Theoretical and Applied Economics
Volume XX (2013), No. 12(589), pp. 83-96

Exploring the determinants of the productivity of indian microfinance institutions

Abdul RASHID
International Islamic University, Islamabad, Pakistan
abdulrashid@iiu.edu.pk
Koire TWAHA
International Islamic University, Islamabad, Pakistan
koire.twaha@gmail.com

Abstract. *This paper attempts to investigate the determinants of productivity in microfinance institutions (MFIs) in India using the empirical Bayesian technique. To do this, we utilize an unbalanced panel dataset covering the period 2005-2011 with 292 observations from 64 institutions. Based on theoretical grounds, three broad factors are specified: institutional characteristics, outreach, and efficiency. We find convincing evidence that institutional characteristics and outreach have both positive and negative effects on the productivity of MFIs, depending on the proxy used in the analysis. However, the efficiency of MFIs affects the productivity negatively. Specifically, we find that the age of the institution positively influences the productivity by 6.1581 points, while number of offices and number of personnel negatively affect it by 26.41% and 8.77%, respectively. Of the outreach variables, numbers of active borrowers positively influence productivity by 0.04%, whereas average loan size appears to have an inverse relationship with productivity. We further find that cost per loan – a proxy for efficiency, has a negative and statistically significant impact of 1.9604 points on the productivity of MFIs. Overall, our investigation suggests that there is a need to build client confidence and pursue innovative credit delivery techniques in reaching out to the poor and achieving high levels of productivity.*

Keywords: productivity; microfinance institutions; efficiency; outreach; empirical Bayesian estimation technique.

JEL Classification: D24.
REL Classification: 15E.

1. Introduction

Microfinance institutions (MFIs) are extending financial and social intermediation tailored to the poor (Ledgerwood, 1998). The main objectives of these institutions are to economically empower the poor masses, achieve the financial ability to alleviate poverty by involving them in income generating activities necessary to accumulate capital, and improve their living standards (Hulme, 1996). However, the business of providing tailored intermediation presents a lot of challenges that influence the productivity of these pro poor institutions. The poor in the developing countries have valueless collateral, scattered, and demand several small loans (Conning, 1999). This demands additional resources for these institutions to function particularly with regards to appraising, disbursing, monitoring, and recovering of loans from these poor clients hence compromising on performance (Hulme, 1996).

The performance of MFIs have been studied a lot in recent years, particularly efficiency (Hermes et al., 2011, Bassem, 2008, Berger, Humphrey, 1997), sustainability (Adongo, 2005, Twaha, 2011). However, only few authors including Gebremichael and Rani (2012) and Sufian (2007) have ventured into the productivity of these institutions. Thus, empirical evidence on what factors determine the productivity of MFIs is limited relatively. This study therefore aims to investigate the factors that are significant in explaining the productivity of MFIs. Specifically, this study examines the influence of institutional characteristics, outreach, and efficiency on the productivity of MFLs using the empirical Bayesian estimation technique. The study uses an unbalanced dataset covering the period 2005-2011 with 292 observations from 64 institutions operation in India.

We find that institutional characteristics and outreach have both positive and negative effects on the productivity of MFIs, depending on the proxy used in the empirical analysis. However, the efficiency of MFIs affects the productivity negatively. Specifically, the age of the institution positively influences the productivity by 6.1581 points, while number of offices and number of personnel negatively affect it by 26.41% and 8.77%, respectively. Of the outreach variables, numbers of active borrowers positively influence productivity by 0.04%, whereas average loan size appears to have an inverse relationship with productivity. The results also indicate that cost per loan – a proxy for efficiency, has a negative and statistically significant impact of 1.9604 points on the productivity of MFIs.

The organization of the rest of the paper is as follows. Next section briefly reviews the literature. Section 3 describes the methodology. Section 4 presents and discusses the findings. Section 5 provides some conclusions and policy implications.

2. Literature review

Productivity is one of the main engine driving firms. However, in microfinance industry, little attention has been paid by researchers to investigate this crucial factor. The existing empirical research has provided evidence that improvements in productivity lead to lower price levels (e.g., Rogers, 1998). Similarly, a relative expansion of financial institutions' output due to increased productivity causes a long-run real reduction in interest rates charged on loans. In what follows, we briefly review some prior empirical studies on the productivity of financial institutions.

Recently, Gebremichael and Rani (2012) investigated total factor productivity of Ethiopian MFIs employing the Malmquist productivity index method. They found that the main source of productivity growth is technical efficiency, particularly improvement in management practices. They also argued that further exploration of the determinants of productivity more especially in MFIs is essential notably regarding institutional and non-institutional factors such as scale and outreach. Andries (2011) analyzed the efficiency and productivity of Eastern Europe banks for the period 2004-2008 using the Malmquist productivity index method. He showed that technical changes improved productivity by 24.27% during the period of the study.

Kent (2009) examined the productivity growth of the nationwide banks of China and a sample of city commercial banks. The estimates of total factor productivity growth were constructed with appropriate confidence intervals using a bootstrap method for the Malmquist index. The productivity growth of the state-owned commercial banks (SOCBs) was compared with the joint-stock banks (JSCBs) and city commercial banks (CCBs). The results indicate that average total factor productivity for the joint-stock banks was better than that of the state-owned banks for some models of measurement but not others. However, on average, city commercial banks have improved their productivity growth both in terms of frontier shift and efficiency gain throughout the whole period. The study also showed that individual state-owned and joint stock banks have improved their productivity growth during the period under study and defined an improving production frontier. Most other banks lagged behind so that the gap between the inefficient banks and the most efficient banks widened. While individual banks have improved their productivity growth, there was no significant evidence that the average productivity growth of Chinese banks as a whole improved during the study period.

Sufian (2007) investigated productivity changes of the Malaysian non-commercial banking financial institutions during the post-merger period of 2001-2004 by applying the non-parametric Malmquist productivity index method. He used annual data from published balance sheets. The empirical findings suggest that these institutions have exhibited productivity regress during this period due to a decline in efficiency rather than technological regress. The results also suggest that the finance companies exhibited productivity growth due to technological progress, while the merchant banks, on the other hand, have experienced productivity decline during the sample period due to technological regress. The relationship between different non-commercial bank financial institutions' size and productivity indicates that the majority of these institutions which experienced productivity growth attributed to technological progress are the large ones, while the majority of them that experienced productivity decline due to technological regress were small ones.

Katerina (2006) evaluated the effectiveness of financial institutions in terms of productivity change of the ten latest members of the European Union (EU) for the period before their entry in the EU, 1996-2002. Katerina used the Data Envelopment Analysis (DEA) to calculate the Malmquist productivity index. Further, she decomposed the index into technological change and technical efficiency change index to determine the exact source of efficiency. In particular, she focused on exploring the relationship between the size of financial institutions and their productivity. She found that the total level of productivity had increased for half of the countries during the six-year period. However, she showed that the relationship between the size of banking institutions and productivity growth is not statistically significant, with the exception of Latvia, where this relationship appears positive and statistically significant.

The above review shows that there is relatively limited empirical evidence on studying the determinants of the productivity of MFIs. The few studies available suggest that advances in management practice are significantly related to the productivity of MFIs. Yet, almost all of the studies have applied the Malmquist productivity index method. Our study mainly differs from the existing empirical literature in two important aspects. First, we use a fairly larger dataset for 64 institutions, covering the period from 2005 to 2011. Second, we use different econometric methodology, namely empirical Bayesian technique.

3. Data and methodology

Understanding what determines the productivity of MFIs is limited due to a lack of empirical analysis in microfinance literature. Some prior empirical studies have examined the determinants of productivity in MFIs (e.g., Gebremichael, Rani, 2012, Sufian, 2007). However, as we mentioned above, these studies employed a non-parametric measure method, namely the Malmquist productivity index. Our study diverts from the previous studies methodologically by applying empirical Bayesian estimation method for exploring the significant derivers of the productivity of MFIs.

3.1. Data nature, sources, sample size, and limitations

Data for this study consist of institutional and financial information over the six-year period from 2005 to 2011 for sixty-four Indian MFIs. We obtain the data from the MIX Market. To respond to the objectives of the study, purposeful sampling method has been used to select the sample units of MFIs under our scope thereby constructing unbalanced panel dataset.

Although the dataset we used in this study covers a large sample of MFIs, the construction of the dataset, however, was limited by two factors. First, relatively few MFIs submitted their information to the mix market. Second, of those institutions that did, fewer submitted data continuously. Because of these limitations, it was difficult to obtain a balanced panel data. Therefore, we left out many MFIs lacking the required data.

Table 1 provides descriptive statistics for each of the variable included in the analysis. The sample consists of 292 bank-year observations. The average age of the institutions included in the study is about 11 years, ranging from minimum 2 years to maximum 38 years. The mean value of cost per loan is 20.92. The maximum value of cost per loan is 246.58, while the minimum cost per loan is only 1.01. The mean value of number of personnel is 1320.51, while the standard deviation of number of personnel is 2736.2. The mean value of number of office is about 162.58, ranging from 1 to 2380 offices.

Table 1. *Descriptive statistics*

	AGE	PESO	OFF	NAB	ALS	CPL
Mean	11.14	1320.51	162.58	371361.80	156.13	20.92
Median	10	353	48	85118.5	132.47	13.75
Maximum	38	22733	2380	6242266	832.93	246.58
Minimum	2	15	1	1125	61.25	1.01
Std. Dev.	6.74	2736.2	339.28	828436.60	99.09	27.21
Obs.	292	292	292	292	292	292

Note: AGE = age in years, PESO = number of personnel, OFF = number of office, NAB = number of active borrowers, ALS = average loan size, CPL = cost per loan.

3.2. Research model, specification, conceptualization, description, and design

3.2.1. Research model

Academic inquiries into the productivity of financial institutions have traditionally been carried out using the Malmquist productivity index method (e.g., Gebremichael, Rani, 2012, Sufian, 2007). However, this study is differing from the existing studies on this issue as it applies the empirical Bayesian estimation technique.

3.2.2. Rational of empirical Bayesian estimation techniques

Berger (1985) outlined a number of benefits associated with this estimation technique: a) The estimated parameters are random with some prior density, and thus, suitable for panel data where parameters of models are individual to one another. b) They provide a natural way of combining prior beliefs and information with data. In the panel data models, the average of individual parameter estimates can be used as prior.(1) c) They are more precise than the classical Bayesian estimates. The standard errors of Bayesian estimates are small, and hence, helpful in getting more reliable inferences. e) These methods provide reliable results for small samples. Contrary to classical Bayesian estimates, empirical Bayesian estimates do not rely on one asymptotic result. Finally, Hsiao (1999) and Koop (1999) highly recommend empirical Bayesian techniques in estimating panel data.

3.2.3. Research model specification

In order to empirically scrutinize the factors that are significant in influencing the productivity of MFIs operating in Indian, we model the productivity as follows:

Efficiency of MFIs = F (Institutional Characteristics, Outreach, and Efficiency)

Specifically, the model can be expressed as follows:

$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \varepsilon_{it} \quad (1)$$

where

Y_{it} = productivity;

X_{1it} = institutional characteristics;

X_{2it} = outreach;

X_{3it} = efficiency;

ε_{it} = error term.

3.3.4. Model conceptualizations

Productivity of a firm explores the relationship between factor input and output in production expressed as a ratio of output to input. It is the ratio of outputs to inputs (Ledgerwood, 1998). For MFIs, to achieve higher levels of productivity in operations, there is a need for employing fewer inputs (such as staff) or providing more output (such as loans) for the same quantity of inputs (staff) (Ledgerwood, 1998). Thus, as argued by Rogers (1998), increasing productivity requires either producing more output with the same amount of inputs or that fewer inputs are required to produce the same level of output. Therefore, it is clear that high productivity levels are achieved when maximum output is obtained for a particular input level. Productivity growth over time requires reducing costs (Rogers, 1998). Consequently, if the productivity growth of a firm is higher than that of its competitors, that firm performs better financially.

3.4. Dependent variables

In this study, we use numbers of borrowers per staff number as a measure of productivity. This ratio is computed by expressing the total number of borrowers in terms of total number of staff members in a given MFI. It is a staff productivity ratio. It provides a clue of the number of staff required to produce a given level of output measured by borrowers. A higher ratio is more desirable as it implies that fewer staffs are actually needed to produce a given number of borrowers. It is the appropriate measure of productivity given the fact that MFIs are characterized by a large number of borrowers accessing very many small loans (Hulme, 1996). This characteristic renders injection of more resources in the course of serving the poor masses, and thus, compromising on the productivity. Additionally, these pro poor institutions have evolved a unique loan delivery methodology including group lending, which reinforces the usefulness of this variable as compared to other alternatives such as loans per staff.

3.5. Independent variables

3.5.1. Institutional characteristics

Age (AG)

The total number of years an MFI has been in operation (i.e., experience) is used as a proxy for the age of the institution. The more years an MFI is in business, the more it understands its clients, especially those with the ability and willingness to pay, other things being equal. Therefore, the age of an institution is expected to have a positive relationship with the productivity of the institution.

Offices (OFF)

The total number of offices (branches) implies a (an) firm (institution) expansion. As firms expand, pressure is exerted on the productivity of firms. Particularly, for MFIs with clients scattered in remote rural areas, the situation becomes more challenging. This variable is therefore hypothesized to have an inverse relationship with the productivity.

Personnel (PESO)

The total number of personnel captures the notion that productivity is enhanced to the extent at which the MFI recruits the right size of inputs (staff) to produce outputs (loans). A lower number as compared to the number of loans is desirable. However, given the nature of microfinance operation, it demands a lot of staff to handle the numerous small loans from very many poor clients. This variable is therefore hypothesized to have an inverse relationship with the productivity of MFIs.

3.5.2. Outreach

3.5.2.1. Breadth of outreach

Number of active borrowers (NAB)

The number of active borrowers is an indicator of the breadth of outreach. The breadth has an inverse relationship with costs and a positive relationship with profitability, the argument being that fixed costs of production are amortized across a larger number and value of outputs. In this context, it is hypothesized that the number of active borrowers is positively related to the productivity.

3.5.2.2. Depth of outreach

Average loan size (ALS)

The average loan balance per borrower is a measure of depth of outreach. Numerous smaller loans by poor clients indicate greater depth of outreach, which requires more resources from the institution. Thus, we expect that the average loan balance per borrower should have an inverse relationship with the productivity of MFIs.

3.5.3. Efficiency

Cost per loan (CPL)

The cost per loan ratio measures the total financial value and other in-kind inputs required to produce a given level of output, as measured by loans. A higher ratio indicates that more financial resources and in-kind contributions are required to

produce a given number of loans. The cost per loan ratio is therefore hypothesized to be inversely associated with the productivity.

3.6. Model design

The empirical Bayesian estimates are weighted average of classical Bayesian estimates and the prior information. Let $\hat{\beta}$ be the classical bayesian estimate of parameters, which can be estimated as

$$\hat{\beta} = (\mathrm{X}'\ \mathrm{X})^{-1}\ \mathrm{X}'\mathrm{Y}$$

Assume $\hat{\beta} \sim \mathrm{N}\ (\mu, \Omega)$, this means $\hat{\beta}$ is itself random normal with prior mean μ and prior variance Ω. In this case, empirical Bayesian estimates will be:

$$\hat{\beta}_{\mathrm{BAYES}} = E(\beta / \hat{\beta}),$$

where

$$\hat{\beta}_{\mathrm{BAYES}} = E(\beta / \hat{\beta}) = [\frac{1}{\sigma^2}(X'X) + \Omega^{-1}]^{-1}[\sigma^2(\mathrm{X}'\mathrm{X})^{-1}\hat{\beta} + \Omega\mu] \qquad (2)$$

$$V(\hat{\beta}_{BAYES}) = (\frac{1}{\sigma^2}\mathrm{X}'\mathrm{X} + \Omega^{-1})^{-1} \qquad (3)$$

The empirical Bayesian estimation procedure used in the study by utilizing Bayesian equations (2) and (3). $\hat{\beta}$ is estimated in the following way $\hat{\beta} = (\mathrm{X}'\mathrm{X})^{-1}\ \mathrm{X}'\mathrm{Y}$, where X is a matrix of the regressors and Y is the matrix of the dependent variable.

The estimation follows the assumption that the productivity of MFIs in India is random with some average performance and this enables estimation of parameters by using productivity determinants for a given MFI. In estimating priors, the average values of a MFI's variables are most ideal and can be arrived at in the following manner; $\bar{Y}i = \frac{1}{Ni}\Sigma Yit$ and $\bar{X}i = \frac{1}{Ni}\Sigma Xit$, where "$i$" is the ith firm, 'Ni' is the number of data points available for ith and t is the time index.

$$\bar{Y} = \begin{pmatrix} \bar{Y}1 \\ \bar{Y}2 \\ : \\ \bar{Y}n \end{pmatrix} \text{ and } \bar{X} = \begin{pmatrix} \bar{X}1 \\ \bar{X}2 \\ : \\ \bar{X}n \end{pmatrix}$$

Then, $\mu = \left(\bar{X}'\bar{X}\right)^{-1} \bar{X}'\bar{Y}$ and $\Omega = \bar{\sigma}^2 (\bar{X}'\bar{X})^{-1}$ are the priors used in the model. With both the posterior and prior parameters available, the empirical Bayesian estimates are described by Equation (1).

4. Empirical results

Table 2 reports our regression results for numbers of borrows per staff. Specifically, the table presents the estimated coefficient, t-statistics, and p-values. The table also reports the value of Adjusted-R^2 and F test. Heteroskedasticity-consistent standard errors are used in the estimation of t-statistics. All the variables included in the model have expected signs and appear to have statistically significant effects on the productivity of MFIs. The estimated value of F-statistic suggests that the overall model is good fit. Below we discuss the results in details.

4.1. Institutional characteristics

The estimated coefficients for all three proxied used for institutional characteristics, namely the age of the institution, number of offices (branches), and personnel, have expected signs and are statistically significant. Specifically, institutional *Age* is positively and statistically significantly related to borrowers per staff. The size of the estimated coefficient is 6.1581, which implies that for any additional year of existence of an MFI, its productivity improves by 6.1581 units per year. This finding is consistent with the idea that experience is important in dealing with the poor clients as it provides chance for lenders and borrowers to understand each other and serve each other more efficiently. Client loyalty as a result of years of dealings would definitely help in reducing the negative impacts of other institutional characteristics like office and personnel.

Table 2. *Results for model of borrowers per staff*

Variables	Coefficient	t-statistic	p-value
Const	325.8122	10.8159	0.000
AGE	6.1581	3.1179	0.002
OFF	-0.2641	-2.2631	0.024
PESO	-0.0877	-5.6368	0.000
NAB	0.0004	5.5169	0.000
ALS	-0.3437	-2.4709	0.013
CPL	-1.9604	-3.9254	0.000
Adjusted-R^2	0.1824		
F-statistic		9.0822	0.000

Note: Const = constant, AGE = age in years, PESO = number of personnel, OFF = number of office, NAB = number of active borrowers, ALS = average loan size, CPL = cost per loan.

The coefficient of number of offices is negative (-0.2641) and appears statistically significant. This implies that the productivity of an MFI decreases by 26.41% when the institution opens an additional office. A possible explanation for this finding is that MFIs use a lot of resources, both financial and human, to service the many clients in need of very small loans with higher unit costs. As more offices imply increasing resources to serve clients demanding credits, opening new office is likely to increase cost, and, thereby, compromising productivity.

Total number of personnel has also a negative and statistically significant effect on the productivity of MFIs. Specifically, the estimated coefficient for number of personnel indicates that the productivity of MFIs decreases by 8.77% when additional personnel are placed. Personnel are paid for their efforts by MFIs. Thus, the more personnel, the more resources depleted in the process of operation, and, hence, a compromise on the productivity.

4.2. Outreach

Outreach had two variables as earlier discussed representing breadth and depth of outreach. The total number of active borrowers (proxy of breadth) has a coefficient 0.0004, suggesting that an additional client increases the productivity of MFIs at a rate of 0.04%. This could have been possible due to partly perfection in the business as time went by as noticed while discussing age factor and possibly the diversification of clients including the rich and middle classes who have sound business knowledge.

The average loan size (proxy for depth) has a coefficient -0.3437. This suggests that extending loans to the poorest segment reduces the productivity of MFIs by 34.37%. This result suggests that the poorest are being served and serving the poorest requires more inputs, which adversely affects the productivity of MFIs.

4.3. Efficiency

Efficiency proxied by the cost per loan has a negative and statistically significant impact of the productivity of MFIs. Specifically, the estimated coefficient for the cost per loan suggests that the numerous loans offered to borrowers reduces productivity as measured by borrowers per staff by 1.9604 points. The negative influence of the efficiency of MFIs makes sense as the demand of numerous small loans by many borrowers renders cost per loan to be high thereby retarding productivity.

To check the robustness of our results discussed above, we run another model where we used loans per staff as a dependent variable instead of borrowers per staff. However, the explanatory variables are identical to the model presented in Table 2. The results are presented in Table 3. Overall, the results obtained from the model of loans per staff are quite similar, both in terms of their signs and

statistically significance, to our earlier results presented in Table 2. Specifically, the results suggest that the age of an MFI is positively and statistically significantly related to numbers of loans per staff, implying that the older MFIs have higher the ratio of loans to their staff than the young ones. On the other hand, we observe that there is a negative relationship between the numbers of office and loans per staff. Similarly, the average loan size and cost per loans are also negatively and statistically significantly related to loans per staff. In sum, the results presented in Table 3 strongly support our earlier results. This implies that the empirical evidence concerning the determinants of the productivity of microfinance institutions we presented here is robust to different proxies for the productivity of MFIs.

Table 3. *Results form model of loans per staff*

Variables	Coefficient	t-statistic	p-value
Const	337.0396	10.8646	0.000
AGE	6.4454	3.1689	0.002
OFF	-0.2473	-2.0512	0.040
PESO	-0.1002	-6.2448	0.000
NAB	0.0005	5.9847	0.000
ALS	-0.3296	-2.2993	0.021
CPL	-2.1172	-4.1108	0.000
Adjusted-R^2	0.2039		
F-statistic		10.4305	0.000

Note: Const = constant, AGE = age in years, PESO = number of personnel, OFF = number of office, NAB = number of active borrowers, ALS = average loan size, CPL = cost per loan.

5. Conclusions and policy implications

This study performed an empirical analysis of the determinants of productivity for 64 MFIs operating in India during the period 2006-2011. Specifically, the study investigates the roles of institutional characteristics, outreach, and efficiency in determining the productivity of MFIs. Our results indicate that both institutional characteristics and outreach have both positive and negative effects on the productivity of MFIs, depending on the proxy used for them. Specifically, we find that the age of MFIs is positively related with the productivity of MFIs, while both the number of offices and the number of personnel have a negative impact on the productivity. Concerning outreach, we find that total number of borrowers, which is used as a proxy for the breath of outreach, is significantly negatively related to the productivity of MFIs. However, the average loan size, which is used as a proxy for the depth of outreach, has a positive and statistically significant on the productivity of MFIs. Finally, our analysis suggests that the efficiency of MFIs proxied by cost per loan has a positive effect on the productivity of MFIs.

Overall, our results suggest that there should be massive mobilization of clients to boost the number of active borrowers. To avoid mission drift, MFIs should extend credit to the poor and find ways of training the poorest of the poor who have no experience in managing financial resources. Basic education should be extended to them at a minimum fee for them to be eligible for funding and to use it productively. This with time will help in reducing the negative impact of average loan size on the productivity of MFIs.

Our analysis also indicates that efficiency is a challenge to the productivity of MFIs. This is true. Since the small numerous clients demanding numerous small credits, the adverse selection and moral hazards are very likely to be involved in micro financing. Efforts should be done to ensure reductions in costs to reduce the cost per loan or per borrower. MFIs should encourage group lending, which has been empirically tested as enhancing efficiency.

Note

(1) Suppose $\widehat{\beta}_i$ is a parameter estimates for the *ith* cross section and let μ and Ω be the parameters of prior distribution then $\mu = \frac{1}{n}\sum \widehat{\beta}_i$ and $\widehat{\Omega} = \frac{1}{n}\sum \widehat{\beta}_i \widehat{\beta}'_i$.

References

Adongo, J., Stork, C. (2005). "Factors influencing the financial sustainability of selected microfinance institutions in Namibia", *NEPRU Research Paper*

Andries, A.M. (2011). "The determinants of bank efficiency and productivity growth in the Central and Eastern European banking systems", *Eastern European Economics,* 49, pp. 38-59

Bassem, B.S. (2008). "Efficiency of microfinance institutions in the mediterranean: An application of DEA", *Transition Studies Review,* 15, pp. 343-354

Berger, A.N., Humphrey, D.B. (1997). "Efficiency of financial institutions: International survey and directions for future research", *European Journal of Operational Research,* 98, pp. 175-212

Berger, J.O. (1985). *Statistical decision theory and bayesian analysis*, Springer

Conning, J. (1999). "Outreach, sustainability and leverage in monitored and peer monitored lending", *Journal of Development Economics,* 60, pp. 51-77

Gebremichael, B.Z., Rani, D.L. (2012). "Total factor productivity change of Ethiopian microfinance institutions (MFIs): A Malmquist productivity index approach", *European Journal of Business and Management*, 4, pp. 105-114

Hermes, N., Lensink, R., Meesters, A. (2011). "Outreach and effiecncy of microfinnace institutions", *World Development*, 39, pp. 938-948

Hsiao, C., Pesaran, M.H., Tahmiscioglu, A.K. (1999). *Bayes estimation of short-run coefficients in dynamic panel data models,* Cambridge University Press

Hulme, D., Mosley, P. (1996). *Finance against poverty*, Routledge, London

Katerina, Lyroudi, Angelidis, D. (2006). "Measuring banking productivity of the most recent European union member countries: A non-parametric approach", *Journal of Economics and Business*, 9, pp. 37-57

Kent, Matthews, Zhang, N. (2009). *Bank productivity in China 1997-2007: An exercise in measurement*, Cardiff Business School, Cardiff University, Wales

Koop, G. (1999). "Bayesian analysis, computation and communication software", *Journal of Applied Econometrics*, 6, pp. 677-689

Ledgerwood, J. (1998). *Sustainable banking with the poor, micro finance handbook – an institutional and financial perspective*, The World Bank, Washington DC

Rogers, M. (1998). *The definition and measurement of productivity*, The University of Melbourne, Australia, Melbourne Institute of Applied Economics and Social Research

Sufian, F. (2007). "Size and total factor productivity change in Malaysian non-commercial banking financial institutions: A non-parametric Malmquist productivity index analysis", *International Journal of Business and Society,* 8, pp. 39-56

Twaha, K. March (2011). *An assessment of the financial sustainability of micro finance institutions in East Africa*, International Institute of Islamic Economics, School of Economic, International Islamic Economics, Pakistan