EFFICIENCY IN COMMUNITY DEVELPOMENT LOAN FUNDS

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ABSTRACT:

We study the efficiency of Community Development Loan Funds (CDLFs) in the U.S.A. between 2002 and 2005. We find that the largest CDLFs tend to be most efficient and that efficiency decreases with age and the proportion of minority representation on the board, while board size does not affect efficiency.

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1. INTRODUCTION:

Community Development Financial Institutions also referred to as Microfinance Institutions, have gained popularity in the last couple of decades or so, not only in developing countries but also in the developed world. In Continental USA the Microfinance industry is quite active with an estimated 1000 registered CDFIs and the latest survey put the asset base of these organizations at $16.9 billion (Hartarska, 2007).The main focus of these institutions has been to reach out to the poor, marginalized and excluded (unbankable) people in the society with micro credit at reasonable interest rates. Poor people in most countries virtually have had no access to formal financial services (Littlefield, Murduch and Hashemi,2003).Through these MFIs/CDFIs, such as the Grameen Bank of Bangladesh and others, poor people are becoming empowered economically (Tucker,2006).Thus, MFIs/CDFIs have become instruments of poverty alleviation and economic empowerment. In recent times however, issues of sustainability of MFIs/CDFIs have been raised by researchers. It therefore becomes necessary to research into the efficiency of MFIs/CDFIs to find out what factors (including internal characteristics) determine the efficiency and thus sustainability of CDFIs/MFIs.

The main objective of this study was to investigate the cost efficiency and thus sustainability of a sample of CDFIs in the United States. Among others, the specific objectives include: i. Estimate the cost efficiency of each CDFI covered in the sample. ii.Find what internal characteristics are determinants of CDFI efficiency level.

In the literature, efficiency measurement dates back to Farrell (1957) when the foundation was laid for the measurement of efficiency and productivity at the micro level. Farrell decomposed efficiency into technical and allocative efficiency. The former measure of efficiency refers to a firm's ability to minimize input use subject to producing a given amount of output or maximize output subject to a given level of input usage. The latter reflects a firm's ability to optimize the use of inputs given their respective prices and the technology available for combining those inputs. These two measures sum up to what is known as economic or total efficiency.

In principle, efficiency measurement of a firm is done by comparing its observed inputs and outputs to a frontier level which represents the most efficient firm. In practice, there may not be any firm that could be described technically, as operating on the frontier in terms of efficiency and we do not often know where the frontier is anyway. However, recent improvement in econometric software does allow for the simulation of a frontier level firm making it possible for individual firms' efficiency to be estimated by simple comparison to the frontier firm.

Several approaches to the estimation of efficiency have evolved over time. Two common approaches that are being used to study efficiency of banks and MFIs are the stochastic frontier (SFA) and the data envelopment approaches (DEA).The former is a parametric (econometric) approach while the latter is non-parametric and non-stochastic (deterministic). Stochastic frontiers seek to overcome the inadequacy of deterministic models which is that they do not account for stochastic disturbances. Stochastic Frontier Analysis was developed independently by Aigner *et al.* (1977), Battese and Corra (1977), Meeusen and van den Broeck (1977), and is based on an econometric specification of a production or cost *frontier*. In this case, the general stochastic frontier function estimation involves the specification of a disturbance term that causes deviation from the frontier by decomposing it into two error components-a symmetric error term to account for random noise and an asymmetric error accounting for inefficiency.

These two methods have been used by various researchers for the same tasks. While some authors say there is no difference in efficiency estimated by the two processes, others find varying degrees of differences in the efficiency estimates.

Ferrier and Lovell (1990) did a study on the cost structure of 575 US banks for the year 1984 in which they employed both SFA and DEA methodologies. Their estimates show mean efficiency to be higher for DEA than SFA at 80% and 74% respectively. Another study that compares SFA and DEA methodologies but incidentally, finds contrasting results to that of Ferrier and Lovell is Resti (1997).He analyses the cost efficiency of 270 Italian banks over the period 1988-1992.He compares the efficiency estimates via parametric and non-parametric methods with the result that reports 81%-92% for SFA as against 60%-78% for DEA.More recent studies find SFA efficiency scores are generally higher than those obtained by DEA (Fiorentino et al, 2003).This may be due to the fact that DEA method does not control for stochastic noise in the data. This way, any random noise such as misspecification and measurement errors are attributed to inefficiency which tends to underestimate the efficiency score and overestimate the inefficiency.

2. CHARACTERISTICS OF CDFIS

From humble beginnings in the 1800s, CDFIs have grown steadily both in absolute numbers and size. As organizations with the sole mandate of providing financial services to low-income communities and individuals, they have lived up to expectation of expanding the frontiers of commerce in these marginalized areas. The creation of a Federal funding agency (CDFI FUND) to provide funds to individual CDFIs was a further shot in the arm. Consequently, there has been an increased scaling up in the operation of CDFIs benefiting from this fund. A growing industry of this nature without a system in place to provide the needed checks and balances could create the potential for financial impropriety, at least guided by the quantum of recent corporate scandals that rocked the American Financial Industry. A Federal Act known as Community Reinvestment Act (CRA) provides the legal framework for regulating and monitoring the activities of CDFIs.

There are four categories of CDFIs mandated by the CRA Act to operate in the industry-Community Development Banks (CDBs), Community Development Credit Unions (CDCUs), Community Development Loan Funds (CDLFs) and Community Development Venture Capital Funds (CDVCFs).

Community Development Loan Funds lend capital to businesses and nonprofit organizations as mandated by the law. By their activities, CDLFs pursue various goals such as promoting economic growth and development, creation of jobs in low-income areas, and increasing the number of businesses owned by women and minorities. This paper focuses on the internal characteristics and cost efficiency of CDLFs.There is no special reason for this choice other than data availability and discretion of the researcher. Other researchers have focused on two or more of the other CDFIs.A comparative study of the impact of board size and board diversity on the performance of CDCUs and CDLFs on the one hand, and internal and external factors affecting efficiency of MFIs on the other hand have already been done (Hartarska, 2007; Hartarska and Mersland, 2007).Using a three year panel data, Hartarska (2007) find no relationship between board size and performance of CDLFs and a negative association between racial and gender diversity and performance. This study further confirms the above findings by using four year panel data on CDLFs to show that board size has a negative insignificant effect on cost efficiency. Other studies that found similar negative association between board size and efficiency include Lipton and Loasch (1992) and Jensen (1993) while Belkhir (2004) found a positive association between board size and performance.Oster and Reagan (2004) explain the reason for an observed positive association between board size and performance. Their study focuses on the effect of board size in non-profit firms and they argue that the positive effect of larger board size may be justified due to additional duties of supervising fundraising activities.

3. EMPIRICAL METHODOLOGY

The cost function of a particular CDFI could be modeled as $f(q_i, p_i; \beta)$, where q represents CDFI output, p is a vector of input prices and β is a vector of coefficients. Assuming there is no inefficiency or errors, the cost function of the most efficient CDFI is given as

$$C_i = f(q_i, p_i; \beta) \qquad 3.1$$

But this is an abstraction from reality, in that inefficiency is a phenomenon that characterizes the operations of all firms. We need therefore to re-model the cost efficiency as

$$C_i = f(q_i, p_i; \beta)\ \xi_I \qquad 3.2$$

Where ξ_i is the level of inefficiency for the ith CDFI.Assuming that the firm achieves optimal level of cost at the desired output levels then ξ_i=1.On the other hand if ξ_i >1 then the firm has cost that is greater than optimal, and thus cost inefficiency is present in its operations. If a firm's observed/actual cost point lies on the cost frontier then it is perfectly cost efficienct.But if the actual cost point lies above the cost frontier (which is most often the case), then it is cost inefficient.

Costs are also assumed to be characterized by measurement errors and other random shocks that could lead to the observed cost deviating from actual. In this case we need to include a stochastic error term to cater for this noise. Thus,

$$C_i = f(q_i, p_i; \beta)\ \xi_i \exp(v_i) \qquad 3.3$$

Taking natural log of both sides yields

$$\mathrm{Ln}\ (C_i) = \ln\{f(q_i, p_i; \beta)\} + \ln \xi_i + v_i \qquad 3.4$$

If we define $u_i = \ln \xi_i$ and assume that $\xi_i \geq 1$, we have

$$\mathrm{Ln}\ (C_i) = \ln\{f(q_i, p_i; \beta)\} + u_i + v_i \qquad 3.5$$

Where $u_i \geq 0$

This is the stochastic cost frontier. The error term is decomposed into two,$\mathbf{v_i}$ which is two-sided (symmetric) and captures the effects of measurement errors and other disturbances outside the control of the decision taker. While $\mathbf{u_i}$ is a one-sided (asymmetric) error that captures the cost inefficiency, measured as the distance of the observed cost from the cost frontier. The non-negativity assumption of the inefficiency error term agrees very well with the practical reality that inefficiency is a common characteristic phenomenon of all firms.

The idiosyncratic error term (**v_i**) is always assumed normally and independently distributed as $N(0, \sigma_v^2)$. Different specifications of the distribution of **u_i** give rise to different functional forms. It is assumed for the purpose of this paper, that the u_i are independently half-normally distributed $\boldsymbol{N^+(0,}\sigma_u^2)$.

Various functional forms have been used to model cost efficiency. In this paper, cost efficiency is modeled in two different ways. In both cases the **u_i** is independently half-normally distributed $\boldsymbol{N^+(0,}\sigma_u^2)$.In both equations also, the inefficiency error term enters as an additive term since inefficiency is expected to increase cost.

Cobb-Douglas model

$$\ln(C_i) = \beta_0 + \beta_q \ln(q_i) + \sum_j^k \beta_j \ln(p_{ji}) + v_i + u_i \qquad 3.6$$

Translog model

$$\ln(C_i) = \alpha_0 + \sum_j \alpha_j \ln(p_j) + \sum_k \beta_k \ln(q_k) + \frac{1}{2}\sum_j \sum_i \gamma_{ji} \ln(p_j)\ln(p_i)$$

$$+\frac{1}{2}\sum_k \sum_l \delta_{kl} \ln(q_k)\ln(q_l) + \sum_j \sum_k \rho_{jk} \ln(p_j)\ln(q_k) + \ln u + \ln v \qquad 3.7$$

Where C_i is cost, q_i is output and p_{ji} are input prices.

3.1 HYPOTHESES

The following hypotheses are formulated in order to help achieve the objectives of the study.

H_0: Board size is not a significant determinant of CDLF efficiency

H_0: Older CDLF are less efficient

H_0: Larger CDLF are less efficient

H_0: Boards dominated by minorities are less efficient

In order to test these hypotheses, the following model linking cost efficiency to firm characteristics was developed and estimated by the method of Ordinary Least Squares.

$$CE_i = \beta_0 + \beta_1 Age_i + \beta_2 Bsize_i + \beta_3 Ta_i + \beta_4 P\min_i + \sum_j^n \beta_j Controls_i + \varepsilon_i \qquad 3.8$$

Where CE is the estimated coefficient of cost efficiency of the ith firm, Age is the number of years the CDLF has been in operation, Bsize is the number of board members, Ta is the dollar value of total assets (a measure of firm size), Pmin is the share of minorities on the board and β_j is a vector coefficients for the control variables. The error term ε_i is niid $(0.\sigma^2)$.The classical linear model assumptions hold and therefore standard t and F-statistics are applied to the hypotheses tests.

4. DATA AND VARIABLES

Four-year panel data on a cross section of Community Development Loan Fund Institutions are used in the analysis. The data was collected by the CDFI Data Project as part of their annual surveys of CDFIs spanning the fiscal years 2002 to 2005.The unit of observation is the CDLFs with complete information over the 4-year period and there are close to 300 of them in the sample.

Following is a description of relevant variables used in the analysis while table1 gives summary statistics of each variable. Variable definitions are given in table 4.

In order to estimate the performance of CDFI Loan Funds, a cost efficiency estimation approach using both translog and Cobb-Douglas functions was adopted. The dependent variable is natural log of total cost as in equations (3.6) and (3.7).For the purpose of this study and the given sample, total cost is defined to include the sum of operating and financial expenses incurred by the CDFI within a fiscal year.

The arguments of the translog and Cobb-Douglas cost frontier functions include output and input prices. The main legal function of CDFI Loan Fund Institutions is to advance loans to businesses. Therefore an appropriate way to measure its performance is to look at the number of loans produced in a given year at the minimum possible cost or to put it otherwise, the number of clients served while not sacrificing the sustainability of the firm. The sustainability issue here is an important one given that the clients served by these institutions are the high risk type with a higher probability of defaulting on loan repayment. Since these institutions do not have the legal backing to accept deposits and/or engage in other financial deals that CDFIs like Credit Unions are able to do, it is appropriate to model their cost frontier with a single output translog function. The cost efficiency generated from a Cobb-Douglas cost frontier does not differ, at least as revealed by this study. Three input prices are included in the cost frontier function namely labor input price, measured as the ratio of personnel emolument to total number of paid personnel employed by the CDFI.Volunteer services provided by unpaid personnel are not included in this analysis just for the purpose of simplicity. Of course their inclusion would not change the results since they are not paid; there is no additional cost to the CDFI by their employment. The price of financial capital is calculated from the given sample data as the weighted cost of capital, while price of physical capital is calculated as the ratio of the difference between operating expense and personnel expense to net assets. Finally, by using the price of physical capital as a numeraire, all prices and total cost are normalized by dividing through by the numeraire.Total cost, output and input prices are thus the variables that are used to estimate the efficiency of CDFIs.A

parametric stochastic translog cost frontier approach is used to derive the efficiencies because of its flexibility and computational ease given the available software.
CDLF characteristics that are postulated to influence efficiency include but not limited to the Age, board size, total assets, number of personnel, profit margin, total equity, capital/asset ratio etc.

For example, Gregoire and Oswaldo (2003) did a study on the Cost Efficiency of Microfinance Institutions in Peru using a Stochastic Frontier Approach. Their study analyses the efficiency of MFIs in Peru between 1999 and 2003 through the estimation of a parametric stochastic cost frontier. Among others, the study finds that MFIs with the largest assets tend to post higher efficiency levels and that efficiency decreases as more MFIs enter the market. The study identifies that loan size, proportion of net assets, financial sufficiency, financial leverage, business experience and proportion of farm loans are the main factors determining the cost efficiency of MFIs.

Cost efficiency of each CDLF was estimated via a stochastic cost frontier using translog functional form. A Cobb-Douglas functional form of the stochastic cost frontier yielded similar prediction of cost efficiency. The estimated efficiency of CDLF was regressed on the internal characteristics to determine those that are significant determinants of performance. Various definitions of firm performance have been used in the literature. Cost efficiency is one such measure of the performance of a firm ie how well it is doing in terms of achieving its objectives.De Young and Berger (1997) used cost efficiency as a measure of efficiency in banking in their study of problem loans in Commercial Banks. Hartarska (2007) studied the impact of board size and diversity on CDFI performance using cost inefficiency as a measure of performance.

The average cost efficiency of CDLF estimated by the translog cost function for the sample is .42 with minimum and maximum being .027 and .79 respectively and with standard error of .18. The averages of cost efficiency estimated from Cobb-Douglas cost frontier do not differ markedly. The data reveals that the average age of CDLF in the sample is 18 years with a wide range of difference in age from 5 to 44 years in operation. Board size as measured by the number of board members also varies from one institution to the other with a sample average of about 13.The largest board in the sample has 32 members while the smallest has 4 members.

Two variables that capture board diversity are the proportion of minorities and females represented on the board. Of particular importance is the influence of board diversity on efficiency of the CDFI. In the sample of 294 CDLFs only 8 of them have boards with all members being minorities while 45 have no minority members on their board. Representation of females on the boards range from zero to 14.Average female representation on all boards in the sample is 32% .There are four boards with the largest female representation than males and these boards have 68% of their membership being female.

5. RESULTS

Tables 2 and 3 present the output from the OLS regression analysis with estimated cost efficiency as the regressand.Most important repressors are board size,age,size of CDLF (measured by total assets), board composition (measured by proportion of minorities and proportion of females) and other controls.

5.1 BOARD SIZE AND CDLF EFFICIENCY

Holding other factors constant, board size has a negative ceteris paribus effect on cost efficiency. The effect is neither economically large nor statistically significant at any conventional level. We cannot reject the null hypothesis that board size is not a significant determinant of efficiency in CDFI Loan Fund Institutions. This supports the findings of Hartarska (2007) that board size is not a significant determinant of efficiency for CDFI Loan Funds Institutions. The negative effect of board size is a reflection of the so-called free-riding concept identified in Lipton and Lorch (1992), Jensen (1993) and further confirmed by the studies of the effect of board size in both large and small corporate boards (Yermack, 1996; Eisenber, Sungren, and Wells, 1998).

5.2 TOTAL ASSETS AND CDLF EFFICIENCY

Total assets, a measure of the size of CDFIs and for that matter all firms is estimated to have a positive effect on efficiency of CDFIs.A unit increase in the dollar value of total assets increases the cost efficiency by 8.55e-10 (Table 2).It seems a negligible effect economically but it is very statistically significant at very small alpha levels, suggesting a positive association between size and efficiency. This constitutes a refutation of the null hypothesis that larger CDLFs are less efficient. This also confirms the findings of Gregoire and Oswaldo (2003) that MFIs with the largest assets tend to post higher efficiency.

5.3 AGE AND CDLF EFFICIENCY

Older firms are poor performers at least as the sample results depict. An additional year in operation reduces the cost efficiency of a CDFI loan fund by .0043 on average. This is a large effect. The null hypothesis that older firms are less efficient is thus validated at all conventional significance levels. This is perhaps a reflection of the negative effect of diminishing returns to scale as the firm grows older.

5.4 EFFECT OF BOARD SIZE AND DIVERSITY ON CDLF EFFICIENCY

The board diversity variables (Pmin and Pfem) are jointly significant at the 1% level. Both variables exhibit a negative impact on efficiency. Individually Pmin is significant but Pfem is not. This also confirms the earlier findings by Hartarska (2007) that for CDLFs, as the proportion of minorities on the board increases, efficiency decreases. In the sample, there are 8 boards with all members being minorities. These 8 CDLFs have an average estimated efficiency of .35 and range from .075 minimum efficiency to a maximum of .67.The average is lower than the sample average of .42 which gives the impression that minority representation on boards decreases efficiency. But one must not lose sight of the fact that this sample is not representative in terms of racial or gender composition. Moreover, the sample is not large enough which tends to limit any general conclusions that might be reached.

5.5 IMPACT OF OTHER VARIABLES

Other control variables in the regression indicate that equity-asset ratio, capital-asset ratio, loan loss reserve and total equity are individually significant determinants of efficiency. The equity-asset ratio and capital-asset ratio are positively associated with level of efficiency of the firm.

The profit margin and liability-asset ratio are insignificant and negatively associated with efficiency. Another variable of interest is the profit motive of the CDLF proxied in this study by the dummy, Fp (indicating whether the CDLF is for profit or not).This variable tends out to be insignificant. Incidentally, of the 293 observations only 3 are for-profit while the rest are non-profit. With this, it becomes impossible to uncover the ceteris paribus effect of the impact of the profit motive on CDLF efficiency. This may explain the insignificance of variable Fp.It's been suggested by some researchers that both for- profit and non-profit organizations aim to minimize their cost of operations. It would therefore have been of interest and insightful to see how this motive impacts the level of efficiency. The direction of future research could aim at uncovering the ceteris paribus effect of the profit motive using a balanced sample of non-profit and for profit firms which hopefully would be more revealing of the true effect of this variable on performance.

6. CONCLUSIONS

This paper explores the determinants of cost efficiency of CDLFs via a parametric stochastic cost frontier approach. Using a four-year panel data the results of the study demonstrates that there is no difference in whether we use a translog or Cobb-Douglas functional form, the cost efficiency estimates are consistently the same over the entire range of firms considered.

The main findings of the study are that CDLFs with the largest assets tend to exhibit higher efficiency levels. Holding other factors constant, board size is found to have a negative though insignificant effect on efficiency. Efficiency also decreases with proportion of minority representation on the board and age of the CDLF. The study identifies that loan loss reserve, total equity, equity-asset ratio, capital-asset ratio are significant factors determining the cost efficiency of CDLFs.These findings are consistent with the literature.

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Table 1.Summary statistics

	Mean	**Standard deviation**	**Minimum**	**Maximum**
CE	.42	.18	.027	.79
Age	18.32	7.78	5	44
Ta	3.11e+07	1.02e+08	102523	1.07e+09
BSIZE	12.82	5.32	4	32
Pmin	.28	.24	0	1
Pfem	.38	.16	0	.83
EtaR	.40	.23	-.056	.96
Equitytidi	1.06e+07	2.61e+07	-183317	2.42e+08
CaptaR	.82	.17	.14	.99
LiabtaR	.59	.23	.04	1.06
LlossR	983343	2370549	0	2.01e+07

Table 2.Results of OLS regression analysis using cost efficiency estimates from translog function as dependent variable (standard errors).

	(1)	*(2)*	*(3)*
Constant	.289*** (.111)	.288*** (.067)	.137 (.242)
Age	-.0043*** (.0012)	-.0038*** (.0011)	-.0043*** (.0012)
Ta	8.55e-10*** (2.86e-10)	6.93e-10** (2.87e-10)	6.30e-10** (2.94e-10)
Bsize	-.00001 (.0017)	-.00045 (.0017)	-.0014 (.0017)
Pmin	-.115*** (.037)	-.121*** (.037)	-.130*** (.037)
Pfem	-.0069 (.057)	-.0122 (.056)	.0075 (.057)
LlossR	-1.88e-08*** (6.26e-09)	-1.67e-08** (6.47e-09)	
EtaR	.132*** (.045)	.141*** (.044)	.314 (.238)
Equitytidi	-4.27e-09*** (1.22e-09)	-3.83e-09*** (1.13e-09)	-5.02*** (1.12)
CaptaR	.257*** (.056)	.277*** (.054)	.264 (.056)
Pmarg		1.59e-09 (5.77e-09)	7.54e-09 (5.62e-09)
LiabtaR			.172 (.234)
Fp	.019 (.087)		
Observations	289	297	293
R-squared	.36	.35	.34
B-P test for Hetero: Chi2=0.00, Prob>0.95			

***Significant at the 1%level. **Significant at the 5% level

Table 3.Results of OLS regression analysis using cost efficiency estimates from Cobb-Douglas function as dependent variable (standard errors).

	(1)	(2)	(3)
Constant	.317*** (.104)	.294*** (.063)	.309*** (.065)
Age	-.0042*** (.0011)	-.0036*** (.001)	-.0039*** (.0011)
Ta	1.08e-09*** (2.68e-10)	9.63e-10*** (2.71e-10)	8.38e-10*** (2.73e-10)
Bsize	-.00074 (.0017)	-.0011 (.0017)	-.0022 (.0016)
Pmin	-.128*** (.035)	-.132*** (.035)	-.143*** (.035)
Pfem	-.029 (.054)	-.036 (.053)	-.0158 (.054)
LlossR	-2.04e-08*** (5.86e-09)	-1.81e-08*** (6.11e-09)	
EtaR	.157*** (.0422)	.167*** (.042)	.171*** (.043)
Equitytidi	-4.52e-09*** (1.14e-09)	-4.28e-09*** (1.07e-09)	-5.36e-09*** (1.04e-09)
CaptaR	.245*** (.053)	.255*** (.051)	.246*** (.053)
Pmarg		2.66e-10 (5.45e-09)	
Fp	-.0056 (.082)		
Observations	289	297	293
R-squared	.37	.36	.34
B-P test of Hetero: Chi2=0.23, prob>0.63			

***Significant at the 1% level

Table 4.Variable definitions

Variable	*Description*
CE	Cost Efficiency, estimated from a translog or Cobb-Douglas function
Age	Number of years CDFI has been operating
Ta	Total Assets
BSIZE	Board Size
Pmin	Proportion of minorities on board
Pfem	Proportion of females on board
Pmarg	Profit margin
EtaR	Equity-to-asset-Ratio
Equitytidi	Total equity (dollars)
CaptaR	Capital-to-asset-Ratio
LiabtaR	Liability-to-asset-Ratio
LlossR	Loan loss Reserve
Fp	For profit, a dummy equal to 1 if legally registered as a profit firm