

Best Financial Practices Analysis and Efficiency of Small Financial Institutions: Evidence from Cooperative Rural Banks in Sri Lanka

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Abstract

Many small financial institutions (SFIs) in developing countries make great effort to provide efficient services to poor house holders. It is generally accepted that maintaining the best financial practices which are of importance in corporate governance mechanism of institutions, has a close relationship with the efficiency of financial institutions, although they are small. This paper seeks to test best financial practices of cooperative rural banks in Sri Lanka (CRBs) and whether these practices have a significant impact on the efficiency of these institutions. The financial practices of CRBs was assessed using ratios of capital adequacy, liquidity, asset quality, loan to deposit, profitability, loan portfolio yield, operational efficiency, and operational self-sufficiency. The efficiency of CRBs in Sri Lanka was examined by using Data Envelopment Analysis (DEA). Based on the data extracted from CRBs' financial statements, correlation coefficients showed that several ratios have significant associations with the efficiency of CRBs. This confirms that efficient CRBs maintain best financial practices which contribute to their higher levels of efficiency.

Keywords: Efficiency, small financial institutions, financial practices, capital adequacy liquidity, Asset quality

INTRODUCTION

There is general consensus on the importance of strengthening the regulatory and supervision mechanisms in the financial services sector for the purposes of stability¹, safety and soundness and thus, the protection of depositors (Llewellyn, 1999, Furstenberg, 1997). The implementation of good governance in regulatory and supervision mechanisms for small financial institutions (SFIs) could help to develop efficient institutions leading to strengthen the entire financial services sector (Mullineux, 2006, Macey and O'Hara, 2003). Finance practices are important in this context. In Sri Lanka, although the Government has implemented quite a range of reforms to strengthen regulation and supervision mechanisms over the last two decades, it has not paid much attention to the regulation and supervision of the rural financial sector which comprises of a wide range of small financial institutions (SFIs). This has not only affected confidence in the whole financial services sector but also the efficiency of these SFIs. The aim of this study is to review the literature related to efficiency and financial practices of small financial institutions.

Operational Activities of CRBs

As formal small financial institutions, CRBs have made significant contributions to credit provisioning

and savings mobilisation from their inception in 1964 (Ameer, 2001). Over the last few decades, these institutions have gained an increasing share of deposits which has been particularly helpful in satisfying growing demand for loans and advances for the people living in most rural parts of Sri Lanka (Ameer, 2001). Currently, CRBs operate within a federated, four-tier cooperative structure with a network of fifteen district cooperative rural banking unions. The Sri Lanka Cooperative Rural Bank Federation Ltd (SLCRB) is the highest organisation of the cooperative rural bank movement and represents the National Co-operative Council. Each CRB in a particular district is a member of a district cooperative rural banking union.

Institutions engaging in microfinance activities around the world are not renowned for their commitment to financial transparency and this factor contributes to the fragile nature of the institutions (Rosenberg et al., 2003, Duflos et al., 2006, Desrochersa and Lamberteb, 2003, Florendo, 2007). Further, no published research into the importance of SFIs as CRBs in Sri Lanka has been identified in the literature. Many financial institutions introduced a wide range of financial services to the rural financial sector after 2000. The number of SFIs operating in the rural finance market increased. This increase in SFIs may have resulted in greater competition and may have affected the overall efficiency of CRBs activities. Hence, an evaluation of their financial

¹A safe and secure financial system encourages financial institutions to function efficiently (CBSL 2006).

strength is of importance to developing the rural financial sector. Therefore, a quantitative assessment of the financial strength and the efficiency of CRBs in Sri Lanka fill this gap.

Financial Strength And Efficiency

Based on theoretical and empirical research, financial soundness has a close relationship with the efficiency of financial institutions (Das and Ghosh, 2006, Berger and Young, 1997). Many risk methodologies for financial institutions show that capital adequacy, liquidity, asset quality, maintaining effective financial structures, profitability, and efficiency of management are key indicators of financial soundness (CGAP, 2003, Saltzman and Salinger, 1998, Richardson, 2002, Microrate, 1996). These indicators have an affect on the efficiency of financial institutions (Bhattacharyya et al., 1997, Berger and Young, 1997, Das and Ghosh, 2006, Kwan and Eisenbeis, 1997, Eisenbeis et al., 1999, Jansson and Taborga, 2000, Miller and Noulas, 1997, Robison and Barry, 1977, Seelanatha, 2007). Although, interpretations of indicators and categories vary between studies, these indicators are important for maintaining financial strength with risk management processes.

The above argument also applies to SFIs. Although they are small, transparency is necessary to build the confidence of customers (Van Greuning et al., 1998, Llewellyn, 1998). With respect to SFIs, inadequate management that results in deficiencies in control of activities, creates programmes that do not provide efficient services in developing countries and these may be unsustainable (Hulme and Mosley, 1996, Holden and Prokopenko, 2001). In Sri Lanka, the recent financial institution collapses could signal that ineffective financial practices were applied within these institutions. In the light of these gaps in the literature, this study seeks to test whether CRBs financial practices have a significant impact on efficiency of CRBs in Sri Lanka. The following hypotheses are formulated.

H₁ CRBs in Sri Lanka operate efficiently in providing microcredit activities.

H₂ CRBs with higher financial strength will have higher levels of efficiency.

The financial strengths of SFIs are assessed using capital adequacy, liquidity, asset quality, loan to deposit, profitability, loan portfolio yield, efficiency of management. Efficiency of management is decomposed further operational efficiency (Almario et al., 2006, CGAP, 2003, Jansson and Taborga, 2000), and operational self-sufficiency (McGuire, 1996, CGAP, 2003). Each variable is measured using ratios based on financial statement data. The ratios are measured as means for each CRB over the study period. Correlation coefficients are used to examine the impact of CRB size and financial practices on

efficiency and to assess the differences in location, Kruskal-Wallis tests are used.

METHODOLOGY

For the assessment of efficiency, data envelopment analysis (DEA) was used to evaluate the efficiency of CRBs in Sri Lanka. DEA is a methodology based on the concept of relative efficiency and is widely used in the productivity and efficiency analysis of financial institutions (Murthi et al., 1997, Brockett et al., 1997, Taylor et al., 1997, Schaffnit et al., 1997, Soteriou and Zenios, 1999, Saha and Ravisankar, 2000, Portela and Thanassoulis, 2007). It permits the selection of efficient firms within the industry. DEA is used in prior studies on the efficiency of financial institutions to examine the impact of some specific changes such as financial reforms, the impact of financial practices and the impact of different ownership groups. Gutiérrez-Nieto, Serrano-Cinca and Molinerob (2007) for example use DEA to analyse the efficiency of Latin American MFIs.

DEA assesses the efficiency frontier on the basis of all input and output information from the sample (Rogers, 1998). Thus, the relative efficiency of firms operating in the same industry can be estimated (Fried et al., 2002). Hence, identification of performance indicators in CRBs is useful for identifying a benchmark for the whole industry. Moreover, the DEA methodology has the capacity to analyse multi-inputs and multi-outputs to assess the efficiency of institutions (Coelli et al., 1998). While many efficiency studies of SFIs use traditional financial ratios (Gibbons and Meehan, 1999, Jansson and Taborga, 2000, Tucker and Miles, 2004) these ratios provide only partial measures of efficiency. Partial measures can be misleading when attempting to draw conclusions about the overall efficiency of institutions (Coelli et al., 1998, Berger and Humphrey, 1997). The DEA approach does not suffer this constraint.

DEA Formulation

Several DEA models have been presented in the literature. The basic DEA model presents an efficiency based on the productivity ratio which is the ratio of outputs to inputs. This study applies Charnes, Cooper and Rhodes's (1978)(CCR) model and Banker, Charnes and Cooper (BCC) (1984) model. The production frontier has constant returns to scale in the CCR model. The basic CCR formulation (dual problem/envelopment form) presents in Equation One (See Appendix One).

Further, the model assumes that all firms are operating at an optimal scale. However, imperfect competition and constraints to finance may cause some firms to operate at some level different to the optimal scale (Coelli et al., 1998). Hence, the Banker, Charnes and Cooper (1984) BCC model is developed with a production frontier that has variable returns to scale. The BCC model forms a convex combination

of DMUs (Coelli et al., 1998). Then the constant returns to scale linear programming problem can be modified to one of variable returns to scale by adding the convexity constraint $\sum \lambda_j = 1$ (Zhu, 2003). The

Equation Two illustrates (see appendix One) the basic BCC formulation (dual problem/envelopment form).

This approach forms a convex hull of intersecting planes (Coelli et al., 1998). These planes envelop the data points more tightly than the constant returns to scale (CRS) conical hull. As a result, the variable returns to scale (VRS) approach provides technical efficiency (TE) scores that are greater than or equal to scores obtained from the CRS approach (Coelli et al., 1998). Moreover, VRS specifications will permit the calculation of TE decomposed into two components: scale of efficiency (SE) and pure technical efficiency (PTE). The relationship of these concepts is shown in the Equation Three (Appendix One). Hence, this study first uses the CCR model to assess TE then applies the BCC model to identify PTE and SE in each DMU.

The Selection of Inputs and Outputs

There is considerable debate in the empirical literature about the selection of input and output combinations. Three basic approaches for financial institutions are used in DEA research. These are the intermediation, production and asset approaches. The intermediation approach views financial institutions mainly as mediators of funds between savers and investors (Avkiran, 1999, Yue, 1992). The production approach emphasises the role of financial institutions as providers of service for account holders (Drake and Weyman-Jones, 1992). With the asset approach, outputs are strictly defined by assets and the productivity of loans (Favero and Papi, 1995). Intermediation approach is used in this study to assess the efficiency of CRBs in Sri Lanka. The other approaches have not been used as the appropriate internal data for decision making units (DMUs) is unavailable to the researchers. An individual CRB is considered as a DMU. The efficiency scores are estimated for individual CRB and mean efficiency scores are calculated for the sample as a whole. The annual trends in estimated efficiency are also examined with mean estimated scores over the study period. The Table 1 (see Appendix Two) presents the input-output specifications. These inputs and outputs have been identified from prior studies conducted in different contexts.

Sample

The study is based on 108 CRBs established in Sri Lanka. The required data was obtained from CRBs for the three years 2003 to 2005. The comparison of efficiency is made between years 2003 to 2005. Year 2003 is chosen to measure the baseline for efficiency

after the introduction of a wide range of financial services to the rural financial sector in many SFIs. This study window is selected to allow newer entrants time to establish their operations prior to estimating their efficiency.

EMPIRICAL RESULTS

Financial practices

As discussed previously, maintaining sound financial practices is expected to influence the efficiency of financial institutions. Therefore, the financial practices of CRBs are assessed to identify if higher level of financial strength have a favourable effect on the efficiency of CRBs in Sri Lanka. Capital adequacy, liquidity, asset quality, loan to deposit, profitability, loan portfolio yield, operational efficiency, and operational self-sufficiency are considered as variables determining sound financial practices in financial institutions. The sampled firms' ratios are calculated as the average of annual figures from financial statements for the three years 2003, 2004 and 2005. Table 2 (Appendix Two) presents the descriptive statistics for financial practices of the sample.

Descriptive statistics (Table 2) show substantial variations in most of the variables with relatively high standard deviations. Some CRBs in the sample neglect to maintain adequate capital adequacy on assets (minimum -11.27%), capital adequacy on deposits (minimum -16.55%), liquidity of assets (minimum -3.52%), and return on assets (minimum -2.90%). The Kolmogorov-Smirnov statistics (Table 2) show the liquidity of assets, return on assets, and operational self-sufficiency variables make significant ($p > 0.05$) departures from the normal distribution.

Efficiency in intermediation

Table 3 presents the summary of efficiency analysis on intermediation. The TE (I) represents technical efficiency (intermediation) in the Charnes, Cooper, and Rhodes (CCR) model [Constant returns to scale (CRS) specification]; PTE (I) represents pure-technical efficiency (intermediation) in the Banker, Charnes, and Cooper (BCC) model [Variable returns to scale (VRS) specification]; and SE (I) represents scale efficiency (intermediation) with VRS. As stated previously, CRS ignores scale differences and assumes that all CRBs are operating at the optimal scale. In contrast, VRS assesses efficiency after controlling for scale differences. Efficiency scores are calculated for both CRS and VRS to shed light on the potential impacts of scale differences on efficiency.

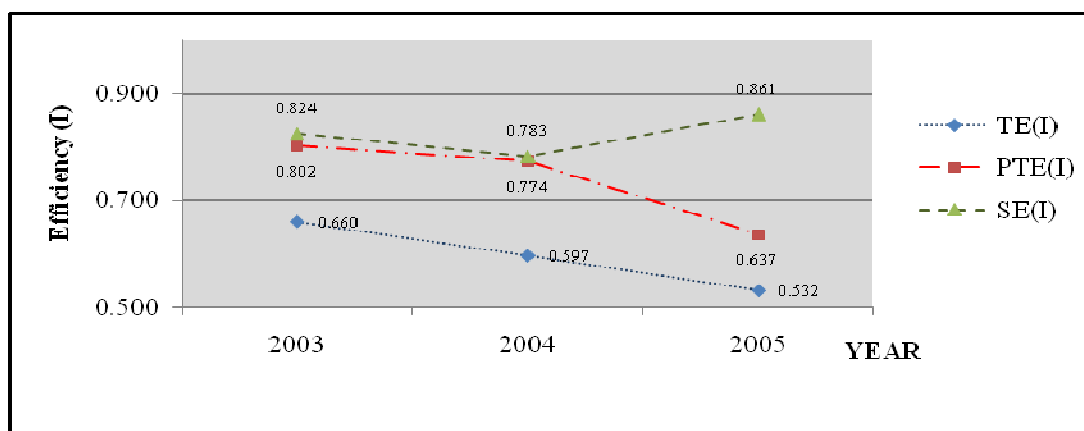
The TE (I) scores in Table 3 show eight CRBs (10%) in 2003, five (5%) in 2004 and six (6%) in 2005 are efficient as indicated by efficiency scores equal to 1.00. The PTE (I) scores show 24 (30%) CRBs are efficient in 2003, 18 (19%) in 2004 and 18 (18%) in

2005. The number of efficient CRBs on SE (I) are consistent with the TE (I) except for 2005.

Figure 1 graphs mean efficiency scores in intermediation during the period 2003 to 2005. Regarding mean scores, there is a downward trend in average TE (I) from 2003 to 2005 (66.0% in 2003, 59.7% in 2004 and 53.2% in 2005). A similar trend exists for PTE (I) (80.2% in 2003, 77.4% in 2004 and 63.7% in 2005). However, although SE (I) declines from 82.0% to 78.0% from 2003 to 2004, it recovers to 86.0% in 2005. The average efficiency scores of the least efficient CRBs in the sample are also

continuously declining over the study period. This is evident in the minimum efficiency scores reported in the Table 1. The minimum efficiency score for TE (I) in 2003 (33%) fell to 16% in 2005. Although the estimated average efficiency scores for all CRBs show a declining trend throughout the study period, there was a slight upward trend in SE (I). This is attributed to scale differences in the CRBs. These results suggest that CRBs do not use their inputs efficiently and they could produce the same outputs while reducing inputs.

Figure 1: Mean efficiency in intermediation, 2003-2005



TE (I) = Technical efficiency in intermediation. PTE (I) = Pure technical efficiency in intermediation.

SE (I) = Scale efficiency in intermediation. Efficiency (I) = Efficiency in intermediation.

Overall, only eight (10% of the sample) CRBs with TE (I) scores of 1.00 could be classified as very strong in terms of the intermediation process. The mean of estimated efficiency scores show that most of the CRBs over the study period did not use their inputs efficiently. Mean scores for efficiency in intermediation over the study period show a continuous decline. This indicates that the majority of CRBs have become less efficient over the study period. These results indicate that CRBs can save more than 30% of their inputs while maintaining the same levels of outputs.

In Sri Lanka, many new financial institutions entered the rural finance market in Sri Lanka and other commercial banks diversified their activities to include microfinance services after 2000. In addition, several structural changes occurred in the financial sector, along with the establishment of wider operating activities in the commercial banking sector. Many financial institutions introduced innovative service delivery mechanisms in financial services to attract customers (CBSL, 2006). However, internal constraints, such as lack of awareness of best

practices in microfinance, weak institutional capacity and a negative perception of the commercialization decision, hamper diversification of activities of MFIs and result in decreasing membership (Charitonenko and De Silva, 2002). These circumstances appear to have adversely affected CRBs functions and their efficiency.

Overall, this negative trend in efficiency over the period suggests that on the whole, CRBs have become less efficient. Therefore, H_1 is rejected and it is concluded that as a sector, CRBs in Sri Lanka do not operate efficiently in providing microcredit activities.

Relationship Between Efficiency and Financial Strength

Eight predictions are formulated in this study for the relationship between the financial practices and the efficiency of CRBs. The predicted relationships for efficiency and the financial practices (capital adequacy, liquidity, asset quality, loan to deposit structure, profitability, loan portfolio yield, operational efficiency, and operational self sufficiency) were presented in Table 4 (appendix two). Spearman correlation coefficients are presented in Table 4, which also indicates which hypothesized relationships are supported by the analysis.

Capital adequacy (equity to assets) has the predicted positive correlation with TE (I) but is not significant (Table 4). This result provides some evidence that CRBs maintaining a higher level of capital (which reflects the higher financial strength) operate at higher efficiency. Higher asset liquidity was predicted to be negatively correlated with efficiency as it reduces the income generating capacity of CRBs. Table 4 shows a negative correlation between liquid assets and the efficiency of CRBs but the associations lack significance. Therefore, these results provide no evidence of a relationship between liquidity ratio and efficiency.

Prior empirical research suggests that asset quality is indicated by the level of the non-performing loans of CRBs. Therefore, a negative correlation is predicted. Table 4 shows that TE (I) and asset quality have a highly significant and moderately sized negative correlation of -0.347. These results indicate that CRBs maintaining well-managed, non-performing loan provisions have greater financial strength and are more efficient in intermediation [TE (I)]. This supports the findings of Berger and Young (1997), Das and Ghosh (2006) that asset quality is closely related to efficiency of a financial institution. The higher the ratio of loans to deposits, the more the bank is relying on relatively more expensive borrowed funds. Hence, a negative relationship is predicted for this ratio and CRB efficiency. Table 4 shows positive correlations between TE (I) and the loan to deposit structure of CRBs. As the coefficients lack significance and are not in the expected direction, the hypothesised relationship is rejected. More profitable CRBs are predicted to be more efficient. This analysis reveals that the correlation coefficient for profitability and TE (I) is positive but not significant (Table 4). Therefore, the hypothesised relationship is rejected. A negative correlation between loan portfolio yield and the efficiency of CRBs is predicted. The associations of portfolio yield and efficiency are highly significant, (TE (I), $\rho = -0.517$). These results indicate support for the hypothesised relationship.

The higher operational cost to loans and higher operational cost to deposits ratios are predicted to have negative relationships with efficiency. The results in Table 4 show that TE (I) scores have highly significant negative correlations for operational cost to loans with efficiency. The operating cost to deposit ratio has a highly significant negative correlation with efficiency in the intermediation model. Overall, these results indicate strong relationships for operational efficiency measured as the ratio of operating costs to loans and TE (I) measures of efficiency. When measured as operational costs to deposits, efficiency is associated with TE (I). A positive correlation between operational self-sufficiency (defined as the ratio of income to

expenses) and efficiency is predicted. Therefore, the evidence for the hypothesised relationship is accepted.

Overall, the correlation coefficients presented in Table 4 indicate asset quality, loan portfolio yield, operational efficiency, and operational self-sufficiency are correlated with the overall efficiency of CRBs when efficiency in intermediation is measured. Overall these correlations confirm that the greater the financial strength the higher the efficiency of CRBs in Sri Lanka. Hypothesis Two (H_2) of this study; that CRBs with higher financial strength will have higher levels of efficiency has strong support for the TE (I) efficiency measures.

CONCLUSION AND POLICY IMPLICATIONS

The main objective of this study is to investigate the efficiency of CRBs in Sri Lanka. Further, to investigate financial practices and their affect on efficiency of these SFIs. From the hypotheses were generated on CRBs' specific characteristics financial practices and overall efficiency. Having obtained the efficiency measures, finally, a correlation analysis is made to explain variation in estimated efficiency scores to explanatory variables; specific characteristics and financial practices. With regards to financial practices, the level of expectations and knowledge of best practices within the majority of CRBs are below the benchmarks. Particularly, their liquidity position and assets quality were not in the acceptable level. In this context, the level of risk exposure of these CRBs is very high. Therefore, the possibility of a consequential failure of going concern may be expected, especially at the time of global financial crises impacting all financial institutions. However, they maintain capital adequacy, return on assets and achieve operating self-sufficiency as compare to the accepted norms.

The empirical analysis in this study shows that several financial practices have significant associations with the efficiency of CRBs in Sri Lanka. This confirms that efficient CRBs maintain good financial practices, which contribute to the higher levels of efficiency. These findings point to policy recommendations that will formulate good financial practices to enhance efficiency. Further, these practices will provide a self-regulation mechanism as well as supervisory tools for regulators.

The findings of this study, although only suggestive of certain correlations, could help bank managers and other authorities to understand the underlying problems for efficiency of these CRBs and policy makers to establish more comprehensive policy settings for promoting SFIs in rural finance sector in Sri Lanka. In particular, given that there are no proper guidelines currently available for financial

management of SFIs. Finding from this study could provide guidance to help accounting and finance professionals increase their knowledge to targeted practices that specifically support SFIs. It can be concluded that findings from this study could help to provide some right directions for developing efficient

REFERENCES

ALMARIO, J., JIMENEZ, E. & ROMAN, P. B. 2006. The development and implementation of a uniform set of performance standards for all types of microfinance institutions in the Philippines. *Essays on regulation and supervision*. National Credit Council and Bangko Sentral Ng Philippine (Philippine Central bank), Philippine.

AMEER, J. M. 2001. Involvement of financial Institutions in microfinance Industry in Sri Lanka. *SAARCFINANCE Seminar on Microfinance-country paper*. 21-23 December 2002, Dhaka, Bangladesh.

AVKIRAN, N. K. 1999. The evidence on efficiency gains: The role of mergers and the benefits to the public. *Journal of Banking and Finance*, 23, 991-1013.

BANKER, R. D., CHARNES, A. & COOPER, W. W. 1984. Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science*, 30, 1078-1092.

BERGER, A. N. & HUMPHREY, D. B. 1997. Efficiency of financial institutions; international survey and directions for future research. *European Journal of Operational Research*, 98, 175 - 212.

BERGER, A. N. & YOUNG, R. D. 1997. Problem loans and cost efficiency in commercial banks. *Journal of Banking and Finance*, 21, 849-870.

BHATTACHARYYA, A., LOVELL, C. A. K. & SAHAY, P. 1997. The impact of liberalization on the productive efficiency of Indian commercial banks. *European Journal of Operational Research*, 98, 250-268.

BROCKETT, P. L., CHARNES, A., COOPER, W. W., HUANG, Z. M. & SUN, D. B. 1997. Data transformations in DEA cone ratio envelopment approaches for monitoring bank performances. *European Journal of Operational Research*, 98, 250-268.

CBSL 2006. Annual report. Colombo: Central Bank of Sri Lanka

CGAP. 2003. *Microfinance consensus guidelines: Definitions and selected terms, ratios, and adjustments for microfinance* [Online]. Washington D.C: CGAP/The World Bank Group. Available:

financial services in the rural finance sector which is one way to alleviate poverty in the country. Moreover, these findings may provide information for future studies to refine the measurement efficiency of SFIs.

http://www.cgap.org/gm/document-1.9.2784/Guideline_definitions.pdf [Accessed 12th Dec.2007].

CHARITONENKO, S. & DE SILVA, D. 2002. *Commercialisation of microfinance in Sri Lanka*, Manila, Asian Development Bank.

CHARNES, A., COOPER, W. W. & RHODES, E. 1978. Measuring the efficiency in decision making units. *European Journal of Operational Research*, 2, 429-44.

COELLI, T., RAO, D. & BATTESE, G. 1998. *An Introduction to efficiency and productivity Analysis*, London, Kulwer Academic Publishers group.

DAS, A. & GHOSH, S. 2006. Financial deregulation and efficiency: An empirical analysis of Indian banks during the post reform period. *Review of Financial Economics* 15, 193-221.

DESROCHERSA, M. & LAMBERTEB, M. 2003. Efficiency and expense preference in Philippines' cooperative rural banks. *CIRPEE working paper no. 03 -21*.

DRAKE, L. & WEYMAN-JONES, T. G. 1992. Technical and scale efficiency in UK building societies. *Applied Financial Economics*, 2, 1-9.

DUFLOS, E., LEDGERWOOD, J., HELMS, B. & MOYART, M. 2006. Country-level effectiveness and accountability review. Colombo, Sri Lanka: CGAP.

EISENBEIS, R. A., FERRIER, G. D. & KWAN, S. H. 1999. The informativeness of stochastic frontier and programming frontier efficiency scores: cost efficiency and other measures of bank holding company performance. *Federal Reserve Bank of Atlanta, working paper 99-23, Dec.1999*, 1-28.

FAVERO, C. A. & PAPI, L. 1995. Technical efficiency and scale efficiency in the Italian banking sector: a non-parametric approach. *Applied Economics*, 27, 385-395.

FLORENDO, J. G. Year. Insights into the corporate governance of Philippine rural banks. *In: research conference on safety and efficiency of the financial system 27th August 2007*, 2007 Philippine. www.upd.edu.ph/~cba/asialink.

FRIED, H., LOVELL, C., SCHMIDT, S. & YAISAWARNG, S. 2002. Accounting for

- environmental effects and statistical noise in data envelopment analysis. *Journal of Productivity Analysis*, 17, 157–174.
- FURSTENBERG, G. M. V. 1997. *Regulation and supervision of financial institutions in the NAFTA countries and beyond*, London, Kluwer Academic Publishers.
- GIBBONS, D., S & MEEHAN, J., W 1999. The microcredit summit's challenge: working toward institutional financial self-sufficiency while maintaining a commitment to serving the poorest families. *Journal of Microfinance*, 1, 131-191.
- GUTIÉRREZ-NIETO, B., SERRANO-CINCA, C. & MOLINEROB, C. M. 2007. Microfinance institutions and efficiency. *International Journal of Management Science*, 2007, 131-142.
- HOLDEN, P. & PROKOPENKO, V. 2001. Financial development and poverty alleviation: Issues and policy implications for developing and transition countries. *IMF working paper*, wp/01/160.
- HULME, D. & MOSLEY, P. 1996. *Finance against poverty*, London Routledge.
- JANSSON, T. & TABORGA, M. 2000. The Latin American microfinance industry: How does it measure up? Washington, D.C.: Inter American Development Bank.
- KWAN, S. & EISENBEIS, R. A. 1997. Bank risk, capitalization, and operating efficiency. *Journal of Financial Services Research* 12, 117-131.
- LLEWELLYN, D. 1998. Principles of effective regulation and supervision of banks. *Journal of Financial Regulation and Compliance*, 6, 312-19.
- LLEWELLYN, D. 1999. The economic rationale for financial regulation. *The Financial Services Authority, London, occasional paper series 1, April*.
- MACEY, J. R. & O'HARA, M. 2003. The corporate governance of banks. *FRBNY Economic Policy Review*, 91-107.
- MCGUIRE, P. 1996. 'Accounting and reporting standards for microfinance institutions', *paper presented to banking with the poor (BWTP) network, sponsored by the CGAP, Singapore, 8-10 July 1996*.
- MICRORATE. 1996. *The MicroRate methodology* [Online]. Washington D.C: MicroRate. Available: <http://www.microrate.com> [Accessed 15th January 2008].
- MILLER, S., M & NOULAS, A., G 1997. Portfolio mix and large-bank profitability in the USA. *Applied Economics*, 29, 505-512.
- MULLINEUX, A. 2006. The corporate governance of banks. *Journal of Financial Regulation and Compliance* 14, 375-82.
- MURTHI, B. P. S., CHOI, Y. K. & DESAI, P. 1997. Efficiency of mutual funds and portfolio performance measurement: A non-parametric approach. *European Journal of Operational Research*, 98, 408-418.
- PORTELA, M. C., A. SILVA & THANASSOULIS, E. 2007. Comparative efficiency analysis of Portuguese bank branches. *European Journal of Operational Research*, 177.
- RICHARDSON, D. C. 2002. *PEARLS monitoring system* [Online]. World council of credit unions Available: http://www.woccu.org/functions/view_document. [Accessed 15th Nov.2007].
- ROBISON, L., J & BARRY, P., J 1977. Portfolio adjustments: An application to rural banking. *American Journal of Agricultural Economics*, 59, 311-320.
- ROGERS, M. 1998. The definition and measurement of productivity. The university of Melbourne, Australia: Melbourne institute of applied economics and social research.
- ROSENBERG, R., MWANGI, P., CHRISTEN, ROBERT, P. & NASR, M. 2003. Disclosure guidelines for financial reporting by microfinance institutions. Washington, D.C.: CGAP/The World Bank Group.
- SAHA, A. & RAVISANKAR, T. S. 2000. Rating of Indian commercial banks: A DEA approach. *European Journal of Operational Research*, 124, 187-203.
- SALTZMAN, S. B. & SALINGER, D. 1998. *The ACCION CAMEL technical note* [Online]. The ACCION International. Available: http://www.microfinancegateway.org/files/1230_012_30.pdf [Accessed 21st Dec. 2007].
- SCHAFFNIT, C., ROSEN, D. & PARADI, J. C. 1997. Best practice analysis of bank branches: an application of DEA in a large Canadian bank. *European Journal of Operational Research*, 98, 269-289.

SEELANATHA, S. L. 2007. *An analysis of efficiency and productivity changes of the banking industry in Sri Lanka*. Unpublished PhD University of Southern Queensland.

SOTERIOU, A. C. & ZENIOS, S. A. 1999. Using data envelopment analysis for costing bank products. *European Journal of Operational Research*, 114, 234-248.

TAYLOR, W. M., THOMPSON, R. G., THRALL, R. M. & DHARMAPALA, P. S. 1997. DEA/AR efficiency and profitability of Mexican banks; A total income model. *European Journal of Operational Research*, 98, 346-363

TUCKER, M. & MILES, G. 2004. Financial performance of microfinance institutions. *Journal of Microfinance*, 6, 41-54.

VAN GREUNING, H., GALLARDO, J. & RANDHAWA, B. 1998. *A Framework for Regulating Microfinance Institutions*, Washington, D.C, Financial Sector Development Department The World Bank.

YUE, P. 1992. Data envelopment analysis and commercial bank performance: a primer with applications to Missouri banks. *Review, Federal Reserve Bank of St. Louis*, 74, 31-43.

ZHU, J. 2003. *Quantitative models for performance evaluation and benchmarking*, London, Kluwer Academic Publishers.

APPENDIX ONE- EQUATIONS

Equation One: The Basic CCR Formulation (dual problem/envelopment form)

$$\text{Min } \theta - \varepsilon \left(\sum_{j=1}^m s_j^- + \sum_{r=1}^s s_r^+ \right)$$

Subject to:

$$\sum_{j=1}^n \lambda_j x_{ij} + s^- = \theta x_{io} \quad (i = 1, \dots, m)$$

$$\sum_{j=1}^n \lambda_j y_{rj} - s_r^+ = y_{ro} \quad (r = 1, \dots, s)$$

$$\lambda_j \geq 0 \quad (j = 1, \dots, n)$$

Source: Zhu (2003)

Equation Two: The Basic BCC Formulation (dual problem/envelopment form)

$$\text{Min } \theta - \varepsilon \left(\sum_{j=1}^m s_j^- + \sum_{r=1}^s s_r^+ \right)$$

Subject to:

$$\sum_{j=1}^n \lambda_j x_{ij} + s^- = \theta x_{io} \quad (i = 1, \dots, m)$$

$$\sum_{j=1}^n \lambda_j y_{rj} - s_r^+ = y_{ro} \quad (r = 1, \dots, s)$$

$$\lambda_j \geq 0 \quad (j = 1, \dots, n)$$

$$\sum_{j=1}^n \lambda_j = 1$$

Source: Zhu (2003)

Equation Three: Relationship between TE, PTE and SE

$$TE_{CRS} = PTE_{VRS} * SE \quad \text{where}$$

TE_{CRS} = Technical efficiency of constant returns to scale

PTE_{VRS} = Technical efficiency of variable returns to scale

SE = Scale of efficiency

Source: Coelli, et al. (1998)

APPENDIX TWO-TABLES

Table 1: Input-output specifications

Variables	Definition	Intermediation approach
		Input/ Output
Total expenses	Amount paid as interest on deposits, wages and other benefits to employees, and expenses incurred on other facilities	Input
Loans	Amount of loan provided	Output
Pawning	Amount of advances provided on pawning	Output
Interest income	Income received on investments as interest	Output
Other income	Income received on other investments	Output

Table 2: Descriptive Statistics For Financial Practices Of CRBs

Financial practices	Number	Minimum	Maximum	Mean	Median	Standard Deviation	Kolmogorov-Smirnov test	
							Z value	p-value
Capital adequacy on assets	48	-11.27%	36.04%	12.23%	10.15%	11.82%	7.53	0.622
Capital adequacy on deposits	48	-16.55%	64.50%	19.27%	12.42%	20.32%	1.10	0.177
Liquidity of assets	96	-3.52%	13.35%	3.01%	2.34%	2.92%	1.72	0.005
Assets quality	78	0.00%	98.21%	26.19%	18.53%	25.36%	1.33	0.056
Loan to deposit	102	4.11%	131.32%	47.21%	39.77%	28.15%	1.33	0.058
Return on assets	104	-2.90%	9.57%	1.77%	1.68%	1.91%	1.97	0.001
Loan portfolio yield	102	0.67%	36.85%	13.26%	12.94%	8.01%	1.12	0.159
Operational efficiency on loans	102	0.63%	31.05%	11.94%	11.48%	7.16%	0.731	0.659
Operational efficiency on deposits	105	0.78%	25.11%	8.02%	7.62%	4.57%	.811	0.527
Operational self-sufficiency	108	63.50%	245.52%	129.07%	123.78%	30.05%	1.38	0.043

Table 3: Summary of Efficiency Analysis in Intermediation

Description	2003			2004			2005		
	TE(I)	PTE(I)	SE(I)	TE(I)	PTE(I)	SE(I)	TE(I)	PTE(I)	SE(I)
No. of evaluated CRBs	78	78	78	97	97	97	101	101	101
No. of efficient CRBs	8	24	8	5	18	5	6	18	7
No. of inefficient CRBs	70	54	70	92	79	92	95	83	94
Mean score	0.660	0.802	0.820	0.597	0.774	0.780	0.532	0.637	0.860
Standard deviation	0.194	0.195	0.120	0.172	0.184	0.150	0.194	0.231	0.170
Maximum score	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Minimum score	0.336	0.352	0.510	0.213	0.223	0.380	0.163	0.236	0.270

TE (I) = Technical efficiency in intermediation. PTE (I) = Pure technical efficiency in intermediation.

SE (I) = Scale efficiency in intermediation.

Table 4: Spearman Correlation Coefficients for Financial Practices and Efficiency

Financial practices	Definition	Hypothesised correlation efficiency	to	Correlation coefficient	Support the hypothesis
				TE (I)	
Capital adequacy	Equity to total assets	Positive		0.199	No
	Equity to deposits	Positive		0.265	No
Liquidity	Liquid assets to liabilities	Negative		-0.147	No
Asset quality	Non-performing loans to total loans	Negative		-0.347**	Yes
Loan to deposit structure	Loans to deposits	Negative		0.006	No
Profitability	Return on total assets	Positive		0.180	No
Loan portfolio yield	Interest income to loans outstanding	Negative		-0.517**	Yes
Operational efficiency	Operating cost to loans	Negative		-0.641**	Yes
	Operating cost to deposits	Negative		-0.590**	Yes
Operational self-sufficiency	Income to expenses	Positive		0.672**	Yes

** Correlation is significant at the 0.01 level

* Correlation is significant at the 0.05 level

TE (I) = Technical efficiency in intermediation.