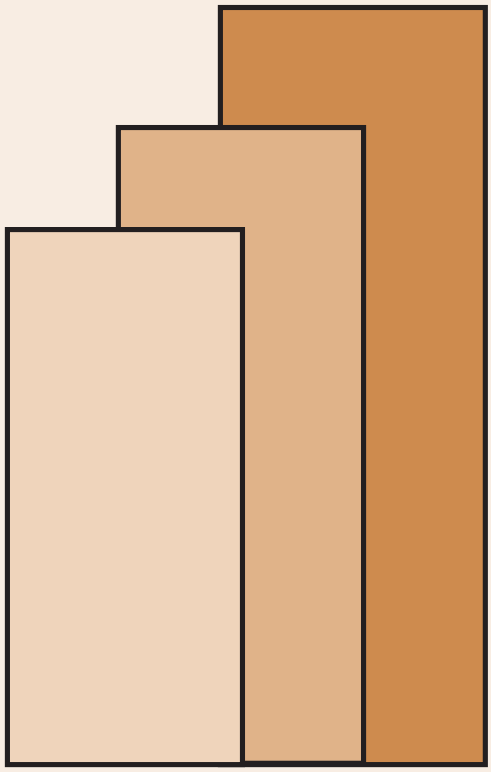
Philippine Institute for Development Studies
Surian sa mga Pag-aaral Pangkaunlaran ng Pilipinas

Efficiency and Expense Preference in the Philippines' Cooperative Rural Banks

Mario B. Lamberte and Martin Desrocher

DISCUSSION PAPER SERIES NO. 2002-12

Service through policy research



November 2002

For comments, suggestions or further inquiries please contact:
The Research Information Staff, Philippine Institute for Development Studies
3rd Floor, NEDA sa Makati Building, 106 Amorsolo Street, Legaspi Village, Makati City, Philippines
Tel Nos: 8924059 and 8935705; Fax No: 8939589; E-mail: publications@pidsnet.pids.gov.ph
Or visit our website at http://www.pids.gov.ph

Efficiency and Expense Preference in the Philippines' Cooperative Rural Banks

Mario Lamberte[*] and Martin Desrocher[+]

October 2002

Abstract

This paper attempted to test whether efficient cooperative rural banks (CRBs) have a better control of their agency costs. We used two different concepts of efficiency, namely, cost efficiency and alternative profit efficiency, and found somewhat different results from both approaches. Using Stochastic Frontier Approach and Distribution Free Approach, we tested two different propositions. The first proposition is that an adequate corporate governance scheme should improve efficiency of CRBs. We failed to find very conclusive evidence that corporate governance theories apply to the Philippines' CRBs. However, the results confirmed both managers' compensation theory and large stakeholders theory. The second proposition is that agency costs should reduce efficiency of CRBs, and we found a much clearer relationship on that issue. As expected, most efficient CRBs are characterized by a better control of agency costs. These results are in accordance with previous studies on shirking behavior among mutual financial intermediaries. We also found that rural CRBs are most profit efficient, despite their somewhat normal cost-efficiency, a manifestation that they are able to charge higher fees for the quality of services they offer. Large CRBs are not able to pass their higher costs to customers through higher fees. We found that small CRBs might have a better interest rate policy, that is, they offer lower rates on both loans and deposits.

Keywords: Agency Costs, Corporate Governance, Efficiency.

1 Introduction

The population of the Philippines currently stands at 80 million. With a population growth rate of 2.36 percent, which is well above the world population growth rate of 1.3 percent, at least 1.9 million people will be added each year to the country's population. Since the economy in the last 15 years has grown only modestly, the number of poor people inevitably keeps on rising. Thus, despite the fact that the number of families falling below the poverty line had declined from 44.2 percent in 1985 to 34.2 percent in 2000, the absolute number of poor people had risen from 26.2 million to 31.3 million during the same period. A great majority of the income earners of poor households are self-employed.

The 1998 Annual Poverty Indicators Survey (APIS) shows that 70 percent of the poorest 40 percent of the respondents relied on entrepreneurial activities as main source of income. However, only 25 percent out of the 8.5 million households with businesses surveyed had obtained credit to finance their business. These households, while self-employed and without access to credit, often experience fluctuations in income and sometimes need extra funds to cope with emergencies, such as sickness and natural calamities. When any of these happens, these households are often forced to use the working capital for their small business and/or sell whatever fixed assets they have. Selling a cow or carabao and

[*] President, Philippine Institute for Development Studies, 106 Amorsolo Street, Legaspi Village, Makati City, Metro Manila, Philippines

[+] Centre de Recherche en Économie et Finance Appliquée, Faculté des Sciences de l'Administration, Université Laval, Québec, CANADA, G1K 7P4.

This is part of the Community-Oriented Financial Intermediaries (COFI) project jointly conducted by the Philippine Institute for Development Studies and University of Laval. The authors are grateful to Jocelyn Alma R. Badiola and Herbert Rizal Docena for excellent research assistance. The authors also wish to thank Ms. Ma. Chelo Manlagñit for carefully reviewing the draft .

farm/business equipment is not an uncommon occurrence among poor households. These poor households, therefore, need the services that would address the financing requirements of their livelihood and consumption needs including lumpy nonfood expenses for health, education and housing improvements.

Development practitioners and policymakers view microfinance as one of the solutions to the growing demand for financial services by poor households and to the reality that most formal financial institutions do not serve the poor because of perceived high risks, high costs involved in small transactions, perceived low profitability and inability of the poor to provide the required physical collateral (ADB 2000). Most if not all of these financial institutions have a business culture that is not geared towards servicing the poor and low-income households. Through microfinance, financial services like savings, credit, and insurance facilities, can be delivered to poor households who will, in effect, be able to smoothen their consumption, manage their risks, build their assets gradually, develop their microenterprises, enhance their income earning capacity and enjoy an improved quality of life. Without permanent access to institutional microfinance, most poor households continue to rely on meager funds from savings and informal sources, which further limit their income and production capacities.

Sustainability of microfinance institutions is a crucial consideration for the poorest of the poor, and a thorough review of the characteristics of healthy microfinance institutions should be given a high priority by all regulatory agencies supervising these institutions. This study, therefore, attempts to analyze the characteristics of the most efficient cooperative rural banks (CRBs) of Philippines with the aim of providing better information to regulatory agencies in regulating and supervising microfinance institutions (MFIs).

1.1 The Philippines' microfinance system

The Philippine financial system consists of formal and informal financial intermediaries. The informal sector is composed of heterogeneous players, such as moneylenders and ROSCAS. The formal financial system can further be broken down into banking institutions, which are authorized to provide credit and accept deposits from the general public, and non-bank institutions, which are authorized to extend loans but are not permitted to accept deposits from the general public.

The banking system is composed of the commercial banking system (universal and ordinary commercial banks), the thrift banking system (savings and mortgage banks, private development banks and stock saving and loans associations), the rural banking system (ordinary or stock rural banks and cooperative rural banks), and government-owned banks. In terms of assets, the banking system overwhelmingly dominates the financial system. Its total assets as of December 2000 amounted to PhP3.3 trillion, or 82 percent of the total assets of the financial system. In the Philippines, MFIs are categorized into the following: rural banks including CRBs; credit-granting non-government organizations (NGOs); and credit unions/cooperatives. While MFIs have steadily increased the volume of loans granted to their clients through the years, their combined market share has remained below 5 percent (Agabin 1998) [1].

1.2 The Philippine rural banking system

Both stock and cooperative rural banks are active in the Philippines' microfinance sector. Rural banks are private banks that were established in the 1950s with government assistance and subsidies to provide services to the agricultural sector. There were about 800 rural banks in 2000 scattered all over the country. Up until the 1980s, they constituted a system of unit banks that is unique in the developing world, and many of them grew out of the operations of moneylenders. The number of CRBs rose from 15 in 1975 to 50 in 2000.

A CRB has a dual personality, that of being a cooperative, on one hand, and a bank, on the other. A CRB is, thus, governed by both banking and cooperative laws, particularly, the New Rural Bank Act or RA 7353, the General Banking Law of 2000 or RA 8791, the Cooperative Code or RA 6938 and the Cooperative Development Authority Act or RA 6939.

CRBs are organized primarily to provide financial and credit services to cooperatives and may perform any or all of the services offered by stock rural banks. Only duly established cooperatives and federations of cooperatives which are registered or re-registered with the Cooperative Development Authority under Republic Act 6938 may become members/organizers of CRBs. A CRB services an average of 5,000 individual borrowers (Guanlao 1999) [19].

Besides increasing geographical diversification, stock and cooperative rural banks have, over time, been increasingly diversifying their loan portfolio across major economic activities. In contrast to the 1980s, today CRBs' loans are less concentrated in the agricultural sector. There has also been a substantial change in the way rural banks finance their lending operations over the years. In 1980, deposits comprised only 43 percent of their total liabilities. A big chunk of their liabilities consisted of borrowings from the Central Bank and other special credit programs of the government. The radical change in rediscounting and interest rate policies in the mid-1980s has encouraged rural banks to mobilize deposits and to rely less on the rediscounting window of the Central Bank for funds. Thus, by 1998, the share of deposits in the total liabilities of rural banks rose to 74 percent. An increase of deposits financing is a normal trend for growing microfinance institutions. In effect, as confidence of consumers towards the institution grows, governmental and grant financing can be reduced, in favor of greater amounts of customers' deposits. This trend is very positive, though it also brings an additional consideration: It decetralizes the sources of financing from a few major donors to various small depositors. Greater diffusion in sources of funds enables managers to act more freely, and thus gives room for expense preference. This creates a common phenomenon in microfinance institutions: The cycle "growth-diffusion of financing-failure". In order to avoid this cycle, regulators should always keep in mind the phenomenon and thus maintain a strong control over expenses of large CRBs.

1.3 Regulatory issues

One of the lessons of the East Asian financial crisis is that banks must be well regulated and adequately supervised. However, new prudential regulations, if applied uniformly to all types of financial institutions, could further force financial intermediaries to ration out small borrowers. Thus, the newly passed General Banking Law tries to achieve a balance between the objectives of tightening up prudential regulations and ensuring the flow of financial services to microenterprises and poor households. This Law includes three provisions concerning microfinance to encourage banks to lend to microfinance borrowers not on the basis of a collateral they can present, which many of them do not have any, but rather on the basis of their cash flows.

The existence of adequate banking offices in all areas in the country can improve access of poor households to banking services. Beginning in 1989, the Central Bank relaxed the regulation on bank entry and branching. This led to the proliferation of banks and branches in the country. Many of these banks became in distress in the aftermath of the East Asian financial crisis and the "El Niño" weather phenomenon that struck in 1998. Thus, the Bangko Sentral ng Pilipinas (BSP) the country's central, bank has declared a moratorium on the opening of new banks and has encouraged merger/consolidation to strengthen their financial position. However, to ensure that microfinance services will not diminish especially in rural areas, the BSP recently approved a partial lifting of the general moratorium on the licensing of new thrift and rural banks to allow entry of microfinance-oriented banks. A rural bank to be established as a microfinance bank is required to have a minimum paid-in capital of PhP5 million (about US$100,000) while the existing capitalization requirement for thrift banks apply. The regulatory framework of rural banks in the Philippines is substantially different from existing systems found in African and Latin American countries. More specifically, a prospective cooperative bank shall file its application for licensing as a bank with the BSP and upon approval, shall be registered with the Cooperative Development Authority. However, only the BSP is responsible for regulating and supervising all CRBs. Since CRBs operate under the New Rural Bank Act, the BSP treats them like ordinary or stock rural banks. Only one (1) cooperative bank shall be established per province. Market is thus segmented by Law to avoid excessive competition and inefficient use of branch

branches among CRBs. However, CRBs compete with thrift banks, rural banks and branches of rural banks operating in their respective provinces.

1.4 Conceptual framework

Experience shows that the CRBs, whose ownership is generally more diffuse than rural banks, had a weaker performance through time than the latter. Reliance on government funds might be associated with this weaker performance. Also interestingly, cooperatives that did not focus on agricultural, electric and transport activities between 1973 and 1986, while the government was pursuing a development policy for these sectors, had a self-reliant and progressive development that contributed to their business viability and success. We propose to study the characteristics of most efficient CRBs to see whether their corporate governance has improved their sustainability through better control of agency costs. We formulate two propositions:

Proposition 1: ***Efficient CRBs have a better corporate governance scheme.***
Proposition 2: ***Efficient CRBs have a better control of agency costs.***

Each proposition will be decomposed further into several aspects, which will be tested in section 6. We will first discuss in detail the concept of efficiency. Efficient financial intermediaries produce a quantity of output at a lower cost than any other intermediary producing the same level of output. Efficiency measurement refers to a comparison of costs of a particular CRB and the most efficient CRB producing the same level of output. For each level of output, we can find the most efficient CRB, and the combination of all these most efficient CRBs produces the efficient cost frontier. Then we estimate the deviation of specific CRBs from their most efficient counterparts, and try to explain these differences. We propose to test the relationship of efficiency with various correlates of corporate governance and agency costs, among others. A similar approach is made for profit efficiency.

2 Review of literature

The review of literature presented below is divided into two sections. The first deals with efficiency of financial intermediaries, and the second, ownership and corporate governance. Since an extensive review of literature on agency costs theory and empirical studies is presented in several studies mentioned in the reference section and other studies of the COFI project, this paper will not cover this literature.

2.1 Efficiency of financial intermediaries

Existing studies estimated the efficiency of financial intermediaries using either parametric or non-parametric techniques. The former assumes a random component in the measurement of efficiency, while the latter assumes that the random component is absent and differences in total costs (or profits) are completely explained by differences in efficiency. According to Berger and Humphrey (1997) [6], most U.S. studies used parametric techniques (110 studies), rather than non-parametric techniques (78 studies). We would like to note that parametric and non-parametric techniques are further divided into various methodologies. We will not judge the relative strengths of these methods here. We rather refer the readers to Berger and Mester (1997) [7] for a thorough review of literature. These authors advocate for the use of parametric methods rather than non-parametric methods to take into account not only technical efficiency but also price-effects (allocative efficiency).

McNulty and Verbrugge (1988) studied stock and mutual S&L, and found no clear difference in cost efficiency between both types. So, we can expect that the methodologies applied to profit maximizing institutions would also be valid for non- profit institutions.

Several studies on efficiency measurement consider the relationship of efficiency with various correlates. Among the most frequently used correlates of inefficiency of financial

intermediaries, we find a negative relationship with size (Hardwick (1990) [21], Drake and Weyman-Jones (1992)[11], Cebenoyan at al. (1993)[8], Mester (1993)[36], and Eisenbis, Ferrier, and Kwan (1999) [12]), a negative relationship with capital ([36], [12]), and a positive relationship with portfolio risk (Eisenbis, Ferrier, and Kwan (1999) [12]). Considering financial cooperatives more specifically, Worthington (1998) [41] also found a negative relationship with size, a negative relationship with capital, and a negative relationship with the number of branches.

2.2 Ownership and corporate governance

Corporate governance can be defined as the combination of all measures that ensure managers to act in the best interest of investors, e.g. to ensure that they receive an adequate return on their investment. It has been shown that an adequate corporate governance scheme can reduce agency costs within corporations (See Shleifer and Vishny (1997) [38]). These authors presented two ways of increasing efficiency of corporate governance. One is to adopt appropriate legal protection of both small and large investors, and the other, to increase concentration of ownership.

It has been demonstrated that concentration of ownership induces managers to be more efficient (see Holderness and Sheehan (1988)[23]). This is because major stakeholders have stronger negotiating power when they face managers, as well as better incentives to keep track of decisions of the latter. This view is generally known as *the Large Shareholders Theory* and it constitutes the first part of the tests we will perform later. Some results were found for a cooperative form of ownership though (See Hansmann (1988) [20], Hart and Moore (1994) [22], and Schleifer and Vishny (1997) [38]). These authors suggested that when large non-shareholder constituencies, such as managers, employees or any other stakeholders, are left with little rent to capture, a greater concentration of ownership might not be optimal for value maximization of the firm.

Jensen's Free Cash Flow Theory stipulates that an appropriate policy to control agency costs is to limit free cash flows available to constrain the expense preference behavior of managers, and this could be done by having an adequate level of debt, and a strong control from the institution's owners. Increased concentration of ownership and greater financial leverage limit managers' incentives to spend on perks and other wasteful activities. Existing literature on this subject concentrated on performance of LBO versus non-LBO firms. Leveraged firms appeared to be more efficient than their non-LBO counterparts (see Jensen (1989) [30], Kaplan (1989) [32], Smith (1990) [39] and other authors in the same number). The recent tendency of CRBs to mobilize more deposits to finance their lending operations seems to fit well with the propositions of recent theory on corporate governance. We thus propose to test whether most efficient CRBs actually had a greater proportion of deposit financing.

Another important aspect of corporate management is included under the Managers' Compensation Theory, which suggests that a higher compensation for managers may give them sufficient incentives to improve efficiency. A number of studies have argued that performance-based compensation is preferable to fixed compensation in order to give adequate incentives to managers to maximize the value of the firm (see Holmstrom (1979) [24], Grossman and Hart (1983) [18], Lambert and Larcker (1987) [34], Jensen and Murphy (1990) [31], and Mehran (1995)). Houston and James (1995) [25] have demonstrated that existing compensation scheme of bank's managers is not sufficiently performance-based to encourage them to take sufficient risks to maximize the value of the firm.

3 Methodology

The main objective in estimating a production function is to explain the quantity of output produced given certain levels of inputs and other relevant factors that might explain the quantity of output produced. Both the production and the intermediation approaches have been used to model the production of financial institutions. The former considers the

institution as a producer of two goods, namely, loans and deposits. The outputs are estimated in number of accounts, while operational costs are represented on the left hand side. The latter, on the other hand, considers the amount of loans and investments as the outputs, while the amount of deposits, capital and wages are considered as the inputs. Interests are added to operating costs on the left hand side to reflect the addition of deposits as an input.

We use the intermediation approach and introduce the possibility of non-linear demand for inputs (the α_{ij} terms), as well as a random component, which can be decomposed into an efficiency component $Ln(u_c)$ and a random component $Ln(\varepsilon_c)$. The random component simply means that the total costs can be explained not only by input prices but also by an inefficiency factor specific to each institution, and a random component including all other factors that might affect total costs. To decompose these effects, we use two well-recognized methodologies, namely, the stochastic frontier approach (SFA) and the distribution-free approach (DFA). Each of these approaches has its own strengths and weaknesses, which we will elaborate below. The main reason for using these two approaches is to strengthen the conclusions that we can derive from the results of our analysis. We do not introduce the usual restrictions of cost minimization (profit maximization) as we are assuming that CRBs do not minimize costs (maximize profits).

A critical assumption associated in the SFA models is that the error term can be decomposed into a random component ($Ln(\varepsilon_c)$), following a normal distribution, and an efficiency component ($Ln(u_c)$), following a half-normal distribution. Many alternative models have been proposed to avoid this critical assumption as the hypothesis of half-normal distribution of the efficiency component received some criticisms recently (Greene (1990)[17] and Berger (1993)[4]). We concentrate on three alternatives. The first consists of eliminating the random component of the error term with the use of a non-parametric model, such as the Data Envelopment Analysis (DEA) or the Free Disposal Hull (FDH). As mentioned earlier, DEA avoids the decomposition of errors between efficiency and randomness by assuming that the random component is simply not present and that the differences in the total costs are completely explained by differences in efficiency (Aly et al.(1990) [3]; Ferrier and Lovell (1990)[15]; Eliasiani and Mehdian (1990)[13]; Ferrier et al. (1991)[14]; Fixler and Zieschang (1991)[16]; Aly et al.(1990) [3]).

The second alternative model, such as the TFA (Lozano (1997)[35]), sets the limit between random error and efficiency. This methodology assumes that the deviations from predicted costs within the lowest quartile are attributable to random error, while deviations in the remaining quartiles are attributable to efficiency. As discussed by Berger (1993)[4], TFA only substitutes the assumption about the distribution of the error term for an equally arbitrary assumption about where efficiency stops and the random error begins.

The results significantly differ from one methodology to another. This has prompted some critics to further elaborate both approaches. Berger and Humphrey attribute the inconsistent rankings to the major ”sins” of these two approaches i.e., too little account of random error by the non-parametric studies and too much structure imposed on the frontier by the parametric approaches.[5]

The third alternative model is to consider a random error component, but eliminate all the distributional constraints by using a panel data set. The virtues of Distribution Free Approach (DFA) estimates, obtained with a panel data set, were described originally in Schmidt and Sickles (1984)[37] and later in Berger (1993) [4], and Berger and Mester (1997) [7]. Robert DeYoung ([10]) also developed a methodology to evaluate the most adequate number of years to consider, with data covering 618 U.S. commercial banks over eleven (11) years. He found that a six-year period is the best compromise between too few (which introduces a large dispersion of residuals) and too much time periods (which is delicate if some trends are included in the data). In our case, the method consists of estimating the average inefficiency of each CRB over the five-year period extending from December 1995 to December 1999. This constitutes the non-random component ($Ln(u_c)$) attributable to inefficiency. This measure is compared to the most efficient CRB over the same period, avoiding short-term variations. The assumption here is that each CRB has a specific inefficiency that is observed over this five-year period, but is also subject to some random

error due to external factors such as macroeconomic problems, or unusual weather conditions, such as "El Niño" weather phenomenon. We do not impose the homotheticity assumption by adding the quantities of outputs on the right hand side (RHS), as well as all the cross-product between prices of inputs and quantities of outputs. In effect, when introducing outputs as independent variables, we relax the simple relationship between inputs and costs. The addition of outputs on the RHS is common within the intermediation approach and frequently used to study economies of scale in financial institutions.

3.1 Model 1: Cost efficiency

The cost function we estimate is represented by Equation 1:

$$\text{Ln}(C) = \alpha + \sum_{i=1}^{5} \beta_i \, Ln\,(p_i) + \sum_{k=1}^{2} \gamma k \, Ln(y_k) + \tfrac{1}{2} \sum_{i=1}^{5} \sum_{j=1}^{2} \beta_{ij} \, Ln(p_i) \, Ln\,(p_j)$$

$$+ \tfrac{1}{2} \sum_{k=1}^{2} \sum_{m=1}^{5} \gamma_{km} \, Ln(y_k) \, Ln\,(y_m) + \sum_{i=1}^{5} \sum_{k=1}^{2} \eta_{ik} \, Ln(p_i) Ln(y_k) + Ln(u_c) + Ln(\varepsilon_c) \qquad (1)$$

The model is estimated using Seemingly Unrelated Regressions (SUR) for the DFA and maximum likelihood estimation procedure for the SFA developed by Coelli (1994)[1].

We now present in more detail the variables we used to estimate the cost function. **Table I** shows the definitions and characteristics of each variable included in our first model (Equation 1). The dependent variable is the total costs of each CRB, in million pesos, deflated by the national Consumer Price Index using 1995 as the base year. The outputs we consider are loans and securities, while the prices we include are real wages, real cost of materials, interest rate on deposits, interest rate on financial obligations and cost of other inputs.[2] After estimating the cost efficiency for each CRB, we proceed to compare with the most efficient CRB. For the DFA, we estimate the following ratio for each CRB:

$$\text{Cost Efficiency} = \frac{C^{min}}{C} = \frac{u_c^{min}}{u_c} \qquad (2)$$

where C^{min} is the minimal cost, associated with the most efficient CRB, and C is the cost of a specific CRB. Equation 2 gives the proportion of costs that is efficiently used by the CRB. For example, if C^{min} is representing 70 percent of C, 70 percent of costs of this CRB is used efficiently, and 30 percent is wasted inefficiently. The SFA, on the other hand, produces estimates of the inefficiently (rather than efficiently) of each CRB. For example, a figure of 10 percent means that the CRB concerned incurs 10 percent more than the cost of the most efficient CRB for the same quantity of outputs produced. They are equivalent, however, in the sense that the most cost-inefficient CRB in the SFA is taken to mean the least cost efficient in the DFA.

We define four size groups based on the real value of assets. The first group includes

[1] The model was estimated using Coelli's (1994) program [9].

[2] Hugues, Mester, and Moon (2000)[29], with a data set consisting of 441 bank holding companies demonstrated that inclusion of capital structure (see also [28], [36],[26], [27] and [7]) and risk-taking into efficiency measurement improves the estimated coefficients, the two variables also included in Hugues and Mester (1998). We included the ratio of liabilities over capital as an independent variable to take into consideration the impact of leverage on costs, as a small CRB does not have access to the same amount of deposits due to a lesser capital. Bigger CRBs have more possibilities to generate profit because they already accumulated some reserves over time that give them more flexibility in their assets-management. We also included ex post credit risk as another independent variable, to consider the fact that greater risk-taking might increase profits, but also endangers the sustainability of the institution. Notwithstanding, none of these two variables has significant signs so we do not include them into our final regressions.

CRBs whose assets are below PhP20 million, the second group between PhP20 million and PhP30 million, the third group between PhP30 million and PhP60 million, and the fourth group above PhP60 million.

3.2 Model 2: Profit efficiency

As discussed earlier, CRBs could have provided better services to their members. However, doing so only increases the costs of the CRB. In effect, we would be penalizing institutions for adopting a strategy of providing better services to their clients, despite the fact that some clients might be willing to pay the additional costs to benefit from improved services. To avoid penalizing CRBs that are providing better services to their clients, we also estimate an alternative profit function besides the cost function. This function enables CRBs to have greater costs but still be competitive through improved services, as reflected by higher profits. This proposition is inspired by Berger and Mester (1997) [7]. The following profit function has the same specification as the cost function defined previously:

$$\text{Ln}(\pi) = \alpha + \sum_{i=1}^{5} \beta_i \, Ln\,(p_i) + \sum_{k=1}^{2} \gamma k \, Ln(y_k) + \tfrac{1}{2} \sum_{i=1}^{5} \sum_{j=1}^{2} \beta_{ij} \, Ln(p_i) \, Ln\,(p_j)$$

$$+ \tfrac{1}{2} \sum_{k=1}^{2} \sum_{m=1}^{5} \gamma_{km} \, Ln(y_k) \, Ln\,(y_m) + \sum_{i=1}^{5} \sum_{k=1}^{2} \eta_{ik} \, Ln(p_i) Ln(y_k) + Ln(u_c) + Ln(\varepsilon_c) \qquad (3)$$

The model is estimated by Ordinary Least Squares (OLS) regression for the DFA and maximum likelihood estimation procedure for the SFA. In order to compare efficiency of CRBs, we need to establish a common measure of what we will call a ”target model”, an exercise similar to the one we have done with the ”Cost efficiency function”. This target is defined as the maximum profit that was realized for a specific level of assets. Each CRB is then compared to this level of profit.

$$\text{Profit efficiency} = \frac{\pi}{\pi^{max}} = \frac{u_c}{u_c^{max}} \qquad (4)$$

Equation 4 gives the proportion of the actual profit of a specific CRB to its maximum potential profit. Both the SFA and DFA use the same procedure for estimating profit efficiency and hence, the results should be interpreted in the same manner.

4 Data

We used annual data of 50 CRBs operating in both rural and urban regions of the Philippines for the period 1995-1999.[3] The variables used to estimate efficiency are defined in **Table I** together with their descriptive statistics. The correlates of efficiency are also presented in the same table. The dependent variables differ for each model; that is, real cost of inputs for Model I and real profit for Model II. The independent variables are the cost of inputs and the quantity of outputs in real terms.

[3] We eliminated observations with incomplete data, leaving 216 observations for the stochastic frontier approach, and 209 for the distribution-free approach (we eliminated observations of less than three years of data). The information is to conform with the requirements established within COFI (stands for Community Oriented Financial Intermediaries) project. The complete list of variables is available upon request.

5 Results

5.1 Efficiency regressions

The results of estimating Equation 1 and Equation 3 are presented in **Table II**. We present the results of both the stochastic frontier approach (SFA) and the distribution-free approach (DFA). The signs of the coefficients of the cost function are generally the same for both the SFA and DFA. In the case of the profit function, however, quite a number of coefficients have different signs for the two approaches.

The efficiency measures by size of CRBs are shown in **Table III**. These are simple averages of individual-efficiencies within each size group. Before proceeding with the discussion of the results, care should be exercised in interpreting the results in Panel A. As already mentioned, the SFA produces cost-inefficiency measures whereas the DFA generates cost- efficiency measures.

As shown in Panel A, the average cost- efficiency varies very little among the asset size groups regardless of the approach being used. Interestingly, they show similar pattern. For SFA, the average cost-inefficiency increases as asset size increases, then declines as asset size increases further (inverted U-curve). For DFA, it declines first, then increases as asset size increases (U-curve). Both results are consistent with each other. However, there are differences in the results produced by the two approaches. First, the SFA shows that CRBs are on average 10.25 percent cost-inefficient while the DFA, 85.25 percent cost-efficient. Second, the SFA results suggest that CRBs with asset size of less than PhP20 million are the least cost-inefficient CRBs, whereas the DFA shows that CRBs with assets of more than PhP60 million are the most cost-efficient. Third, the most cost-inefficient CRBs in the SFA are those with assets of PhP30-PhP60 million, whereas the least cost-efficient CRBs in the DFA are those having assets of PhP20-PhP30 million. Thus, the results derived from the two approaches would not allow us to make a conclusion regarding which asset-size group is the most cost-efficient.

Panel B shows the average profit efficiency by the same asset-size groups. The SFA produces higher average profit efficiency than the DFA. This is consistent with the results obtained for cost efficiency measures discussed above. Here, the results obtained from the two approaches are completely different from each other. SFA exhibits an inverted U-curve, that is, the average profit efficiency increases first, then declines as asset size increases, whereas the DFA shows a U-curve, that is, the average profit efficiency declines first, then increases as asset size increases. Also, the least profit efficiency asset-size group in the SFA is the most profit efficient in the DFA. Thus, we cannot reach a clear conclusion regarding which asset-size group is the most profit efficient.

Interestingly, according to the SFA, small and large CRBs are more cost-efficient, and yet they have the worst profit efficiency. These institutions, as argued by Berger and Mester, could be characterized by a greater market power. In the case of very large CRBs we can understand that their size can allow them to exercise some market power in the highly concentrated CRB market. But the same cannot be said to very small CRBs. We have to admit that some factors other than size could have affected the results. We suspect that quality of relationship with members might have something to do with this greater market power. This should be investigated further, but we would like to present some possibilities that may be interesting to consider in the future. We estimated the median quality and diversity of products, and found that small CRBs are not offering better quality of service or diversity of products, as can be observed below:

Size (PhP M)	Median quality of service[4]	Mean diversity of products[5]
Below 40	4.55%	2.90
40-60	13.06%	3.81
60-80	11.67%	3.65
Above 80	14.22%	3.78

We then considered two alternative indicators of quality of service to clients, namely, lower interest rates on loans and high interest rates on deposits. We calculated a comparative measure adopted from Smith [40] to estimate the relative advantage of creditors (clients who hold a credit from the CRB) and debtors (clients who hold a deposit in the CRB). The advantage to creditors is the difference between the median rate on loans[6] of our complete sample of CRBs and the rate asked by each CRB to their clients. The interpretation is that the lower the rate charged by a particular CRB (compared to sector's median) to its customers, the greater the advantage offered to creditors. The definition of advantage to debtors is somewhat different: it is the difference between the rate offered on deposits of each CRB and the median rate offered by the sector. The greater the difference, the greater the advantage to depositors of the CRB. We find that CRBs whose assets are below PhP60 million offered lower lending rates as well as lower deposit rates - a scheme that might be more appropriate for their clients. Larger CRBs, on the other hand, offer higher deposit rates and also charge higher lending rates.

Size (PhP M)	Advantage to creditors	Advantage to debtors
Below 40	0.45%	-0.32%
40-60	0.37%	-0.60%
60-80	-2.89%	0.37%
Above 80	-0.90%	0.93%

We observe that relative advantages of creditors and debtors are strongly related to the relative importance of respective stakeholders. Small CRBs are characterized by large creditors[7] and small debtors.[8] The interests of creditors should be dominant in small CRBs, as larger stakeholders have greater negotiating power.

To conclude this section, we would like to review the most important results. Small and large CRB are less cost efficient, but more profit efficient. Cost inefficiency of small CRBs can be explained by diseconomies of scale, while large CRBs probably manifest some expense preference. In the case of large CRBs, greater profit efficiency can be explained by greater market power, but for small CRBs, further investigation should be done in order to explain profit efficiency. We could not demonstrate that small CRBs are providing more services to their members. However, results show a clear tendency of small CRBs to give greater advantage to their borrowers through lower interest rates on loans. This behavior was not observed for larger CRBs, which charge higher rates on loans to give higher rates on their deposits.

[4] Defined as non-financial operating income, in millions, deflated by national 1995 Consumer Price Index / Number of members. We consider this ratio as a measure of quality of service to clients. The measure was considered by Worthington [41] and Kumbhakar et al. (2001)[33] as an approximation of diversity of services.

[5] Defined as a Diversity of services Index (Add 1 for each service the credit union offers among the following: Commercial, Consumer, or Mortgage loans, and Deposits), [1, 2, 3, 4, or 5]. The index is a combination of four dummy variables, taking a value of one when the product is offered, and zero when it is not.

[6] Calculated as the ratio of interest income over total loans.

[7] Average credit of 131 324 pesos for small CRBs, compared to a 20 000-27 000 pesos for the remaining size groups.

[8] 31 679 pesos on average. Remaining size groups have smaller figures.

5.2 Correlates of efficiency

Before studying the relationship of our four efficiency measures with various risk variables, we would like to know whether these measures are positively correlated with the rate of return on assets (ROA), a widely accepted indicator of sustainability of financial institutions. The results of regressing ROA on our four efficiency measures are shown below. The positive relationship between ROA and the SFA profit efficiency measure is statistically significant, which is to be expected. A profit efficient CRB should be financially sustainable. The other results in the table below do not show any statistical significance.

Alternative efficiency measures	Coefficient	Significance
Cost efficiency, Stochastic Frontier Approach	0.004	
Cost efficiency, Distribution-Free Approach	-0.059	
Profit efficiency, Stochastic Frontier Approach	0.583	***[9]
Profit efficiency, Distribution-Free Approach	-0.120	

We have considered four major groups of correlates of efficiency: market and macroeconomic characteristics; corporate governance; risk; and agency costs. The variables and their descriptive statistics are presented in Table I. We would like to point out that three quarters of CRBs are located in predominantly rural provinces of the country. Average credit risk is 22.34 percent for CRBs compared with only 7.33% for the commercial banking sector. This could be the reason why 9 percent of the CRBs had to be assisted by the government in the last five years in the form of temporary capital infusion, which the CRBs have to liquidate over a period of time.

Let us turn now to the discussion of the results of a multivariate regression including the complete list of correlates. These results are presented in **Table IV**. Before proceeding, it should be recalled that the SFA produces cost- inefficiency measures while DFA, efficiency measures. The signs of the correlates' coefficients of the two approaches should therefore be opposite to each other to obtain consistent results. With respect to profit efficiency, the signs of the correlates coefficients should be the same for both the SFA and DFA. The discussions below focus only on those correlates that are found to have statistically significant relationship with the efficiency measures.

5.2.1 Measures of market characteristics

Regardless of the approach being used, geographical location (i.e., rural or urban regions) does not show any effect on the cost or profit efficiency of CRBs. Real GDP growth increases cost and profit efficiency. However, the growth of regional domestic product has a positive impact on CRBs' profit efficiency. Banking density produces different results for both approaches. In the case of FSA, it affects cost-inefficiency positively, meaning that provinces with fewer banks serving the population tend to have more cost-inefficient CRBs. On the other hand, the DFA results suggest that banking density has a positive impact on cost and profit efficiency of banks. These contradictory results need to be investigated further. As regards the time trend, it has a significantly negative effect on profit efficiency under the SFA. It is to be noted that because of the East Asian financial crisis and the El Nino weather phenomenon, the Philippine banking system including CRBs has been experiencing financial difficulties as can be observed from the rising non-performing loans since 1998.

5.2.2 Measures of corporate governance

We tested three theories of corporate governance: manager's compensation theory; free cash flows theory; and large shareholders theory. We obtained mixed results. We found

[9] Significant at 1% level.

that a higher compensation of managers, as indicated by MGTWAGE, tends to increase profit efficiency of CRBs, which supports the existing theory on manager's compensation. The variable, AVGSHR, which measures the average value of shareholdings, increases cost and profit efficiency of CRBs.[10] These results are consistent with the large shareholders theory and support the observations of Hansmann, Hart and Moore, and Schleifer and Vishny discussed earlier. However, we obtained some results that are not completely in accordance with existing theories on corporate governance. For instance, the variable, SHRDUM, raises cost-inefficiency. This confirms the free cash flow theory because a higher proportion of capital to total liabilities means that more cash flows are available for perks, which effectively reduces cost efficiency. On the other hand, it raises profit efficiency, which is contrary to the free cash flow theory. Another variable, DEPLIAB, does not exhibit any significant effect on any of the efficiency measures. It therefore does not give any indication as to whether or not it supports the free cash flow theory, which states that greater interest burden on deposits and financial obligations (increase of financial costs) translates into less flexibility for perks, and thus improves profit efficiency.

We also considered the extent of support provided by the government to CRBs and found that it significantly reduces cost-inefficiency of CRBs. This is to be expected since CRBs that received financial assistance from the government are closely monitored by regulator agencies. Contrary to some common belief the intervention of the State in the activities of some CRBs proved to be fruitful.

5.2.3 Measures of risk

Credit risk, leverage and interest rate risk all are expected to increase cost and profit efficiency of CRBs. The results appear to be mix. Credit risk (CRRISK) raises cost-inefficiency in the case of the SFA, while it increases cost-efficiency in the case of the DFA. However, both approaches generated results suggesting that credit risk raises profit efficiency, confirming results found in previous studies. Interest rate gap (INTGAP) is found to have statistically significant, positive effect on profit efficiency under the DFA, which supports a priori expectations. The variable, LEVERAGE, does not have any significant effect on the efficiency measures regardless of the approach being used.

5.2.4 Measures of agency costs

The most conclusive results are obtained in the case of agency costs. The coefficients of the three variables representing different dimensions of agency costs have the expected signs and are statistically significant. The quantity of assets per member, ASSETMEMB, a measure of empire building, is positively correlated with cost efficiency estimated by the DFA as well as the profit efficiency estimated by both approaches. The interpretation of a positive coefficient might be that greater assets permit better diversification. The ratio of deposits over credit, DEPCRED, a measure of funds acquired from members that are not used for financial intermediation, but rather wasted in inefficient operations such as maintaining luxury offices, cars for managers, etc., is negatively correlated with cost-efficiency. A similar result is obtained for FIXASSETS, which is the proportion of fixed assets to total assets. However, contrary to a priori expectations, the sufficiency of financial margin to cover operational expenses, SUFMARG, is positively correlated with cost- inefficiency.

We would like to take a few lines to discuss the manager's compensation theory as it relates to the latest literature on corporate governance and agency costs. We want to focus on that issue in order to deal with those who might propose putting controls on compensation of CRBs' top managers so as not to endanger the sustainability of CRBs. Thus, we have analyzed the relationship of top manager's relative salary with various measures of risk. The results are presented in **Table V**. To construct this table, we first ordered the observations on the basis of the ratio of top manager's salary to personnel expenses within each size group. At the outset, we want to highlight a rather surprising result, that is, small CRBs (those with assets of less than PhP30 million) are paying their managers better than all their larger

[10] We test whether the coefficient associated to AVGSHR is significantly positive. In all but one case we do find conclusive results.

counterparts. This result may be attributed to their relative efficiency as well as to the fact that they have a lean staff. We have observed that an increase of top manager's relative compensation reduces agency costs and improves performance of the CRB. The estimates shown in groups 3 and 4 indicate that the ratio of financial margin over operational costs is higher for CRBs offering a better pay to their top managers. The ratios of fixed assets to total assets and deposits to total loans are lower for CRBs offering a better compensation, except for the smallest institutions.

We also tested the relationship between top managers' compensation and three variables of corporate governance and four variables of efficiency, but did not find any conclusive results. As can be observed, the results are not very clear, and more research should be devoted to that issue. A positive relationship seems to exist between top managers' compensation and ROA. Altman (1983) [2] considered various studies on bankruptcy prediction and found that a high ROA could reduce the probability of failure of the financial institution. We conclude that a better compensation package for top managers can improve the sustainability of the CRBs, and sustainable microfinance institutions will have a long-term beneficial impact on poverty reduction in Philippines.

5 Conclusions and recommendations

The effort to alleviate poverty in emerging economies can be enhanced with the establishment of efficient and sustainable microfinance institutions. In order to increase sustainability of such institutions, first, we have to know the characteristics of the most successful microfinance institutions. Cost and profit functions have been frequently applied to estimate efficiency of various financial intermediaries in different countries. We estimated two different concepts of efficiency, namely, cost efficiency and profit efficiency. For each concept, we specified two different models. The first excludes credit risk and leverage from the model, and the second includes them.

We found that agency costs significantly reduce the cost-efficiency of CRBs. In fact, they appear to be much more important than corporate governance issues. These results are consistent with the observations of Schleifer and Vishny (1997) and other authors referred to therein. After testing various theories, we obtained only one clear result: increasing managers' compensation should result in improved performance of CRBs, which is also in accordance with the expense preference theory. This theory states that an appropriate compensation package for managers should reduce expense preference. The policy implication is clear that is, regulatory agencies should avoid imposing controls on top managers' compensation. Proponents of such controls usually argue that managers' compensation should not be too high at the expense of members' meager revenues. This argument seems fallacious as such controls would in fact reduce CRB's sustainability. To clarify our results further, we first ordered our observations on the basis of the ratio of top manager's salary to personnel expenses within each size group. The results show that an increase in top manager's relative compensation reduces agency costs and improves performance of the CRBs. We also considered efficiency measures, but did not find any conclusive results.

Controls on top managers' compensation have not been actually discussed in Philippines, and we do not think such a policy should be considered. Based on existing literature, we are of the view that introduction of adequate performance-based compensation would be more appropriate. However, we need information to study the benefits of such a scheme to reduce agency costs and improve performance of mutual financial intermediaries such as Philippines' CRBs.

We also found that rural CRBs are the most profit efficient, despite their somewhat regular cost efficiency, a manifestation that they are able to charge higher fees for the quality of services they offer. Big CRBs were shown to have the lowest average cost efficiency, and worst, they have not been able to pass these higher costs to customers through higher fees. We then considered quality of service and diversity of products for each size group, but did not find that smaller CRBs have been offering better quality of services or more diverse

products. What we did observe though is that small CRBs offer lower rates on loans and deposits than larger CRBs. We also demonstrated, contrary to some common belief that State intervention in the activities of some CRBs proved to be fruitful. In order to focus State intervention and avoid the ”growth-diffusion of financing-failure” cycle, we propose that special attention should be given to cost structure of larger CRBS because they are generally inclined to have expense preference behavior.

References

[1] Meliza Agabin. Philippine microfinance NGOs: At the crossroads? study conducted for the developing standards for microfinance project. USAID-TSPI Development Corporation, 1998.

[2] Edward Altman. Corporate financial distress - a complete guide to predicting, avoiding, and dealing with bankruptcy. 1983. Wiley, New York, NY.

[3] Hassan Y. Aly, Richard Grabowski, Carl Pasurka, and Nanda Rangan. Technical, scale, and allocative efficiencies in U.S. banking: An empirical investigation. Review of Economics and Statistics, 72:211–218, 1990.

[4] Allen N. Berger. "Distribution-free" estimates of efficiency in the U.S. banking industry and tests of the standard distributional assumptions. The Journal of Productivity Analysis, 4:261–292, 1993.

[5] Allen N. Berger, Patrick L. Brockett, William W. Cooper, and J.T. Pastor. New approaches for analyzing and evaluating the performance of financial institutions. European Journal of Operational Research, 98:170–174, 1997.

[6] Allen N. Berger and David B. Humphrey. Efficiency of financial institutions: Inter-national survey and directions for future research. European Journal of Operational Research, 98:175–212, April 1997.

[7] Allen N. Berger and Loretta J. Mester. Inside the black box: What explains differences in the efficiencies of financial institutions? Journal of Banking and Finance, 21:895–947, 1997.

[8] Sinan A. Cebenoyan, Elizabeth S. Cooperman, Charles A. Register, and Sylvia C. Hudgins. The relative cost efficiency of stock versus mutual savings and loans: A stochastic cost frontier approach. Journal of Financial Services Research, 7:151–170, 1993.

[9] Tim Coelli. A guide to FRONTIER version 4.1: A computer program for stochastic-tic frontier production and cost function estimation. Department of Econometrics. University of New England. Australia, 1994.

[10] Robert DeYoung. A diagnostic test for the distribution-free efficiency estimator: An example using U.S. commercial bank data. European Journal of Operational Research, 98:243–249, 1997.

[11] Leigh Drake and T.G. Weyman-Jones. Technical and scale efficiency in UK building societies. Applied Financial Economics,2:1–9,1992.

[12] Robert A. Eisenbis, Gary D. Ferrier, and Simon H. Kwan. 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, 1999.

[13] Elyas Elyasiani and Seyed M. Mehdian. A non-parametric approach to measurement of efficiency and technological change: The case of large u.s., commercial banks. Journal of Financial Services Research, 4:157–168, 1990.

[14] Gary D. Ferrier, Shawna Grosskopf, Kathy Hayes, and Suthathip Yaisawarng. Economies of diversification in banking: A frontier approach,. WP, Southern Methodist University, 1991.

[15] Gary D. Ferrier and C.A. Knox Lovell. Measuring cost efficiency in banking: Econometric and linear programming evidence. Journal of Econometrics, 46,:229–245, 1990.

[16] Dennis J. Fixler and Kimberly D. Zieschang. Pricing imputation problems in commercial banking: A production function approach. WP, Bureau of Labor Statistics, 1991.

[17] William Greene. A gamma distributed stochastic frontier model. Journal of Econometrics, 46:141–163, 1990.

[18] Sanford J. Grossman and Oliver D. Hart. Implicit contracts under asymmetric information. Quarterly Journal of Economics, 98:123–157, 1983.

[19] Agapito H. Guanlao. Cooperative banks revisited, past performance and future prospects. Working paper presented in the Rural Finance Symposium sponsored by Agricultural Credit Policy Council, 1999.

[20] Henry Hansmann. Ownership of the …rm. Journal of Law,Economics,andOrganization, 4:267–304, 1988.

[21] P. Hardwick. Multi-product cost attributes: A study of U.K. building societies. Oxford Economic Papers, 42:446–461, 1990.

[22] Oliver Hart and John Moore. The governance of exchanges: Members' cooperatives versus outside ownership. Harvard University, 1994. manuscript.

[23] Cli¤ord G. Holderness and Dennis P. Sheehan. The role of majority shareholders in publicly held corporations: An exploratory analysis. Journal of Financial Economics, 20:317–347, 1988.

[24] Bengt Holmstrom. Moral hazard and observability. The Bell Journal of Economics, 10:74–91, 1979.

[25] Joel Houston and Christopher James. CEO compensation and bank risk - is compensation in banking structured to promote risk taking? Journal of Monetary Economics, 36:405–432, 1995.

[26] Joseph P. Hugues, William W. Lang, Loretta J. Mester, and Choon-Geol Moon. E¢cient banking under interstate branching. Journal of Money, Credit, and Banking, 28:1045–1071, 1996.

[27] Joseph P. Hugues, William W. Lang, Loretta J. Mester, and Choon-Geol Moon. Recovering risky technologies using the almost ideal demand system: An application to U.S. banking. Working Paper No.97-8, Federal Reserve Bank of Philadelphia, 1997.

[28] Joseph P. Hugues and Loretta J. Mester. A quality and risk-adjusted cost function for banks: Evidence on the "too-big to-fail" doctrine. The Journal of Productivity Analysis, 4:293–315, 1993.

[29] Joseph P. Hugues, Loretta J. Mester, and Choon-Geol Moon. Are scale economies in banking elusive or illusive? evidence obtained by incorporating capital structure and risk-taking into models of bank production. Working Paper, May 2000.

[30] Michael C. Jensen. Eclipse of the public corporation. Harvard Business Review, pages 61–74, 1989.

[31] Michael C. Jensen and Kevin J. Murphy. Performance pay and top-management incentives. Journal of Political Economy, 98:225–264, 1990.

[32] Steven Kaplan. The effects of management buyouts on operations and value. Journal of Financial Economics, 24:217–254, 1989.

[33] Subal C. Kumbhakar, Ana Lozano-Vivas, C.A. Knox Lovell, and Iftekhar Hassan. The effects of deregulation on the performance of financial institutions: The case of Spanish savings banks. Journal of Money, Credit, and Banking, 33:101–120, February 2001.

[34] Richard A. Lambert and David F. Larcker. Executive compensation effects of large corporate acquisitions. Journal of Accounting and Public Policy, 6:231–244, 1987.

[35] Ana Lozano Vivas. Profit efficiency for Spanish savings banks. European Journal of Operational Research, 98:381–394, 1997.

[36] Loretta J. Mester. E¢ciency in the savings and loan industry. Journal of Banking and Finance, pages 267–286, 1993.

[37] Peter Schmidt and Robin C. Sickles. Production frontiers and panel data. Journal of Business and Economic Statistics, 2:367–374, 1984.

[38] Andrei Shleifer and Robert W. Vishny. A survey of corporate governance. Journal of Finance, 52:737–783, 1997.

[39] Abbie Smith. Corporate ownership structure and performance: The case of management buyouts. Journal of Financial Economics, 27, 1990.

[40] Donald J. Smith. A theoretical framework for the analysis of credit union decision making. Journal of Finance, 34:1155–1168, September 1984.

[41] Andrew C. Worthington. The determinants of non-bank financial institution efficiency: A stochastic cost frontier approach. Applied Financial Economics, 8:279–287, 1998.

Table I

PANEL A
Definition of variables and their characteristics

	Dependent Variables - Efficiency	Mean	Std Dev.	Minimum	Median	Maximum
Costs	Real costs, in million pesos, deflated by the Consumer Price Index (CPI) with 1995 as the base year.	9.82	17.81	0.26	4.82	131.66
Pi	Real profit, defined as net income, in million pesos and deflated by the CPI.	49.74	4.94	0.00	49.24	70.75

	Basic Independent Variables	Mean	Std Dev.	Minimum	Median	Maximum
y1	Quantity of output: Loans, in million pesos, deflated by the CPI.	46.22	76.57	1.86	22.30	598.34
y2	Quantity of output: Securities, in million pesos, deflated by the CPI (Total assets less loans and fixed capital).	13.03	25.00	0.33	6.34	197.64
p1	Cost of input: Real wage rate, in million pesos by employee and deflated by the CPI.	0.11	0.09	0.00	0.09	0.48
p2	Cost of input: Real cost of materials, in percentage, defined as occupancy expenses divided by the book value of fixed assets, deflated by the CPI.	40.72%	44.95%	0.73%	25.34%	293.37%
p3	Cost of input: Real annual, *ex post* interest rate on deposits, in percentage.	9.42%	5.64%	1.26%	8.50%	49.15%
p4	Cost of input: Real annual, *ex post* interest rate on financial obligations, in percentage.	11.39%	41.75%	0.22%	6.28%	587.48%
p5	Cost of input: Real cost of other inputs, defined as total costs less financial costs, occupancy expenses and wages and salaries divided by total assets, in percentage.	3.69%	2.22%	0.12%	3.39%	20.13%

PANEL B
Definition of correlates and their characteristics

Correlates of Market and Macro Economic Characteristics		Mean	Std Dev.	Minimum	Median	Maximum
RURAL	Dummy variable: 1 if the rural bank is located in a rural region, 0 elsewhere.	0.74	0.44	0.00	1.00	1.00
GRDPGRW	Real GDP growth rate of the region, in percentage.	3.58%	3.78%	-6.40%	3.90%	22.90%
POPBANK	Banking density (Population/ Number of banks), in thousand	0.02	0.01	0.01	0.01	0.07
T	Time trend	3.07	1.43	1.00	3.00	5.00

Correlates of Corporate Governance		Mean	Std Dev.	Minimum	Median	Maximum
SHRDUM	Dummy variable: 1 if the proportion of capital to total liabilities is greater than the median of rural banks, 0 elsewhere. Measure the degree of diffusion of control, which reduces potential capacity of stakeholders to influence managers.	0.49	0.50	0.00	0.00	1.00
DEPLIAB	Proportion of deposits to total liabilities, a higher ratio means greater diffusion of control	0.50	0.16	0.10	0.51	0.93
AVGSHR	Diffusion of ownership: Average value of shareholdings, in million pesos. A higher value is associated with a potentially greater influence of shareholders over managers.	0.37	0.33	0.00	0.26	2.12
GVTINT	Dummy variable: 1 if the government intervened the rural bank in the current year.	0.08	0.28	0.00	0.00	1.00
MGTWAGE	Top manager salary as a proportion of total assets (in thousands) of the rural bank.	0.38	0.32	0.00	0.32	2.22

Correlates of Risk		Mean	Std Dev.	Minimum	Median	Maximum
CRRISK	Credit risk, *ex post* pass-due loans ratio, in percentage.	21.99%	17.98%	0.00%	17.40%	98.42%
LEVERAGE	Ratio of total liabilities to capital. A higher ratio means that the institution is taking more financial risk.	6.15	11.92	-6.40	4.25	127.87
INTGAP	Interest rate risk: The interest rate Gap, measured as the ratio of short term assets over short term liabilities, gives an approximation of interest rate risk exposure.	2.69	1.51	1.15	2.22	11.16

Correlates of agency costs		Mean	Std Dev.	Minimum	Median	Maximum
ASSETMEMB	Average quantity of assets (in millions of pesos) by member.	0.95	2.68	0.02	0.34	22.53
DEPCRED	Proportion of deposits allocated to loans. A lower proportion means resources from deposits are invested in activities other than financial intermediation, in percentage.	54.21%	20.75%	9.34%	54.90%	119.20%
FIXASSETS	Proportion of fixed assets to total assets. A higher proportion means assets are diverted into unproductive uses of funds, in percentage.	4.05%	3.37%	0.59%	3.15%	22.96%
SUFMARG	Sufficiency of financial margin: (Financial income - Financial costs) / Operational costs. Measures the proportion of operational costs covered by the financial margin. A higher ratio is associated with more efficient management, in percentage.	79.41%	46.69%	-100.92%	78.29%	374.97%

Note: Panel A of the table presents the basic characteristics of variables related to cost and profit efficiency equations.
The characteristics of correlates of efficiency are presented in Panel B.

Table II

Estimated coefficients and their significance

Coef.	Variable name	Stochastic Frontier Approach Cost		Stochastic Frontier Approach Profit		Distribution Free Approach Cost		Distribution Free Approach Profit	
α	Constant	-7.299	***	16.993	***	-7.782		-37.543	
$\gamma 1$	Quantity of loans	4.004	***	-0.545		3.738	***	12.649	*
$\gamma 2$	Quantity of securities	-2.145	***	0.837		-1.593	*	-6.872	
$\beta 1$	Wage rate	-0.303		-0.026		-0.344		2.986	
$\beta 2$	Cost of materials	0.351		0.429	*	-0.208		-7.247	**
$\beta 3$	Interest on deposits	-0.046		-0.234		-0.268		-8.387	
$\beta 4$	Interest on financial obligations	-0.029		-0.039		-0.831	*	0.488	
$\beta 5$	Cost of other inputs	1.149	**	0.707		1.971	***	17.084	***
$\gamma 11$	Quantity of loans*Quantity of loans	-0.254	**	0.009		-0.111		-0.664	
$\gamma 22$	Quantity of securities*Quantity of securities	-0.019		0.045		0.111		-0.095	
$\beta 11$	Wage rate*Wage rate	0.056	***	0.005		0.016		-0.236	*
$\beta 22$	Cost of materials*Cost of materials	0.014		-0.018		0.011		-0.168	
$\beta 33$	Interest on deposits*Interest on deposits	0.017		0.174	**	-0.010		0.076	
$\beta 44$	Interest on financial obligations*Interest on financial obligations	-0.031	*	0.049	**	-0.090	***	0.108	
$\beta 55$	Cost of other inputs*Cost of other inputs	0.208	***	0.085	**	0.239	***	0.058	
$\gamma 12$	Quantity of loans*Quantity of securities	0.138	*	-0.031		-0.012		0.188	
$\eta 11$	Quantity of loans*Wage rate	-0.044		0.057	*	-0.015		-0.426	
$\eta 12$	Quantity of loans*Cost of materials	-0.034		0.007		-0.028		0.316	
$\eta 13$	Quantity of loans*Interest on deposits	0.011		0.099	*	0.035		1.000	**
$\eta 14$	Quantity of loans*Interest on financial	0.170	***	-0.077	**	0.253	***	-0.336	
$\eta 15$	Quantity of loans*Cost of other inputs	-0.014		-0.070	*	-0.015		-0.671	
$\eta 21$	Quantity of securities*Wage rate	0.005		-0.069	**	-0.004		0.382	
$\eta 22$	Quantity of securities*Cost of materials	0.009		-0.010		0.034		0.041	
$\eta 23$	Quantity of securities*Interest on deposits	0.055		-0.021		0.047		-0.578	
$\eta 24$	Quantity of securities*Interest on financial obligations	-0.106	***	0.061	**	-0.160	***	0.238	
$\eta 25$	Quantity of securities*Cost of other inputs	0.007		0.009		0.003		-0.071	
$\beta 12$	Wage rate*Cost of materials	0.014		-0.019		0.013		0.167	
$\beta 13$	Wage rate*Interest on deposits	-0.085	**	-0.103	***	-0.088	*	0.062	
$\beta 14$	Wage rate*Interest on financial obligations	-0.096	***	0.032		-0.075	***	0.046	
$\beta 15$	Wage rate*Cost of other materials	-0.009		0.035		-0.044		-0.400	
$\beta 23$	Cost of materials*Interest on deposits	0.010		0.060	***	-0.070	**	-0.152	
$\beta 24$	Cost of materials*Interest on financial obligations	0.019		0.008		0.037	**	-0.049	
$\beta 25$	Cost of materials*Cost of other inputs	-0.030		0.011		0.001		0.369	*
$\beta 34$	Interest on deposits*Interest on financial obligations	-0.002		-0.085	**	-0.008		-0.230	
$\beta 35$	Interest on deposits*Cost of other inputs	-0.055		-0.094	**	-0.008		0.189	
$\beta 45$	Interest on financial obligations*Cost of other inputs	0.022		0.003		0.058	*	-0.197	
	Number of observations	216		216		209		209	
	Significance Level of Likelihood ratio or F-statistic					0.00		0.00	
	Durbin-Watson Statistic					1.43		2.06	

Note: The first and third columns present the estimated coefficients of Equation 1, for both Stochastic Frontier Approach (SFA) and Distribution Free Approach (DFA) respectively. Column 1 shows the estimates of cost inefficiency, while column 3 shows the

** : 10% level of significance.*

***: 5% level of significance.*

****: 1% level of significance.*

Table III

PANEL A
Average Cost Efficiency

	Stochastic Frontier Approach (*)		Distribution Free Approach		
Size	N	Average	N	Average	ρ
Below 20M	38	10.22%	38	85.51%	53.5%
20M-30M	50	10.23%	49	84.11%	54.5%
30M-60M	46	10.29%	43	85.28%	52.1%
Above 60M	58	10.25%	58	86.04%	36.7%
Total	192	10.25%	188	85.25%	46.9%

(*) Cost inefficiency in this case.

PANEL B
Average Profit Efficiency

	Stochastic Frontier Approach		Distribution Free Approach		
Size	N	Average	N	Average	ρ
Below 20M	38	90.49%	38	72.73%	21.5%
20M-30M	50	90.96%	49	71.32%	29.2%
30M-60M	46	90.96%	43	71.42%	23.0%
Above 60M	58	88.74%	58	82.52%	-9.9%
Total	192	90.26%	188	74.61%	0.7%

Note: Panel A shows that, for SFA, the average cost-inefficiency increases as asset size increases, then declines as asset size increases further (inverted U-curve) while for DFA, it declines first, then increases as asset size increases (U-curve). Both results are consistent with each other. However, there are differences in the results produced by the two approaches: First, the SFA shows that CRBs are on average 10.25% cost-inefficient while the DFA, 85.25% cost-efficient. Also, the results derived from the two approaches would not allow us to make a conclusion regarding which asset-size group is the most cost-efficient.

Panel B shows the average profit efficiency by the same asset-size groups. The SFA produces higher average profit effiency than the DFA. This is consistent with the results obtained for cost efficiency measures discussed above. Here, the results obtained from the two approaches are completely different from each other. SFA exhibits an inverted U-curve, that is, the average profit efficiency increases first, then declines as asset size increases, whereas the DFA shows a U-curve, that is, the average profit efficiency declines first, then increases as asset size increases. Also, the least profit-efficient asset-size group in the SFA is the most profit-efficient in the DFA. Thus, we cannot reach a clear conclusion regarding which asset-size group is the most profit efficient.

Table IV

Estimated coefficients of the correlates and their significance

	Stochastic Frontier Approach		Distribution-Free Approach	
	Cost Efficiency	Profit Efficiency	Cost Efficiency	Profit Efficiency
Correlates of Market and Macro Economic Characteristics				
RURAL	0.007	-0.180	0.000	0.000
GRDPGRW	0.000	0.095 ***	0.000	0.000
POPBANK	0.000 **	0.000	0.000 ***	0.000 ***
T	-0.038	-0.530 ***	0.001	0.000
Correlates of Corporate Governance				
SHRDUM	0.024 ***	0.208 ***	0.013	0.000 **
DEPLIAB	0.034	-0.148	0.034	0.000
AVGSHR	-0.767 ***	2.827 ***	0.018 *	0.000
GVTINT	-0.252 ***	0.310	0.003	0.000
MGTWAGE	0.018	0.942 **	-0.007	0.000 **
Correlates of Risk				
CRRISK	0.270 ***	1.540 ***	0.039 *	0.000 ***
LEVERAGE	0.053	0.735	0.000	0.000
INTGAP	-0.001	0.003	-0.004	0.000 **
Correlates of agency costs				
ASSETMEMB	-0.009	0.119 **	0.000 **	0.000 ***
DEPCRED	0.000 ***	0.000 ***	-0.073 **	0.000
FIXASSETS	0.671 ***	-3.037 ***	-0.530 ***	0.000
SUFMARG	2.135 ***	1.041	0.010	0.000

Note: We have considered four major groups of correlates of efficiency: market and macro-economic characteristics; corporate governance; risk; and agency costs. It should be recalled that the SFA produces cost-inefficiency measures while DFA, efficiency measures. The signs of the correlates' coefficients of the two approaches should therefore be opposite to each other to obtain consistent results. See Section 5.2 for a complete discussion of results.

** : 10% level of significance.*

***: 5% level of significance.*

****: 1% level of significance.*

Table V

Impact of top manager's compensation on performance of the CRB

				Efficiency				Corporate Governance			Agency costs				Risk and performance		
CRB size	Distribution	N	Top manager's salary / Personnel expenses	CSFA	PSFA	CDFA	PDFA	SHRDUM	DEPLIAB	AVGSHR	ASSET MEMB	DEP CRED	FIX ASSETS	SUF MARG	CRRISK	ROA	ROE
	Group 1	11	0.34%	10.24%	92.19%	85.31%	84.57%	60.00%	51.27%	60.69%	109,255	57.77%	2.33%	62.72%	40.36%	1.77%	5.00%
	Group 2	11	0.70%	10.20%	93.99%	82.71%	75.13%	90.91%	41.29%	28.28%	83,794	43.58%	3.89%	73.64%	29.68%	2.01%	13.05%
< 20 M	Group 3	11	1.05%	10.25%	91.52%	86.26%	69.21%	100.00%	44.99%	39.96%	92,202	42.51%	3.40%	79.36%	29.34%	0.99%	5.04%
	Group 4	10	2.53%	10.25%	92.59%	86.97%	69.51%	80.00%	51.59%	55.17%	143,565	52.55%	3.34%	67.73%	26.73%	0.88%	2.61%
	Total	43	1.13%	10.23%	92.65%	85.18%	74.40%	83.72%	47.51%	44.91%	121,160	49.00%	3.28%	71.15%	30.97%	1.49%	6.83%
	Group 1	13	0.43%	10.22%	88.83%	85.49%	70.50%	38.46%	57.89%	23.68%	311,109	62.24%	3.48%	75.84%	26.43%	1.80%	7.15%
	Group 2	13	0.64%	10.25%	92.74%	84.72%	70.19%	53.85%	54.53%	71.49%	403,058	58.14%	5.35%	58.99%	25.48%	1.10%	24.88%
20-30 M	Group 3	12	1.00%	10.20%	92.03%	83.48%	70.78%	33.33%	49.14%	39.70%	352,759	55.02%	3.83%	78.07%	24.59%	1.66%	11.99%
	Group 4	12	2.99%	10.24%	87.59%	84.23%	67.48%	53.85%	47.04%	25.59%	393,430	47.08%	3.18%	106.31%	19.16%	2.95%	10.83%
	Total	50	1.27%	10.23%	90.28%	84.53%	69.74%	45.10%	52.21%	40.12%	365,331	55.63%	3.96%	79.83%	23.90%	1.88%	13.75%
	Group 1	10	0.22%	10.20%	92.77%	85.98%	74.28%	60.00%	51.73%	28.31%	511,317	57.19%	4.48%	78.67%	17.69%	3.10%	13.89%
	Group 2	10	0.48%	10.23%	92.01%	84.13%	74.30%	50.00%	45.57%	23.89%	411,524	46.32%	4.26%	88.87%	16.23%	4.19%	20.57%
30-60 M	Group 3	9	0.68%	10.32%	90.52%	86.25%	71.41%	44.44%	36.74%	35.87%	975,049	33.34%	4.39%	103.94%	17.20%	2.72%	13.33%
	Group 4	9	1.76%	10.43%	91.23%	89.98%	74.34%	66.67%	51.10%	39.50%	346,482	51.12%	2.93%	92.47%	17.91%	3.91%	15.67%
	Total	38	0.76%	10.29%	91.67%	86.50%	73.62%	55.26%	46.41%	31.59%	555,847	47.24%	4.03%	90.61%	17.24%	3.49%	15.94%
	Group 1	13	0.10%	10.21%	80.26%	83.59%	90.86%	0.00%	59.80%	35.80%	7,085,107	68.21%	4.78%	35.53%	15.42%	0.68%	-6.09%
	Group 2	13	0.26%	10.27%	85.48%	83.78%	76.85%	30.77%	53.95%	20.20%	904,757	59.72%	5.15%	66.05%	12.54%	3.55%	22.62%
> 60 M	Group 3	13	0.48%	10.25%	92.92%	85.06%	75.12%	38.46%	48.95%	21.96%	625,531	52.42%	4.65%	93.69%	15.68%	4.57%	26.43%
	Group 4	12	0.84%	10.31%	92.81%	87.75%	74.46%	25.00%	36.41%	31.25%	1,657,770	41.92%	4.28%	96.82%	9.89%	4.11%	25.77%
	Total	51	0.41%	10.26%	87.77%	84.99%	79.42%	23.53%	50.04%	27.23%	2,586,145	55.84%	4.73%	72.56%	13.45%	3.21%	17.01%

Note: To construct this table, we first ordered the observations on the basis of the ratio of top manager's salary to personnel expenses within each size group. At the outset, we want to highlight a rather surprising result, that is, small CRBs (those with assets of less than 30 million pesos) are paying their managers better than all their larger counterparts. This result may be attributed to their relative efficiency as well as to the fact that they have a lean staff. We have observed that an increase of top manager's relative compensation reduces agency costs and improves performance of the CRB. The estimates shown in groups 3 and 4 indicate that the ratio of financial margin over operational costs is higher for CRBs offering a better pay to their top managers. The ratios of fixed assets to total assets and deposits to total loans are lower for CRBs offering a better compensation, except for the smallest institutions. We conclude that a better compensation package for top managers can improve the sustainability of the CRBs, and sustainable microfinance institutions will have a long-term beneficial impact on poverty reduction in Philippines.