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PREDICTING REGULAR SAVING BEHAVIOR OF THE POOR USING DECISION TREES – AN IMPORTANT INPUT TO FINANCIAL INCLUSION IN INDIA

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ABSTRACT

Microfinance in India is a rapidly growing industry, focusing however, only on the credit side of finance without an adequate emphasis on Microsavings. There are multi-pronged efforts underway to bring the poor under the ambit of the financial system. Financial literacy efforts are also pursued by NGOs to make the poor understand the importance of savings in their lives. 125 million new bank accounts have been opened as of February 2015 under the new scheme of the government of India, 72% of which show zero balances. Having a savings account is only a first step in the financial inclusion efforts. Getting people to save requires a combination of financial literacy, hand holding and discipline aimed specifically at those who may not save regularly, left to themselves. Towards this end it is important to identify the regular saving potential among the poor. This study has developed a predictive model using decision trees to group the poor into potential regular and non-regular savers. The study was based on survey research administered to 700 respondents in Tamil Nadu, South India. The decision tree is able to predict with 90% accuracy, the regular saving potential among the poor. The paper has strong implications for banks, NGOs and others concerned with microsavings, financial inclusion and financial literacy. Categorizing the poor into potential regular and non-regular savers can enable target group specific efforts which can have symbiotically benefitting outcomes to the poor and the institution.

KEYWORDS: Microsavings, Saving regularity, Predictive model, Decision Tree, Saving by the Poor, Saving potential.

1. INTRODUCTION

Amidst growing awareness and realization that the world's poor are excluded from the formal financial systems, Microfinance, amongst many other initiatives, has come in to bridge this wide gap. Although Microfinance refers to the entire range of financial services such as savings, money transfers, production and investment credit and insurance, the focus of the industry and therefore the studies so far, have mainly been

on Microcredit, i.e., the extension of very small, frequent loans to a large number of poor clients[1].Wright (2008) argues that Microfinance is the only industry still to adopt a 'product centric' approach of trying to sell to customers whatever is produced. He emphasizes the need for the industry to shift to a 'market-driven' approach where the industry can innovate and provide products that their customers need. What the poor need is not only credit but equally a means to be able to save[2]. The possibility to save money in a secure place while also earning a meager interest can help low-income households to gain control over their income streams which can in turn smoothen their consumption patterns.

Savings by the poor has both a macro economic as well a micro economic perspective. While policy makers, regulators and the government have focused on the macro aspect (Gersovitz, 1988) (Horioka, 2006), the micro aspect assumes a lot of importance in understanding the saving behavior of the poor, who are a huge customer base to the financial system, especially in the context of the current efforts towards financial inclusion (Collins, Morduch, Rutherford, & Ruthven, 2009).

RESEARCH OBJECTIVE

The study aims to explore and present a family's ability to save regularly as a function of its income, size of family, nature of income, major expenditures, etc., in other words, given the circumstances that they presently stand in, whether they are able to save regularly. A predictive model has been built to gauge the potential for regular savings by the poor, given the family size and demographic information like income, age, education levels, etc. This is of importance especially in the current context of the efforts of the Indian government to support financial inclusion by opening bank accounts for every individual. True inclusion, however, has the opening of accounts only as the very beginning; it is never a deterministic factor in bringing about complete inclusion. In the Indian context, the poor have accounts that have stayed dormant for years (Tyler, Ravi, Bhat, Ramji, & Ballem, 2012). 125 million new savings accounts have been opened in India under the new Pradhan Mandri Jan DhanYojana (PMJDY) scheme as of January 2015 out of which 72% of the accounts show zero balance (Demirguc-Kunt, Klapper, Singer, & Oudheusden, April 2015). Hence, account opening has to be followed by efforts, both in terms of financial literacy and an initial hand holding to get people to start saving regularly by weaning them from complete reliance on credit. To be able to do this it is important to understand and predict the propensity of the poor to save regularly based on certain easily identifiable independent variables. It will thus enable to identify those groups of poor that already have the potential to save regularly and could therefore start using these accounts and services without the need for much of intervention in the

[1] The definition of poor is normally on the basis of Purchasing Power Parity benchmark set by the Millennium Development Goals (MDG) of the United Nations. People living with an income less than 2 US dollars per day are considered to be poor. This study however refers to the poor from the perspective defined in the text above.

[2] Rutherford (1997) defines savings as "an act of putting aside a small part of current income in order to accumulate the same into a large sum useful for consumption or for investment purpose at a different time"

form of financial literacy drives and handholding. While the group that may not save regularly (as predicted by the model) could be assisted by removing the roadblocks to their regular savings[3].

2. LITERATURE REVIEW AND CONTEXTUAL BACKGROUND

2.1 CAN AND WILL THE POOR SAVE?

There are arguments that the poor already being vulnerable will not be able to save. This approach has played a huge role of a deterrent in the minds of both policy makers and financial institutions from focusing their attention and efforts to the mobilization of microsavings from the poor (Adams D. W., 2009). The efforts by Safesave in Bangladesh and the Village Savings and Loan Associations in Africa provide ample support to the fact that poor people will save if given the opportunity to do so (Rutherford, 2000).

Several studies have emphasized the importance of planned savings for the poor for two distinct needs. One, for planned expenditures intended to meet the life cycle events like marriage, children's school fees etc. Second, to meet the cash flow needs that are required to meet not just the essential regular expenses but also emergencies, especially in the light of the irregular income streams for the poor (Alphina, Veena, & Denny, 2010). While there have been contentions that the poor are too poor to save, there have been stronger contentions that they are too poor not to save (Rutherford, 2005). Their financial vulnerability necessitates that even small occasional surpluses if stacked away can grow to meaningful and useful lump sums that could be drawn upon during emergencies.

2.2 THE CRITICAL ROLE OF SAVINGS IN THE LIVES OF THE POOR AND ITS NEGLECT

With the sole focus of Microfinance institutions turning towards credit, there is a stage that is being set for the likes of the global financial meltdown that occurred in the western world. The loans in this case may be micro in nature but macro in number and involves a substantial population in developing countries getting into a frame of mind where credit is an immediate recourse to solving problems of poverty. Policy makers, donors and bankers have propagated credit aggressively while completely ignoring the benefits of thrift[4].Adams D. W.(2009) asserts that the poor do save when appropriate opportunities and incentives are created and also brings out that benefits through savings accrue to individuals, financial intermediaries and the economy in general. He points out that thrift would ensure safety of the surplus generated, help people resist from spending the small surpluses, enhance the discipline in the individual to put a ceiling on the desires for wants and to postpone consumption and also thereby indirectly influencing their credit worthiness in the eyes of the lenders. He also iterates that focusing on deposit collection can also be beneficial to the institution which can

[3] However, if the non regularity in savings springs from a complete inability due to non-availability of surplus money that can be saved, efforts like financial literacy cannot help them to save. But the study, as mentioned, does not deal with the abject poor. The respondents were those who could save, at least meager amounts, when educated about the importance of saving and when helped in the procedures involved in savings.

[4] The discipline exercised by individuals who choose not to spend or consume today, but to put something aside for the future, use to be known as thrift (Blankenhorn, 2008)

achieve economies of scale and scope besides being easily able to understand the credit worthiness of the potential borrowers, through their deposit history.

2.3 OPTIONS AVAILABLE TO SAVE

Even long after non-profit organizations began offering credit services, the poor have had to use informal avenues and their own social networks to save money. A study by Collins et al. documented that poor households in Bangladesh, India and South Africa, struggle to find a savings vehicle that can accommodate small periodic contributions and hence turn to friends, family and informal service providers (Collins, Morduch, Rutherford, & Ruthven, 2009). In the developed countries all households, including that of the poor, have access to a wide variety of savings products while there is a sharp contrast both in terms of access and use of these savings products in developing countries (Karlan & Morduch, 2010). This does not however deter the poor from finding their own less safer means to save informally. More than three decades ago, Adams D. W. (1985) argued that it is incorrect to assume that the poor cannot save. With evidences from rural saving behavior of many economies Adams showed quite high levels of saving propensities among the rural households. He also argues that this inclination to save is negatively affected by rural financial markets that tend to emphasize micro-credit and thereby negatively affect the saving tendencies of the poor because of the loan repayment commitments that consume most of their surpluses (Adams D. W., 1978).

2.4 IMPORTANCE OF PREDICTING SAVING BEHAVIOR

While there been several studies which found evidence that the poor do save (Adams D. W., 2009); (Alphina, Veena, & Denny, 2010); (Rutherford, 1996); (Karlan & Morduch, 2010) given an opportunity to save, there are also studies which documented the dormancy of several of the savings accounts held by people in India (Tyler, Ravi, Bhat, Ramji, & Ballem, 2012). Therefore, there are reasons more than just access to accounts that either enables or dissuades the poor from saving. The current efforts of the government of India through the Pradhan Mantri Jan DhanYojana (PMJDY[5]) to bring every household under the ambit of the formal financial system is a commendable effort in the direction of the financial inclusion initiative. Under this scheme as also supported by the RBI's notification to nationalized banks[6] there is an emphasis on banks to open over 630 Financial Literacy Centres (FLCs) which will focus on imparting the knowledge of importance of savings, importance of saving early, and the importance of savings with banks, among many other objectives. These efforts are accompanied by heavy expenditures. Reports indicate that the government spent over Rs.100 crores in just advertising about the scheme (Dasgupta, 2014). The nationalized banks have spent over Rs.2000 crores in opening the bank accounts as on February 2015[7]. However, 72% of these accounts opened under the PMJDY scheme show zero balances (Demirguc-Kunt, Klapper, Singer, & Oudheusden, April 2015). These efforts

[5] http://www.pmjdy.gov.in/financial_literacy.aspx - accessed on 02.04.2015

[6] RBI notification RBI/2011-12/590 dated 06.06.2012

[7] http://www.business-standard.com/article/finance/banks-spent-around-rs-2-000-crore-for-opening-accounts-under-jan-dhan-yojana-iba-chairman-115020300116_1.html - accessed on 02.04.2015

by the government are also complemented by the operations of NGOs like Sanchayan[8] which work towards financial literacy to help people understand the importance of savings and insurance in their lives, apart from acting as facilitators for the same.

It was also evident from the field studies and interactions with NGOs and banks that all efforts towards financial inclusion and literacy were not addressed towards any specific target group. It was a generic effort that was conducted in a given region and population. For a person who saves regularly, attending such a program is rather redundant. While, non – regular savers require more specific attention and hand holding in using these services. Regular reminders and coercions will help until the individual begins to save regularly. Such attention is superfluous and might even turn detrimental to regular savers who may want independence in their financial decision making. Hence, to make this a target group specific effort especially in regions where banking services are presently expanding, in the absence of adequate prior knowledge about the saving behavior of the poor, a predictive model can serve to identify and group people depending on their potential for regular savings.

Drawing inspiration from the benefits such a predictive model can have on the effectiveness of financial inclusion and regular saving behavior of the poor, the study has the following objective.

3. RESEARCH QUESTION

   What are the influencers that promote the regular saving behavior of the poor? How can a predictive model help to group people as regular or non regular savers based on these determinants?

4. METHODOLOGY

A decision tree model has been constructed to predict the regularity in the saving behavior of the poor. The independent variable that the model attempts to predict is a dichotomous nominal variable which captures whether or not an individual saves regularly[9]. There are several independent variables (most of which are demographic) which act as predictors of the dependent variable. The Decision Tree procedure employs a tree-based classification model. It classifies cases into groups or predicts values of a dependent (target) variable based on values of independent (predictor) variables. The starting point of a decision tree is a 'root node'. The branches from the root node lead through the 'child' nodes. The basic process adopted by a decision tree is that it tries to split the data being studied into smaller groups by iteratively classifying nodes (variables) as a 'parent' or a 'child' based on the homogeneity of within node distances of the cases observed in the node or the heterogeneity of between node distances. Homogeneity refers to the similarity between values that the independent variables take, while heterogeneity refers to the differences in the values. This iteration is done with the background of the nodes being able to distinguish between those which contribute and those which

[8]http://sanchayansociety.org/

[9]Saving any amount at least once in a month is considered as regular saving in this study.

do not to the prediction of the dependent variable. The process is iterated until splitting of each child node is either infeasible or stopped in fulfillment of a specified statistical rule.

4.1 DATA AND VARIABLE DEFINITIONS

4.1.1 SURVEY METHODOLOGY

The data used for the study has been collected through personal field visits to 12 regions in South India and through personal interviews with over 750 female participants. The sample size was chosen in adherence to the requirements of various individual statistical tests that were performed[10]. The regions were chosen as a convenient sample while bearing in mind the need for a representative sample. I was able to identify the people to interview with the help of information provided by local microfinance institutions who knew about the income and background of people. The data thus collected yielded 612 valid responses for analysis, after being cleaned and subjected to tests of reliability. The choice of sites is a mix of rural and semi-urban locations. The sites are from the southern state of Tamil Nadu in India:

- Pothanur (Near Coimbatore)
- Ramanathapuram
- Marudhamalai
- Ondipudhur
- Karuvalur (Near Avinashi)
- Pollachi
- Perambur
- T.Nagar
- Dharmapuri
- Namakkal
- Red hills
- Mohanur

4.1.2 HOUSEHOLD AS A UNIT OF STUDY: REPRESENTED BY WOMEN

Although the people who were interviewed for the study were all women, the questions that were put to them were pertaining to those of the household. For example, questions dealt with total household expenses, number of earning members in the family etc. There were a few reasons for choosing to interview only women for the study, although the study is of the household's saving behavior and not restricted to women. The first reason was that it is much easier to meet groups of women who come for their weekly meetings of the Self Help Groups or the local Microfinance institution's loan repayment processes. Secondly, respondents to the study had to be patient enough and also had to have the time to participate in the survey and provide answers

[10] The GPower 3.1 software application was used to determine the required sample size the decision tree model.

that truly represent reality. Generally, with a short pilot study, it was observed that men are neither patient and interested nor do they have the time (or at least project themselves to be busy) to answer the questions. Several questions required a more detailed explanation in the vernacular language (than how the question actually reads) in order to ensure that the responses truly reflect what the question intends to measure. This process was quite time consuming and the pilot study revealed that most of the women were not only participative but also very interested and responsive, as compared to men. Therefore, it was decided that only women will be considered in the sample set, however, the questions posed to them and the measures solicited will not all be restricted to women.

4.2 VARIABLES CONSIDERED IN THE STUDY

The independent variable that the study uses is a dichotomous nominal variable which captures whether or not an individual saves regularly. The dependent variables have been identified based on previous studies (Phipps & Woolley, 2008); (Bertrand, Karlan, Mullainathan, Shafir, & Zinman); (Vogel & Burkett, 1986); (Bouman & Hospes, 1994); (Robinson, 1994); (Moulick, 2008) (Von, 1984); (Adams D. W., 1978); (Adams D. W., 1985); (Rutherford, 1996) and on consultation with experts in the Microfinance industry and through the pilot study. By saving preferences, I mean and consider those factors that can act as enablers to a regular saving behavior by the poor. I had the support of several Microfinance institutions in South India and the variables were vetted by the analysts and the field staff who interact with the poor on a regular basis during their regular bi-weekly meetings. The independent variables used in the prediction of the dependent variable (saving regularity) are:

- Age
- Level of Education
- Family size
- Number of children
- Nuclear/Joint family
- Number of earning members
- Average monthly income
- Daily/regular employment
- Having a bank or PO account
- Channel of savings
- Repayment towards loan

5. FINDINGS AND DISCUSSIONS

SPSS (Software Package for Social Sciences) was used to build the decision tree model. SPSS has an algorithm that can determine a decision function that can predict the value of a dependent variable depending on the values of the independent variables. The CRT model has been used as the tree growth model to be used by SPSS. This model was chosen after experimenting with the other models that are offered by SPSS like CHAID, Exhaustive CHAID, and Quest.

CHAID stands for Chi-Squared Automatic Interaction Detection. At each step, CHAID chooses the independent (predictor) variable that has the strongest interaction with the dependent variable. Categories of each predictor are merged if they are not significantly different with respect to the dependent variable.

The CRT growing method attempts to maximize within-node homogeneity. The extent to which a node does not represent a homogenous subset of cases is an indication of impurity. For example, a terminal node in which all cases have the same value for the dependent variable is a homogenous node that requires no further splitting because it is 'pure'. The method used to measure impurity and the minimum decrease in impurity required to split nodes can be selected.[11]

The CRT out did the CHAID and the Exhaustive CHAID methods of tree growth in terms of the much better predictive accuracy which minimized the misclassification errors. The CRT had a predictive accuracy of 90.8%, higher than the CHAID and Exhaustive CHAID methods (86.1%).

Under the CRT method of tree growth, for scale dependent variables, the least-squared deviation (LSD) measure of impurity is used. It is computed as the within-node variance, adjusted for any frequency weights or influence values. In this case, the dependant variable (Regular saving) is categorical and hence 'Gini' measure of impurity is adopted, which is a default measure for categorical variables. This was also found to yield a lower misclassification error than the alternate 'Twoing' measure that is offered by SPSS.

In the Gini measure, splits are found that maximize the homogeneity of child nodes with respect to the value of the dependent variable. Gini is based on squared probabilities of membership for each category of the dependent variable. It reaches its minimum (zero) when all cases in a node fall into a single category.

The model summary of the decision tree is presented below.

Decision Tree- Model Summary		
Specifications	**Growing Method**	CRT
	Dependent Variable	Do you save regularly?
	Independent Variables	Level of education, Family size, No of children, Daily or Regular employment, Average monthly income, No of earning members, Channel of savings, Repayment towards loan
	Validation	Cross Validation
	Maximum Tree Depth	5
	Minimum Cases in Parent Node	100
	Minimum Cases in Child Node	30

[11] Source: IBM SPSS User Manual

Results	**Independent Variables Included**	No of earning members, Family size, Average monthly income, No of children, Repayment towards loan, Channel of savings, Daily or Regular employment
	Number of Nodes	9
	Number of Terminal Nodes	5
	Depth	4

Table 1: Decision Tree – Model Summary

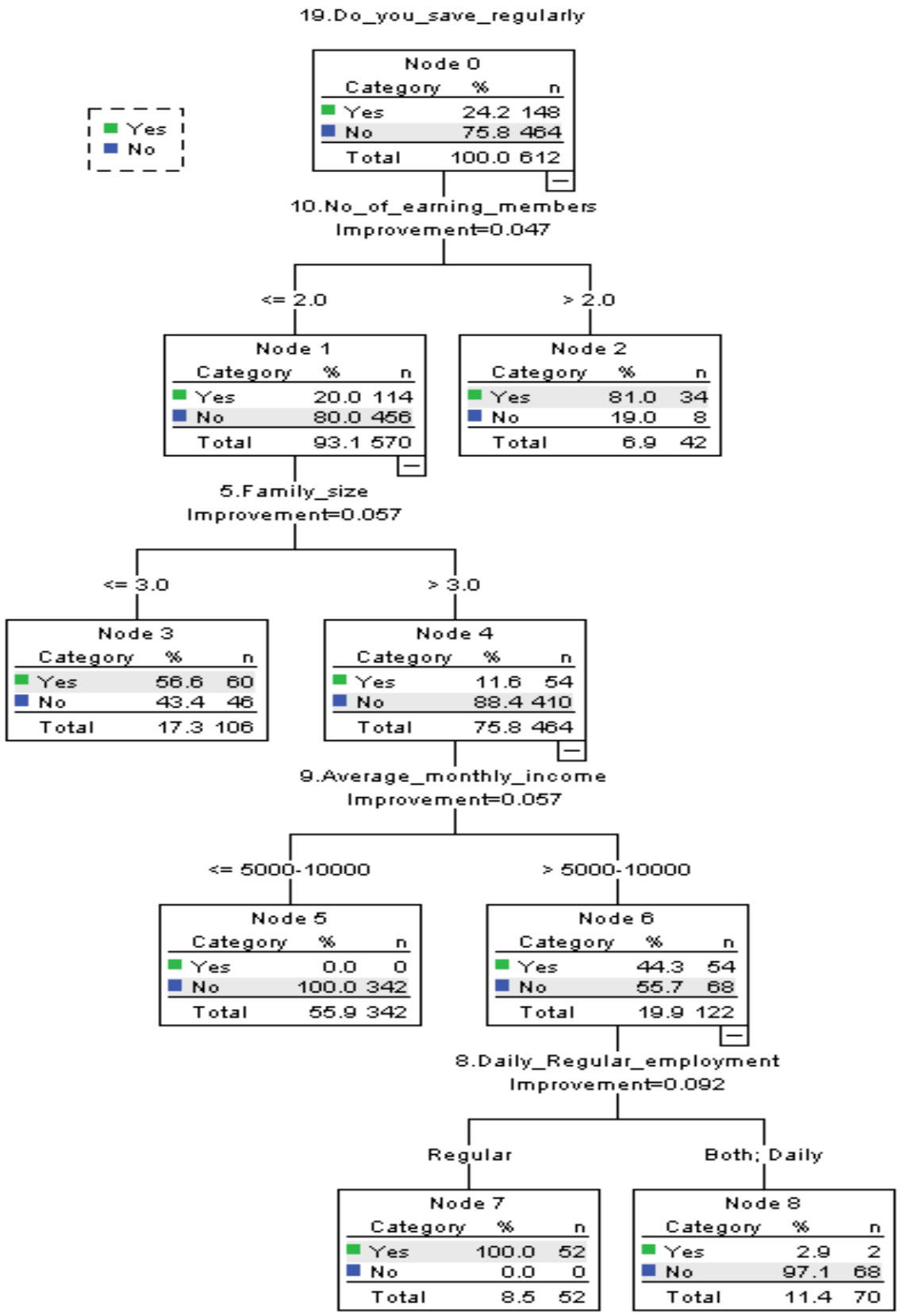
19.Do_you_save_regularly
Yes
No
Node 0
Category % n
Yes 24.2 148
No 75.8 464
Total 100.0 612
10.No_of_earning_members
Improvement=0.047
<= 2.0
> 2.0
Node 1
Category % n
Yes 20.0 114
No 80.0 456
Total 93.1 570
Node 2
Category % n
Yes 81.0 34
No 19.0 8
Total 6.9 42
5.Family_size
Improvement=0.057
<= 3.0
> 3.0
Node 3
Category % n
Yes 56.6 60
No 43.4 46
Total 17.3 106
Node 4
Category % n
Yes 11.6 54
No 88.4 410
Total 75.8 464
9.Average_monthly_income
Improvement=0.057
<= 5000-10000
> 5000-10000
Node 5
Category % n
Yes 0.0 0
No 100.0 342
Total 55.9 342
Node 6
Category % n
Yes 44.3 54
No 55.7 68
Total 19.9 122
8.Daily_Regular_employment
Improvement=0.092
Regular
Both; Daily
Node 7
Category % n
Yes 100.0 52
No 0.0 0
Total 8.5 52
Node 8
Category % n
Yes 2.9 2
No 97.1 68
Total 11.4 70

Figure 1: Decision Tree Model

Tree Table											
Node	Yes		No		Total		Predicted Category	Parent Node	Primary Independent Variable		
	N	Percent	N	Percent	N	Percent			Variable	Improvement	Split Values
0	148	24.20%	464	75.80%	612	100.00%	No				
1	114	20.00%	456	80.00%	570	93.10%	No	0	No of earning members	0.095	<= 2.0
2	34	81.00%	8	19.00%	42	6.90%	Yes	0	No of earning members	0.095	> 2.0
3	60	56.60%	46	43.40%	106	17.30%	Yes	1	Family size	0.114	<= 3.0
4	54	11.60%	410	88.40%	464	75.80%	No	1	Family size	0.114	> 3.0
5	0	0.00%	342	100.00%	342	55.90%	No	4	Average monthly income	0.115	<= 5000-10000
6	54	44.30%	68	55.70%	122	19.90%	No	4	Average monthly income	0.115	> 5000-10000
7	52	100.00%	0	0.00%	52	8.50%	Yes	6	Daily or Regular employment	0.184	Regular
8	2	2.90%	68	97.10%	70	11.40%	No	6	Daily or Regular employment	0.184	Both; Daily

Table 2: Decision Tree Table

Risk			
Method	**Estimate**	**Std. Error**	
Re substitution	**.092**	**.012**	
Cross-Validation	**.092**	**.012**	
Classification			
	Predicted		
Observed	**Yes**	**No**	**Percent Correct**
Yes	**146**	**2**	**98.6%**
No	**54**	**410**	**88.4%**
Overall Percentage	**32.7%**	**67.3%**	**90.8%**

Table 3 : Decision Tree -Classification Summary

INTERPRETING THE DECISION TREE

Interpreting the tree diagram involves travelling down along the tree's paths from the root node to the leaf node (the last of the child nodes with no further child nodes). Inferences can also be made along the traversed path.

- ✓ Starting from the root node, in the overall sample of 612 respondents 25% of the people are regular savers and the remaining 75% are irregular savers
- ✓ Moving down from the root node, the first child node in the tree is that of the 'number of earning members' in a family. If the number of earning members in a family is more than 2, that is, 3 or more, then in 81% of the cases the family saves regularly. If the number of earning members is less than or equal to 2, then only in 20% of the cases, the family saves regularly.
- ✓ Moving down the tree to further child nodes, the conditions imposed are cumulative in nature (like the AND logic function). If the number of earning member are less than 2 *and* the family size is less than or equal to 3, 106 families in the sample satisfy this condition and among them 60% save regularly. If the number of earning member are less than 2 *and* the family size is greater than 3, then only in 12% of the cases, the family saves regularly.
- ✓ Moving further down to the next level of child nodes, adds a further cumulative set of conditions. If the number of earning member is less than 2 *and* the family size is greater than 3 *and* average monthly income is in the Rs.5000-10000 range, then there are no regular savers in the category that fulfils these combined set of criteria. In the sample I have studied, 342 families satisfy this set of conditions and did not save regularly.

- ✓ If the number of earning member is less than 2 *and* the family size is greater than 3 *and* average monthly income is greater than Rs.10000, then among 122 families which satisfy this condition, 54% of them are regular savers.
- ✓ Moving onto the last layer of child nodes, one more cumulative condition gets added. If the number of earning members is less than or equal to 2, *and* family size greater than 3, *and* average monthly income greater than Rs.10000 *and* if the employment is regular, then all the 52 families which satisfy all of these conditions were found to be regular savers. While, if the number of earning members is less than or equal to 2, *and* family size greater than 3, *and* average monthly income greater than Rs.10000 *and* if the employment is of a daily wage nature, then out of 70 families which satisfy all of these criterion only 2 are regular savers.

These cumulative rules can be applied to a new dataset by moving down the tree from the root to the leaf node and subject to the fulfillment of the rules, a family can be predicted to either belong to a regular or irregular saver category. If data is insufficient to validate all the conditions from the root to the leaf node, then depending on the extent of information available, it is possible to traverse up to any child node of the tree and predict with a considerable degree of accuracy (indicated at the respective child nodes) the possibility of a family being a regular saver. The tree table presented is an alternate representation of the Tree diagram.

The model's predictive accuracy is inferred through the risk table that SPSS generates. At a standard error of 0.012, the model does a commendable job in being able to classify a family as regular saver based on the knowledge of certain independent variables about the family which the model uses to classify them.

The classification table indicates that it is able to predict the regular savers with a 98% accuracy. However, there is only an 88% accuracy in classifying the irregular savers. Despite that, at an overall predictive accuracy of 90%, the model is certainly usable for prediction.

6. CONCLUSIONS AND RECOMMENDATIONS

The decision tree built indicates that among the independent variables considered in the study, *number of earning members, family size, average monthly income, number of children, repayment towards loan, channel of savings, daily or regular employment* are the influencers of regular saving behavior included in the model based on their statistically significant association with the regular saving behavior (Table 1). Further, the resultant decision tree model indicates that the *number of earning members, family size, average monthly income and nature of employment* are the deterministic independent variables which influence the regular saving behavior of the poor.

This can serve as an input to the financial literacy centers that are being set up under the RBI's mandate, to NGOs working towards effective financial inclusion through financial literacy and also to the branches of banks which are at the end of the channel in effecting financial inclusion.

The decision tree can group people into two different categories of those who would potentially save regularly and those who might not and thus can help in planning for efficient and target group specific financial literacy programs and hand holding initiatives by the government and NGOs working on financial inclusion and literacy. These predictive models developed basing on data collected from a sample could be applied to a larger population within the same geography. Although yet to be verified and tested, such an approach could potentially have a better impact since the approaches towards financial literacy and inclusion is tailor made to the specific target groups. It also has a potential to reduce the costs of financial literacy initiatives since it is now focused only towards the predicted group which requires attention.

The limitation of the study is that the predictive model has been built based on data from one state. Its applicability to the other states is yet to be tested. However, all region specific exploratory studies have this short coming which is an opportunity for further work to compare and validate findings across various geographies.

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