that operate in the country, taking 2013–2019 as the final period of analysis. We analyze the efficiency, both technical and economic (allocative and cost efficiency), of the banks that make up the banking subsector of E.G. based on parametric frontier methodologies (SFA, or the stochastic frontier approach), as well as non-parametric frontier methodologies (DEA, or data envelopment analysis). In the case of SFA modeling, we use different production function specifications: Cobb–Douglas, translog function and cost functions. In the second stage, the operational efficiency of banks is analyzed with DEA non-parametric frontier techniques, based on different specifications and modeling: panel data, cross-sectional data, constant returns to scale (CRS) and variable returns to scale (VRS); as well as the estimation of total factor productivity (TFP) based on the Malmquist index and the superefficiency DEA model. The third methodological stage includes the competitiveness evaluation of the financial sector based on two key indicators, namely the Boone indicator and the Panzar–Rosse H-statistic.

The main results regarding both the technical and economic efficiency (allocative and cost efficiency) of the banks that make up the banking subsector of E.G., obtained using parametric frontier methodologies (SFA), suggest that banks operate with low levels of efficiency on average; meanwhile, the efficiency results obtained with the Cobb–Douglas production function and translog production function are very similar (31.3% and 30.6%, respectively).

When carrying out the analysis of technical and economic efficiency with non-parametric frontier methodologies and an input-oriented DEA model assuming CRS or constant returns to scale (with cross-sectional data), the efficiency results indicate that CCEI Bank achieves a high level of technical, allocative and cost efficiency, and the rest of the banks present low levels of technical efficiency, with an average efficiency of 38%. This study also contributes to the competitiveness literature by including a longitudinal analysis with two key indicators (the Boone indicator and Panzar–Rosse H-statistic). According to our results, the average Boone indicator (β) of the E.G. banking subsector is β = −0.69. The longitudinal analysis over the analyzed period indicates that the Boone indicator showed an improvement. Regarding the H statistic, the Panzar–Rosse indicator (H) of the E.G. banking subsector for the period is H = 0.14, indicating that the banking sector has a structure of monopolistic competition.

The rest of this study is structured as follows: the next section shows the theoretical framework and literature review. The third section presents the Materials and Methods, including the database and the methodology used to measure efficiency through different models and assumptions, with the methodology of stochastic frontiers (SFA—stochastic frontier analysis) and data envelopment analysis (DEA), as well as the analysis of competitiveness based on indicators, specifically the Boone indicator and the Panzar–Rosse H-statistic. Finally, the final sections (fourth, fifth and sixth) respectively show the main results, the discussion and the conclusions of this study, as well as the managerial implications and the main limitations.

2. Literature Review

The efficiency score of a production unit can be calculated by comparison with respect to the production frontier or optimal behavior, including best practices and the efficient productive units [12]. Therefore, efficiency is a relative concept, based on the comparison of the performance of a unit with other similar ones. In this regard, [13] defined an empirical reference standard that is the production frontier, made up of the best companies in the sample. Farrell's proposal [13] is based on the assumption that there are constant returns to scale, meaning that technology can be represented by a unit isoquant, which represents the combinations of inputs that allow one unit of output to be produced.

Early studies on efficiency and bank competitiveness focused on scale and scope efficiencies. Methodologically, these studies mainly used cost functions. To better understand the concept of efficiency, it is necessary to analyze it from different perspectives: some authors analyze different types of efficiency and define technical efficiency, allocative efficiency and global efficiency [12,14,15]. Following [13], global efficiency is broken down into two efficiency characteristics: technical and allocative. The first component, technical efficiency, represents the effectiveness in the production process, from inputs or resources to outputs or results. A company (firm or decision-making unit—DMU) is technically efficient if it achieves comparatively the highest production with a given level of resources (inputs), as well as if it comparatively achieves a certain level of production with fewer inputs or factors. The second component is allocative efficiency, which can be defined as the managerial ability to combine optimal input weights, taking into account the price level.

X-efficiency studies were initially proposed by [16], and this subject defines another main line of efficiency research. Efficiency X, also called managerial efficiency, mainly includes cost efficiency as well as profitability efficiency analyses. In the case of cost efficiency, X efficiency derives from the cost function that evaluates the closeness of the cost of a bank to that of the reference company to produce the same results under the same conditions [17,18].

Different authors have addressed the issue of cost efficiency in the banking sector [19,20]. Some authors [21] consider it necessary that for a company to minimize costs, two conditions must be met: (i) on the one hand, the factors must be fully exploited, so that the amount used is the lowest possible, according to the production process chosen; (ii) on the other hand, the productive factors must be combined in the proportions that their prices advise, in order to produce in the cheapest way; that is, the most appropriate production process must be chosen. If the first condition is met, the company is producing with technical efficiency; if the second is fulfilled, we can say that there is allocative efficiency; and as a result of both, the company will be cost efficient.

The competitiveness concept can be approached in several ways: a consumption and production approach, firm competitiveness, economic competitiveness and international competitiveness, among others. With regard to competitiveness, from an economic perspective, it can be defined as the ability of a company to achieve profitability in the market with respect to its competitors [22]. Thus, competitiveness depends on the relationship established between the amount of product offered and its value, compared to the inputs needed to produce or obtain it and the productivity of other companies in the market [23]. In this sense, it is considered that a company can be competitive in its prices if it can offer its merchandise at a price that allows it to cover production costs and obtain a return on the sum or capital it has invested. Competitiveness can also be defined from this perspective as the ability to generate greater consumer satisfaction by setting a price, or the ability to offer a lower price given a certain quality [24,25]. In the international economic sphere, the word competitiveness is used to refer to a country that has the possibility of selling its products or services on the world market, with respect to other competing countries [26]. A country is considered to be competitive as long as all of the companies within it are competitive; that is, a country is competitive when its business sector is, since said sector is the engine of a nation's economy [27].

Focusing on firm competitiveness, some authors [22] have established a classic competitiveness definition when considering the firm's comparative performance with rival companies, in relevant product variables such as price and quality, as well as other main aspects of the service quality, such as the delivery time. [28] defined competitiveness as the ability of a company to permanently integrate into processes of change and innovation, considering social and environmental aspects in its business activities, thereby managing to stay and stand out in a global market, through sustainable development and through the creation of value products.

Regarding the competitiveness of an industry, some authors [29] define it as the ability of national companies in a particular sector to achieve sustained success relative to their foreign competitors, without protections or subsidies. The competitiveness of an industry, then, can be measured in terms of the overall profitability of the companies, the trade balance in the industry, the balance between outgoing and incoming foreign direct investment and direct measurements of cost and quality, while the competitiveness of a company can be measured through its profitability, its level of participation in national and international markets, as well as the level of its exports. Improving competitiveness at the macroeconomic level is a major challenge for countries and regions. An increase in the competitiveness of a country translates into an improvement in the standard of living of its citizens [30]. On the other hand, the concept of competitiveness at the microeconomic level (firm competitiveness) is closely related to productivity in the use of resources or factors of production. Improving productivity is also a challenge at the macro- and microeconomic levels, since it directly affects the competitiveness of companies. Competitiveness is a broad research topic, from the causes that determine superiority at the macro- and microeconomic level to the strategies to improve it. This issue has been extensively addressed in the previous literature, possibly given its implications for public policy and business management [22,24,25].

3. Materials and Methods

3.1. The Financial Sector of Equatorial Guinea

The financial sector of E.G. is made up of a central bank, five commercial banks, three microfinance institutions and five insurance institutions, whose activity is regulated by the Central African Banking Commission (COBAC). The BEAC, or Bank of Central African States, as a central bank, is the supervisory body for the financial and monetary policy of the six member states of the community zone of CEMAC (Economic and Monetary Community of Central Africa). It is responsible for the issuance of notes and coins of the Central African Cefa Franc, as well as the protection and stabilization of the national currency, maintaining the financial system of the member countries and providing an efficient and uninterrupted operation of the payment system. It also manages the foreign reserves of the member states [31]. The five commercial banks that make up the banking subsector of G.E. are:

1. Societé Generale de Banques en Guinea Equatoriale (SGBGE), of French origin. It has operated in the country since 1999, replacing the old BIAO.
2. Caisse Commune d'Epargne et d'Investissement (CCEI Bank), of Cameroonian origin, which was recently acquired by the Equatorial Guinean State. It has been operating in the country since 1994, and is the oldest of all.
3. Banque Gabonaise de Financement et d'Investissement (BGFI Bank), of Gabonese origin. It has operated in the country since 2001.
4. Ecobank, a subsidiary of the pan-African bank Ecobank. It has operated in the country since 2012.
5. Banco Nacional de GE (BANGE), which is the fully state-owned bank of E.G. It was launched in 2006 as part of the national development plan Horizon 2020.

The three microfinance institutions of E.G. are of recent foundation:

- Atom Finance, born in response to the need to create institutions that can promote financial inclusion in the country and thus provide opportunities for small and micro-enterprises as well as individual entrepreneurs and other individuals without access to financial services offered by banks. It offers services such as financial inclusion, micro-credit, deposits (or micro-savings), salary direct debit from small local businesses and national money transfers.
- Bonafide Microbank, which is an institution specialized in providing microcredit services to entrepreneurs, both individual and micro-enterprises.
- Gajo Trading, which is specialized in national and international money transfer services at a very favorable cost, and is qualified as a provider of high-quality and comfortable services.

3.2. Data

The analysis carried out, taking into account the availability of data, dealt with the five commercial banks that operate in the country during the period of 2010–2019. Table 1 (panels A–E) shows the evolution of the main variables in said period: the number of branches, number of employees, number of clients, volume of deposits and volume of loans.

As can be seen in Table 1 (panels A, B, C and E), the evolution of the number of branches, number of employees, number of clients and volume of loans, was positive throughout the entire period analyzed. In the case of the number of branches, it increased from 19 to 59, the number of employees evolved from 748 to 1326, and the number of clients had a positive variation from 117,717 to 213,303. The volume of loans also experienced a favorable variation throughout the analyzed period, going from 474,675 to 849,040, as shown in Table 1, panel E. However, as can be seen in Table 1, panel D, although the variable volume of deposits (million XAF) experienced a positive evolution from 2010 to 2014, as of 2015, the evolutionary trend of this variable clearly decreased.

Table 1. Evolution of main variables of commercial banks (2010–2019).

Panel A: Evolution of the number of branches										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
BANGE	4	4	6	7	11	13	16	18	24	28
SGBGE	5	5	5	5	5	5	6	6	6	7
CCEI Bank	7	8	8	9	9	10	10	10	11	11
BGFI Bank	3	4	5	5	6	6	7	7	7	7
Eco-Bank	0	0	1	1	1	2	2	3	5	6
TOTAL	19	21	25	27	32	36	41	44	53	59
Panel B: Evolution of the number of employees										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
BANGE	180	201	208	218	215	299	345	413	469	487
SGBGE	230	255	288	277	281	283	292	293	292	304
CCEI Bank	196	205	212	217	221	228	250	245	254	267
BGFI Bank	142	148	156	159	163	165	160	162	167	163
Eco-Bank	0	0	10	25	28	48	57	75	93	105
TOTAL	748	809	874	896	908	1023	1104	1188	1275	1326
Panel C: Evolution of the number of clients										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
BANGE	49,707	50,800	61,850	63,880	66,075	76,820	83,000	91,707	100,000	110,000
SGBGE	27,820	27,760	27,765	30,771	32,411	30,863	30,446	30,847	31,564	31,803
CCEI Bank	31,690	31,725	32,150	32,650	32,900	33,460	33,780	34,250	34,800	35,000
BGFI Bank	8500	10,300	11,800	13,200	14,800	15,200	15,980	16,520	16,800	17,300
Eco-Bank	0	0	1200	5312	7285	8090	9674	13,500	15,215	19,200
TOTAL	117,717	120,585	134,765	145,813	153,471	164,433	172,880	186,824	198,379	213,303
Panel D: Evolution of the volume of deposits (millions of XAF)										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
BANGE	91,200	102,000	160,500	187,200	221,850	408,561	349,192	366,546	383,900	401,254
SGBGE	4,099,258	3,616,633	3,618,958	3,998,730	3,883,731	4,318,559	3,714,263	2,922,668	3,009,326	3,018,003
CCEI Bank	487,122	492,935	725,722	895,939	690,678	550,976	476,740	428,530	263,946	249,070
BGFI Bank	0	0	398,082	290,626	203,365	200,066	202,097	220,624	219,990	225,371
Eco-Bank	0	0	4300	11,420	11,650	10,380	11,350	10,830	10,682	10,534
TOTAL	4,677,580	4,211,568	4,907,562	5,383,915	5,011,274	54,88,542	4,753,642	3,949,198	3,887,844	3,904,232
Panel E: Evolution of the volume of loans (millions of XAF)										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
BANGE	0	0	0	1208	2161	10,850	26,295	31,865	41,119	21,607
SGBGE	15,008	11,723	11,171	13,082	9842	10,995	13,302	20,753	10,033	12,319
CCEI Bank	459,667	545,071	438,497	592,144	715,804	700,262	635,251	625,306	649,485	648,062
BGFI Bank	0	0	111,209	122,295	105,578	124,222	118,999	136,388	143,099	151,819
Eco-Bank	0	0	3712	12,127	12,450	13,800	13,450	14,233	14,733	15,233
TOTAL	474,675	556,794	564,589	740,856	845,835	860,129	807,297	828,545	858,469	849,040

Source: Own elaboration of the data offered by the banks.

3.3. Variables and Descriptive Statistics

Total costs include interest expense, personnel costs and other operating costs. A key issue in the debate about the variables to include in the model is related to the role of bank deposits. The previous literature shows a lack of unanimity specifically regarding their consideration as inputs (resources) or as output variables. To establish a consensus, it would be necessary to think of two different approaches that have been developed in the previous literature when analyzing banking efficiency based on deposits: the production approach and the intermediation approach [32–35]. The first perspective is the production approach: this theory defines financial institutions and banks as production units that provide financial services. This approach defines savings accounts (deposits) as output variables. The alternative approach is the intermediation approach. Since the role of financial institutions is intermediation, this approach includes savings accounts (deposits) as input variables [32,34]. Neither of these frameworks explains all of the features of banks and financial institutions [33].

Taking into account previous studies and focusing our study on a purely intermediary approach, deposits are considered as inputs in the banking production process. From this context, based on the previous literature and data availability, the output variables can be defined as follows:

(1) Total loans (Y_1), which mainly include loans (long-term, medium and short-term) and invoices (commercial and discounted). Total loans do not include loan loss reserves.
(2) Other earning assets (Y_2), which mainly include central bank deposits, deposits with other banks, as well as investments (short-term and long-term).
(3) Income without interest (Y_3), which includes derivatives of commissions and the net commission, and other operating income.

The inputs, meanwhile, also include three variables:

(1) Deposits (I_1), which mainly include deposits by customers, loans and funds.
(2) Work (I_2), consisting of the total number of full-time registered employees at an individual bank.
(3) Fixed assets (I_3), which provide the essential materials for the operation of the bank.

Input prices are defined and calculated as follows:

(1) Input price (W_1), which is interpreted as the ratio of interest expense to total deposits.
(2) Labor price (W_2), which is the ratio of personnel spending (total remuneration, including salaries, wages and other benefits paid to employees) to the number of employees.
(3) Fixed assets price (W_3), interpreted as the ratio of operating expenses to fixed assets.

Table 2 reflects the descriptive summary of the total costs, outputs and input prices to better estimate the efficiency of the financial institutions (commercial banks in this case) of Equatorial Guinea (E.G.). Table 3 reflects the same data from the banks (total costs, outputs and input prices), but in average terms for the reference period (2010–2019). Finally, Table 4 summarizes the descriptive statistics of the different variables of the banks that are analyzed in this section.

Table 2. Total costs, outputs, inputs and input prices for E.G. banks (2010–2019).

	ENTITY	Y1	Y2	Y3	W1	W2	W3	I1	I2	I3	CT
2010	BANGE	-	198,001	17,198	0.092	15.092	0.28	91.2	180	30,364	19,636
	CCEI Bank	459,667	175,042	5416	0.008	8.581	0.216	487,122	230	45,507	15,826
	SGBGE	15,008	252,378	6777	0.001	14.327	0.009	4,099,258	196	1,147,121	15,899
	BGFI Bank	-						-	142		-
	Ecobank	-						-	-		-
2011	BANGE	-	215,120	20,233	0.092	14.227	0.265	102,000	201	33,738	21,162
	CCEI Bank	545,071	205,932	6372	0.009	8.599	0.216	492,935	255	50,564	17,349
	SGBGE	11,723	280,420	7530	0.001	15.22	0.009	3,616,633	205	1,274,579	17,481
	BGFI Bank	-						-	148		-
	Ecobank	-						-	-		-
2012	BANGE	-	223,145	22,481	0.065	15.275	0.265	160,500	208	37,486	23,513
	CCEI Bank	438,497	228,813	7080	0.005	8.46	0.216	725,722	288	56,182	18,528
	SGBGE	11,171	293,121	8210	0.001	15.802	0.01	3,618,958	212	1,275,393	18,940
	BGFI Bank	111,209	73,150	5315	0.008	7.949	1.026	398,082	156	8211	12,875
	Ecobank	3712	11,420	3821	0.363	23.59	1.568	4300	10	1369	3942
2013	BANGE	1208	241,005	24,651	0.046	17.147	0.318	187,200	218	34,709	23,444
	CCEI Bank	92,144	222,149	7150	0.004	9.773	0.22	895,939	277	52,020	17,853
	SGBGE	13,082	305,822	8890	0.001	16.498	0.009	3,998,730	217	1,408,313	20,399
	BGFI Bank	122,295	81,215	6450	0.012	13.403	0.948	290,626	159	11,783	16,867
	Ecobank	12,127	15,301	4652	0.211	42.824	2.117	11,420	25	1694	7067

Table 2. *Cont.*

	ENTITY	Y1	Y2	Y3	W1	W2	W3	I1	I2	I3	CT
2014	BANGE	2161	247,321	23,815	0.03	20.454	0.393	221,850	215	33,057	24,051
	CCEI Bank	15,804	211,570	6593	0.005	10.705	0.22	690,678	281	49,543	17,367
	SGBGE	9842	318,523	9570	0.001	17.24	0.01	3,883,731	221	1,368,064	21,858
	BGFI Bank	105,578	83,450	6720	0.02	20.503	0.777	203,365	163	11,896	16,702
	Ecobank	12,450	19,182	5116	0.239	68.046	2.489	11,650	28	2019	9713
2015	BANGE	4957	257,851	22,162	0.013	18.385	0.471	408,561	299	30,608	25,055
	CCEI Bank	700,262	156,738	5042	0.006	11.378	0.213	550,976	283	46,299	16,166
	SGBGE	10,995	331,224	10,250	0.001	17.719	0.01	318,559	228	1,520,253	23,317
	BGFI Bank	24,222	112,010	5810	0.02	26.301	0.669	200,066	165	13,565	17,372
	Ecobank	13,800	23,063	5672	0.31	57.083	2.758	10,380	48	2344	12,420
2016	BANGE	34,005	170,822	18,104	0.011	19.809	0.693	349,192	345	25,140	28,209
	CCEI Bank	635,251	142,045	4218	0.007	11.668	0.149	476,740	292	53,081	14,623
	SGBGE	13,302	343,925	10,930	0.001	17.08	0.011	714,263	250	1,544,150	24,776
	BGFI Bank	18,999	105,870	5974	0.02	33.692	0.474	202,097	160	21,483	19,608
	Ecobank	13,450	26,944	6228	0.267	62.714	2.962	11,350	57	2669	14,506
2017	BANGE	82,644	83,793	17,500	0.008	19.785	0.867	366,546	413	26,907	34,279
	CCEI Bank	25,306	59,190	3883	0.009	11.952	0.112	428,530	293	53,721	13,319
	SGBGE	20,753	356,626	11,610	0.001	18.367	0.011	2,922,668	245	1,600,120	26,235
	BGFI Bank	136,388	96,420	6320	0.019	39.763	0.422	220,624	162	24,685	20,959
	Ecobank	14,233	30,825	6784	0.276	58.792	3.121	10,830	75	2994	16,742
2018	BANGE	128,000	92,001	16,900	0.005	18.816	1.231	383,900	469	23,745	39,999
	CCEI Bank	49,485	53,210	3148	0.016	12.529	0.07	263,946	292	58,265	11,856
	SGBGE	10,033	369,327	12,290	0.001	18.622	0.011	3,009,326	254	1,656,090	27,694
	BGFI Bank	43,099	89,177	6545	0.019	44.866	0.317	219,990	167	31,031	21,401
	Ecobank	14,733	34,706	7340	0.301	56.388	3.249	10,682	93	3319	19,240
2019	BANGE	23,723	87,310	15,900	0.003	19.027	1.452	401,254	487	24,192	45,758
	CCEI Bank	648,062	51,087	3051	0.018	12.498	0.039	249,070	304	55,490	10,432
	SGBGE	12,319	382,028	12,970	0.001	18.577	0.012	3,018,003	267	1,712,060	29,153
	BGFI Bank	151,819	81,382	6800	0.018	52.415	0.267	225,371	163	36,591	22,399
	Ecobank	15,233	38,587	7896	0.346	57.893	3.355	10,534	105	3645	21,953

Source: Own elaboration of the data offered by the banks.

Table 3. Total costs, outputs and input prices for E.G. banks in mean values (2010–2019).

Variable	BANGE	CCEI Bank	SGBGE	BGFI Bank	Eco-Bank
Total Cost (Millions XAF)	28,511	15,332	22,575	14,818	10,558
Total Asset (Millions XAF)	405,315	781,563	4,144,613	229,889	100,268
Social Capital (Millions XAF)	12,000	10,000	10,022	20,000	10,000
Outputs					
Y1: Loans (Millions XAF)	67,670	600,955	12,823	126,701	25,795
Y2: Other Assets (Millions XAF)	181,637	150,578	323,339	90,334	25,004
Y3: Incomes without interest (Millions XAF)	19,894	5195	9903	6242	5939
Input Prices					
W1 Fund Price	0.037	0.009	0.001	0.017	0.289
W2 Labor Price	17.801	10.614	16.945	23.889	42.733
W3 Fixed Asset Price	0.623	0.167	0.01	0.612	2.702
Number of branches	28	11	7	7	6
Total observations	50				

Source: Own elaboration of the data offered by the banks.

Table 4. Descriptive Statistics: total costs, outputs and input prices 2010–2019 (M XAF).

	TC	TA	SC	Y1	Y2	Y3	W1	W2	W3	I1
BANGE										
Mean	28,511	405,315	12,000	67,670	181,637	19,894	0.037	17.801	0.623	267,220
Median	24,553	395,542	12,000	53,559	206,561	19,168	0.021	18.600	0.432	285,521
Minimum	19,636	327,489	12,000	0	83,793	15,900	0.003	14.227	0.265	91,200
Maximum	45,758	499,144	12,000	182,644	257,851	24,651	0.092	20.454	1.452	408,561
S. Deviation	8680	53,670	0	73,210	69,428	3181	0.035	2.231	0.430	127,486
CCEI Bank										
Mean	15,332	781,563	10,000	600,955	150,578	5195	0.009	10.614	0.167	526,166
Median	15,996	766,981	10,000	630,279	165,890	5229	0.008	11.041	0.214	490,029
Minimum	10,432	598,264	10,000	438,497	51,087	3051	0.004	8.460	0.039	249,070
Maximum	18,528	1,071,674	10,000	715,804	228,813	7150	0.018	12.529	0.220	895,939
S. Deviation	2716	150,106	0	93,661	71,854	1572	0.005	1.641	0.070	201,213
SGBGE										
Mean	22,575	4,144,613	10,022	12,823	323,339	9903	0.001	16.945	0.010	3,620,013
Median	22,588	4,183,667	10,022	12,021	324,874	9910	0.001	17.160	0.010	3,666,611
Minimum	15,899	3,277,490	10,022	9842	252,378	6777	0.001	14.327	0.009	2,922,668
Maximum	29,153	4,891,601	10,022	20,753	382,028	12,970	0.001	18.622	0.012	4,318,559
S. Deviation	4438	529,346	0	3200	41,196	2071	0.000	1.474	0.001	490,029
BGFI Bank										
Mean	14,818	229,889	20,000	126,701	90,334	6242	0.017	23.889	0.612	196,022
Median	17,119	254,634	20,000	123,259	86,313	6385	0.019	23.402	0.571	211,678
Minimum	0	0	20,000	105,578	73,150	5315	0.008	0.000	0.267	0
Maximum	22,399	425,731	20,000	151,819	112,010	6800	0.020	52.415	1.026	398,082
S. Deviation	8291	133,934	0	16,966	13,393	507	0.004	18.633	0.287	119,618
Eco-Bank										
Mean	10,558	100,268	10,000	25,795	25,004	5939	0.289	42.733	2.702	8115
Median	11,067	79,739	10,000	28,535	25,004	5950	0.288	56.736	2.860	10,608
Minimum	0	0	10,000	3712	11,420	3821	0.211	0.000	1.568	0
Maximum	21,953	247,225	10,000	43,387	38,587	7896	0.363	68.046	3.355	11,650
S. Deviation	7761	92,437	0	12,478	9506	1388	0.051	25.688	0.615	4774

Source: Own elaboration of the data offered by the banks. TC = Total Cost; TA = Total Asset; SC = Social Capital; Y1 = Total Loans; Y2 = Other Earning Assets; Y3 = Income without Interest; W1 = price of funds; W2 = Labor Price; W3 = Fixed Asset Price.

In empirical studies on efficiency, there are other explanatory variables that have a significant influence on said levels of efficiency in a business sector, such as environmental and surrounding variables: geographical, political, economic, social or cultural [36]. In fact, these variables tend to have a high impact on the empirical results when they are included or considered in the efficiency models [37]. Environmental and surrounding variables, in the case of financial institutions, can be grouped into two categories [38,39]:

(a) Variables related to macroeconomic features that could influence the main characteristics of the demand for banking products.
(b) Specific variables or factors that could influence the model of the banking system.

Environmental factors include macroeconomic variables, but also social ones that suggest the main macroeconomic and social circumstances in which banks are offering their financial services [40,41]:

(1) Population density (Z_1), or the population of a country per km^2. According to the IMF, banks can be more cost-efficient by providing products and services in areas with a low population density. E.G. had a population density of 50.6 people per km^2 in 2019 [40].
(2) GDP per capita (Z_2), or the income per capita and the ratio of GDP to population. In general, a country with a high GDP per capita indicates that it has a relatively well-developed, open and more competitive financial market. According to the IMF, E.G. had an average GDP per capita of XAF 8,370,423 or USD 16,240 during the period analyzed [40].

(3) Inflation (Z_3), approached by the Consumer Price Index (CPI) as a main indicator or proxy variable for inflation. The increase in CPI could influence the depreciation of the currency with negative effects that affect the increase in the price level. The World Bank discloses that during the analyzed period, E.G. had an average inflation rate of 2.84% per year [41].

(4) Unemployment rate (Z_4)—up to a certain point, a higher unemployment rate normally indicates higher costs for operating banks due to the demand for precautionary savings. According to the World Bank, during the analyzed period, E.G. had an average unemployment rate of 8.76% [41].

The second category of environmental variables includes four main variables: bank concentration, net interest margin, capital ratio and intermediation ratio [38,39].

(5) Banking concentratio (Z_5), measured by the total assets of the largest banks as part of the total assets of the entire banking industry. The previous literature indicates that there is an ambiguous relationship between bank concentration and the cost of banks. The main conclusions of [42] support the hypothesis of banking concentration as an indicator of market power that is positively related to the cost of banks. While the cost can decrease considerably due to high management, higher production efficiency can lead to greater concentration. Thus, the relationship between bank concentration and the cost of banks is negative.

(6) Capital Ratio (Z_6), or the relationship between equity and risk-weighted assets. This ratio measures the financial health of a bank and relates the funds a financial institution has to deal immediately with possible unforeseen events with the risk it assumes through the assets it has on its balance sheet. According to data provided by the World Bank, during the period studied, the average capital ratio for the banking system of G.E. in the study period was 23.11% [41].

(7) Net interest margin (Z_7) is the percentage of the book value of the bank's net interest income and the total assets that generate income. This variable (net interest margin) takes into account the bank's effectiveness in the production process, by transforming deposits into loans. We expect that high net interest margins could have a positive influence by reducing costs as well as increasing net interest income.

(8) Intermediation ratio (Z_8) is the percentage of loans to deposits. The intermediation ratio takes into account the bank's effectiveness in the production process, by transforming their deposits into loans. We expect a negative association between the intermediation ratio and costs.

3.4. Bank Efficiency Analysis Methods

3.4.1. Stochastic Frontier Analysis

The stochastic frontier model was initially proposed for cross-sectional data by [43] and [44] The original model is a parametric method that considers a production function and two main components in the error term: technical inefficiency and random effects. The original specification is shown in the following expression:

$$Y_i = \beta X_i + (V_i - U_i) \quad \forall i = 1,\ \ldots,\ N \tag{1}$$

where Y_i is the output variable, X_i is an input vector (firm i), and $(V_i - U_i)$ is the error term. The first component V_i is a random variable $(\mid \left|N\left(0,\sigma_u^2\right)\right|$ and the second component is U_i as a non-negative random variable that accounts for technical inefficiency $\mid \left|N\left(0,\sigma_u^2\right)\right|$.

In this work, a Cobb–Douglas-type cost function was specified with panel data assuming a semi-normal distribution. Following the Cobb–Douglas-type cost function, to model a stochastic frontier cost function, we changed the error term specification $(V_{it} - U_{it})$ to $(V_{it} + U_{it})$. The original model of the cost function is as follows:

$$Y_{it} = \beta X_{it} + (V_{it} + U_{it}) \quad \forall i = 1,\ \ldots,\ N; t = 1,\ \ldots,\ T \tag{2}$$

In our case, to achieve the main objective of this work, we specified the following Cobb–Douglas stochastic cost frontier model with panel data. Following [45] and taking the observations of the five commercial banks in the subsector during the period of 2013–2019, the following model was estimated:

$$\ln TC_{it} = \beta_0 + \beta_1 lnW_{1it} + \beta_2 lnW_{2it} + \beta_3 lnY_{1it} + (V_{it} + U_{it}) \quad (3)$$

where CT_{it} is the total production cost of bank i in the period of time t (2013–2019), W_{1it} and W_{2it} are the input prices (funds and labor, respectively) of bank i in the period of time t (2013–2019), and Y_{1it} is the output (bank loans) of bank i in the same period of time. The components V_{it} and U_{it} are the random error and the inefficiency component, respectively. The inefficiency model was also formulated:

$$U_{it} = \delta_0 + \delta_1 lnZ_{8it} + \delta_2 lnZ_{5it} + w_{it} \quad (4)$$

where Z_{8it} and Z_{5it} are the intermediation ratio and banking concentration, respectively, two environmental variables that are used as components of inefficiency, while the variable w_{it} is the random error of the inefficiency model.

3.4.2. Data Envelopment Analysis (DEA)

Another way to analyze the efficiency of financial institutions is through non-parametric methods. Among the best known is data envelopment analysis (DEA). In this analysis, the terminology "firm" or institution is replaced with the terminology decision-making unit (or DMU). The technical, allocative and cost efficiency of the banks to be studied are analyzed, as well as the Malmquist productivity index.

Having information about prices and considering the behavioral objective, such as cost minimization or profit maximization, both efficiencies (technical and allocative) can be measured. In this case, the following input-oriented DEA model can be proposed for cost minimization (input-oriented DEA cost model and assuming CRS):

$$min_{\lambda, x_i^*} w_i' x_i^* \quad (5)$$

Subject to:

$$-y_i + Y\lambda \geq 0,$$
$$x_i^* - X\lambda \geq 0,$$
$$N1'\lambda = 1$$
$$\lambda \geq 0,$$

The total cost efficiency (CE) of the i DMU is calculated as:

$$CE = \frac{w_i' x_i^*}{w_i' x_i} \quad (6)$$

that is, the rate of minimum cost over observed cost.

In our case, based on the intermediation approach, bank loans Y_{1i} were considered as the output variable, and bank deposits and labor (I_1 and I_2, respectively) as inputs. To include allocative efficiency in the model, and thus determine the three efficiencies (technical, allocative and cost), the input prices of funds and labor (W_1 and W_2, respectively) were included in the estimated model. Assuming constant returns to scale (CSR), allocative efficiency is obtained as the ratio of technical efficiency to cost efficiency,

$$Allocative\ Efficiency\ \frac{Cost\ Efficiency}{Technical\ Efficiency} \quad (7)$$

In the case of the input-oriented DEA panel data technical efficiency model assuming CRS, also known as the DEA CCR model, it consists of solving the following linear program:

$$\min\theta \tag{8}$$

Subject to:

$$\sum_{n=1}^{N} y_{nj}\lambda_n \geq y_{mj};\, j = 1,\, 2,\, \ldots,\, J$$

$$\sum_{n=1}^{N} x_{ni}\lambda_n \leq \theta_m x_{mi};\, i = 1,\, 2,\, \ldots,\, I$$

$$\lambda_n \geq 0;\, n = 1,\, 2,\, \ldots,\, N;\, \theta_m\ libre$$

where $\theta_m = Efficiency\ rate\ of\ m - DMU$

For this model, bank loans Y_{1i} were considered as the output variable, and bank deposits and labor (I_1 and I_2, respectively) as inputs.

Regarding the efficiency score of the standard CRS model developed by [46], in this study we also implemented DEA super-efficiency modeling [47]. This algorithm makes it possible to establish the ranking of the efficient units (firms or DMUs) that obtain a score higher than one, as well as to advance in benchmark analysis knowing the real performance of each company evaluated as efficient. To do this, the efficiency score is calculated with the CCR model (see Equation (5)) excluding the evaluated DMU from the restrictions in order to assess the maximum radial change that is feasible for a DMU (or firm) to continue being efficient [47].

3.4.3. DEA Malmquist Model with Panel Data

One of the approaches in the DEA literature is the estimation of the Malmquist productivity index with panel data, where results can be obtained assuming both returns to scale (CRS or constant returns to scale and VRS or variable returns to scale).

The authors [48] adopted an index for productivity measures initially proposed by [49] in the consumer theory field. The authors [50] develop the Malmquist index (MI) assuming two consecutive time periods (t and t + 1) and the production technology in each of them based on distance functions. The input-oriented Malmquist index (MI) is formulated as follows:

$$MI(y_{t+1}, x_{t+1}, y_t, x_t) = \left[\frac{d_i^t(y_{t+1}, x_{t+1})}{d_i^t(y_t, x_t)} . \frac{d_i^{t+1}(y_{t+1}, x_{t+1})}{d_i^{t+1}(y_t, x_t)}\right]^{\frac{1}{2}} \tag{9}$$

Equation (11) reflects the productivity (t + 1 period) compared with that of the reference period (t). In the literature on the Malmquist index, a value greater than unit (MI > 1) will indicate a TPF (total factor productivity) increase from the reference period (t) to period t + 1. This TPF indicator is actually the geometric mean of two Malmquist total factor productivity indexes, where one of them is based on the technology of the reference period (t), while the another uses the technology of the t + 1 or next period. To calculate the TPF indicator from the above equation, we calculated the distance functions based on four linear programming (LP) problems. We started by assuming the CRS technology, and we were faced with the following LP:

$$\left[d_i^t(y_t, x_i)\right]^{-1} = max_{\varnothing,\lambda}\phi, \tag{10}$$

Subject to:

$$-\phi y_{it} + Y_t\lambda \geq 0,$$

$$x_{it} - X_t\lambda \geq 0,$$

$$\lambda \geq 0,$$

The next formulations of linear programming (LP) are as follows:

$$\left[d_i^{t+1}(y_{t+1}, x_{i+1})\right]^{-1} = max_{\varnothing,\lambda}\phi, \tag{11}$$

Subject to:

$$-\phi y_{it+1} + Y_{t+1}\lambda \geq 0,$$
$$x_{it+1} - X_{t+1}\lambda \geq 0,$$
$$\lambda \geq 0,$$

$$\left[d_i^{t}(y_{t+1}, x_{i+1})\right]^{-1} = max_{\varnothing,\lambda}\phi, \tag{12}$$

Subject to:

$$-\phi y_{it+1} + Y_{t}\lambda \geq 0,$$
$$x_{it+1} - X_{t}\lambda \geq 0,$$
$$\lambda \geq 0,$$

$$\left[d_i^{t+1}(y_{t}, x_{i})\right]^{-1} = max_{\varnothing,\lambda}\phi, \tag{13}$$

Subject to:

$$-\phi y_{it} + Y_{t+1}\lambda \geq 0,$$
$$x_{it} - X_{t+1}\lambda \geq 0,$$
$$\lambda \geq 0,$$

3.5. Competitiveness Analysis Methods

3.5.1. Boone Indicator

For the estimation of the Boone indicator, [51] formulated a model aimed at estimating the market share:

$$ln(S_i) = \alpha + \beta ln(Cm_i) + u_i \tag{14}$$

where S_i is the market share or participation, defined as $S_i = \frac{Y_{1i}}{\sum_{j=1}^{n} Y_{1j}}$, Y_{1i} is the output of bank i (loans), and the sum of the denominator indicates the output of the banking system as a whole $(i \in j,\ j = 1,\ \ldots, n)$. Additionally, Cm_i is the marginal cost of bank i and u_i represents the error term, while the parameter β is interpreted as the Boone indicator. With the previous equation, it is possible to observe a high share or market share in those banks with lower marginal costs—that is, with a negative β coefficient. In other words, the authors found that there is an inverse correlation between market share and marginal cost in the banking sector. Therefore, the higher the competitiveness in the sector, the stronger this inverse relationship is and the larger, in absolute terms, the value of the coefficient β will be.

For empirical reasons, the equation is specified in log-linear terms, basically to avoid heteroscedasticity problems. Furthermore, this specification implies that β is an elasticity, which facilitates its interpretation and comparison. In fact, from the above equation, it follows that, under a situation of perfect competition, the market share of each bank trends to zero, so the dependent variable trends to $-\infty$. As each agent is a price taker, and the price is equal to the marginal cost, the term that accompanies the coefficient β is constant, which implies that β trends to $-\infty$. On the contrary, $\alpha = \beta = 0$ is consistent with a monopoly scenario, where the share of the only bank is $S_i = 1$.

In this work, the estimates are established for the five commercial banks that make up the E.G. banking subsector for the period of 2013–2019—that is, a panel data analysis with 35 observations is performed. In this case, Equation (14) can be written as:

$$ln(S_{it}) = \alpha + \beta ln(Cm_{it}) + u_{it} \tag{15}$$

where S_{it} is the market share of bank i, in period t, defined as $S_{it} = \frac{Y_{1it}}{\sum_{j=1}^{n} Y_{1jt}}$, Y_{1it} is the output of bank i in period t (loans), and the sum indicates the output of the banking system as a whole $(i \in j,\ j = 1,\ \ldots, n)$. Additionally, the Cm_{it} is the marginal cost of bank i in period t and u_{it} represents the error term, while the parameter β is interpreted as the Boone indicator.

The Boone indicator can sometimes be estimated as the elasticity (in discrete terms) of the benefits obtained by the banking subsector during a period with respect to its costs incurred during said period. In other words, the Boone indicator relates the benefits and marginal costs of the banking subsector in a given period. Mathematically:

$$\beta = \frac{\partial \pi_t / \pi_m}{\partial C_t / C_m} = \frac{\partial \pi_t}{\partial C_t} . \frac{C_m}{\pi_m} \tag{16}$$

where $\partial \pi_t$ is the change in profit of the banking subsector in period t; π_m is the average benefit obtained by the subsector in period t; ∂C_t is the total cost of the banking subsector in period t; while C_m is the average cost of the banking subsector in period t. In this case, β is the Boone indicator of the banking subsector during the period in question.

3.5.2. Panzar–Rosse H-Statistic

The model proposed by Panzar and Rosse (P–R) has similarities with the one proposed by Boone. The P–R index consists of the sum of elasticities (total income with respect to the price) of all banks. In other words, the P–R index relates the total revenues to the input prices of the banking subsector in a given period. The authors [52] developed a model of competitive behavior as a reaction to the empirical and theoretical deficiencies of structural models such as the structure–behavior–performance paradigm. These authors derived a test to assess the degree of competitiveness from the estimation of income equations in reduced form. There are different studies that have used the P–R indicator in different empirical contexts [53–60]. One way of comparing the degree of competitiveness existing in the banking markets is through an index constructed as the sum of the elasticities of bank revenues in the face of variation in input prices, this index being known as the H-Statistic [55].

$$H = \sum_{k=1}^{m} \frac{\partial R_i}{\partial w_{ki}} . \frac{w_{ki}}{R_i} \tag{17}$$

where ∂R_i is the variation in equilibrium income, ∂w_{ki} is the variation in the price of the inputs and the subscripts k and i indicate the type of inputs and the company with which it is working, respectively.

The type of competitiveness should be analyzed as the degree of influence of resource prices (or input prices) on equilibrium income. For this, it is assumed that firms operate at their long-term equilibrium levels. [61] showed that the H-statistic is an increasing function of the elasticity of demand—that is, the lower the market power exercised by banks, the higher H will be, which implies that this statistic is not only useful for differentiating certain types of market behavior, but its magnitude can be assumed as a measure of the degree of competitiveness.

The H-statistic is an indicator of competitiveness that allows for differentiating market behaviors. This measure is inversely proportional to the market power of banks: a higher value of H indicates a lower market power [61]. Furthermore, the H-statistic is an increasing function with respect to demand elasticity. Extreme market structures are useful to understand the underlying intuition in the construction of the H indicator [55,62]. When the market structure is perfectly competitive, a change in factor prices results in a corresponding change in average and marginal costs. The output level is not affected, and the price level rises in the same proportion as marginal costs. In this case, the H-statistic takes the value of one, because revenues increase in the same proportion as the increase in factor prices. At the opposite extreme, in a monopolistic market structure, an increase in input prices would be reflected (just as in perfect competition) in an increase in marginal costs faced by the monopolist in this case, and consequently in higher prices. However, since the monopoly always operates on the elastic part of its demand curve, the new revenue would be lower than when costs were lower. Thus, an increase in the price of inputs would translate into a fall in revenue and a negative H indicator, while a value between zero and one assumes the existence of a certain degree of market power consistent with a regime of imperfect competition other than monopoly or perfect collusion, since in this case revenues grow less than proportionally to variations in the price of factors of production, due to the greater instability of demand that characterizes this type of market.

4. Results

4.1. Efficiency of the Financial Sector

When carrying out the analysis of both the technical and economic efficiency (allocative and cost efficiency) of the banks that make up the banking subsector of E.G., we obtain different results with different methods and specifications, as reflected in Table 5: firstly, based on a parametric frontier methodology (SFA—stochastic frontier model), and secondly based on a non-parametric frontier methodology (data envelopment analysis—DEA). Regarding the stochastic frontier analysis (SFA) with panel data, three different models were estimated. A Cobb–Douglas production function, shows that CCEI Bank and Ecobank present significant levels of technical efficiency (0.716 and 0.57, respectively), with the average technical efficiency of the subsector being 0.313. Very similar results are obtained with a translogarithmic production function—that is, the same banks mentioned above present significant levels of technical efficiency (0.699 and 0.708, respectively), with the average technical efficiency of the subsector being 0.306. Finally, with a function of Cobb–Douglas costs, different levels of cost efficiency are obtained, where BANGE, BGFI Bank and Ecobank present higher levels of cost efficiency (3.34%, 2.62% and 5.08%, respectively), with the average level being 2.8%.

Table 5. Efficiency of the Financial Subsector of E.G.

	Stochastic Frontiers Panel Data			Data Envelopment Analysis (DEA)						
ENTITY	**Production Function C-Douglas**	**Production Function Translog**	**Cost Function C-Douglas**	**DEA Cross S. T. Efficiency**	**DEA Cross S. Alloc. Effic.**	**DEA Croos S. Cost Eff.**	**DEA P. Data (CRS)**	**DEA Malmquist (CRS)**	**DEA Malmquist (VRS)**	**Superefficeincy DEA Ranks (Number of Time Periods)**
BANGE	0.051	0.025	0.033	0.231	0.702	0.162	0.581	0.784	0.931	1
CCEI Bank	0.716	0.699	0.019	1.000	1.000	1.000	0.964	1.000	1.000	2
SGBGE	0.001	0.004	0.010	0.017	0.170	0.003	0.620	0.598	0.848	2
BGFI Bank	0.228	0.093	0.026	0.346	0.979	0.339	0.925	0.872	0.889	2
Eco Bank	0.570	0.708	0.051	0.343	0.660	0.226	1.000	1.000	1.000	**5**
Mean	**0.313**	**0.306**	**0.028**	**0.387**	**0.702**	**0.346**	**0.818**	**0.851**	**0.934**	

Source: Own elaboration.

Regarding the data envelopment analysis (DEA), different models were estimated both with cross-sectional data and with panel data, and the following results were obtained: with an input-oriented DEA model and assuming RCE (with cross-section data), it was observed that CCEI Bank has a high level of technical, allocative and cost efficiency (1.00), and the rest of the banks present low levels of technical efficiency, with an average of 0.38. With respect to allocative efficiency, all banks (with the exception of SGBGE) present sufficient levels of allocative efficiency, with the average allocative efficiency of the subsector being 0.7; meanwhile, and with the exception of CCEI Bank, all banks have low levels of cost efficiency, with an average of 0.35.

With an input-oriented DEA model and assuming CRS (with panel data), it is observed that almost all banks show acceptable levels of technical efficiency, with CCEI Bank, BGFI Bank and Ecobank showing the highest levels of technical efficiency. With this model, an average technical efficiency of the subsector of 0.82 is also obtained. The two estimated DEA Malmquist models (assuming CRS and VRS) lead to similar results at average technical efficiency levels (0.85 and 0.93, respectively). With these two models, almost all banks present acceptable levels of technical efficiency.

Following the DEA modeling initially proposed by [47], we carried out a super-efficiency analysis that allows us to obtain the ranking of the units that are classified as super-efficient (with an efficiency score greater than one) throughout he analyzed period 2013–2019. Table 5 shows the super-efficiency report. As can be seen, Ecobank is the top-ranked company and BGFI bank is the worst ranked company. These results could be useful in benchmark analysis comparing the relative performance of the companies to select the best-ranked firm as a reference model.

A very important observation during the analysis is that, despite having high volumes of deposits (exceeding all of the rest of the subsector), the SGBGE bank presents very low levels of efficiency, both technical and allocative and in costs in all models, except for in the last three models (DEA with panel data and Malmquist with CRS and VRS). These results seem to suggest that the bank needs to make certain changes or modifications to its operations to be an efficient bank from an intermediation perspective, which has been the approach followed in this work. In this case, it is also worth mentioning that, from a purely production perspective, SGBGE would be the most efficient bank, since if it considers its deposits as outputs, we would say that it is producing large volumes of outputs using lower amounts of inputs. Reiterating once again what was indicated above, from an intermediation or microfinance service-provision perspective, SGBGE must modify its operating techniques to provide coverage to the segment of the population excluded from the traditional financial system. From the same intermediation approach, it should also be noted that CCEI Bank is the best bank or the most efficient bank in the subsector, as it presents sufficient or high levels of efficiency with all the estimated models. In other words, it is the bank that knows best how to combine its inputs to achieve its outputs—that is, loans and other services to its customers.

4.2. Competitiveness of the Financial Sector

In the analysis of the competitiveness of the E.G. financial sector and taking 2013–2019 as the ideal period of analysis, fundamentally due to the abrupt changes that the country's economy has suffered since 2013, the year in which the country entered into crisis, the following results were obtained, which are shown in Table 6.

Table 6. Boone indicator for E.G. financial subsector (2013–2019).

	2013–2014	**2014–2015**	**2015–2016**	**2016–2017**	**2017–2018**	**2018–2019**
Profit variation (Δπt)	6704.33	5098.22	−1086.77	−861.62	−2707.73	−2278.72
Average Profit (πm)	17,848.45	23,749.72	20,864.95	15,000.25	13,215.58	10,722.36
Cost Variation (ΔCt)	4061.59	4637.97	7391.70	9812.70	8655.85	9504.70
Average Cost (Cm)	87,660.90	92,010.68	98,025.52	106,627.72	115,861.99	124,942.26
Boone Indicator (β)	**8.11**	**4.26**	**−6.91**	**−0.62**	**−2.74**	**−2.79**

Source: Own elaboration.

The average Boone indicator *(β)* of the E.G. banking subsector for the period of 2013–2019 is $\beta = -0.69$, presenting an improvement during the analyzed period, starting from an initial value $\beta = 8.11$ in the period 2013–2014 to $\beta = -2.79$ in the period 2018–2019. This result shows that during the analyzed period, the E.G. banking subsector had significant growth in its level of competitiveness, which begins to be reflected with the fall in the value of β since the 2015–2016 period. It is in this period that the subsector begins to show a certain degree of competitiveness, since it is the moment in which its negative values are significant in absolute terms.

Regarding the H-statistic proposed by [52], with the aim of studying the competitiveness of the E.G. banking subsector, data from the period of 2014 to 2019 were considered (due to the complete unavailability of data for 2013), and, following Equation (17), the results shown below in Table 7 were obtained. Firstly, a high fluctuation is observed in the variation in the banks' revenues in the financial subsector. This fluctuation in the variation in revenues can be explained by the economic situation of the country during the analyzed period, which also had significant effects on the banks of the subsector. However, the price of the inputs does not suffer as much variation throughout the analyzed period.

Table 7. P–R indicator for E.G. financial subsector (2014–2019).

	2014–2015	2015–2016	2016–2017	2017–2018	2018–2019
Total Revenues variation (ΔRi)	−458.17	6960.53	1766.13	−445.34	−4588.25
Average Revenue (Ri)	970,67.31	100,318.49	104,681.81	105,342.21	102,825.41
Input Price variation (ΔWi)	−5.80	14.22	3.95	2.94	9.48
Input price (Wi)	114.09	111.86	114.34	112.27	112.23
P-R Indicator	**0.09**	**0.55**	**0.49**	**0.16**	**−0.53**

Source: Own elaboration.

The average H-statistic or Panzar–Rosse indicator (H) of the E.G. banking subsector for the period 2014–2019 is $H = 0.14$. However, it oscillated between -1 and +1 values throughout the analyzed period, highlighting the structure of monopolistic competition that said banking subsector presented during this period. As [52] concluded, the value of the H-statistic normally oscillates in a range $(-\infty < H \leq 1)$. Hence, $H < 0$ (negative) implies that the banking sector has a monopolistic structure, $0 \leq H < 1$ implies that the banking sector has a structure of monopolistic competition, while $H = 1$ implies that the banking sector operates under a perfect competition structure.

5. Discussion

To explain the relationship between banking competition, efficiency and the financial stability of the E.G. financial system, we based our study on the contributions of [63], who concluded that higher efficiency scores as well as higher profit margins could positively influence the banking sector and also stimulate financial stability. Now, analyzing E.G.'s financial sector from this perspective, we must evaluate the technical efficiency results of the banks in the sector, as well as the levels of competitiveness based on the different approaches used during the analysis, with the aim of highlighting the relationship of these variables with financial stability in the sector.

From the efficiency results (both technical and economic) obtained in this work, we find that the E.G. financial sector (represented by the banking subsector) presents low levels of efficiency in overall terms. The results obtained in this work also indicate that said financial sector is less competitive, thus presenting a structure of monopolistic competition. Thus, coinciding with the contributions of other authors [4,63], it would not be amiss to speak of instability or low financial stability in the financial sector of E.G. Additionally, even when we perform a non-empirical analysis of the true situation of the E.G. financial sector, the evidence of financial instability in the sector cannot be ignored.

The main implications at the theoretical level in view of the results advise, in this case, in order to promote greater financial stability in the E.G. economy, that the banks in the sector improve their efficiency levels, as well as achieve perfect competition in the sector, and in this way they can guarantee said financial stability. To achieve this aim, it is recommended that the banks that make up the E.G. financial sector, in order to reach sufficient levels of efficiency as loan providers, should work harder to minimize their costs, while they need to find better strategies to develop said business. However, from public policies and at the level of other practical implications, it is also possible to intervene in banking activity not only to ensure that said activity is collaborating in the development of the country, but also to promote financial inclusion and promote microenterprise, as well as other types of private enterprise. All of the above can positively influence the increase in competition in the sector, reducing banking concentration. If the sector manages to achieve a sufficient level of efficiency in banking activity, as it is responsible for financial intermediation in the country, this will be able to foster a spirit of competitiveness, even in other non-financial national firms, and thus guarantee the financial stability not only of the financial sector, but of the entire national economy.

6. Conclusions

This work has fulfilled its main objective, which was to analyze the degree of efficiency with which the E.G. financial sector works, as well as its degree of competitiveness and its relationship with financial stability in the country. Efficiency and competitiveness analysis provides empirical evidence contributing to the scarce literature on the financial system of E.G. To carry out efficiency and competitiveness analysis of the aforementioned sector, data from the 2013–2019 time period (panel data) were used, collected from different databases published by international organizations (such as IMF, World Bank, BEAC, CEMAC, etc.).

The efficiency analysis carried out with different models of stochastic frontiers shows low levels of efficiency at the subsector level (both technical efficiency and cost efficiency). The technical efficiency of the subsector ranges from 0.025 to 0.7, with a mean of 0.3. However, CCEI Bank is the one with the best technical efficiency results (0.716), accompanied by Ecobank (0.57), while cost efficiency levels range between 1.03% and 5.1%, with an average of 2.8%. The efficiency analysis carried out with different DEA models shows optimistic results for technical efficiency (0.58–1.00), with an average technical efficiency of 0.82 at the sector level, while cost efficiency remains very low (0.35); therefore, the sector presents an acceptable allocative efficiency level (0.7). In line with the previous literature on efficiency, although the results of this research show different values of comparative efficiency based on parametric and non-parametric frontier methodologies, the classification of companies according to efficiency score in the different specifications and models is similar.

It is recommended that the banks in this sector, in order to reach a level of efficiency as providers of loans to the social class excluded from the traditional financial system, should work harder to minimize their costs, while they have to find better strategies to develop said business. However, the national government must also intervene in the banking activity to ensure that said activity is collaborating in the development of the country, to favor financial inclusion and promote microenterprise, as well as other types of private entrepreneurship. Without a sufficiently efficient and competitive business sector, a sustainable life for citizens cannot be guaranteed.

Another important final conclusion indicates that there is low competitiveness in the E.G. financial system; that is to say, throughout the analyzed period, the financial system (that is, the banking subsector) presented a high banking concentration, where certain banks dominated over others. We are thus able to conclude that the mentioned financial system operates under a structure of monopolistic competition, according to the results obtained with the data of said period. However, there has been a fluctuation in this subsector, showing slight improvements throughout the analyzed period. Regarding the comparative analysis between the E.G. financial system and those of other countries in the CEMAC zone, it has been found that, in overall terms, the E.G. financial system is less competitive, a comparison that was performed based on several indicators, such as the global competitiveness index (the E.G. financial system does not present data for this), Boone indicator, Panzar–Rosse H-statistic, and other financial ratios, such as ROA, ROE, net interest margin, bank efficiency ratio and non-interest income to total income ratio. Most of these indicators indicate that the E.G. banking subsector lacks a sufficient level of competitiveness compared to the others in the CEMAC zone. However, it outperforms countries such as the Congo and the Central African Republic in some respects.

Considering the low levels of efficiency, as well as the low levels of competitiveness obtained in the research carried out, and observing the high fluctuation of the country's economy, we could conclude based on the previous literature [63] that there may be a direct relationship between these three variables, meaning that an efficient financial system is a competitive financial system, and guarantees financial stability in the country. If the E.G. banking subsector manages to achieve a sufficient level of efficiency in banking activity, as it is responsible for financial intermediation in the country, in line with the previous literature, this may foster a spirit of competitiveness in the sector, and even in other national non-financial firms, and thus guarantee the financial stability of not only the financial sector, but of the entire national economy.

The main limitations of this article include the analyzed time period, which should be extended to consider a broader time horizon, as well as the possibility of undertaking an international investigation that includes the banking sector of the CEMAC countries. Finally, if we take into account the important role played by the informal financial sector of an economy (micro-financial institutions), and the fact that it protects both individuals and micro-enterprises without access to the traditional financial system (banks and other financial institutions), future empirical studies that include the comparative efficiency of these economic agents could be addressed. This informal sector provides minimal funds to be able to carry out their economic activities, since the banks will not be able to support and finance the activity of all of these people. This informal sector experiences an obstruction in E.G. and has not reached maturity due to the bad business climate in the country. Public policies must be oriented to avoid, due to the absence or weakness of the informal sector, all of the weight falling on the traditional financial sector. It is necessary to authorize more microfinance institutions and encourage their creation in the country, as in this way economic growth can be stimulated in Equatorial Guinea, guaranteeing a sustainable standard of living.

Author Contributions: Conceptualization, T.O.E.-M. and P.A.; methodology, T.O.E.-M. and P.A.; software, T.O.E.-M. and P.A.; validation, T.O.E.-M. and P.A.; formal analysis, T.O.E.-M. and P.A; investigation, T.O.E.-M. and P.A.; data curation, T.O.E.-M.; writing—original draft, T.O.E.-M.; writing—review & editing, P.A.; supervision, P.A.; project administration, T.O.E.-M. and P.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: The authors acknowledge the economic and administrative support from the Universidad Nacional de Educación a Distancia (UNED).

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Asongu, S.A. Knowledge Economy and Financial Sector Competition in African Countries. *Afr. Dev. Rev.* **2014**, *26*, 333–346. [CrossRef]
2. Moyo, B. An analysis of competition, efficiency and soundness in the South African banking sector. *S. Afr. J. Econ. Manag. Sci.* **2018**, *21*, 14. [CrossRef]
3. Manini, M.M.; Abdillahi, U.A. Corporate governance mechanisms and financial performance of commercial banks in Kenya. *IOSR J. Bus. Manag.* **2015**, *17*, 25–40.
4. Rahman SM, K.; Chowdhury MA, F.; Tania, T.C. Nexus among Bank Competition, Efficiency and Financial Stability: A Comprehensive Study in Bangladesh. *J. Asian Financ. Econ. Bus.* **2021**, *8*, 317–328.
5. Rajan, R. Insider and Outsiders, the Choice between Informed and Arm's-Length Debt. *J. Financ.* **1992**, *47*, 1367–1400. [CrossRef]
6. E Stiglitz, J. Capital Market Liberalization, Economic Growth, and Instability. *World Dev.* **2000**, *28*, 1075–1086. [CrossRef]
7. Claessens, S.; Laeven, L. What Drives Bank Competition? Some International Evidence. *J. Money Credit. Bank.* **2004**, *36*, 563–584. [CrossRef]
8. Levine, R. Financial Development and Economic Growth: Views and Agenda. *J. Econ. Lit.* **1997**, *35*, 688–726.
9. Ma, Y.; Yao, C. Openness, financial structure, and bank risk: International evidence. *Int. Rev. Financ. Anal.* **2022**, *81*, 102065. [CrossRef]
10. Olaniyi, C.O.; Adedokun, A. Finance-institution-growth trilogy: Time-series insights from South Africa. *Int. J. Emerg. Mark.* **2022**, *17*, 120–144. [CrossRef]
11. Akpa, E.O.; Awode, S.S.; Okwu, A.T.; Oseni, I.O. The global financial crisis (Gfc) and remittances received in Africa: Any lessons for COVID-19? *South-East. Eur. J. Econ.* **2020**, *2*, 217–239.
12. Álvarez, A. *La Medición de la Eficiencia y la Productividad*; Ediciones Pirámide: Madrid, Spain, 2014.
13. Farrell, M.J. The Measurement of Productive Efficiency. *J. R. Stat. Soc. Ser. A Gen.* **1957**, *120*, 253–290. [CrossRef]
14. Coelli, T.J.; Rao, D.S.P.; O'Donnell, C.J.; Battese, G.E. *An Introduction to Efficiency and Productivity Analysis*; Springer Science & Business Media: Berlin/Heidelberg, Germany, 2005.

15. Färe, R.; Grosskopf, S.; Lovell, C.A.K. *The Measurement of Efficiency of Production*; Springer Science & Business Media: Berlin/Heidelberg, Germany, 2013; Volume 6.
16. Leibenstein, H. Allocative Efficiency vs. X-Efficiency. *Am. Econ. Rev.* **1966**, *56*, 392–415.
17. Frantz, R.S. *X-Efficiency: Theory, Evidence and Applications*; Springer Science & Business Media: Berlin/Heidelberg, Germany, 2013; Volume 2.
18. Leibenstein, H. Aspects of the X-Efficiency Theory of the Firm. *Bell J. Econ.* **1975**, *6*, 580. [CrossRef]
19. Ferrier, G.D.; Lovell, C. Measuring cost efficiency in banking: Econometric and linear programming evidence. *J. Econ.* **1990**, *46*, 229–245. [CrossRef]
20. Tuškan, B.; Stojanović, A. Measurement of cost efficiency in the European banking industry. *Croat. Oper. Res. Rev.* **2016**, *7*, 47–66. [CrossRef]
21. Haralayya, D.; Aithal, P.S. Analysis of cost efficiency on scheduled commercial banks in India. *Int. J. Curr. Res.* **2021**, *13*, 17718–17725.
22. Schwab, K.; Zahidi, S. *Global Competitiveness Report: Special Edition 2020*; World Economic Forum: Cologny, Switzerland, 2020.
23. Atkinson, R.D. *Competitiveness, Innovation and Productivity*; The Information Technology & Innovation Foundation: Washington, DC, USA, 2013.
24. Loch, C.H.; Chick, S.E.; Huchzermeier, A. *Management Quality and Competitiveness*; Springer: Berlin/Heidelberg, Germany, 2008.
25. Vrontis, D.; Christofi, M.; Katsikeas, C.S. An assessment of the literature on cause-related marketing: Implications for international competitiveness and marketing research. *Int. Mark. Rev.* **2020**, *37*, 977–1012. [CrossRef]
26. Helga, K. Country competitiveness: An empirical study. *Balt. Reg.* **2017**, *9*, 31–44.
27. Dosi, G.; Grazzi, M.; Moschella, D. Technology and costs in international competitiveness: From countries and sectors to firms. *Res. Policy* **2015**, *44*, 1795–1814. [CrossRef]
28. Sarmiento, S.; Sánchez, A.; Cruz, M. Competitividad y desarrollo sustentable empresarial. *Rev. Int. Nueva Gestión Organ.* **2009**, *4*, 112–134.
29. Falciola, J.; Jansen, M.; Rollo, V. Defining firm competitiveness: A multidimensional framework. *World Dev.* **2020**, *129*, 104857. [CrossRef]
30. Labarca, N. Theoretical Considerations of Managerial Competitiveness. *Omnia* **2007**, *13*, 158–184.
31. Ngua, A.C. *Integración Económica en África Central: La CEMAC y sus Efectos en los Países Miembros*; Universidad de Valladolid: Valladolid, Spain, 2015.
32. Bod'a, M.; Zimková, E. Efficiency in the Slovak Banking Industry: A Comparison of Three Approaches. *Prague Econ. Pap.* **2015**, *24*, 434–451. [CrossRef]
33. Fukuyama, H.; Matousek, R. Modelling bank performance: A network DEA approach. *Eur. J. Oper. Res.* **2017**, *259*, 721–732. [CrossRef]
34. Holod, D.; Lewis, H.F. Resolving the deposit dilemma: A new DEA bank efficiency model. *J. Bank. Financ.* **2011**, *35*, 2801–2810. [CrossRef]
35. Karray, S.C.; eddine Chichti, J. Bank size and efficiency in developing countries: Intermediation approach versus value added approach and impact of non-traditional activities. *Asian Econ. Financ. Rev.* **2013**, *3*, 593–613.
36. Burgstaller, J. Retail-bank efficiency: Nonstandard goals and environmental determinants. *Ann. Public Coop. Econ.* **2020**, *91*, 269–301. [CrossRef]
37. Delis, M.D.; Papanikolaou, N.I. Determinants of bank efficiency: Evidence from a semi-parametric methodology. *Manag. Financ.* **2009**, *35*, 260–275.
38. Maredza, A. Internal Determinants of Bank Profitability In South Africa: Does Bank Efficiency Matter? *Int. Bus. Econ. Res. J.* **2014**, *13*, 1033. [CrossRef]
39. Sufian, F.; Habibullah, M.S. Bank-specific, industry-specific and macroeconomic determinants of bank efficiency: Empirical evidence from the Thai banking sector. *Margin J. Appl. Econ. Res.* **2010**, *4*, 427–461. [CrossRef]
40. International Monetary Fund (IMF, 2020). COVID-19: An Unprecedented Threat to Development. Available online: https://www.imf.org/en/Publications/REO/SSA/Issues/2020/04/01/sreo0420 (accessed on 12 April 2022).
41. The World Bank (WK). Climate Change Adaptation and Economic Transformation in Sub-Saharan Africa. 2021. Available online: https://www.worldbank.org/en/publication/africa-pulse/pulse-2021-am (accessed on 23 March 2022).
42. Dietsch, M.; Lozano-Vivas, A. How the environment determines banking efficiency: A comparison between French and Spanish industries. *J. Bank. Financ.* **2000**, *24*, 985–1004. [CrossRef]
43. Aigner, D.; Lovell, C.A.K.; Schmidt, P. Formulation and estimation of stochastic frontier production function models. *J. Econ.* **1977**, *6*, 21–37. [CrossRef]
44. Meeusen, W.; van den Broeck, J. Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error. *Int. Econ. Rev.* **1977**, *18*, 435–444. [CrossRef]
45. Coelli, T.; Rao, D.S.P.; Battese, G.E. *An Introduction to Efficiency and Productivity Analysis*; Kluwer Academic Publishers: New York, NY, USA, 1998.
46. Charnes, A.; Cooper, W.W.; Rhodes, E. Measuring the efficiency of decision making units. *Eur. J. Oper. Res.* **1978**, *2*, 429–444. [CrossRef]

47. Andersen, P.; Petersen, N.C. A Procedure for Ranking Efficient Units in Data Envelopment Analysis. *Manag. Sci.* **1993**, *39*, 1261–1264. [CrossRef]
48. Caves, D.W.; Christensen, L.R.; Diewert, W.E. The Economic Theory of Index Numbers and the Measurement of Input, Output, and Productivity. *Econometrica* **1982**, *50*, 1393–1414. [CrossRef]
49. Malmqüist, S. Index number and indiference curves. *Trab. Estad.* **1953**, *4*, 209–242.
50. Färe, R.; Grosskopf, S.; Norris, M.; Zhang, Z. Productivity growth, technical progress, and efficiency change in industrialized countries. *Am. Econ. Rev.* **1994**, *84*, 66–83.
51. Van Leuvensteijn, M.; Bikker, J.A.; van Rixtel, A.A.; Kok, C. A new approach to measuring competition in the loan markets of the euro area. *Appl. Econ.* **2011**, *43*, 3155–3167. [CrossRef]
52. Panzar, J.C.; Rosse, J.N. Testing for "monopoly" equilibrium. *J. Ind. Econ.* **1987**, *35*, 443–456. [CrossRef]
53. Bikker, J.A.; Shaffer, S.; Spierdijk, L. Assessing Competition with the Panzar-Rosse Model: The Role of Scale, Costs, and Equilibrium. *Rev. Econ. Stat.* **2012**, *94*, 1025–1044. [CrossRef]
54. Camino-Mogro, S.; Armijos-Bravo, G. Assessing Competition in the Private Banking Sector in Ecuador: An Econometric Approach with the Panzar-Rosse Model. *Cuad. Econ.* **2018**, *41*, 225–240.
55. Gutiérrez de Rozas, L. *Testing for Competition in the Spanish Banking Industry: The Panzar-Rosse Approach Revisited*; Banco de España: Madrid, Spain, 2007.
56. Sanchez-Cartas, J.M. The Panzar–Rosse H statistic and monopoly. Issues on its use as a market power measure. *BE J. Econ. Anal. Policy* **2020**, *20*, 20200193. [CrossRef]
57. Shaffer, S.; Spierdijk, L. The Panzar–Rosse revenue test and market power in banking. *J. Bank. Financ.* **2015**, *61*, 340–347. [CrossRef]
58. Solano, J.; Camino-Mogro, S.; Armijos-Bravo, G. Intra-banking competition in Ecuador: New evidence using panel data approach. *J. Econ. Financ. Adm. Sci.* **2020**, *25*, 295–319. [CrossRef]
59. Rapapali, M.; Simbanegavi, W. *Competition in South African Banking An Assessment Using the Boone Indicator and PanzarRosse Approaches*; Working Papers 9819; South African Reserve Bank: Pretoria, South Africa, 2020. Available online: https://ideas.repec.org/p/rbz/wpaper/9819.html (accessed on 5 April 2022).
60. Budhathoki, P.B.; Rai, C.K.; Rai, A. Assessing Bank Competition in Nepal Using Panzar-Rosse Model. *J. Asian Financ. Econ. Bus.* **2020**, *7*, 759–768. [CrossRef]
61. Vesala, J. *Testing for Competition in Banking: Behavioral Evidence from Finland*; Bank of Finland: Helsinki, Finland, 1995.
62. Apergis, N. Competition in the banking sector: New evidence from a panel of emerging market economies and the financial crisis. *Emerg. Mark. Rev.* **2015**, *25*, 154–162. [CrossRef]
63. Bolívar, H.R.; Nacional, I.P.; Rodríguez, T.G. Competencia, Eficiencia y Estabilidad Financiera en el Sector Bancario Mexicano. *Rev. Mex. Econ. Finanz.* **2015**, *10*, 39–58. [CrossRef]