

Determinants of Financial Self Sufficiency of Andhra Pradesh Microfinance Institutions

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Abstract

Microfinance aims to reduce poverty and generate profit by providing financial services to poor and unprivileged section of society. The southern state of Andhra Pradesh in India which is known as Mecca of Microfinance accounts for about 30% of the credit extended by MFIs. Andhra Pradesh Microfinance Crisis 2010 led to the shutdown of many emerging and small MFIs and loss of loan portfolio rose to the extent of Rs 7,200 crore. Financial sustainability became very challenging issue for Microfinance institutions. This study uses cross sectional high quality panel data from MIX (Microfinance Information Exchange) market of 10 microfinance institutions of Andhra Pradesh, for the period 2005 to 2013 to examine the patterns of financial viability. This study employed pooled OLS model, fixed effect model and Random effect model of panel data in order to check consistency of results.

Keywords: Financial sustainability; Microfinance institutions; Microfinance crisis

Introduction and Issues

Microfinance institutions (MFIs) have proved to be very important in growth and development of a country. MFIs enhance financial deepening in an economy thereby contributing to an economy's development by providing financial services to the extremely poor section of society. Nowadays, MFIs face challenge of sustainability and outreach. There has been increased pressure on MFIs to decrease dependence on donations, grants and subsidized funding. As providing Microfinance services is a costly business due to high transaction and information cost. At presents, large number of Microfinance programs is still depending on donors, grants and donations which mean that MFIs are not financially sustainable. In 1990s, the issue of sustainability of MFIs gave rise to important debate between financial system approach and poverty lending approach (Robinson, 2001) [1].

According to the report of Deutsche bank (2007) only 1-2% of MFIs in the world are financially sustainable [2]. 8% of all MFIs are close to being profitable. 70% of all MFIs are heavily dependent on subsidy. Microfinance in India has grown at tremendous pace in recent years, achieving significant outreach amongst the poor household across the country. According to the status of Microfinance report 2011-12 there are about 1,000 MFIs in country working in various legal forms, Puhazhendhi [3]. The southern state of Andhra Pradesh accounts for about 30% of the credit extended by MFIs. According to the article published in, "Business Standard" the number of Self-help groups is declining over the years an indication of weakening SHG movement in India. NABARD has also raised alarm over rising Non Performing Assets (NPAs) or Bad loans in SHG bank linkage model. Andhra Pradesh Microfinance crisis led to the following repercussions that Non Performing Assets (NPAs) of Andhra's MFIs is an all time high of over 96% in the year 2011. Smaller emerging MFIs shut down their business operations and loss of MFI portfolio to the extent of Rs. 7,200 crore.

Research objectives

The study is focused on achievement of following objectives.

1. To determine the factors affecting financial sustainability of microfinance institutions in Andhra Pradesh.
2. To analyze the effect of increasing interest rates on Financial Performance of Andhra Pradesh MFIs.

Literature Review

Schafer and Fukasawa in this paper titled "Factors determining operational self sufficiency among Microfinance institutions" investigate about the factors affecting operational self sufficiency of MFIs [4]. The empirical investigation is based on the data of 1,000 MFIs retrieved from MIX market for the year 2006 and 2008 scattered in different part of the world. Their empirical findings by multiple regression analysis revealed that number of borrowers, write off ratio were found to be important determinants of operational self sufficiency. Moreover, there was no significant difference in 2006 before the worldwide financial crisis and in 2008.

Zerai and Rani examined technical efficiency of Ethiopian micro finance institution (MFIs) by utilizing data of 19 micro finance institutions taken from mix market with the help of stochastic frontier analysis [5]. The findings of the study revealed that average efficiency score of 71.72% of Ethiopian MFIs. Assets, operational sustainability, depth of outreach have significant impact on efficiency. The empirical findings confirm tradeoff between efficiency and outreach of Ethiopian MFIs.

Cull, Demirgüç-Kunt and Morduch examines by using dataset of 245 microfinance Institution effect of prudential supervision on MFI profitably outreach to small scale borrowers and women [6]. Their finding suggest that profit oriented micro finance institution respond to supervision by maintaining profit rates and but at the cost outreach to women and poor client that are costly to reach. Their empirical finding shows that supervision has a negative effect on outreach, because supervision is positively related with average loan balance while it is negatively related with the percentage of women borrowers.

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Gutiérrez-Nieto, Serrano-Cinca and Molinero in their paper discussed about dual performance of MFIs i.e social and performance [7]. Out of data set of 450 institutions for the year 2003 from mix microfinance information exchange only 89 MFIs were selected for which complete information was available. Data envelopment analysis (DEA) was used to calculate the social and financial efficiency of MFIs. Operating cost and assets gross loan portfolio used as inputs. Gross loan portfolio and financial revenue are used as outputs for measuring financial efficiency. No. of active borrowers and indicator of benefit to the poorest are used as output variable to calculate social efficiency. The result of financial efficiency and social efficiency was correlated with various financial ratios to withdraw the result and interpretation. The findings of this paper suggest that except one, no MFIs are socially efficient but financially efficient MFIs exist. There is low positive relationship between social and financial efficiency of MFIs.

Tehulu used unbalanced panel data from 2004 to 2009 of 23 microfinance institutions in east Africa to identify the factors affecting financial sustainability. The study used binary probit and ordinary probit regression models to identify the factors. The empirical result regression revealed that management efficiency and portfolio at risk is negative and significantly related with financial sustainability. Management inefficiency, portfolio at risk, loan intensity and size are important factors of financial sustainability [8].

Gonzalez examined the technical efficiency of micro finance institution by using DEA and also identify differences in efficiency with the help of Tobit regression average loan size, proportion of assets used as performing portfolio, scale of operation, ratio of payroll to expenses, age, structure of the board and for profit status of MFIs are the indicators used to determine differences in efficiency [9]. The empirical evidence shows tradeoff between sustainability and outreach in Mexican MFIs. Moreover, this study provides an idea how to use tools to analyze the relative technical efficiency of MFIs.

Rai in his research work "A comparative analysis of the financial performance of micro finance institution of India and Bangladesh" analyzed the financial performance of Indian MFIs and compared it with MFIs of Bangladesh from different point of view by using various performance indicators and Ratios [10]. Mann Whitney U test is used to compare financial performance of India and Bangladesh MFIs. Kruskal Wallis one way ANOVA is used to analyze age wise performance of Indian MFIs after categorizing MFIs into young, mature and old. This study covers the period of 2007-08. There is no significant difference between the means of Bangladesh and Indian MFIs on operational self sufficiency, yield on gross loan portfolio and return on assets. NBFC MFIs are financially more viable and outreach is high.

Masood and Ahmad measured the technical efficiency of micro finance institution by applying stochastic frontier approach of unbalanced panel data of 40 micro finance institutions withdrawn from mix market for the period 2005-08 [11]. The objective of the study is to benchmark the best practice MFIs by assigning ranks and to determine the factors responsible for variation in efficiency level. The findings of the study revealed that efficiency level of micro finance institution is very low and it is increasing during the study period and there is no evidence of trade off. MFIs in southern part of India are more efficient than other MFIs. Moreover unregulated MFIs are more efficient than regulated MFIs.

Gutierrez et al. employed data envelopment analysis (DEA) approach to efficiency to prove that ratio analysis does not capture DEA efficiency. This study highlights an important aspect that, "how

DEA model be specified i.e. which input and output variables should be chosen [12]. A methodological approach based on multivariate analyses is applied in order to choose appropriate model specifications and to produce ranking of MFIs in terms of efficiency. The finding of the study is based on data obtained data of 30 MFIs from micro rate web page from the year 2003. The selection of inputs and outputs indicators is based on Yaron's (1994) outreach and sustainability framework. The study reveals that level of MFIs depend on the particular model. This model is also relevant for efficiency assessment.

Hassan and Sanchez investigates about the technical and scale efficiency of MFIs by using Data envelopment analysis. The data of 215 MFIs was taken from mix (A CGAP data base of MFIs around the globe). These MFIs are scattered in region of Latin America, Middle East and North Africa and South Asia. The efficiency of MFIs is analysed following both production approach and intermediation approach. The inputs indicators for the intermediation approach are operating expenses, total financial expenses and labour. The indicators used as output in intermediation approach are gross loan portfolio, total funds and financial revenues. On the other hand, operating expenses and labour are used as input in production approach and Numbers of active borrower is as only input. The empirical findings of the study depicts that technical efficiency is higher for formal MFIs. South Asian MFIs have higher efficiencies in comparison to latin America and middle east and north African MFIs. The efficiencies are of pure technical nature i.e. MFIs are wasting their resources and not producing enough outputs [13].

Data and Methodology

The empirical findings of the study are based on the financial data of Microfinance institutions withdrawn from MIX market (Microfinance Information Exchange database). Mix market provides information about historical and social performance information data of more than 2100 microfinance institutions worldwide serving about 94 million clients. The study is based on the unbalanced panel data consists of 10 Microfinance institutions representing over the period 2005 to 2013 with total 76 observations. As of 31st March 2013 around 200 Indian Microfinance institutions reported data to the MIX. Out of 18 Andhra's Microfinance institutions 10 have been selected for this study. The criteria for selecting the MFIs were based on the time period of 9 years (2005-2013). However data provide by these institutions was incomplete. We have selected those institutions which report at least 5 years data from the period 2005 to 2013 to MIX database. On the basis of this criterion 10 MFIs have been selected. Therefore on the basis of sample size and time period our data is unbalanced panel data with 76 observations.

After fulfilling the above criteria, the unbalanced panel data of 10 microfinance institutions for 9 years period 2005 to 2013 is used for analysis and interpretation. These microfinance institutions are representative of around of around 55% of total number microfinance institutions in Andhra Pradesh given their size and age. It has been attempted to include all categories of size (large, medium and small) and age (old, medium and young) MFIs.

Sampling technique

The purposive sampling technique on the basis of following points given below is adopted. Only those MFIs which follow the followings assumptions are selected for the present study.

1. Only those MFIs which report data to the MIX market

(Microfinance information exchange) of Andhra Pradesh are taken into consideration for this study.

2. Out of the 18 Andhra MFIs which report data to the MIX 10 MFIs have been selected. Only those MFIs which are operating during the period 2005-2013 are selected.
3. Only those MFIs which report at least five years data during the period 2005-2013 is selected for the present study.
4. MFIs do not provide full information regarding the variables. Some observations are missing in the data.
5. After fulfilling the above criteria, the unbalanced panel data of ten firms for nine years during the period (2005 to 2013) are taken into consideration.

The use of panel data enhances tracking variables changes in measured variables and relationship overtime [14]. It allows us to control for unobserved characteristics of individuals cases or MFIs and facilitates causal inferences in situations where inferring causality would be very difficult in case if we had only single year cross sectional data. According to Gujarati, by studying repeated cross sectional data of same cases or firms, Panel data is considered better to study dynamic changes [15]. Furthermore, panel or longitudinal data help us to study the importance of lags in the behavior. We used the pooled OLS model, fixed effect model and random effect model of panel data. However, we try to check the consistency of results by using all the three models independently. Finally Gretl version 1.9.12 software is used to generate regression results and panel diagnostics command in Gretl to determine most appropriate model. On the basis of result of F test, Hausman test and Breusch pagan test most appropriate model is determined and finally our result and interpretation is based on most appropriate model.

Dependent and independent variables

This section states about definitions of independent variables and their expected hypothesis sign related to factors affecting financial sufficiency model. Hypotheses of the study, In line with the main objective of the study, the researcher have developed the following hypotheses based on the theories and empirical studies discussed in literature related to financial self sufficiency.

Dependent variable

Financial self sufficiency (FSS): The key dependent variable in our analysis of profitability is the financial self sufficiency (FSS) ratio, a measure of an institution's ability to generate sufficient revenue to cover its costs. Values below one indicate that it is not doing so. The financial self sufficiency ratio is the best measures of financial performance because the data readjusted as described below and because it offers a more complete summary of inputs and outputs than standard financial ratios such as return on assets or equity.

$$FSS = \frac{\text{Operating Income (Loans+Investments)}}{\text{Operating Costs+Loan Loss Provisions+Financing Costs+Adjusted Cost of Capital}}$$

Independent variables and expected hypothesis

Real gross portfolio yield: Portfolio yield is a percentage that shows the institutions ability to generate revenue to covers its Financial and operational expenses. It represents the average gross returns as a proportion of portfolio outstanding. It shows the amount received from interest payments during the period by Microfinance institutions. In

case the MFIs following cash accounting system the portfolio yield will not include (interest and fee) income generated by delinquent loan. It indicates the efficiency of micro finance institution in generating cash revenue from their outstanding loan portfolio. In simple words Portfolio Yield shows how much on average the MFIs receives in interest payment on its loan. It is a good indicator of delinquency as if Portfolio at risk is low (as reported by MFI) if the yield is lesser than expected than there is delinquency [16].

The study of indicates the coefficient for gross loan portfolio yield is positive and significant with all three measures of financial performance (financial self sufficiency, operational self sufficiency and return on assets indicating that individual based lenders earns more profit than their average interest are higher [17]. However the result is quite different for village banks or solidarity lenders. For Group lenders and solidarity lenders there is not significant relationship between interest rates and profitability even after controlling for cost? Rahman and Mazlan empirical findings revealed significant and positive relationship between yield on gross loan portfolio and financial self sufficiency [18]. The study of De Crombrugghe et al. founds the gross portfolio yields affects the financial self sufficiency [19]. The finding of the study show financial self sufficiency is positive through interest and fees revenues. The study of Woller and Schreiner shows that real portfolio yield is statistically significant determinant of financial self sufficiency [20]. Adongo and stork found that all the financial institutions during the selected period were financially unsustainable [21]. The study suggests that they were not charging enough interest rates that can cover all financial costs and non-financial costs and risk of their operation. The study of Cull et al. shows that interest rates are related with improved financial performance for individual lenders only [17]. Nyamsogoro empirical findings revealed positive relationship between yield on gross loan portfolio and financial self sufficiency [22]. Hence, based on the earlier empirical evidences, the following hypothesis is framed.

H₁: There exists a positive relationship between yield on gross loan portfolio and financial self sufficiency.

Capital cost to total assets ratio: The capital cost to total assets ratio is used as standard inverse proxy of leverage, especially in banking research because regulatory attentions are paid to capital assets ratio [23]. In context of financial performance agency costs hypothesis states that increasing leverage or decreasing capital assets ratio is associated with reduction in agency cost of outside equity and improvement in financial performance. Kar concludes that reduction in capital cost ratio may raise efficiency [24]. Gebremichael predicted positive relation between capital assets ratio and financial self sufficiency [25]. Accordingly the following hypothesis is predicted.

H₂: There exists a negative relationship between capital cost to assets and financial self sufficiency.

Gross loan portfolio to total assets ratio: Gross loan portfolio to total assets ratio is an indicator of financing structure. It is the ratio of adjusted gross loan portfolio to adjusted total assets. It is an indication of their focus of lending as otherwise these funds could have been utilized for some income generating purpose. Tehulu also predicted that loan intensity affects positively to financial sustainability and his findings show that the coefficient of gross loan portfolio to total assets ratio is positive and significant at 5% level [8]. Cull et al. empirical findings revealed positive relationship between gross loan portfolio to total assets ratio and financial sufficiency [26]. Kar also expected uncertain relationship between gross loan portfolio and financial self sufficiency [24]. However, based on the prior empirical evidence, we

predict positive relationship between financial performance and gross loan portfolio to total assets ratio. Accordingly, the following hypothesis is suggested

H₃: There exists positive relationship between gross loan portfolio to total assets ratio and financial self sufficiency.

Average loan balance per borrower: Average loan size is taken as proxy for depth of outreach. It measures the efficiency of microfinance institutions in selling loans. It is calculated by dividing average gross loan portfolio by number of active borrowers. The size of loan can affect FSS and even portfolio at risk. However, larger loans may be more risky than smaller loans, but their cost per rupee is assumed to be small, if there is some fixed cost per loan. The size of the loan is often taken as indicator of coverage i.e. ability of MFIs to reach poor, as poor people are expected to avail for smaller loan than larger amount of loan. It is interesting to determine how important the effect of the size of the loan and to determine how MFIs perform for given loan size. The findings of the study of Gonzalez shows that larger loans are associated with higher cost efficiency and thereby profitability [9]. However the findings of Cull et al. are against the findings of above two studies [26]. The study revealed that the Micro banks or MFIs which provide smaller loans are not less profitable than those which provide bigger loan. The findings of the study revealed that the average loan sizes are not strongly associated with financial performance indicators. Institutions which provide larger loans are not less profitable than which provide bigger loan amount. Woller and Schreiner found that the depth of outreach is inversely related with financial self sufficiency [20]. Nyamsogoro study also indicates that average loan size is positively and significantly related with financial self sufficiency [22]. Adongo and Stork found that profitability is related with bigger or wealthier loan size per borrower [21]. Therefore, based on the review of prior empirical and theoretical evidences the following hypothesis is suggested.

H₄: There exists a positive relationship between average loan balance per borrower and financial self sufficiency.

Portfolio at risk (30 days): Portfolio at risk indicates that how much an MFI is efficient in making collections of loans. Higher PAR indicates inefficiency of MFIs i.e. indicates lower repayment rates. Lower the PAR the more inefficient the microfinance institutions will be and thereby financially sustainable. Portfolio at risk captures the accounting convention that loans exceeding 30 days overdue pose an unacceptably high risk of non-repayment [24]. He predicted an inverse relationship between PAR (30) and profit efficiency and his findings show negative insignificant relationship between PAR (30) and firm performance. The study of Cull et al. conclude that higher interest rates are associated with higher rates of non-repayment but for individual based lenders only [26]. Moreover, according to one specification individual based lenders charging higher interest rates higher profit than those charging interest intermediate rates. Tehulu also found that credit risk measured by PAR (30) days found to have a negative and significant impact on financial sustainability of MFIs [8]. The empirical findings of Nyamsogoro disclosed that, there is a statistically significant and negative relationship between portfolio at risk and financial sustainability [22]. Thus, in the line with prior studies the following hypothesis is proposed.

H₅: There exists a negative relationship between portfolio at risk and financial self sufficiency.

Personnel productivity ratio: Personnel productivity measures the amount of quality services delivered by microfinance institutions staff to their customers. The finding of the Cull et al. shows that there is negative relationship between charging higher interest rates and

having a large customer base. Accordingly, the following hypothesis is suggested [26].

H₆: There exists an uncertain relationship between labour cost to assets and financial self sufficiency.

Size: The size of an MFI is defined as natural logarithm of total assets of the MFIs. Hermes et al. [27]; Mersland and Strom [28]; Bogan, Johnson, and Mhlanga [29]; Hartarska [30] shows that the MFI size do not effects its financial sustainability. While study of Mersland and Strom, Bogan et al., Hartarska used total value of its assets as MFIs size indicator [28-30]. The study of Hartarska shows that the MFIs size did not affect its financial sustainability [30]. While the study of Mersland and Strom, and Bogan et al. revealed that the size of an MFI is associated with its financial sustainability [28,29]. The empirical finding of Cull et al. shows that size of MFI is statistically significant and positively linked to its financial performance [26]. The study of Nyamsogoro found that the size of MFI significantly affects its financial sustainability [22]. Similar findings were also disclosed by the study of Cull et al [26]; Robinson [1]; Bogan et al. [29]; Mersland and Strom [28]. Therefore in the line with prior empirical findings, the following hypothesis is suggested.

H₇: There exists a positive relationship between size of MFIs and financial self sufficiency.

Age of MFIs: The study of Cull et al. revealed that the age of MFIs is significantly and positively related with all three measures of sustainability i.e. (FSS, OSS and ROA) [26]. The study of Gonzalez depicts that the age of Indian MFIs never comes up significant with financial self sufficiency and operational self sufficiency [9]. The findings of Robinson imply that age is significant variable to effect financial self sufficiency [1]. The findings by Nadiya show that relationship between age of MFIs and operational self sufficiency is not significant for determining changes in operational self sufficiency [31]. The study of Bogan et al. shows that the age of MFIs is related to financial sustainability [29]. Nyamsogoro found that age of microfinance institution is not significantly related with financial self sufficiency [22]. Hence, in the line with prior studies the following hypothesis is proposed.

H₈: There exists a positive relationship between age of MFIs and financial self sufficiency (Table 1).

Operational model for financial self sufficiency (FSS)

$$\text{MODEL (FSS)}_{i,t} = \alpha_1 + \beta_1(\text{YOGP})_{i,t} + \beta_2(\text{CCTA})_{i,t} + \beta_3(\text{GLPTA})_{i,t} + \beta_4(\text{L_ALBPB})_{i,t} + \beta_5(\text{P30})_{i,t} + \beta_6(\text{PEA})_{i,t} + \beta_7(\text{L_ASS})_{i,t} + \beta_8(\text{AGE})_{i,t} + \epsilon_{i,t}$$

Where (FSS)=dependent variable {(Financial Self Sufficiency (FSS) in percentage for firm "i" during time period "t")}

α_1 =Constant

$\beta_1(\text{YOGP})_{i,t}$ =coefficient of Independent variable, yield on gross loan portfolio for firm "i" during time period "t"

$\beta_2(\text{CCTA})_{i,t}$ =coefficient of Independent variable, Capital/Assets ratio for firm "i" during time period "t"

$\beta_3(\text{GLPTA})_{i,t}$ =coefficient of Independent variable, Gross loan portfolio to total assets ratio for firm "i" during time period "t"

$\beta_4(\text{L_ALBPB})_{i,t}$ =coefficient of Independent variable, Average loan balance per borrower for firm "i" during time period "t"

$\beta_5(\text{P30})_{i,t}$ =coefficient of Independent variable, Portfolio at risk (30) days for firm "i" during time period "t"

β_6 (PEA)_{it}=coefficient of Independent variable, Labour cost to total Assets ratio for firm “i” during time period “t”

β_7 (L_ASS)_{it}=coefficient of Independent variable, Size (log of Total Assets) for firm “i” during time period “t”

β_8 (AGE)_{it}=coefficient of Independent variable, AGE of MFIs for firm “i” during time period “t”

ϵ_{it} =Error term

Descriptive Statistics

The Table 2 shows the results of descriptive statistics of dependent and independent variables employed in the study. The average loan size is generally used as a measure of depth of outreach. Smaller amount of loan indicates better outreach to poor. The descriptive statistics for mean value of average loan size per borrower is 4.98 in its natural logarithm value. In real term the value for the mean is (149.94\$) indicating that MFIs provide (150\$) per borrower. The maximum value of loan balance per borrower is (235\$) is an indication of serving non poor clients. However the minimum value of (77\$) is an indication of better outreach to poor. If FSS value is one or greater than one, it indicates that MFIs are financially self-sustainable. On the other hand less than one indicates that MFIs are not financially self-sustainable. As per the result of descriptive statistics for FSS, the mean value is 0.657 (65.7%) indicates that MFIs in the sample are not financially self-sufficient. The capital cost to assets ratio has an average value of (0.070). It means that around 7% of equity financing is done against total assets by microfinance institutions. Furthermore, the minimum value

is 0.0008 and maximum value is 0.365. It indicates that proportion of equity financing is quite low against the total assets.

The result of pair wise correlation is reported in Table 3. The results of correlation analysis show that all the variables except age and (L_ass) are below the threshold limit of (0.7). The result revealed that the variable age is highly correlated with size at (0.73). We further computed variance inflation factor (VIF) for each coefficient to detect the culprit variable causing multicollinearity. The results of VIF values are reported in Appendix Gujarati (2003) and Hair et al. (2006) suggest that variance inflation factor above 10 causes multicollinearity [14,15]. Following the Hair et al. criteria of VIF [14] it is evidence from the result of VIF values of independent variables in all the models ranges from 1 to 3 i.e. within the threshold for nonexistence of multicollinearity. It implies that regression coefficient will be fairly estimating the model.

Results of Financial Self Sufficiency Model by Pooled OLS model, Fixed Effect Model and Random Effect Regression Models

In this section the result of factors affecting financial self sufficiency model is shown by pooled OLS model, random effect model and fixed effect model. In order to check consistency, we employed all the three models of panel data. Finally, our result and interpretation is based on most appropriate model which is chosen on the basis of result of F test to make choice between pooled OLS and fixed effect model, Breusch pagan test to make choice between pooled OLS and random effect model. Finally, Hausman test to make choice between random and fixed effect model.

S/N	Variable Standard Name	Description	Variable description as used in regression	Expected effect on the FSS
1	Real Gross Portfolio Yield	(Yield on gross portfolio (nominal) - Inflation rate)/(1+Inflation rate)	YOGP	Positive
2	Capital to Assets ratio	Adjusted total equity/Adjusted total assets	CCTA	Negative
3	Gross loan portfolio to total assets ratio	Gross loan portfolio/total assets	GLPTA	Positive
4	Average loan balance per borrower	Adj. GLP/Adj. Number of Active Borrowers	I_ALBPB	Positive
5	Portfolio at risk	The fraction of loan portfolio that is overdue past 30 days or more; that is PAR 30=Portfolio at risk/ Gross loan portfolio	P30	Negative
6	Labour cost to assets	Personnel expenses/total assets	PEA	Positive or negative
7	SIZE OF MFI	The size of MFIs measured by value of its Assets	I_ASS	Positive
8	MFI AGE	Years since its establishment to when evaluation is considered. It also measure length of it outreach.	AGE	Positive

Table 1: Definitions of independent variable and their expected hypothesis sign related to Financial self sufficiency model.

Descriptive statistics of dependent and independent variables					
Variable	Mean	Standard	Minimum	Maximum	No. of observations
FSS	0.657846	0.313578	0.0360245	1.78001	76
YOGP	0.109191	0.197436	0.1304	0.9954	76
CCTA	0.0705189	0.0574553	0.0008	0.3655	76
GLPTA	1.11314	0.997195	0.6528	8.916	76
p30	0.192328	0.320923	0	0.9954	76
PEA	0.0471257	0.0163077	0.0165	0.0917	76
I_Ass	17.3295	1.99854	13.9942	20.6751	76
AGE	15.5263	5.37767	4	27	76
I_ALBPB	4.9821	0.241976	4.34381	5.45959	76
ALBPB	149.947	35.3323	77	235	76

Note: FSS=financial self sufficiency ratio, YOGP=yield on gross loan portfolio to total assets ratio, CCTA=Capital cost to total assets ratio, GLPTA=gross loan portfolio to total assets ratio, P30=Portfolio at risk (30) days, PEA=Labour cost to total assets ratio, I_ASS=Log of total assets (size), AGE=age of MFIs since its establishment, I_ALBPB=log of average loan balance per borrower, ALBPB=Average loan balance per borrower

Table 2: Descriptive statistics.

Summary of panel data

In this section the coefficients of econometric regressions (pooled, fixed and random) have been summarized to facilitate an overall overview. The Table 4 shows panel data regression for the year 2005-2013 with financial self sufficiency as dependent variable. The table reports summary of pooled OLS, fixed effect and random effect model of financial self sufficiency (FSS) on (GLPTA), yield on gross loan portfolio (YOGP), capital cost to assets (CCTA), gross loan portfolio to total assets (GLPTA), average loan balance per borrower (ALBPB), portfolio at risk (30) days (p30), labour cost to assets (PEA), size of MFI, Assets (ASS), age of MFIs in years (AGE).

Table 4 shows the results from pooled, fixed, and random models. The dependent variable is the financial self sufficiency. According to the result of panel diagnostic command (Result reported in Appendix A and B) fixed effect model is more appropriate and consistent than Pooled OLS and Random effect model. *, **, *** significant at 10%, 5% and 1% level respectively. Figures that are in bold are p values. Figures in parenthesis are t values based on Robust (HAC) standard errors. Figures in brackets are coefficients (Table 4).

This study employed pooled OLS model, fixed effect model and Random effect model of panel data in order to check consistency of results. Though, our results and interpretation is based on most appropriate model which is determined on basis of result of F test, Breusch-pagan test and Hausman test. The result reported in Appendix (B) of panel diagnostic command for FSS model shows that the F statistic value is 3.03 with P value is (0.004) a low p value counts against the null hypothesis that the pooled OLS model is adequate, in favour of the fixed effects alternative. Secondly Breusch-Pagan test is applied on FSS model in order to decide between pooled regression and random effects model. The LM statistic value is 2.18 with P value 0.139. As the P value is much greater than the 5% level of significance. Therefore, our Null hypothesis articulated as pooled regression is more consistent and appropriate than the random effects model remains accepted. Finally the choice between fixed effects and random effects tested through Hausman's specification test. The null hypothesis is framed as random effect is more appropriate and consistent to fixed effects model. The result of Hausman test in Appendix B for FSS model indicates that the low p value of 0.03 is much less than the 5% level of significance. A low p value counts against the random effects model is consistent, in favour of the fixed effect model. Hence, fixed effect is more consistent than the random effects model. The results indicate that fixed effect model is more appropriate than pooled OLS and Random effect model. Therefore results and interpretation for financial self sufficiency (FSS)

model is based on the fixed effects model which is discussed in detail in next section.

The explanatory power (R^2) for FSS model is 0.38 in case of pooled OLS model. This reflects that 38% change in FSS model can be explained jointly by the given firm or MFIs specific factors; while the remaining 62% is attributed to the factors outside the model. In case of fixed effect for FSS model explanatory power (R^2) is 0.58 which reflects that 58% changes can be explained by the firm specific determinants, while 42% is attributed to the factors outside the model. Moreover, the value of (R^2) for FSS random effect model is 0.38 reflecting that 38% change in FSS model is due to Firm specific variable and remaining 62% is attributed to the factors outside the model.

Findings and Discussion of Financial Self Sustainability (FSS) Model

Yield on gross loan portfolio

The yield on gross loan portfolio measure of average interest rate on loan to customers is strongly significant and positively associated at 1% significance level in Pooled model. It indicates that increasing interest rates improves financial sustainability of Andhra Microfinance institutions. The econometric result of regression analysis revealed that for one unit increase in a yield on gross loan portfolio financial self-sustainability ratio is expected to increase by 0.66 units, holdings all other variables constant. This suggest that yield on gross loan portfolio is significant variable influencing financial sustainability of microfinance institutions. It also indicates that MFIs tend to be more profitable when interest rates are higher. Finally, it can be concluded that increasing interest rates is clearly associated with improved level of financial self sufficiency. The findings of this study are consistent with that of Nyamsogoro, De Crombrughe et al. concluded that yield on gross loan portfolio positively affect the financial sustainability of microfinance institutions [19,22]. The findings of the Cull et al. revealed that yield on gross loan portfolio is significant and positively associated across all the measures of financial self-sustainability i.e. Return on Assets, Financial sustainability, Operational self-sustainability for individual based lenders only [26]. The findings of this study are consistent with our findings. Therefore based on regression results, the alternative hypothesis articulated as yield on gross loan portfolio is positively associated with financial self sufficiency is accepted.

Capital cost to assets

The study finds an insignificant negative relationship of capital cost to assets with financial self sufficiency. Therefore on the basis of our

	AGE	CCTA	FSS	GLPTA	L_ALBPBG	L_ASS	P30	PEA	YOGP
AGE	1								
CCTA	-0.3077	1							
FSS	-0.32014	0.035301	1						
GLPTA	0.22275	-0.1773	-0.37808	1					
L_ALBPBG	0.053976	0.110357	0.070101	-0.08627	1				
L_ASS	0.732431	-0.33276	-0.05729	-0.07058	0.086663	1			
P30	0.284837	-0.21015	-0.34307	0.457572	0.16452	0.040008	1		
PEA	0.240223	0.212528	0.061753	-0.23289	-0.44092	0.254694	-0.23841	1	
YOGP	0.025384	-0.00825	0.24652	-0.11474	-0.02301	-0.06441	0.322258	0.223271	1

Source: Gretl output.

Note: FSS=financial self sufficiency ratio, ALBPBG=Average loan balance per borrower to GNI per capita, YOGP=yield on gross loan portfolio to total assets ratio, CCTA=Capital cost to total assets ratio, GLPTA=gross loan portfolio to total assets ratio, P30=Portfolio at risk (30) days, Pea=Labour cost to total assets ratio, L_ASS=Log of total assets (size), AGE=age of MFIs since its establishment, ALBPB=Average loan balance per borrower

Table 3: Multicollinearity results.

Variables	Pooled OLS regression model	Fixed effect regression model	Random effects regression
Const	(-0.172192)	(-0.499381)	(-0.172192)
	[-0.0643]	[-0.5390]	[-0.2207]
	0.94891	0.59194	0.82599
YOGP	-0.541798	-0.451348	-0.541798
	[3.2606]	[2.3153]	[3.1016]
	0.00175***	0.02415**	0.00282***
CCTA	(-0.71581)	(-0.476002)	(-0.71581)
	[-0.7853]	[-0.5966]	[-1.0325]
	0.43502	0.55311	0.30557
GLPTA	(-0.00126836)	-0.0310568	(-0.00126836)
	[-0.4954]	[0.7628]	[-0.0345]
	0.62196	0.4487	0.97259
I_ALBPB	-0.212125	-0.130244	-0.212125
	[1.2702]	[0.6904]	[1.3699]
	0.2084	0.49269	0.17529
p30	(-0.370474)	(-0.336808)	(-0.370474)
	[-2.0084]	[-2.0049]	[-2.9955]
	0.04864**	0.04965**	0.00384***
PEA	(-0.736011)	(-1.08831)	(-0.736011)
	[-0.0853]	[-0.3375]	[-0.2716]
	0.93225	0.73694	0.78674
I_ASS	-0.0603387	0.145989	-0.0603387
	[0.8008]	[2.8237]	[2.0243]
	0.00125***	0.00650***	0.04693**
AGE	(-0.438934)	(-0.731365)	(-0.438934)
	[5.8795]	[-2.7452]	[-2.9228]
	0.00001***	0.00804***	0.00473***
r _e ²	0.385346	0.58225	0.388844
Adjusted R ²	0.311955	0.459806	0.31587
F-statistic	5.250555	4.755233	5.328531
P – value (F)	0.000041	3.86E-06	0.000035
Durban-Watson	1.427617	1.437774	1.655338

Robust (HAC) standard error,

Included 10 cross-sectional units,

Time-series length: minimum 5, maximum. *, **, *** significant at 10%, 5% and 1% level respectively.

Table 4: Model: Dependent variable: Financial self sufficiency.

result capital cost to assets is insignificant variable influencing financial self sufficiency of Andhra Microfinance institutions. The result of cull et al. indicated that coefficients on the capital cost variables show differences in the way of different type of lenders (Individual, Group and solidarity) generate profits [26]. The findings revealed that, there is no significant difference between capital cost and financial sustainability measure for group lenders. Therefore based on the regression results we reject the alternative hypothesis articulated as there is negative relationship between capital cost to assets and financial self sufficiency.

Gross loan portfolio to total assets

Gross loan portfolio is insignificant predictor in determining financial self sufficiency. The findings shows that Gross loan portfolio to total assets ratio is insignificant variable influencing financial self sufficiency of Andhra Microfinance institutions. However, the findings of cull et al. revealed loan to assets ratio is significant and positively associated with measures of financial sustainability [26]. Therefore based on the regression result the alternative hypothesis is rejected

which was formulated as there is positive relationship between gross loan portfolio to total assets and financial self sufficiency.

Log of average loan balance per borrower

The average loan size defined as the average gross loan divided by the number of borrowers. The coefficient is positively associated but insignificant in fixed effect regression model. The result of regression analysis shows that average loan size is not a significant predictor. Therefore, our findings suggest that average loan balance per borrower is not an important factor influencing financial self sufficiency. Our findings are consistent with the findings of cull et al. which indicates that average loan size is not strongly significant with financial sustainability of Microfinance institutions [26]. The study of Nadiya et al. is also against the findings of this study, which shows that operational self sufficiency is significantly and negatively associated to average loan size per borrower [31]. Our findings is also against the findings Gregoire and Tuya, Adongo and stork, Gonzalez, Nyamsogoro which revealed that financial sustainability is significantly and positively linked to average loan size [9,21,22,32]. Therefore, based on the regression result from the study, the alternative hypothesis articulated as there is positive relationship between average balance per borrower and financial self sufficiency is rejected.

Portfolio at risk (30) days

The portfolio at risk measures indicates how much a Microfinance institutions is efficient in making collections of loans. The higher the portfolio at risk indicates lower repayment rates, an indication of inefficient MFI. In simple words, a high portfolio at risk ratio would limit the income derived from Microfinance operations and therefore amount of lendable funds reduces. This would result in rationing of credit and ultimately the continuous supply of quality loan services would be affected and have a negative impact on financial sustainability of MFIs. The result of regression analysis revealed that the coefficient is significant at 5% level and negatively associated with financial self sufficiency. It indicates that Less efficient the MFIs are (higher par) ultimately less will be its financial sustainability. The result of regression analysis confirms the alternative hypothesis that significant reduction in portfolio at risk (30) days should have a positive impact on financial sustainability of MFIs i.e. portfolio at risk is expected to be negatively associated with financial sufficiency. Our findings are consistent with prior empirical findings of Nyamsogoro, Ayayi and sene shows that, there is negative relationship of portfolio at risk with financial sustainability [22,33].

Labour cost to assets (pea)

Labour cost to assets is insignificant negative predictor in determining financial self sufficiency of Andhra Microfinance institutions. Our findings are contrary to findings of Cull et al, shows that labour cost are associated with improved profitability for individual based lenders [26]. For group based lenders the coefficient on their labour cost variable is negative and significant. The findings of this study show that coefficient is negatively associated but insignificant in Random effect model i.e. most appropriate model as per the result of panel diagnostic. Therefore based on the regression result from the study, we fail to reject the null hypothesis which was formulated as there is no significant relationship between labour cost to assets ratio and financial sustainability.

Size (total assets)

Total Assets is the proxy measure for the size of MFIs. The econometric result of regression analysis revealed that Total Assets is

strongly significant at 1% level and positively associated with financial self sufficiency. It indicates that, MFI size does improve its financial sustainability. It means that a change in the size (total Assets) causes a change in financial sustainability positively. The econometric result revealed that for one unit increase in Size of MFIs, financial self sufficiency ratio is expected to increase by (0.03) units, holdings all other variable constant. The findings of this study are consistent with that of Cull et al. [17,26]. He found that MFIs size is positively and significantly linked to financial self sufficiency. Our findings are also consistent with Bogan et al, Hartarska and Nadolnyak, Coleman and Osie and Robinson [1,29,34,35]. However or findings is contrary to the findings of Hartarska [30]. Thus, the findings support the alternative hypothesis articulated as size of MFIs affects financial sustainability positively.

AGE (log value)

The age of MFI refers to the period; MFI has been in operational since it came into existence. The variable age is expected to be positively related to financial self sufficiency. However, the fixed effect regression model shows that age of MFIs is highly significant at 1% level and negatively associated with financial self sufficiency. It indicates that MFIs age does not improve its financial sustainability. It also means that mature MFIs are not financially sustainable. This result is quite strange because with increasing age MFIs must become efficient. Our findings contradict with the study of cull et al. which shows that MFIs age is significantly and positively related with financial self sufficiency [26]. Our findings also contradict with findings of Nadiya et al and Nyamsogoro which shows that age is not significant factor influencing financial self sufficiency [22,31]. Based on the result of fixed effect regression, the alternative hypothesis articulated as, age of MFIs expected to be positively associated with financial self sufficiency is rejected.

Conclusion

Our findings revealed that the important determinant of financial self-sustainability are yield on gross loan portfolio, portfolio at risk (30) days, size and age. The p values of independent variables are highly significant at 1% level in both model FSS model only portfolio at risk is significant at 5% level in FSS model. However labour cost to assets ratio, average loan balance per borrower, gross loan portfolio to total assets ratio and capital cost to assets ratio are insignificant predictor of financial self sufficiency. The findings of yield on gross loan portfolio are consistent with the study of Nyamsogoro and De Crombrughe et al. found that yield on gross loan portfolio significantly and positively affects the financial performance [19,22]. The finding of portfolio at risk is consistent with the findings of Nyamsogoro and Ayayi and Sene concluded that there is negative association between portfolio at risk and financial sustainability [22,33]. The findings of yield on gross loan portfolio that increasing interest rates are associated with improved financial performance is consistent with De Crombrughe et al, Cull et al. and Nyamsogoro [19,22,26]. To be financially sustainable Andhra's MFIs must charge optimum enough interest rates in order to cover not only for operating cost but also for the possible losses as a result of loan default. But, it must be done cautiously considering the impact of increasing loan interest rate on loan repayment and depth of outreach to poor clients (Appendix A).

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