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Technical Efficiency of Credit Unions in Ghana

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Abstract The study examined the technical efficiency of 66 Credit Unions (CUs) in Ghana using a Cobb-Douglas Stochastic frontier model for the period 2009 to 2012. Factors influencing the technical inefficiency of the CUs were also investigated. We applied the production and intermediation approaches to efficiency modelling to select the input and output variables to generate the technical efficiencies of the CUs. The results show average technical efficiency of 53.40% and 57.96% across the sampled CUs over the period for the production and intermediation models respectively. Thus CUs can improve inputs use by about 47% and 42% on the average to increase outputs through its production and intermediation channels respectively. We also found staff numbers and productivity as critical inputs that influence technical efficiency of the CUs. Finally, CUs can take advantage of increasing returns in financial intermediation to restructure and engage in mergers to strengthen their capital base and competitiveness in Ghana.

Keywords: *credit unions, technical efficiency, Stochastic Frontier Analysis (SFA), Ghana*

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1. Introduction

Credit unions (CUs) are thought of as cooperative credit institutions that provide a variety of financial services to safeguard the wellbeing of members. The core objective of CUs is to promote thriftiness, encourage savings and provide a medium where members can readily access credit at reasonable and competitive interest rates. The growth and development of CUs and financial cooperatives across the globe therefore has a positive impact on the poor. There are 34 countries in Africa and about 86 countries worldwide which have embraced the concept of CUs. Ghana was the first African country to adopt the credit union system and currently has about 435 CUs.

Typically, the nature and modus operandi of CUs distinguishes them from commercial banks and other nonbank financial institutions in Ghana. The CUs are relatively small-size non-profit organizations that offer pro-poor financial support to members. Being non-profit entities nevertheless, does not exempt CUs from pursuing goals of efficiency. They are required to operate on sound financial principles in order to be sustainable and to achieve their goal of improving members’ welfare.

Particularly in Ghana, stiff competition offered by the universal banks and other nonbank financial institutions pose as threats to the sustainability of CUs. The aggressive marketing strategies pursued by actors within the liberalized financial market have resulted in a decline of customer loyalty. Hence attracting new clients as a channel of realizing economies of scale is increasingly becoming difficult as retaining old ones. Unfortunately, the inability to provide innovative services such as ATMs, money transfers, investment loans, debit and credit cards, and higher loan sizes backed by innovative management systems and marketing strategies serve as some of the survival weaknesses of CUs compared to commercial banks [54].

Recent reports suggest that the membership size of CUs in Ghana is increasing in the face of growing competition. However, the actual number of established CU institutions is declining. A report by CUA [16] shows that 70% of CUs were rated as ‘unsatisfactory’ in 1996, with 42% of them placed in the ‘worst category’. Though by 2001 these ratings had improved to 60% and 15%, respectively, the proportion of strong financially sound CUs was still low at 29% [16]. The performance of CUs in the country must therefore be given prime attention given the unique services they offer. One question that easily pops up to the curious mind is what their current level of performance is and what critical factors account for the performance levels? Unfortunately, no such empirical support useful for understanding the current level of CUs performance in Ghana exists.

A vital starting point in evaluating the performance of CUs in Ghana is therefore how technically efficient they are in transforming the limited financial inputs into desirable outputs. The analysis of their performance is of great significance to their survival and competitiveness in the industry [48]. Not only can such an analysis be a powerful management tool for operatives, but it could also constitute an important input for informing institutional policy development. In 2007 alone, the Credit Union Association (CUA) had to disburse off 47 million Ghana Cedis to help distressed CUs.

Though several studies exist on the technical efficiency of other financial institutions such as commercial banks [3,4,7,23], rural banks [17] and microfinance institutions [50]; there is a lack of research that focuses on measuring the technical efficiency of CUs in Ghana. Little is known about the technical efficiency of CUs and the factors that account for the levels of efficiency. According to Worthington [54] though credit unions play pertinent roles in the financial system, there is a low-key focus on their technical efficiency and productivity status, which are important for recommending structural and organisational changes in the sector.

The study has two key objectives. First, we contribute to the limited literature by examining the technical efficiency of CUs in Ghana over the period 2009-2012 using the stochastic frontier technique. Second, we analyse the firm specific factors that determine the level of technical inefficiency of CUs in Ghana. To do this we focused on the bi-dimensional goals of the CUs system and assess the performance in terms of production outcomes and intermediation functions. Our work therefore stresses the performance of CUs in terms of reaching their cross dimensional mission.

The remainder of the paper is structured as follows. Section 2 provides review of the concept and measurement of efficiency in addition to a brief review of related empirical studies. Section 3 outlines the methodology for the study and Sections 4 reports the empirical results. Section 5 concludes the paper.

2. Literature Review

2.1. Efficiency Concepts

It is generally agreed in the efficiency literature that when decision-making units are encouraged to operate at thresholds of high efficiency, resources will be optimally used to maximize benefits. For a financial institution such as CUs this will ensure that scarce financial resources will be channelled efficiently to meet the needs of the increasing sum of financial demanders. Theoretically, efficiency is expressed as the difference that exists between the actual and maximum attainable value of inputs and outputs. When additional level of outputs are produced without increasing the amount of inputs employed, or when the same amount of outputs are produced with less inputs; efficiency is said to be improved. There is a mix of perspectives to the definition and explanation of what constitutes efficiency in production because of the diverse units, contexts, or sectors of the economy in which it could be looked at. The critical question underpinning all efficiency measurements; however is the magnitude of goods and services produced per unit of input [6]. Two components of efficiency are espoused in literature; allocative and technical efficiency [15]. This study explores the technical efficiency of CUs in Ghana.

Ogunniyi [49] defines technical efficiency as the firm's capacity to obtain the maximum level of output given the same amount of inputs. In general economic theory, the measurement of efficiency is depicted by the firm's position on the production possibility frontier; which represents its production technology. The closer the firm's position is relative to the production frontier, the more technically efficient it is said to be. The reverse is also true for technically inefficient firms [15]. Koopmans [36] cited in [47] emphasized that the idea of technical efficiency draws out two policy directives for economic units. First, can the same combination of inputs employed churn out higher output levels than what is currently obtain? Second, can the level of inputs currently employed be significantly reduced to produce the same level of output? Hence when CUs are able to reduce at least one input without altering the current level of output; or are able to produce additional units of at least one output holding the input mix constant, then technical efficiency improvement has occurred.

2.2. Efficiency Measurement

The stochastic frontier production function is used to generate the technical efficiencies of decision-making units (i.e. CUs) following the pioneering works of [5,21,44]. Various extensions exist in literature (see [24]) after [5], focusing on cross-sectional and panel data models and how the issue of inefficiency should be modelled. The advantage of using the stochastic frontier analysis (SFA) is its ability to distinguish errors that are due to bad luck and those that are within the control of the firm.

This study followed [10] and [11] models to specify the stochastic frontier production function as:

$$Y_{it} = f\left(X_{it};\beta\right)exp\left(V_{it} - U_{it}\right) \tag{1}$$

where Y_{it} is the output of the i^{th} CU, with $i = 1, 2, 3 \dots, \dots, N$, and $t = 1, 2, 3 \dots, \dots, T$, X_{it} is the (kx1) vector of the input quantities, $f(X_{it}, \beta)$ production function of the CU, β is the coefficient vector of X_{it}, V_{it} is an error term (two-sided) that characterises statistical noise assumed to be independently and identically distributed and is normally distributed with a zero mean and variance σ_V^2 . U_{it} is the one-sided (non-negative) error term representing inefficiency and are normally distributed with mean μ and variance σ_U^2.

Technical efficiency (TE_{it}) of a given CU is defined to be the ratio of observed output (Y_{it}) to the corresponding frontier output (Y_{it}*) using the available technology and is defined as follows in equations (2a)-(2c).

$$TE_{it} = \frac{Y_{it}}{Y_{it}^*} \tag{2a}$$

$$TE_{it} = \frac{f\left(X_{it}\beta\right)\exp\left(V_{it} - U_{it}\right)}{f\left(X_{it}\beta\right)\exp\left(V_{it}\right)} \tag{2b}$$

$$TE_{it} = \exp\left(-U_{it}\right) \tag{2c}$$

For technical efficiency to occur exp (V_{it}) = 1 and U_{it} = 0 since exp (0) = 1. Thus *TE* has values that range between 0 and 1, with 1 defining efficient CUs and 0 inefficiency CUs. It should be noted that the larger the U_{it}, the less technically efficient the CU is.

Early studies estimated efficiency levels of economic units using a two-step procedure [30,51] however, this method has been criticized that it violates the assumptions of the error term. The common and widely used procedure is to estimate both equations in a single stage [11]. In direct contrast to the two-step procedure, the single stage procedure requires the parameters of the frontier production function to be simultaneously estimated with those of the inefficiency function. The determinants of inefficiency (U_{it}) function was estimated simultaneously with equation (1) and is specified as follows:

$$U_{\text{it}} = \delta_0 + \sum \delta_{\text{n}} R_{n,i,t} + w_{it} \quad (3)$$

where $R_{n,i,t}$ is the vector of firms' specific and environmental factors affecting technical efficiency level, δ is the group of parameters estimated, and w_{it} is the error term.

2.3. Related Empirical Studies

In contrast to CUs, there is a large volume of work on the efficiency of formal financial institutions globally. Among the plethora of research on the efficiency of formal financial institutions include [2,9,13,34,45,55].

Interestingly the few studies on CUs have concentrated on investigating their cost efficiencies [20,22,43,54]. Worthington [54] is one key study on the technical efficiency of CUs, which also utilized the stochastic frontier approach to analyse the X-inefficiencies of 150 CUs in Australia for the year 1995. He concluded that large and well-capitalized CUs with small branch networks are more efficient. Similarly Esho [20] analyzed 80 CUs located in New South Wales and concluded that average loan size and capital strength are significant determinants of CU efficiency. With reference to Ghana, Salakpi [53] and Ofei [48] are some useful studies on CUs but they did not estimate the technical efficiencies of the CUs. The current study focuses on measuring the technical efficiency of the CUs in Ghana from both the intermediation and production approaches.

2.4. Credit Unions System in Ghana

The first CU in Africa was established in Jirapa in the Upper West Region of Ghana in 1955. It was mainly formed for the parish community and promoted by missionaries. By 1974, the CUs had been widely accepted and comprised of both parish and workplace CUs (see, [48]). The growth of CUs has increased steadily since their birth in Ghana. By 1999, the average membership had increased from about 127 to 425 per CU. Official statistics reports 446 CUs with a total membership size of about 437,520 in 2012 and 451 CUs with 532,348 total memberships in 2013 (see Table 1 below). In 2015 the total number of CUs stood at 435 showing a reduction in the total number of CUs.

Table 1. Number of Credit Unions in Ghana

Regions	Total #	Total #	Total membership
	2015	2013	2013
Greater Accra	161	155	92,782
Ashanti	76	84	120,248
Eastern	35	33	18,983
Western	26	27	82,457
Brong Ahafo	35	31	93,316
Central	36	44	45,407
Northern	20	32	21,837
Upper West	12	14	22,545
Upper East	14	11	9,782
Volta	20	20	24,991
Total	435	451	532,348

Source: CUA Records.

CUs in Ghana can be grouped under three categories: parish type, occupational (work-place), and community focused organizations. Members who share a common religious bond form parish CUs. The purpose is to provide financial assistance to members within the religious organization. Members who share a work within the same occupation form occupational CUs. These are usually promoted by trade unionists. Community based CUs are created to help members within the same locality to find financial assistance. As at 2015, there were about 136 parish CUs, 147 occupational based CUs and 149 community-based CUs in Ghana. A greater number of CUs are found in the Greater Accra Region followed by Ashanti and Central regions. The trend shows that Ashanti and Brong Ahafo have the highest total number of membership per CU respectively. The distribution also shows that CUs are predominantly found in the southern part of Ghana than in the north. CUs are registered as thrift societies that can accept deposits from and give credit to their members. Competitive pressures being a major reason, CUs in Ghana have currently moved away from operating solely on institutional basis to opening up to the larger variety of clients within their locality. The Ghana Cooperative Credit Union Association (CUA) is the mother body that is mandated to oversee and streamline the operations of the CUs in Ghana. Apart from its oversight responsibilities, CUA is also expected to provide financial and technical assistance to its members which includes among others education and training, auditing, bookkeeping, and risk management insurance [48].

3. Empirical Methodology

3.1 Model Specification

In estimating the firm level technical efficiency, a number of SFA functional forms espoused in literature could be considered. These include the Cobb-Douglas, translog, and quadratic production functions. The Cobb-Douglas production functional form, notwithstanding its recognised weaknesses is considered simple, popular, and is used frequently to measure the technical efficiency of financial institutions (see [19,33]). It is usually criticized for its structural impositions on the production technology of decision-making units (DMUs) by restricting the production elasticity to unity [46]. The translog form is useful for its flexibility in permitting substitution effects among inputs and its close approximation to reality [24]. It is however criticized for its sensitivity to multicollinearity and the potential insufficient degrees of freedom problem caused by the interaction terms in the function. More so, interaction terms in the translog function usually lack economic meaning [1]. Kopp and Smith [37] have indicated that functional form has a distinct but rather infinitesimal effect on estimated efficiency. Literature suggests that the selection of the functional form to represent the data and the distributional term of the error depends on the imposition of restrictions and the data attributes. Because of the small size of our data and the limitations associated with the translog model with respect to insufficient degrees of freedom, the

Cobb-Douglas model was preferred and estimated within the stochastic frontier framework.

We modelled the CUs as both production units and financial intermediaries [12]. Under the production approach, CUs produce financial outputs or services such as deposits and loans to clients. With the intermediation approach, financial institutions are thought of as intermediaries between savers and creditors. That is, financial units acts as channels through which loanable funds are transferred to economic units who require these funds to undertake relevant projects. Berger and Humphrey [12] argue that, the structure of the intermediation approach allows the inclusion of interest expenses, which accounts for 25% - 75% of total financial costs. This may therefore render the intermediation approach as more useful than the production approach in appraising entire financial institutions; although technically there is no perfect approach.

The specific models estimated are given by:

Production Approach:

$$lnQP_{it} = \beta_0 + \beta_1 lnST_{it} + \beta_2 lnCB_{it} + V_{it} - U_{it} \quad (4)$$

where QP_{it} is the log of number of loans and deposit of i^{th} CU over time t. βs are the parameters to be estimated. See Table 2 for description of variables.

Intermediation Approach:

$$\begin{aligned} lnQL_{it} = \beta_0 + \beta_1 lnST_{it} + \beta_2 lnCB_{it} \\ + \beta_3 lnD_{it} + V_{it} - U_{it} \end{aligned} \quad (5)$$

where QI_{it} is the log of the volume of loans plus investments, number of borrowers and total income in a cooperative financial institution unit. βs are the parameters to be estimated.

The econometric specification of the associated inefficiency level, U_{it} in (6) given the vector of quantities of firm-specific factors is estimated based on (4) and (5) as follows:

$$\begin{aligned} U_{it} = \delta_1 NIM_{it} + \delta_2 ALB_{it} + \delta_3 SZ_{it} + \delta_4 LI_{it} \\ + \delta_5 LD_{it} + \delta_6 BPS_{it} + \delta_7 IYTY_{it} + \delta_8 DPS_{it} \\ + \delta_{89} DR_{it} + \delta_{10} Age_{it} + \delta_{11} ROA_{it} + \varepsilon_{it} \end{aligned} \quad (6)$$

where U_{it}= level of inefficiency.

3.2. Data

The data we analysed was obtained from the Ghana Association of Credit Union (CUA) for the financial years 2009 to 2012. Definitions and measurement of the variables and their a priori expectations are provided in Table 2. All the variables are transformed or converted into either an aggregated form or a divisive construct; and then into natural logs as deemed appropriate for the specification of the empirical models (4), (5), and (6). All the models were estimated using the Maximum-Likelihood (ML) estimation (BHHH) procedure [24].

In all 66 CUs across the country were sampled. Table 3 provides a summary statistics for the variables used. The data shows that CUs on the average give more loans than deposits received. Total operating costs is also observed to be high compared to the average number of borrowers. The number of staff on average is 7, which is relatively small compared to commercial banks and other non-bank financial institutions in Ghana. The CUs on average tended to have high staff productivity proxied by the average borrower per staff ratio.

Table 2. Definition of Variables and A priori Expectations

Variables		Definitions	A priori sign
Output variables			
Number of loans	**(NL)**	Total number of borrowers for each co-operative.	na
Volume of deposits	**(D)**	Total deposits of members of a particular co-operative	na
Gross loan portfolio	**(GLP)**	Volume of loans granted to members in a particular year.	na
Number of borrowers	**(BRW)**	Total number of borrowers for each co-operative.	na
Total income	**(TY)**	Income from traditional and non-traditional activities.	na
Volume of investment	**(INV)**	Investment in shares, treasury bills and CUA house bonds.	na
Total Operating Cost		Total expenses less personal and interest charges	
Input Variables			
Number of Staff	**(ST)**	It is made of total number of full time employees	+
Deposits	**(D)**	Total deposits of members	+
Cost per Borrower	**(CB)**	Cost incurred on each borrower measured as non-interest expenses per number of borrowers	+
NIM		Net interest margin measured as interest income less interest expenses divided by total assets.	-
ALB		Average loan balance measured as total volume of loans divided by number of borrowers.	-
SZ		Size measured as logarithm of total assets.	+
LI		Loan intensity measured as total volume of loans divided by total assets.	+
LD		Loan deposit ratio measured as total volume of loans divided deposits.	-/+
BPS		Borrower per staff measured as number of borrowers divided number of full time employees	+
IYTY		Interest income to total income ratio measured as total volume of loans divided by total income.	+
DPS		Deposit per staff obtained by dividing deposits by number of full time employees.	+
ln D		Growth in deposits measured as natural logarithm of deposits.	-/+
Age		Number of years the company has been in existence	+
Return on assets	**(ROA)**	Ratio of profit after tax to total assets	+

Table 3. Descriptive Summary of Variables

Variable		Mean	Minimum	Maximum	Coefficient of variation
Total operating cost	*GHc*	172,658.46	3,451.92	2,052,816.00	1.42
Total income	*GHc*	219,904.33	3,797	2,557,762	1.54
Number of borrowers	*units*	571.55	9	5872	1.46
Number of staff	*units*	7	1	56	1.12
Age	*years*	17.52	2	43	0.6
Gross loan portfolio	*GHc*	852,744.67	6,450.00	16,406,415	2.26
Investment	*GHc*	367,280.45	2,710.00	4,175,211	1.66
Deposit	*GHc*	13,503.31	0.01	12,642,985	1.44
Deposit per staff	*ratio*	190,789.50	13,270.13	1,339,879.00	0.91
Borrowers per staff	*ratio*	103.02	1.29	1,211	1.43
Average loan balance	*ratio*	2,874.59	0.02	108,734.60	3.21
Size	*log*	5.84	4.27	7.09	0.09
Net interest margin	*ratio*	0.27	-0.03	17.74	5.91
Interest paid on funds	*%*	0.044	0.0002	0.537774	1.273
Loan intensity	*ratio*	0.75	0.02	24.13	2.35
Loans deposit ratio	*ratio*	1.11	0.03	35.59	3.31
Interest income total income ratio	*ratio*	2.05	0.09	91.36	4.38
Growth in deposit	*log*	13.34	10.19	16.35	0.09
Return on assets	*ratio*	0.03	-0.15	0.85	2.48

4. Empirical Results

4.1. Estimation of Stochastic Frontier Model

Table 4 reports the results of the estimated models. From the test statistics, the likelihood ratio test shows the existence of inefficiency among the CUs. The LR test at 5% significance also indicates the two estimated models robustness [35].

The results of the Maximum-Likelihood estimates of the parameters of the Cobb–Douglas Stochastic frontier function for the production approach indicates that only the number of staff was positive and significant. The sum of the input shares (elasticities) is less than unity (0.995), an indication of decreasing returns to scale. The elasticity of number of staff, which represents the share labour input in production, shows that a one per cent growth in labour input leads to a 0.93% increase in output. Cost per borrower is insignificant.

Table 4. Maximum Likelihood Estimates of the Stochastic Production Functions

Variables		Parameters	Production Approach	Intermediate Approach
			β (t-value)	β (t-value)
Constant		β_0	12.358 (28.728) ***	5.408 (5.626)***
Staff	(ST)	β_1	0.932 (12.341) ***	0.310 (2.953)**
Cost per borrower	(CB)	β_2	0.063 (0.893)	0.187 (2.480)**
Deposits	(D)	β_3		0.548 (7.229)***
Test Statistics				
Sigma-squared (σ^2)			1.427 (5.070)***	1.385 (6.325)***
Gamma			0.660 (4.904)***	0.508 (4.519)***
LR test			5.109	7.229
log likelihood			-247.466	-259.448

Source: Authors (2016). *,**,*** denotes coefficient significant at 10%, 5% and 1% significant values.

The results from the intermediation approach, shows that all the inputs of intermediation are positive and significant. The sum of the elasticities is more than one (1.045), indicating increasing returns to scale. This evidence of increasing returns is in line with findings from other CU movements [20] [1] and will support the call for restructuring and mergers among CUs in Ghana. The elasticity of the number of staff as shown in the intermediation model indicates that a per cent increase in the labour input results in a 0.31% increase in the output of a CU. The positive contribution is consistent with the results from the production approach and suggests the importance of labour in the financial services delivery of CUs in Ghana. Cost per borrower has a significant share of 0.187 in intermediation but is inconsistent with the results from the production approach.

4.2. Average Technical Efficiency

Table 5 and Table 6 shows the frequency distribution of technical efficiency scores of the CUs calculated over the 4year sample period. Overall, the distribution of technical efficiency scores for production approach show that efficiency ranges from 17.5% to 75.0% across the sampled CUs for the period. For the intermediation approach, technical efficiency ranges from 30.0% to 84.95% for the CUs.

[1] For a list of similar results, see Glass, McKillop, and Quinn, Modelling the Performance of Irish Credit Unions, 2002 to 2010, Financial *Accountability & Management*, 30(4), November 2014, 0267-4424.

Table 5. Distribution of Technical Efficiency-Production Approach

Efficiency (%)	Frequency	Percentage	Cum. Freq.
< 53	32	49	32
=/> 53	34	52	66
Total	66	100	
Mean		53.43%	
Minimum		17.50%	
Maximum		75%	

Source: Authors computations.

Table 6. Distribution of Technical Efficiency-Intermediation Approach

Efficiency (%)	Frequency	Percentage	Cum. Freq.
< 53	15	23	15
=/> 53	51	77	66
Total	66	100	
Mean		57.96%	
Minimum		30.83%	
Maximum		84.95%	

Source: Authors computations.

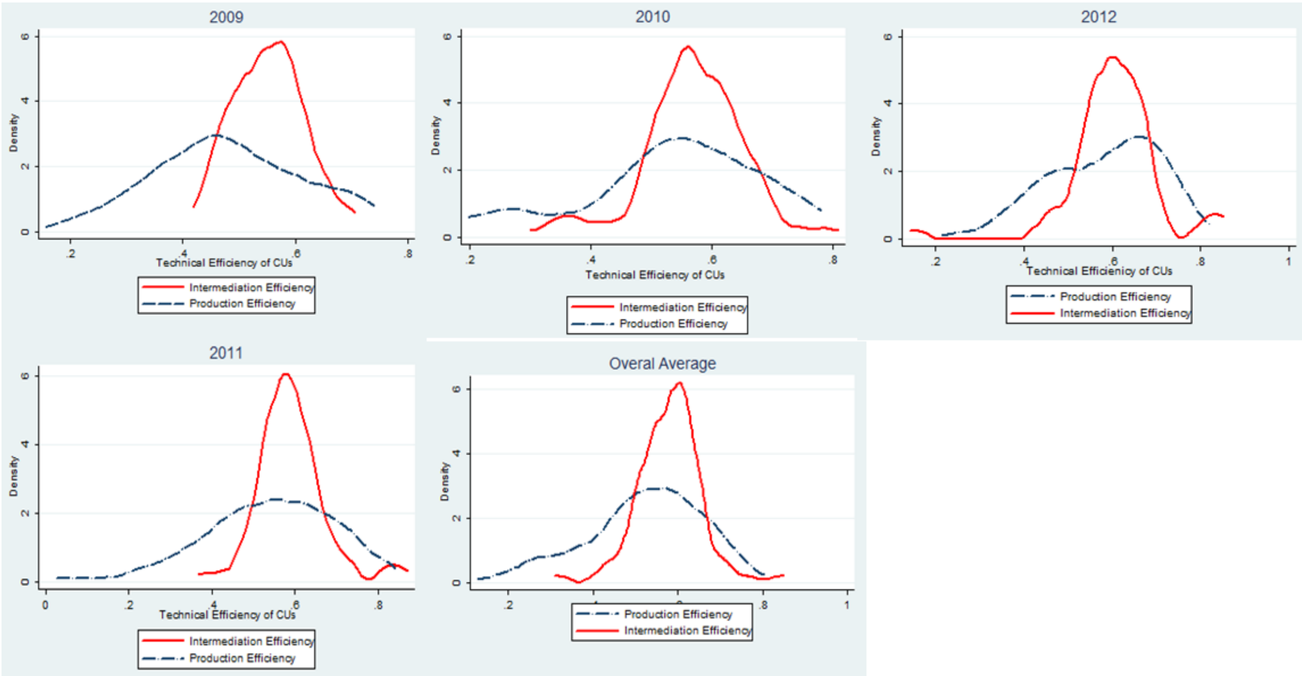

Figure 1. Distribution of Technical Efficiency (Intermediation vs. Production)

The mean annual technical efficiency scores from 2009-2012 for production approach are 48.02%, 53.0%, and 53.89% and 57.96% respectively. For the intermediation approach, the annual mean technical efficiency scores were 55.12%, 56.84%, 59.13, and 60.07% respectively for the period. The consistent increase in the annual mean scores indicates a rising efficiency change; which can be attributed to learning curve effects. The overall average technical efficiency is 53.40% and 57.96% for the production an intermediation approaches respectively. The results reveal significant presence of technical inefficiency (input wastage) among the CUs in Ghana. The frequency distribution tables shows that the technical efficiency scores are clustered in the range of 41% to 64% for all the approaches used. This is well depicted by the panel of density functions in Figure 1.

4.3. Determinants of Technical Inefficiency

From model (6) we estimated the variables in the inefficient term that influence the technical inefficiency of CUs. The results are presented in Table 7. Results of the production model (4) show that factors such as: the size of the CU, loan intensity, borrower per staff, depositor per staff, number of depositors and returns on assets are major determinants of inefficiency. Specifically, the Maximum-Likelihood estimates showed that increases in the levels of depositor per staff, borrower per staff (proxies for staff productivity) and deposit rate significantly reduce inefficiency; and thereby improving technical efficiency. This result compares the fact inherent in the efficiency literature that improvement in staff productivity significantly enhances production (see [47]). Oteng-Abayie et al [50] asserts that the level of staff productivity in financial organisation can be determined by a number of factors including the nature of training programmes, the skill set of the staff, the capacity to attract skilled labour, degree of motivation and the marketing strategy of the financial organization. Meanwhile firm specific factors such as ROA, loan intensity and size had an estimated positive impact on inefficiency contrary to their a priori expectations. The result on size showed that smaller firms are more technically efficient in production than their larger counterparts. This can be attributed to the fact that beyond certain size, as the firm grows larger; agency, coordination and dysfunction problems accentuate and this may lead to increase in inefficiency. Maksimovic and Phillips [40] consider that there is an optimal firm size beyond which; it will be detrimental for the organization to increase. Furthermore, the results indicate that an increase in loan intensity reduces technical efficiency. This result is rather interesting since the provision of loans is the major component of the profitability of a CU. The reason could be that because CUs are allowed to give out loans only to its members they might be caught up in the web of giving out excessive loans and this might affect profit levels.

Table 7. Determinant of Inefficiency

Variables		Parameters	Production Approach	Intermediate Approach
Net interest income	(NIM)	δ_1	0.004 (0.03)	-0.006 (-0.55)
Average loan balance	(ALB)	δ_2	1.02 (0.18)	2.4 (0.46)
Size	(SZ)	δ_3	0.114 (3.46) **	-0.15 (-4.74)***
Loan intensity	(LI)	δ_4	0.014 (-3.05)**	-0.018 (-4.04)***
Loan-deposit ratio	(LD)	δ_5	-0.007 (-0.22)	-0.0033 (-1.07)
Borrower per staff	(BPS)	δ_6	-0.002 (-2.71) **	-0.68 (-0.11)
Interest-income ratio	(IYTY)	δ_7	-0.078 (-0.39)	-0.002 (-1.09)
Deposit per staff	(DPS)	δ_8	-4.71 (-10.82) ***	-0.085 (-1.38)
Deposit rate	(DR)	δ_9	-0.093 (-6.44) ***	0.0499 (3.6)***
Age	(AGE)	δ_{10}	- 0.005 (-0.92)	-0.009 (-1.72)*
Return on assets	(ROA)	δ_{11}	0.254 (3.26) **	-0.139 (-1.86)*

*,**,*** denotes coefficient significant at 10%, 5% and 1% significant values.

The maximum-likelihood estimations of the intermediation model (5) show that size, loan intensity, number of depositors, age and ROA are significant sources of technical inefficiency. However, a closer look shows that the intermediation model results produced opposite effects for Size, loan intensity, deposit rate, and ROA compared to the production model. For instance the result on the effect of size on inefficiency reveal, contrary to the production approach that inefficiency decreases with increasing levels of firm size; suggesting that large firms are more technically efficient. This implies that large CUs are technically efficient in intermediation than small size CUs; while small size CUs are technically efficient in production than their larger counterparts. That is, large CUs pursue goals of intermediation than production.

On the effect of loan intensity (LI), we observed a statistically significant positive effect on technical efficiency under intermediation approach contrary to the result of the production approach. This reflects the notion that profits may not necessarily be accrued based on the degree or quantity of loans provision but the quality of these loans in terms of how much return it generates, whether the loans are produced from the internally generated funds; risk of default etc. This supports the argument that the positive link between loan intensity and CUs technical inefficiency could be ascribed to the capability of efficient CUs to manage their services more productively.

Deposits Rate (DR) is positively correlated with technical efficiency in production approach and negatively related to technical efficiency in the intermediation model. This shows that CUs with high deposits rate are technically efficient in production whiles those with low growth rates are technically efficient in intermediation. The simple reason being that high deposit rates attract a lot of depositors who want to reap higher returns on savings; however this becomes a liability to the CU who must make interest payment on these deposits. This might encourage the CUs to look for alternative sources of investment in order to reap additional returns on investments to meet its liabilities. When this happens the traditional function of intermediation is curtailed though in terms of production the financial cooperative might be increasing in economies of scale.

Furthermore, the results on ROA confirmed a priori expectation under the intermediation approach. Increasing levels of ROA was associated with increasing levels of technical efficiency. The results confirm previous finding by [12]. Meanwhile for the production approach a significant negative sign was obtained suggesting that profitability (ROA) reduces technical efficiency in production. This is logical only when the incumbent CU is caught in the ambition of making huge profits at the expense of meeting its social goals of reaching out to the poor. Especially in the presence of weakened industrial systems and market failure, firms may be engaged in rent seeking to the detriment of their client.

Finally, there is evidence to suggest that in acts of intermediation, firms get better with age. The negative coefficient for age in the intermediation model suggests that technical efficiency improves as institutions grow in experience. This also goes to confirm the importance of training and experience in the industry, as the evidence shows the existence of a learning curve effects in the sector.

5. Conclusion

The study examined the technical efficiency of 66 CUs in Ghana for the period 2009-2012 using Cobb-Douglas stochastic frontier production and intermediation models. A number of findings emerged from the analysis.

First, the overall average technical efficiency level indicates that CUs have room to improve on its ability to utilised existing resources to expand on its output levels by about 47% and 42% respectively. Secondly, the consistent rise in the technical efficiency scores over the study period indicates an improvement in use of financial technology. Thus it appears that CUs are learning to use the mix of inputs to produce its financial services. Third, the share of labour input coupled with the positive influence of staff productivity suggest that CUs could leverage on the quality of their staff through retention and investment in professional training in modern financial services delivery. CUs must therefore concentrate on programmes that focus on adequately equipping staff and motivating staff productivity to be able to maximize output [50]. Fourth, from the intermediation point of view, CU managements must explore opportunities of economies of scale in production by exploring opportunities for restructuring and mergers of the fragmented and relatively small number of CUs into stronger and well-capitalised CUs. This would help CUs to deliver competitive financial services to its constituents and ultimately achieve its long-term goal of reducing poverty.

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