European Journal of Economic and Financial Research
ISSN: 2501-9430
ISSN-L: 2501-9430
Available on-line at: http://www.oapub.org/soc

DOI: 10.46827/ejefr.v8i2.1677 Volume 8 | Issue 2 | 2024

ESTIMATION OF EFFICIENCY AND THE IMPACT OF COVID-19 ON THE EFFECT OF ACCESS TO FINANCE ON EFFICIENCY OF SMALL AND MEDIUM ENTERPRISES (SMEs) IN THE WESTERN AREA OF SIERRA LEONE

Richard E. O. Pearce[1],
Abdullah Bah[2i]
[1]Dr., Department of Banking and Finance,
Institute of Public Administration and Management (IPAM),
University of Sierra Leone,
AJ Momoh Street, PO Box 570, Freetown,
Sierra Leone
orcid.org/0009-0009-3778-3364
[2]Department of Banking and Finance,
Institute of Public Administration and Management (IPAM),
University of Sierra Leone,
AJ Momoh Street, PO Box 570, Freetown,
Sierra Leone
orcid.org/0009-0008-9926-4706

Abstract:
To estimate efficiency and the impact of COVID-19 on the effect of access to finance on the efficiency of small and medium enterprises (SMEs) in the Western Area of Sierra Leone, the study adopted the stochastic frontier estimation method of determining the 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 the experience of firms, the latter results suggesting that more experience does not push their production outwards but inwards. However, other factors found significant in efficiency differences among firms include gender of the head of the SME, educational level, professional training of the firm heads, sector of operation and the area of operation of the SMEs. 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.

[i] Correspondence: email richieeopearce@yahoo.com, bahabdullah001@gmail.com

JEL: F13, F15

Keywords: COVID-19, small and medium enterprises, efficiency, Sierra Leone

1. Introduction

The role of SMEs in providing productive employment and earning opportunities is of great concern among policymakers, 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 the 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. However, 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 Liedholm and Mead (1987) 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 correlation 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 deals with the estimation of efficiency and the impact of COVID-19 on the effect of access to finance on the efficiency of Small and Medium Enterprises (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 the efficiency of SMEs provides differing views held by 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); CollSerrano and Blasco-Blasco (2011); Mohamad *et al.*, (2010); 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 realised by Barchue and Aikaeli (2016), Balios *et al.*, (2015) and Charoenrat and Harvie (2014).

2.1.1.1 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, Tabor *et al.*, (2018), Hiebl (2017) and Klein and Bell (2007) pointed out that there may be SMEs that employ non-family managers, and therefore, agency issues may also occur in these firms. So Charoenrat and Harvie (2014), Le and Harvie (2010) and Álvarez and Crespi (2003) 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. Alternatively, Pitt and Lee (1981) opined 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 (2015) 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 (1998) 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 are derived directly or indirectly from human resources. Charoenrat and Harvie, (2014) found that there is a direct relationship between the positive effect of 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 (1992) 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 in the development of efficient and competitive SMEs. Beck *et al.*, (2005) and 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 has a positive impact on efficiency among SMEs. Charoenrat *et al.* (2013) deduced that governments of various countries are developing 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. Golovko and Valentini (2011), Salomon and Shaver (2005) and Álvarez and Robertson (2004) 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, Clerides *et al.* (1998) claimed that 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. Wagner (2007) and Arnold and Hussinger (2005) 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 the efficiency of SMEs although the methodologies used in the literature are different.

The empirical literature on SME efficiency dates back to 1900 when some researchers found out that to be able to formulate and implement business strategies that enable SMEs to improve their competitiveness, it is necessary to identify those factors that affect the performance of SMEs. For example, Pitt and Lee (1981) investigated how size, age and facilities affect cost efficiency in manufacturing SMEs whilst Barchue and Aikaeli (2016); Balios *et al.* (2015), Charoenrat and Harvie (2014); Álvarez and Crespi (2003); 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 (2011) 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 the 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 percent) are less profit efficient than medium banks (82percent) and large banks (86 percent) (Akhigbe and McNulty, 2005). 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 percent and is positively related to age, educational level, farming experiences and household size. Hyuha *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 show that the average efficiency is 80.7 percent, so that 19.3 percent 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 percent and 99.9 percent, with an average of 41.4 percent. 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.

Bahta and Baker (2015) in Botswana find an average profit efficiency of 58 percent for a sample of 556 small livestock producers in Botswana. The research showed that the factors that influenced the high degree of inefficiency (42 percent) 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 percent and 73 percent, with a mean of 60percent. 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

Pearce. R and Bah. A (2023) used the stochastic frontier function to estimate SME efficiencies in the Western Area of Sierra Leone from 2018 to 2020. This study leverage on this approach and is used in this chapter to estimate SME efficiencies in the Western Area of Sierra Leone during the COVID-19 era. This frontier was first developed by Aigner, Lovell and Schmidt (1977) 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.

The frontier estimated is given as:

$$Y_{it} = \exp(\beta_0 + \beta X_{it} + V_{it} - U_{it}) \quad \text{i} = 1,2,3\ldots\ldots\ldots\ldots \text{ N: t} = 1,2,3\ldots\ldots\ldots\text{T} \qquad (3.1)$$

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.

3.2.1 Factor Productivity

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

3.2.2 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.

3.2.3 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).

3.2.4 Experience

The experience of a firm, measured as the age of the firm, is expected to have a positive effect on the performance of the firm. The basic tenet here is that the longer a firm operates the higher 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 a negative effect on performance in this sense.

3.3 Variable Measurement

The measurement of the variables of the model is shown in Table 3.1. Table 3.1 presents the model variable measurement.

Table 3.1: 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 the 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 the 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 percent.

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 Issues

The data is based on a survey of 450 registered SMEs in the Western Area of Sierra Leone carried out by Pearce and Bah (2023) from 2018 to 2020 and in what follows we discuss the core data issues.

a. Sample Design

A survey of 450 SMEs in the Western Area of Sierra Leone gives the data for the study. The sampling of SMEs was done such that ownership structure and main structure of the operation of the SMEs were considered, in addition to the geographical location (urban or rural) of the 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[ii] which was used as the sample frame. A simple random sampling technique was applied to have the representative of the population, with the idea of capturing differences in the location of firms and the 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.

b. Sample Size Determination

There are 538 registered SMEs in the Western Area of Sierra Leone, based on the sampling frame. The sample size was determined using a marginal error of 2 percent and a confidence level of 95 percent, which gave a sample size of 440. However, as this is only the minimum sample size, we rounded it to 450 to account for non-response. A random sample was used by assigning numbers to the 538 SMEs in the population before a random selection of our sample.

[ii] Small and Medium Enterprises Development Agency.

4. Empirical Results

The stochastic frontier estimates of the output of the 450 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 4.2 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 percent. Thus, the time invariant stochastic frontier model was estimated. Table 4.3 shows the time invariant model of the net business earnings of the SMEs. The results of Table 4.3 are therefore the preferred model and this model was used to derive the efficiency values of the firm.

Table 4.2: 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

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 4.3: Stochastic Frontier Estimate of SME Net Business Earnings with Time Invariant Efficiency

Time-invariant inefficiency model — Number of obs = 1044
Group variable: id — Number of groups = 381

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

Table 4.4 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 percent to 84.5 percent with a mean of 29.12 percent during the three-year period 2018, 2019 and 2020. The median efficiency is 15.09 percent. That is fifty percent of the firms surveyed are only 15 percent efficient and the upper quartile is 42.5 percent. Thus, 75 percent of the firms are with efficiency that is less than 42.5 percent. This implies that the efficiencies of SMEs in Western Area of Sierra Leone are low, suggesting the need to build efficiency of firms.

Table 4.4: Descriptive Statistics of SME Efficiency

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

Table 4.5 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 1percent level. The mean efficiency of female-headed firms is less than that for the male-headed firms by 9.6 percent. Hence, the male mean efficiency is 32.4 percent and that of female 22.8 percent.

Table 4.5: SME Mean Efficiency by Gender

Panel A: The Efficiency Differential Regression			
	Coefficient	**t**	**P-value**
Dummy Gender	-9.60	-6.07	0.001
Constant	32.41	35.03	0.001
F (1,1348)		38.87	
P-Value		0.001	
Obs		1350	
Panel B: The Estimated Efficiencies (Percent)			
Gender		**Efficiency (Percent)**	
Male		32.4	
Female		22.8	

Table 4.6 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 percent. The table shows that it is only firms with heads that have degrees that have efficiencies that are significantly higher than those with no formal education. The mean efficiency of firms with degrees is 40.14 percent (30.89 plus 9.25). In the case of firms whose heads have a diploma, the difference in mean efficiency of 3.56 percent 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 a 1 percent level of significance.

Table 4.6: 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	0.001
Constant	30.89	13.26	0.001
F (4,1345)		36.33	
P-Value		0.001	
Obs		1350	
Panel B: The Estimated Efficiencies (Percent)			
Educational Level of Firm Head		**Efficiency (Percent)**	
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	

Table 4.7 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 percent, followed by those in construction, with the least from real estate a, at 8.9 percent. 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 4.7: SME Mean Efficiency by Sector

Panel A: The Efficiency Regression			
	Coefficient	**t**	**P-value**
Dummy Construction	34.6	9.55	0.001
Dummy Education	36.0	4.06	0.001
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	0.001
Constant	26.6	33.77	0.001
Dummy Education	36.0	4.06	0.001
F (7,1342)		21.69	
P-Value		0.001	
Obs		1,350	
Panel B: The Estimated Efficiencies (Percent)			
Sector		**Mean Efficiency (Percent)**	
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

Table 4.8 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 percent level of significance.

Table 4.8: SME Mean Efficiency by Training by Professional Training

Panel A: Efficiency Regression			
	Coefficient	**t**	**P-value**
Dummy Training	5.4	3.60	0.001
Constant	26.6	26.15	0.001
F (1,1348)		12.97	
P-Value		0.001	
Obs		1350	
Panel B: The Estimated Efficiencies (Percent)			
Professional Training Receipt		**Mean Efficiency (Percent)**	
Yes		31	
No		26.6	

Table 4.9 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 percent level of significance.

Table 4.9: SME Mean Efficiency by Training by Recent Professional Training

Panel A: Efficiency Regression			
	Coefficient	**t**	**P-value**
Dummy Recent Training	5.8	3.67	0.001
Constant	27.1	28.95	0.001
F (1,1348)		13.44	
P-Value		0.001	
Obs		1350	
Panel B: The Estimated Efficiencies (Percent)			
Professional Training Receipt		**Mean Efficiency (Percent)**	
Yes		32.9	
No		27.1	

Table 4.10 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 percent, 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 4.10: SME Mean Efficiency 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	0.001
F (1,1348)		0.17	
P-Value=		0.679	
Obs		1350	
Panel B: The Estimated Efficiencies (Percent)			
Access to Bank Borrowing		**Mean Efficiency (Percent)**	
Yes		28.4	
No		27.8	

Table 4.11 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 percent, which is lower than those that in the urban area by 3.7 percentage points and is significant at the 5 percent 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 4.11: 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	0.001
F (1,1348)		5.57	
P-Value		0.0184	
Obs		1350	
Panel B: The Estimated Efficiencies (Percent)			
Location		**Mean Efficiency (Percent)**	
Urban		30.5	
Rural		26.7	

5. Conclusion and Recommendation

5.1 Conclusion

Small and Medium Enterprises (SMEs) have been considered by 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 chapter was to estimate the efficiency of SMEs and determine the impact of COVID-19 on the effect of access to finance on 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 the 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.

5.2 Recommendations

Based on the empirical results, a number of recommendations are made. These are discussed in what follows:

1) Firms in the Western Area of Sierra Leone should be given more professional training so that when they have access to finance, they can be more efficient because access to finance is not found to create firm efficiency differences.
2) Firms headed by females should be given more attention when grants are available from institutions seeking to develop SMEs because female-headed firms are found to be less efficient. This can help reduce gender inequality in firm efficiency.
3) Firms in trade, real estate and in construction require assistance in the form of training and other forms that can build their efficiencies given their low levels of efficiencies, lower than mean efficiencies while the other sectors are above mean efficiencies.
4) Given that primary school graduates and secondary school graduates have the least efficiency these categories require further training and other forms of support that can push them up the efficiency ladder. Moreover, as degree holders are the most efficient, it is important to support the education of the young in Sierra Leone up to degree level so that when they enter SME businesses to seek self-employment, they will be more efficient.

Conflict of Interest Statement

The authors declare no conflicts of interest.

About the Author(s)

Dr. Richard E.O Pearce is a Lecturer and the head of the Department of Banking and Finance at the Institute of Public Administration and Management (IPAM) University of Sierra Leone. He holds a PhD in Development Studies at the N'Jala University. His research interests span across trade and finance, international business, financial economics, and banking and finance. ORCID: orcid.org/0009-0009-3778-3364

Abdullah Bah is a Lecturer in the Faculty of Accounting and Finance, Department of Banking and Finance at the Institute of Public Administration and Management (IPAM) University of Sierra Leone. His research interests span across macroeconomics, financial economics, trade and finance, international business, accounting and finance, and banking and finance. ORCID: orcid.org/0009-0008-9926-4706

References

Akhigbe, A. and McNulty, J. E. (2003). The Profit Efficiency of Small US Commercial Banks. *Journal of Banking and Finance*, 2003, Vol. 27, Issue 2, 307-325

Álvarez, R. and Crespi, G. (2003). Determinants of Technical Efficiency in Small Firms in Chile. *Small Business Economics*, 20 (3) 233-244

Álvarez, R. and Robertson, R. (2004). Exposure to foreign markets and plant-level innovation: evidence from Chile and Mexico. *J. Int. Trade Econ. Dev., 13* (1) (2004), pp. 57-87.

Arnold, J. M. and Hussinger, K. (2005). Export behavior and firm productivity in German manufacturing: a firm-level analysis. *Rev. World Econ., 141* (2) (2005), pp. 219-243

Bahta, S. and Baker, D. (2015). Determinants of Profit Efficiency among Smallholder Beef Producers in Botswana. *International Food and Agribusiness Management Review* Volume 18 Issue 3.

Balios, D. Eriotis, N. Fragoudaki, A. and Giokas, D. (2015). Economic Efficiency of Greek Retail SMEs in a period of high fluctuations in economic activity: a DEA approach. *Applied Econometrics*. 47 (33) (2015), pp. 3577-3593

Barchue, W. and Aikaeli, J. (2016). Efficiency of Small and Medium-sized Enterprises in Liberia: The Case of Monrovia. *Journal of Business Management 10*(8)

Batra, G. and Tan, H. (2003). *SME technical efficiency and its correlates: cross-national evidence and policy implications*. World Bank Institute Working Paper, 9. Washington

Charoenrat, T., Harvie, C. and Amornkitvikai, Y. (2013). Thai manufacturing small and medium-sized enterprise technical efficiency: Evidence from firm-level industrial census data. *Journal of Asian Economics*. *Volume 27*, August 2013.

Clerides, S., Lach, S., and Tybout, J. R. (1998). Is Learning by exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco. *Quarterly Journal of Economics, 113*(3).

Cohen, A. (1992). Antecedents of organizational commitment across occupational groups: A meta-analysis. *Journal of Organizational Behaviour*. Volume 13, Issue 6 November 1992

Coll-Serrano, V. and Blasco-Blasco, O. (2006). Análisis comparativo de la eficiencia de la PYME textil española: Una aproximación al efecto de la liberalización en el periodo 2004-2006. Rect@: Rev. Electrón. Comun. Trab. *ASEPUMA, 12* (1) (2011).

Cortes, M., A. Berry and A. Ishaq (1987). *Success in Small and Medium Scale Enterprises: The Evidence from Colombia,* Baltimore, Maryland: Johns Hopkins Press

Cyree and Spurlin (2005). The effects of big-bank presence on the profit efficiency of small banks in rural markets *Journal of Bank Finance, 36* (2012), pp. 2593-2603

Datta, D. K., Guthrie, J. P. and Wright, P. M. (2005). Human resource management and labor productivity: does industry matter? *Acad. Manag. J., 48*(1) (2005), pp. 135-145

Diamond, D. W. (1991). Monitoring and reputation: the choice between bank loans and directly placed debt *J. Polit. Econ., 99*(4) (1991), pp. 689-721

Dong, Y. and Men, C. (2014). SME financing in emerging markets: Firm characteristics, banking structure and institutions. *Emerging Markets Finance and Trade, 50*(1), 120-149

Galawat, F. and Yabe, M. (2012). Profit efficiency in rice production in Brunei Darussalam: a stochastic frontier approach. *Journal of ISSAAS (International Society for Southeast Asian Agricultural Sciences)*, 2012, Vol. 18, No. 1.

Golovko, E. and Valentini, G. (2011). Exploring the complementarity between innovation and export for SMEs growth. *J. Int. Bus. Stud., 42* (2011), pp. 362-380

Hamilton, R. T. and Fox, M. A. (1998). The financing preferences of small firm owners. *Int. J. Entrepreneur Behaviour. Res., 4*(3) (1998), pp. 239-248

Hiebl, M. R. (2017). Finance managers in family firms: an upper-echelons view. *J. Fam. Business Management 7*(2) pp. 207-220

Hill, H. and Kalirajan, K. P. (1993). Small enterprise and firm-level technical efficiency in the Indonesian garment industry. *Appl. Econ., 25* (9) pp. 1137-1144.

Hussain, I., Hussain, M. and Hussain, S. (2009). Public-private partnership and SMEs development: the case of AJ and K. Pakistan. *Int. Rev. Bus. Res. Pap*., 5(5) (2009), pp.37-46

Hyuha, T. S., Bashaasha, B., Nkonya, E., and Kraybill, D. (2007). Analysis of Profit Inefficiency in Rice Production in Eastern and Northern Uganda. *African Crop Science Journal, 15*(4), 243–253

Jones-Evans, D. (2015). Access to finance to SMEs at a regional level – The case of France Wales. *Venture Capital, 17*(1-2), 27-41.

Jovanovic B. (1982). Selection and the evolution of industry. Econometrica: *J. Econom. Soc., 50*(3) pp. 649-670

Klein, S. and Bell, F. A. (2007), Non-family executives in family businesses: a literature review. Electron. *J. Fam. Bus. Stud., 1*(1) pp. 19-37

Kolawole, O. (2006). Determinants of Profit Efficiency Among Small Scale Rice Farmers in Nigeria: A Profit Function Approach No 25238, 2006 Annual Meeting, August

12-18, 2006, from International Association of Agricultural Economists Queensland, Australia

Kotey, B. and O'Donnell, C. J. (2002). Data envelopment analysis in small and medium enterprises: a study of the Australian food, beverages and tobacco manufacturing industry. *Small Enterprises. Res., 10* (2), pp. 3-22

Le, V. and Harvie, C. (2010). *How do Vietnamese's SMEs Performs? Technical efficiency in the manufacturing sector and its sub-sectors*, School of Economics, Faculty of Commerce, University of Wollongong, Australia

Liedholm, C. and D. Mead (1987). *Small Scale Industries in Developing Countries: Empirical Evidence and Policy Implications*, Working Paper, Department of Agricultural Economics, Michigan State University.

Little, I. M. D., Dipak Mazumdar and John Page (1987). *Small Manufacturing Enterprises in Developing Countries: A Comparative Study of India and other Countries,* New York: Oxford University Press

Love, J. H. and Roper, S. (2015.) SME innovation, exporting and growth: a review of existing evidence. *Int. Small Bus. J., 33* (1) (2015), pp. 28-48

Lundvall, K. and Battese G. E. (2000). Firm size, age and efficiency: evidence from Kenyan manufacturing firms. *J. Dev. Stud., 36* (3) (2000), pp. 146-163

Mattev, M. and Anastasov, Y. (2010). Determinants of small and medium sized fast-growing enterprises in central and Eastern Europe: a panel data analysis. *Financial theory and practice*, Vol. 34 No. 3.

Malerba, F. (1992). Learning by firms and incremental technical change. *Econ. J.*, 102 (413), pp. 845-859

Mini, F. and Rodriguez, E. (2000). Technical efficiency indicators in a Philippine manufacturing sector *Int. Rev. Appl. Econ*., *14*(4) pp. 461-473

Mohamad, R. Majid, N. A. Noh, N. F. and Ahmad M. F. (2010). Technical efficiency (TE) of small and medium (SME) food enterprises in West Malaysia. *Econ. Technol. Manag. Rev., 5* (2010), pp. 51-55

Nganga, S. K.; Kungu, J.; Ridder, N. de; Herrero, M. (2010). Profit efficiency among Kenyan smallholders milk producers: a case study of Meru-South district, Kenya. *African Journal of Agricultural Research 5*(5).

Ogunniyi, P. (2011). Profit efficiency among maize producers in Oyo state, Nigeria. *ARPN J. Agric. Biol. Sci., 6* pp. 11-17

Pearce R. E. O and Bah. A. (2023). Estimation of Efficiency and the Effect of Access to Finance on Efficiency of Small and Medium Enterprises in the Western area of Sierra Leone. *Journal of Applied Finance & Banking,* Vol. 14, No. 1, 2024, 1-23

Pfeffer, J. (1994). Competitive advantage through people. *Calif. Manag. Rev., 36*(2)

Pitt, M. M. and Lee, L. (1981). The measurement and sources of technical inefficiency in the Indonesian weaving industry. *Journal of Development Economics*. Volume 9, Issue 1, August 1981

Purwanto P., Manongga D., Ineke Pakereng M. A. (2014). Efficiency of Small and Medium sized Tofu Enterprises (SME) in Salatiga using Data Envelopment Analysis (DEA), *International Journal of Computer Applications. (8)*2

Rafiki, A. (2019). Determinants of SME growth: an empirical study in Saudi Arabia. *International Journal of Organizational Analysis,* September.

Salomon, R. M. and Shaver, J. M. (2005). Learning by exporting: new insights from examining firm innovation. J. *Econ. Manag. Strategy, 14* (2) (2005), pp. 431-460

Segura, J. and Toledo, L. (2003). Tamaño, estructura y coste de financiación de las empresas manufactureras españolas. *Investig. Econ., 27* (1)

Wagner, J. (2007). Exports and productivity: a survey of the evidence from firm-level data. *World Econ., 30* (2007), pp. 60-82

Yang, J. C. (2006). The efficiency of SMEs in the global market: measuring the Korean performance. *J. Policy Model*. *28* (8) (2006), pp. 861-876

Yang, C. H. and Chen, K. H. (2009). Are small firms less efficient? *Small Bus. Econ., 32* (4), pp. 375-395

Yusoff, W. F. W., Gafar, M., Zabri, S. M. and Omar, S. S. (2016). An Analysis of Entrepreneurial Ecosystem Among Small Medium Industries (SMEs) in Malaysia: A Proposed Model. *Journal of International Business Management.* Vol 10 Issue 17.