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Estimation of Efficiency and the Effect of Access to Finance on Efficiency of Small and Medium Enterprises (SMES) in the Western area of Sierra Leone

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Abstract

To estimate the efficiency of SMEs and the effect of access to finance on the efficiency of SMEs the study adopted the stochastic frontier estimation method of determining efficiency of firms. A model of maximum performance (capacity) was estimated using 450 SMEs randomly selected from the population of registered SMEs in the Western Area of Sierra Leone from 2018 to 2020. The model of net business earnings was estimated using the Maximum Likelihood procedure and the firm efficiencies were consequently estimated. The mean inefficiencies are estimated by various categories, including SMEs access to bank credit to determine firm characteristics that are associated with higher mean efficiencies. The empirical results reveal that the potential of firms is determined positively by capital productivity and labour productivity and negatively by experience of firms, the latter results suggesting that more experience (in terms of age) does not push their production outwards but inwards. However, other factors are found significant in efficiency differences among firms. These are: gender of the head of the SME, educational level, professional training of the firm heads, sector of operation and the area of operation.

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Keywords: Efficiency, Finance, Small and Medium Enterprises.

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1. Introduction

The role of SMEs in providing productive employment and earning opportunities is of great concern among policy makers, donor agencies and researchers. Until the 1970s most developing country governments paid little attention to SMEs, but rather were promoting industrialization through policies that favored large businesses. Since 1970s there has been great awareness that the premium placed on large firms as being responsible for employment growth and alleviating poverty dwindled but that enhancing the development of SMEs may be an effective way of fostering growth and equity. Although there are still doubts as to the roles played by SMEs as their efficiencies have not been gauged. Little, Mazumdar and Page (1987); Cortes, Berry and Ishaq (1987) and Mead and Liedholm (1998) note that the evidence is mixed about how efficient SMEs are relative to larger firms. This issue is critical since inefficient SMEs are unlikely to compete and survive, grow and generate employment. Several factors are thought to constrain SME growth, but there is little empirical evidence on whether the constraints are binding or which market failures are most important. Shortages of working capital among SMEs are often cited as the principal constraint. Other factors often referred to include poor access to information, low levels of skills, weak management, and limited technological capabilities, but their relative importance is not well known. As a result, policymakers have often been forced to devise policies with little or incomplete information about SMEs. This thesis addresses some of these issues using rich firm-level data from 450 SMEs in the Western Area of Sierra Leone. It derives firm-level estimates of technical efficiency, compares the distributions of efficiency across firms of different sizes, and identifies its most important correlates. This allows us to address the following questions: Are small firms less efficient than their larger counterparts? If so, why? Are there inherent constraints in being small, and not being able to take advantage of economies of scale in productive activities? Or are SMEs less efficient because they use lower quality inputs, invest less in productivity-augmenting activities such as technology and training, and have weak management capabilities?

There has been growing debate about the role of SMEs in generating growth and employment in developing countries like Sierra Leone. Thus, knowledge about their levels of efficiency, distribution, and correlates is critical if policymakers are to determine whether policies targeting SMEs are needed, and if so, what kinds of policies and delivery mechanisms will be appropriate.

This study examines the effect of access to finance on the efficiency of small and medium enterprise (SMEs) in the Western Area of Sierra Leone.

2. Literature Review

2.1 Theoretical Literature

2.1.1 Efficiency of SMEs

The theoretical literature on efficiency of SMEs provides differing views held by the various scholars.

Literature addressing the efficiency of SMEs focused on estimating cost efficiency (cost minimization) which measures how close the costs of a company are to the costs of a best-practices company that produces the same output under the same conditions. Studies relating to these include: Barchue and Aikaeli (2016); Balios et al. (2015); Mohamad et al., (2010); CollSerrano and Blasco-Blasco, (2006); Yang, (2006); Kotey and O'Donnell, (2002) and Hill and Kalirajan, (1993). The classical approach to measuring the performance of SMEs usually focused on cost efficiency ignoring the important role that income inefficiencies can have in performance as realized by Barchue and Aikaeli (2016), Balios et al., (2015) and Charoenrat and Harvie (2014).

2.1.2 Determinants of SMEs Efficiency

Various indicators have been used to determine the efficiency of SMEs. Firm size, firm age, labour productivity, government assistance and export activities have been important factors deemed to determine the efficiency of SMEs. Lundvall and Battese, (2000) and Mini and Rodriguez (2000) in their study found that company (firm) size affects efficiency. This is buttressed by Jovanovic (1982) who found out that in a competitive market, the most efficient companies survive and grow, whereas inefficient companies stagnate or exit the industry. Yang and Chen (2009) observed that smaller firms are more flexible, have non-hierarchical structures and do not suffer from agency problems owing precisely to their smaller size. However, Hiebl, (2017), Klein and Bell, (2007) and Tabor et al., (2018) pointed out that there may be SMEs that employ non-family managers, and therefore, agency issues may also occur in these firms. So Álvarez and Crespi, (2003), Charoenrat and Harvie, (2014) and Le and Harvie, (2010) advised that these differences could more than offset their size disadvantage and make them more technically efficient than larger companies.

On the role of firm age, Lundvall and Battese (2000) found that in competitive markets, the oldest organizations will be the most efficient because market inertia will expel inefficient companies. Also, Hill and Kalirajan (1993) and Jovanovic (1982) observed that older companies are more experienced in terms of their production and commercial processes and therefore more efficient. Finally, age can also be a significant factor because younger companies have more problems accessing credit. Diamond (1991) observed that the rationale underlying this idea is that the risk of any loan varies with the duration of the relationship between the company and the financial institution. Thus, the age and efficiency of a company are expected to be positively correlated although some scholars advised that a negative relationship between age and efficiency is also possible because young

companies have more modern infrastructure and the most advanced technologies. This is supported by Batra and Tan (2003) who realised that the benefit of the accumulated knowledge in a company due to its greater age cannot be compensated by the higher costs of outdated physical and technological infrastructure. Likewise, Hiebl (2017) opined that it is also possible that older SMEs can exhibit lower efficiency due to greater risk aversion and, therefore, show a lower capacity for innovation, which in turn reduces profitability.

Labour productivity has been another factor found to be significant in determining SME efficiency. Datta et al. (2005) and Pfeffer, (1994) advised that it is important to consider the relationship between labour productivity and efficiency because there is a relatively direct relationship between them and many companies' competitive advantages is derived directly or indirectly from human resources. Charoenrat and Harvie, (2014) found that there is direct relationship between positive effect from worker training and skills on the efficiency of companies. Malerba, (1992) concluded that greater employee skills and knowledge facilitate the introduction and use of new technologies, stimulate innovation, and increase the efficient use of resources. Cohen (1998) discovered that the qualifications and skills of employees also have a positive effect on the provision of a company's goods and services and therefore on the image perceived by its customers. This situation typically both increases the loyalty of existing customers and attracts new customers, with the consequent effect on revenue. However, SMEs have significant limitations on investing in training mainly due to a lack of economic resources

Also, government assistance is another significant factor for the development of efficient and competitive SMEs. Hamilton and Fox (1998) found out that the structure and costs of financing affect the competitiveness of companies and these difficulties in accessing finance restrict the potential of SMEs to execute projects related to technological innovation and internationalization to improve their efficiency. Segura and Toledo (2003) also found out that SMEs have greater debt than large firms in addition to higher financing costs and more restricted access to funding. However, Barchue and Aikaeli, (2016) and Hussain et al., (2009) found out that gaining greater access to credit have a positive impact on efficiency among SMEs. Thus, governments of various countries are taking actions to facilitate financing for SMEs as a strategy to enhance their competitiveness, innovation and socio-economic development. These strategies are important as they tend to cushion the difficulties SMEs experience in accessing funding and their importance to economic growth and job creation.

Export activity also influences SMEs performance. Álvarez and Robertson (2004), Salomon and Shaver (2005) and Golovko and Valentini (2011) found out that exports have a positive impact on efficiency because companies that export benefit from access to new information sources and knowledge that are sometimes not available in the local market which can be utilized to be more efficient. However, exports do not cause companies to be more efficient, but rather, the most efficient companies choose to operate in international markets because yields are higher. Love and Roper (2015) advised that the management skills necessary to penetrate

export markets could be different from those required to succeed in local markets. Hence the two cannot be compared. Arnold and Hussinger (2005) and Wagner (2007) examined the influence of export activity on the performance of SMEs and found out that there is no unanimous agreement about whether the most efficient companies are more likely to become exporters or whether exports make companies more efficient.

Balios et.al (2015), Le and Harvie (2010), Yang (2006), Lundvall and Battese (2000), and Mini and Rodriguez (2000) approached the issue differently and showed that profit efficiency improves with increasing SME size. This demonstrates that larger SMEs are able to take advantage of economies of scale to a greater extent and have better opportunities to access information and technological resources. Jones-Evans (2015); Beck and Cull (2014) and Dong and Men (2014) found out that in several national and regional surveys across the globe, owners and managers of SMEs consistently rank access to funds as the number one constraint to the growth of their businesses. Consequently, both extant research and empirical evidence have established that SMEs lack access to adequate finance to fund their operations and growth. This phenomenon is referred to as the "funding gap."

2.2 Empirical Literature

2.2.1 Determinants of SMEs Efficiency

Many empirical studies have been put forward to look at what determines efficiency of SMEs although the methodologies used in the literature are different.

Empirical literature on SME efficiency dates back to the 1900 with the work of Lovell (1993) who found out that to be able to formulate and implement business strategies that enable SMEs improve their competitiveness, it is necessary to identify those factors that affect the performance of SMEs. For example, Álvarez and Crespi (2003); Balios et al. (2015); Barchue and Aikaeli (2016); Charoenrat and Harvie (2013, 2014); Charoenrat et al. (2013); and Kotey and O'Donnell (2002) analysed how cost efficiency of SMEs is affected by factors, such as employee qualifications, owner experience, location, type of company, female participation in the workforce, capital-labour ratio, foreign investment, export activity and government support. However, there is no consensus amongst them about the impact of these factors on cost efficiency in SMEs.

Barche and Aikaeli (2016) in Liberia used stochastic frontier analysis (SFA) techniques to analyse primary data to investigate the efficiency status of SMEs in Monrovia and found out that government policy is critical for SMEs development. This is supported by Yusoff et al (2016) in Malaysia who used six main entrepreneurial ecosystem variables (government, policy, finance, culture, support, markets and human capital) in relation to their impact on business performance of Malaysian SMEs and found out that there should be policies for both entrepreneurship and SMEs to enhance SMEs development. Also, Rafiki (2019) in Saudi Arabia examined the determinants of the growth of SMEs in the Kingdom of

Saudi Arabia using 119 managers from SMEs and variables delineated from theories (human capital, social capital, strategy and organization), which are associated with the firm's growth that include; the size of the firm, firm age, manager's education, training, experience, financing and network relationship and found out that the size of the firm, the experience of the manager, training, financing and the network relationship play a significant role in the firm's growth.

Akhigbe and McNulty (2003) study the profit efficiency of small US banks for 1990, 1992, 1994 and 1996, differentiating between large banks, small banks within one MSA, and small banks not limited to one MSA. Assuming banks use the same technology, the results obtained in the period analysed show that small banks are more profit efficient than large banks. However, in a later work, these same authors compare the profit efficiency of small, medium and large banks for the period 1995–2001 and conclude that small banks (75%) are less profit efficient than medium banks (82%) and large banks (86%) (Akhigbe and McNulty, 2003). Cyree and Spurlin (2005) analyse the effects of competing with large banks on the profit efficiency of small banks that operate in rural markets. The results show that a small bank has low levels of profit efficiency when it competes with a single large bank. However, the profit efficiency of the small bank increases when it competes with several large banks in a rural market.

Kolawole (2006) in Nigeria examined the determinants of profit efficiency among small scale paddy rice farmers in Nigeria using a stochastic Cobb–Douglas profit frontier model. The results show that profit efficiency is 61% and is positively related to age, educational level, farming experiences and household size. Hyuba et al. (2007) in Uganda carried out similar work in Uganda, highlighting that rice farmers do not operate on the profit frontier and that the main causes of this situation are low levels of education and limited access to extension services. The empirical results of Galawat and Yabe (2012) in Darussalam who studied rice production in Brunei Darussalam using a stochastic frontier approach shows that the average efficiency is 80.7%, so that 19.3% of profit is lost due to a combination of technical, allocative and scale inefficiencies.

Ogunniyi (2011) in Nigeria measures profit efficiency among 240 maize producers in Nigeria, showing that the efficiency varies between 1% and 99.9%, with an average of 41.4%. Additionally, the inefficiency model shows that education, experience, extension and non-farm employment were significant factors influencing profit efficiency. Purwanto et al (2014) in Salatiga on the efficiency of 31 small- and medium-sized tofu enterprises using data envelopment analysis shows that only two SMEs were overall efficient, four SMEs were efficient in scale and eight SMEs were technically efficient. The remaining 23 SMEs were inefficient. They also found that the determinants of inefficiency were soybean availability, production expenses, the width of the production area and the number of employees. Harmain et al (2015) in Indonesia, in Bantul district interviewed 35 female small entrepreneurs of food and beverage subsector to find out the efficiency of the business they operated. Using data envelopment analysis (DEA) the result shows that only 9 SMEs were overall efficient and the remaining were inefficient.

Bahta and Baker (2015) in Botswana find an average profit efficiency of 58% for a sample of 556 small livestock producers in Botswana. The research showed that the factors that influenced the high degree of inefficiency (42%) were education level, distance to the commonly used market, herd size, access to information and income from crop production. Finally, the results of a study by Nganga et al. (2010) in Kenya using a stochastic profit frontier showed that the efficiency of profits of small milk producers in Kenya varied between 26% and 73%, with a mean of 60%. This study further observed that the level of education, experience, and size of the farm influenced profit efficiency positively, while profit efficiency decreased with age of the farm.

3. Methodology

3.1 Model Specification

In the spirit of technical efficiency in production Aigner, Lovell and Schmidt (1977) developed the stochastic frontier function and later applied by other researchers including Kumbhakar and Lovell (2000). This has been applied by other researchers in various fields, including the estimation of tax potential. This approach is also used in this chapter to estimate SME efficiencies in Western Area of Sierra Leone. The frontier estimated is given as

$$Y_{it} = \exp(\beta_0 + \beta X_{it} + V_{it} - U_{it}) \quad \text{i = 1,2,3…… N:} \qquad \text{t = 1,2,3……T} \qquad (1)$$

U is a normally distributed error term with mean μ and variance σ_u^2 and V is a normally distributed term with zero mean and variance of σ_v^2. U is a random variable with non-negative values while V is the usual stochastic disturbance term found in an econometric model, which can take both positive and negative values. Both U and V are statistically independent. Y is output, X is the vector of input variables, β is a vector of parameters, V is the disturbance term while U is the inefficiency term.

Y is the net business earnings of the firms, X takes the following variables: capital productivity, labour productivity, leverage, liquidity and experience of the SMEs.

3.2 Model Variables and Expected Signs

The expected signs of the coefficients of model variables are discussed here. For variables with negative effects, the coefficient estimates are expected to be negative and those with positive effects are expected to have positive coefficient estimates.

Factor Productivity

The productivities of capital and labour are expected to have positive effects on the potential of firms. The productivity of capital increases performance of firms as in the case of productivity of labour through increase in efficiency.

Leverage
The degree of leverage gives the amount of debt used to finance the capital of SME (relative to owner's equity). Where debt exceeds equity, there is high leverage. In this case, it is difficult for the firm to meet its debt obligation, which decreases net earnings as the high debt has to be financed. The financing of the debt increases global expenditure and net earnings decline. The fact that some assets of the SME may be seized by the creditors also reduces the performance of the firm. Hence, leverage has negative effect on firm performance.

Liquidity
High level of current liquidity (measured as ratio of current assets to current liabilities), which indicates the capacity of the firm to maintain its short term liquidity makes the SME to be able to adjust to the business environment with ease. In addition, firms have higher ability to meet their financial obligations when current liquidity is high. In this regard, it is expected that current liquidity has a positive effect on performance of SMEs. However, current liquidity may have negative effect on performance as the liquidity could have been used to support investment and performance. Thus, firms with low current assets could be the fast growing firms. This has been emphasized in Mateev and Anastasov (2010).

Experience
The experience of a firm, measured as the age of the firm, is expected to have positive effect on the performance of the firm. The basic tenet here is that the longer a firm operates the higher is the chance for it to absorb shocks, given its experience. In addition, the better it is able to manage its business from the experiences of previous obstacles and opportunities. However, where younger firms are more innovative they can easily adapt to the business skills and operations. In this case, experienced firms can underperform when compared with younger ones. Hence, experience may have negative effect on performance in this sense.

3.3 Variable Measurement

The measurement of the variables of the model is shown in Table 1.

Table 1: Model Variables, Measurement and Expected Signs

Variable	Measurement
Earnings	Net Annual Business Earnings, taken as sales or total revenue minus expenditure
Capital Productivity	Net Net Annual Business Earnings divided by tangible assets
Labour Productivity	Net Net Annual Business Earnings divided by number of employees
Experience	Number of Years of Firm Existence
Leverage	Total Debt divided by Total Asses
Liquidity	Current Asset divided by Current Liabilities (which is current ratio, representing short term liquidity)

3.4 Estimation Technique

This maximum likelihood estimation is used, as it is the standard approach for estimating the stochastic frontier. It was applied here in the context of time-varying efficiency and time invariant efficiency. All variables of the model are expressed in log, which is the approach to the maximum-likelihood estimation in stochastic frontier model estimation The significance of the time-varying term determines whether the model is preferred to the time invariant model. The technical efficiency of each firm is then obtained. The technical efficiency level of a firm t is the ratio of the actual output (Y) to maximum output(Y), multiplied by 100 and technical inefficiency is 100 minus the technical efficiency. The highest level technical efficiency is therefore 100 %.

The estimated efficiencies are then regressed on various dummy variables representing SME characteristics to determine which components of these characteristics have higher efficiencies and whether the differences are significant. That is the mean efficiencies are obtained by these categories to determine how efficiency varies with firm characteristics.

3.5 Data Issue

A structured survey questionnaire was designed and administered to the selected SMEs. The information collected included among others: main sector of operation/services provided, ownership structure of the SME, the years of experience of the SME, the number of persons employed, the profit or loss of the SME, the gender of the SME head, the level of education of the SME head and the tangible assets of the SME.

(i) Sample Design

A survey was conducted and analysis was done based on the survey data. We discuss the survey design here. The sampling of SMEs was done such that ownership structure and main structure of operation of SMEs were considered, in addition to geographical location (urban or rural) of firm in the Western Area of Sierra Leone. A list of all SMEs was obtained from the register of the formal SMEs (that is, registered SMEs) from SMEDA[3] which was used as the sample frame. Simple random sampling technique was applied to have the representative of the population, with the idea of capturing differences in location of firms and sector of operation of the firms. However, given the low activity of registered SMEs in Agriculture and Mining, these were not considered in the survey.

(ii) Sample Size Determination

There are 538 registered SMEs in the Western Area, based on the sampling frame. The sample size was determined using the following formula (3.2), which is the formula for sample size determination estimating population proportion.

$$\text{Sample size} = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p\,(1-p)}{e^2 N}\right)} \quad (2)$$

Where N= Population Size, p is population proportion, which is taken as 0.5 for an unknown population proportion, e = margin of error and z = z-score.
Table 2 shows the various sample sizes with different marginal errors and confidence levels.

Table 2: Sample Size Determination

Population	Confidence Interval	Margin of Error	Sample
538	95	2%	440
538	95	3%	358
538	95	5%	225
538	99	2%	477
538	99	3%	417
538	99	5%	298

Source: Researchers' calculation, 2023

We used a confidence interval of 95 and a margin of error of 2% which gives a sample of 440 because of the low margin of error and the high confidence interval and given the other candidates for sample size, the time and resource can allow for this, though it is the highest. However, 450 samples were selected to ensure that at least 440 respondents participated. A random sample was used by assigning numbers to the 538 SMEs in the population and placed in a bowl, stirred properly to ensure that each of the numbers has an equal chance of being selected. The numbers were then drawn one at a time (without replacement) and placed into a separate box until all the 450 were selected which became the sample for the study. The SMEs were divided into zones and the following zones were established within the Western Area: Goderich, Lumley, Aberdeen, Aberdeen Road, Congo Cross, Murray town, Brookfield, Freetown Central, Kissy Road, Regent, Upgun, Kissy, Wellington and Calaba Town, Hastings, Rokel and Waterloo. Table 3 shows the distribution of the questionnaire to SMEs.
From the number of SMEs in each stratum, pro rata was used to determine the number of SMEs from each stratum to be assigned in the sample. A random sample was used to determine the SMEs from each stratum by assigning numbers to each of the SMEs in the chosen stratum. These numbers were then placed in a bowl, stirred properly to ensure that each of the numbers has an equal chance of being selected. The numbers were then drawn one at a time (without replacement) and

placed into a separate box until the total number of SMEs required for each stratum were selected which became the SMEs to be administered questionnaire for each stratum in the sample.

Table 3: SMEs Population, Sample Size and Distribution of Questionnaire in the Western Area of Sierra Leone

No.	Area	Number of SMEs	Cumulative Total	Number of Questionnaire Administered	Cumulative Total
1	Goderich	13	13	11	11
2	Lumley	19	32	16	27
3	Aberdeen	13	45	11	38
4	Aberdeen Road	26	71	22	60
5	Congo Cross	19	90	16	76
6	Murray Town	13	103	11	87
7	Brookfield	32	135	27	114
8	Freetown Central	120	255	100	214
9	Kissy Road	51	306	43	257
10	Regent	23	329	19	276
11	Upgun	32	361	27	303
12	Kissy	34	395	28	331
13	Wellington	19	414	16	347
14	Calaba Town	13	427	11	358
15	Hastings	39	466	32	390
16	Rokel	13	479	11	401
17	Waterloo	59	538	49	450
TOTAL		**538**		**450**	

Source: Researchers' compilation, 2023

4. Results

The stochastic frontier estimate of the output of the SMEs, measured as net business earnings, was estimated using the maximum likelihood approach, which is the approach to the estimation of a stochastic frontier model. Table 4 shows the results of the stochastic frontier model. The estimated model shows that the eta coefficient, which measures the significance of time varying efficiency, is not significant, as it has a p-value of 10.7 %. Thus, the time invariant stochastic frontier model was estimated. Table 5 shows the time invariant model of the net business earnings of the SMEs. The results of Table 5 are therefore the preferred model and this model was used to derive the efficiency values of the firm.

The stochastic frontier estimates show that the determinants of the capacity of the

SMEs are capital productivity, labour productivity and experience of firms while leverage and liquidity do not explain firm capacity as they are not significant. In addition, capital productivity, labour and productivity have positive effects on the capacity of firms while experience has a negative effect. The negative effect of experience implies that firms with more experience tend to have lower capacity than younger firms. This suggests that as firms gain experience over time, their potential declines. Hence, younger SMEs in Western Area of Sierra Leone tend to have higher capacity or potential than the more experienced ones.

Table 4: Stochastic Frontier Estimate of SME net Business Earnings with Time Varying Decay Model

Time-varying decay inefficiency model			**Number of obs = 1044**			
Group variable: id			**Number of groups = 381**			
Time variable: year			**Obs per group:**		**min = 1**	
					avg = 2.7	
					max = 3	
			Wald chi2(5) = 2002.55			
Log likelihood = -743.24563			**Prob > chi2 = 0.0000**			
LnNBEN	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
LnCapital_P	.2636832	.0247746	10.64	0.000	.2151258	.3122406
LnLabour_P	.591947	.0250065	23.67	0.000	.5429352	.6409588
Lnleverage	.0069282	.0202549	0.34	0.732	-.0327706	.046627
Lnliquidity	.0196127	.0206226	0.95	0.342	-.0208069	.0600323
Lnexperience	-.1008038	.0295676	-3.41	0.001	-.1587552	-.0428524
_cons	10.52023	.4569831	23.02	0.000	9.624558	11.4159
/mu	2.168756	.2090539	10.37	0.000	1.759018	2.578494
/eta	-.009454	.0058586	-1.61	0.107	-.0209366	.0020287
/lnsigma2	-.4166804	.0740406	-5.63	0.000	-.5617973	-.2715635
/lgtgamma	1.927449	.1062078	18.15	0.000	1.719286	2.135612
sigma2	.6592316	.0488099			.5701834	.7621869
gamma	.8729668	.011778			.8480368	.8943166
sigma_u2	.5754873	.0490217			.4794066	.671568
sigma_v2	.0837443	.0046908			.0745505	.0929381

Source: Researchers' compilation, 2023

Table 5: Stochastic Frontier Estimate of SME net Business Earnings with Time Invariant Efficiency

Time-varying decay inefficiency model			**Number of obs = 1044**			
Group variable: id			**Number of groups = 381**			
Time variable: year			**Obs per group:**		**min = 1**	
					avg = 2.7	
					max = 3	
			Wald chi2(5) = 2051.12			
Log likelihood = -744.56276			**Prob > chi2 = 0.0000**			
LnNBEN	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
LnCapital_P	.2602462	. 02473	10.52	0.000	. 2117763	. 3087162
LnLabour_P	.5979856	. 0247657	24.15	0.000	. 5494458	. 6465255
Lnleverage	. 0054297	. 0202187	0.27	0.788	-.0341982	. 0450575
Lnliquidity	. 0195482	. 0206177	0.95	0.343	-.0208618	. 0599582
Lnexperience	-.1249375	. 0259723	-4.81	0.000	-.1758422	-.0740327
_cons	10.51973	. 4584027	22.95	0.000	9.621274	11.41818
/mu	2.155444	. 2078458	10.37	0.000	1.748074	2.562814
/lnsigma2	-.4303339	. 073149	-5.88	0.000	-.5737033	-.2869645
/lgtgamma	1.907795	. 1056366	18.06	0.000	1.700751	2.114839
sigma2	.6502919	. 0475682			.563435	.7505384
gamma	.8707712	. 0118872			.8456328	.8923371
sigma_u2	.5662555	. 0477837			. 4726012	.6599099
sigma_v2	. 0840364	. 0047093			. 0748064	.0932665

Source: Researchers' compilation, 2023

Table 6 shows the descriptive statistics of model variables. The table shows that the efficiencies of the SME firms in Western Area of Sierra Leone range from 2.08 % to 84.5 % with a mean of 29.12 % during the three years' period 2018, 2019 and 2020. The median efficiency is 15.09 %. That is 50 % of the firms surveyed are only 15 % efficient and the upper quartile is 42.5 %. Thus, 75 % of the firms are with efficiency that is less than 42.5 %. This implies that the efficiencies of SMEs in Wester Area of Sierra Leone is low, suggesting the need to build efficiency of firms.

Table 6: Descriptive Statistics of SME Efficiency

Observations	1350
Mean	29.12 %
Median	15.09 %
Upper Quartile	42.5 %
Standard Deviation	27.93
Minimum	2.08 %
Maximum	84.52 %

Source: Researchers' compilation, 2023

Table 7 shows the efficiency regression by gender. It shows that female owned SMEs are less efficient than their male counterparts and this difference is significant at the 1% level. The mean efficiency of female-headed firms is less than that for the male-headed firms by 9.6 %. Hence, the male mean efficiency is 32.4 % and that of female 22.8%.

Table 7: SME Mean Efficiency by Gender

Panel A: The Efficiency Differential Regression			
	Coefficient	**T**	**P-value**
Dummy Gender	-9.60	-6.07	0.000
Constant	32.41	35.03	0.000
F (1,1348)	38.87		
P-Value	0.000		
Obs	1350		
Panel B: The Estimated Efficiencies (%)			
Gender	**Efficiency (%)**		
Male	32.4		
Female	22.8		

Source: Researchers' compilation, 2023

Table 8 shows the efficiency regression by against the dummies for the various categories of education. The table shows that the constant is 30.89, which is the efficiency of the reference group. As the reference group is the SMEs with heads that have no formal education, the efficiency of SMEs with heads that have no formal education is 30.89 %. The table shows that it is only firms with heads that have degree that have efficiencies that are significantly higher than those with no formal education. The mean efficiency of firms with degrees is 40.14 % (30.89 plus 9.25). In the case of firms whose heads have diploma, the difference in mean efficiency of 3.56 % is not significant, while their efficiency is below that for firms with no formal education. Firms with secondary education and those with primary education have mean efficiencies that are below the mean efficiency of firms with no formal education and these efficiencies are significant at 1% level of significance.

Table 8: SME Mean Efficiency by Education

Panel A: The Efficiency Differential Regression			
	Coefficient	**t**	**P-value**
Dummy Degree	9.95	3.7	0.000
Dummy Diploma	-3.56	-1.32	0.187
Dummy Secondary	-8.91	-3.31	0.001
Dummy Primary	-23.29	-5.62	0.000
Constant	30.89	13.26	0.000
F(4,1345)	36.33		
P-Value	0.000		
Obs	1350		
Panel B: The Estimated Efficiencies (%)			
Educational Level of Firm Head	**Efficiency (%)**		
Firms with Degree	40.84		
Firms with Diploma Heads	27.33		
Firms with Secondary School Heads	21.98		
Firms with Primary School Heads	7.6		
Firms with no Formal Education Heads	30.89		

Source: Researchers' compilation, 2023

Table 9 shows the mean efficiency by sector. The table shows that the firms with the highest level of efficiency are those in education with mean efficiency of 62 %, followed by those in construction, with the least from real estate a, at 8.9 %. Panel A of the table shows that these efficiency differentials from firms that are in trade are significant except for those in real estate, whose efficiency differential from the reference group, trade is not significant.

Table 9: SME Mean Efficiency by Sector

Panel A: The Efficiency Regression			
	Coefficient	**t**	**P-value**
Dummy Construction	34.6	9.55	0.000
Dummy Education	36.0	4.06	0.000
Dummy Medical	9.5	2.66	0.008
Dummy Transport	-8.3	-2.01	0.045
Dummy Real Estate	-17.7	-1.64	0.102
Dummy Research	15.1	2.41	0.016
Dummy Others	28.6	5.55	0.000
Constant	26.6	33.77	0.000
F(7,1342)	21.69		
P-Value	0.000		
Obs	1,350		
Panel B: The Estimated Efficiencies (%)			
Sector	**Mean Efficiency (%)**		
Construction	61.2		
Education	62.6		
Medical	36.1		
Transport	18.3		
Real Estate	8.9		
Research	41.7		
Others	55.2		
Trade	26.6		

Source: Researchers' compilation, 2023

Table 10 shows the mean efficiencies of firms by receipt of training. The table shows that for firms with no receipt of training, the mean efficiency is 26.6, which is lower than those that received training by 5.4 percentage points and is significant at the 1 % level of significance.

Table 10: SME Mean Efficiency by Training by Professional Training

Panel A: Efficiency Regression			
	Coefficient	**t**	**P-value**
Dummy Training	5.4	3.60	0.000
Constant	26.6	26.15	0.000
F(1,1348)	12.97		
P-Value	0.000		
Obs	1350		
Panel B: The Estimated Efficiencies (%)			
Professional Training Receipt	**Mean Efficiency (%)**		
YES	31		
NO	26.6		

Source: Researchers' compilation, 2023

Table 11 shows the mean efficiencies of firms by receipt of recent professional training. The table shows that for firms with no receipt of recent professional training, the mean efficiency is 27.1, which is lower than those that received training by 5.8 percentage points and is significant at the 1 % level of significance.

Table 11: SME Mean Efficiency by Training by Recent Professional Training

Panel A: Efficiency Regression			
	Coefficient	**T**	**P-value**
Dummy Recent Training	5.8	3.67	0.000
Constant	27.1	28.95	0.000
F(1,1348)	13.44		
P-Value	0.000		
Obs	1350		
Panel B: The Estimated Efficiencies (%)			
Professional Training Receipt	**Mean Efficiency (%)**		
YES	32.9		
NO	27.1		

Source: Researchers' compilation, 2023

Table 12 shows the mean efficiencies of firms by receipt of bank borrowing, the measure of access to finance here. The table shows that for firms without access to finance, the mean efficiency is 27.8 %, which is lower than those that received training by 0.63 percentage point. However, the difference is not significant. This implies that firms that received bank loan were equally inefficient as those that did not receive bank borrowing.

Table 12: SME Mean Efficiency by Training by access to bank borrowing

Panel A: Efficiency Regression			
	Coefficient	**T**	**P-value**
Dummy Bank Borrowing	0.633	0.41	0.679
Constant	27.8	25.44	0.000
F(1,1348)	0.17		
P-Value	0.679		
Obs	1350		
Panel B: The Estimated Efficiencies (%)			
Access to Bank Borrowing	**Mean Efficiency (%)**		
YES	28.4		
NO	27.8		

Source: Researchers' compilation, 2023

Table 13 shows the mean efficiencies of firms by location of the SMEs. The table shows that for firms in the rural area of Western Area of Sierra Leone, the mean efficiency is 26.7 %, which is lower than those that in the urban area by 3.7 percentage points and is significant at the 5 % level of significance. This implies that firms located in the urban area of Western Area of Sierra Leone are more efficient than those in the rural areas.

Table 13: SME Mean Efficiency by Location

Panel A: Efficiency Regression			
	Coefficient	**t**	**P-value**
Dummy Urban	3.73	2.36	0.018
Constant	26.73	21.11	0.000
F(1,1348)	5.57		
P-Value	0.0184		
Obs	1350		
Panel B: The Estimated Efficiencies (%)			
Location	**Mean Efficiency (%)**		
Urban	30.5		
Rural	26.7		

Source: Researchers' compilation, 2023

5. Conclusion

Small and Medium Enterprises (SMEs) have been considered in the literature as important in poverty alleviation and employment creation. However, they do not operate without problems. These problems or constraints are part of the factors responsible for them not to be able to operate at their maximum capacities. These problems can be diverse depending on the positions of the SMEs themselves and access to finance has shown to be a common factor in a number of studies around the world, among others. The objective of this paper was to estimate the efficiency of SMEs and determine the effect of access to finance on the efficiency of SMEs in the Western Area of Sierra Leone. The study adopted the stochastic frontier estimation method of determining efficiency of firms. A model of maximum performance (capacity) was estimated using data on a survey of firms from the Western Area of Sierra Leone and a model of net business earnings was estimated using the Maximum Likelihood procedure and the firm efficiencies were consequently estimated. The mean inefficiencies are estimated by various categories, including access to bank credit or not, to determine firm characteristics that are associated with higher mean efficiencies.

The empirical results reveal that the potential of firms is determined positively by capital productivity and labour productivity and negatively by experience of firms, the latter results suggesting that more experience does not push their production outwards but inwards. Moreover, firm mean efficiencies are not found to vary across the three periods 2018, 2019 and 2020, suggesting the COVID-19 Pandemic did not affect firm efficiencies. The mean firm efficiency is found to be 29.1 %, median efficiency is 15.1 %, and upper quartile efficiency was found to be 42.5 %. This reveals that the efficiency of SMEs in the Western Area of Sierra Leone during the period 2018 to 2020 was very low as about 50 % of firms have efficiency that is less than 15.1 % while average is only 29.1 %.

The result shows that firms with access to bank borrowing have mean efficiency of 28.4 % while those with no access have mean efficiency of 27.8 %. However, this difference was not found to be statistically significant, implying access to bank borrowing is not an efficiency constraint for SMEs in Western Area of Sierra Leone. However, other factors are found significant in efficiency differences among firms. There are: gender of the head of the SME, with male headed firms having higher efficiency, SMEs headed by degree holders having higher efficiency, followed by those with no formal education with the least to primary school graduates while secondary school graduates are behind Diploma holders. Firms in education are the best on efficiency with 62.6 % and those in construction follow. Trade firms are below the mean efficiency, with efficiency of 26.6 %. Moreover, firms with training are better than their counterparts without training and the same applies to recent training. Firms in urban areas are found to be more efficient than their counterparts in the rural areas.

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