FLEXIBLE INTEREST RATE GRID FOR TRANSPARENT CREDIT APPROVAL PROCESS – A STUDY BASED ON CUSTOMERS' PERSPECTIVE

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Abstract: *Indian banks are evolving with innovative methods in loan approval process, in order to retain their retail customers and to get rid of competition. One of the methods in sanctioning retail loans is based on the CIBIL's credit score. Retail customers having good credit score bargain for less interest rate. There was a lack of transparency in establishing flexible credit approval system. To enable the banker to fix transparent credit approval system with the coherence of the customers, the research was done from the customers' perspective. Responses from 328 retail loan borrowers were gathered through interview schedule. The research revealed that, a hundred point swell in credit score decreases the interest rate by 40 basic points. The research concludes that the CIBIL's credit scoring system is a tool used for price discrimination; but it could not be used as price control mechanism by the banks.*

Keywords: CIBIL, Credit score, Loan Approval Process

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1.0 INTRODUCTION

Less than one household out of seven citizens has credit access in urban India. Approximately a quarter of the total households in India borrows loan from informal sources (Kochar,1997). To knock out the informal sources of lending, Indian banks are evolving with innovative methods. The purpose of earning good credit score is gaining momentum among the borrowers. The customers having good credit score negotiate with their banks for a better interest rate. In order to retain their customers, the banks are also willing to provide better interest rates to their deserving customers. Public sector banks at their own accord accommodate such customers in order to extend mortgage loans with good quality of collateral. Banks are getting ready to relinquish the top rated customers by forgoing foreclosure charges. This helps to establish a trust relationship among the deserving customers. The differential pricing structure for loan approval process is standardized by FICO in US. Indian banks are also providing flexible interest rate based on credit scores; but they are not following standardized and transparent procedures to fix the interest rate. Past researches proved that there is a disagreement between customers and bankers while choosing the interest rate (Bhide, 2001; Pati, 2010; Ramasundaram G, 2009). The competition commission of India, while enquiring the complaints relating to Govind Aggarwal vs ICICI Bank and Ramachandra Reddy vs HDFC Bank, held that there was a lack of transparency in the system of fixing the lending rate under “floating rate” scheme (CCI,2011). Hence, to develop a 'transparent-flexible interest rate system', we undertake the research from the customers’ perspective. Loan approval system is successful only if it gains strong acceptance from the customers. Hence the research has been carried out from the customers’ standpoint.

2.0 LITERATURE REVIEW

The bargaining power of the loan borrowers are depending upon the credit scores and credit literacy among them is increasing (Lyons,2007). Kossman's research established a road map for designing, implementing and monitoring a credit scoring model (Kossmann, 2003). Credit scoring is considered as the mode of processing and evaluation of diverse credit risk with respect to credit applications of borrowers. The credit scores created by various agencies is coinciding with other non-traditional variables (Guszcza, 2003). From the bankers’ perspective, the credit scoring leads to reduce the delinquency cost and resolve the servicing problems in lending (Cutts,2004). Credit rating created a positive change in borrowers’ attitude in redeeming the debt (Gregory Elliehausen, 2007). Credit rating system also

augmented the rural financing and enables the financial inclusion. (Satchidanan, 2006). After the introduction of credit scoring system, the average rate of growth in a consumer's credit increased (Capon, 1982). The present research enables the bankers to determine the prime lending rate based on the credit scores. This enables the bankers not only to retain their customers but also augment the prompt payment attitude of the borrowers. We focused on the primary dimensions of the lending system that a banker and a customer must perform, In order to achieve the customization strategy.

3.0 AIM OF THE STUDY

The primary objective of the research is to discover the differential pricing mechanism at the time of sanctioning credits to retain their customers. To facilitate the primary objective, following queries have been raised in sequential order and answered.

- Are customers courteous towards CIBIL's credit scoring?
- What are the dependent variables that affect credit scores from the perception of the customers?
- Is there any association between credit scores and interest rates?
- What is the spill over between credit scores and interest rates?
- How to segment the loan borrowers?

Based on the empirical findings, flexible interest rate grid has been established by segmenting the customers with attitudinal variables.

4.0 METHODOLOGY

The research has been done from the customers' perspective. Primary data were collected from 328 loan borrowers residing in the Coimbatore district of Tamilnadu, through interview schedule. The loan borrowers were identified through snow ball sampling. The retail loan borrowers, who have used CIBIL credit score to avail credit in twenty five branches of five public sector banks, were interviewed. Interest rates are measured based on interest rate basic points. The stage wise analysis is depicted in Table-I.

Table I: Input-Process-Output Table

Stages	Purpose	Input	Process	Output
I	To find out the loan approval factors as perceived by customers.	Primary data – Secondary variables	Factor analysis and Conjoint Analysis.	Redemption indicator, Redemption capacity, Cost indicator and Hedging. Among this redemption capacity is having relative importance.
II	To find out the dependent variable that is reflected in credit rating.	Primary data – Primary variables	'F' Test	Income of the customers is coinciding with credit scores
III	To measure the association between credit scores and interest rate	Credit Score and Interest Rate	Chi-square Test	There is a significant association.
IV	To find out the spill over effects between credit score and interest rate.	Credit scoring interest rate grids	VECM modeling	An increase in 100 points of credit scores will decrease interest rate by 40 bps.
V	To segment the borrowers	Credit Scores and Income level	Cluster Analysis	Four classification
VI	To establish a flexible interest rate grid	Output of previous stages	Grid	Fixation of interest rates

5.0 MODUS OPERANDI OF CREDIT SCORING

FICO (Fair Isaac Corporation) is the first prominent agency that established the credit scoring. Bill Fair and Earl Issac established FICO in 1956. It has a credit score model which is of wide acceptance in United States. In FICO, the credit score of a borrower ranges from 300 to 850 and the factors considered in the evaluation of a borrower's credit worthiness are payment history, credit utilization, span of credit history, types of credit used and credit enquiries. FICO scores are readily available for consumer reporting agencies for scrutiny in countries like USA and Canada. Credit Information Bureau (India) Ltd introduced the concept of CIBIL scores. CIBIL monitors all the loan information provided by its own member banks. A CIBIL score is a three digit numeric expression of a borrower who are deserved to borrow loans. The score has been calculated by incorporating records of all the

credit facilities availed by the borrowers, past payment history, amount overdue, number of inquiries and suit-filed status. However, the information regarding income, amount deposited with the bank, details of borrowers' assets, details of investments are not considered for calculating the credit score. Only those bankers, who share all the customers' credit details with CIBIL have access to the credit scoring. Usually credit score ranges from 300 to 900 points. The closer the score of the borrower to 900, the more favourably the loan application will be viewed by the banks. The factors affecting the score of an individual are late payments or defaults in the recent past, high utilization of credit limits, higher utilization of credit cards and credit hungry behaviour. The credit score of a borrower is not mandatory, though the amount of credit depends on the individual bank. CIBIL's credit score is not under the preview of Right to Information Act, 2005. Apart from the CIBIL credit report, banks also evaluate other criteria like the income of the borrower, length of residence, employment details etc.

6.0 ANALYSIS

6.1 Stage I - Loan approval factors

Before the introduction of credit scoring, the bankers used to consider the capacity, capital and credit worthiness of the borrower before sanctioning the credit. After the introduction of CIBIL's credit scores, bankers are considering the credit score as well as income earning capacity of the borrowers.

In the first stage, we wish to find out the loan approval factors considered by banks from the customers' stand. From the past researches, twenty three variables had been identified. The variables are further divided in to primary and secondary variables. The primary variables are mandatory factors to be considered by the banks before sanctioning credits. They are income, deposits of the customers, asset holdings, investments and collateral securities. The secondary variables are discretionary factors considered by the banks while providing loans. They are character, fast track redemption, referrals, multiple loans, working capital, aging schedule, credit history, delinquency cost, hidden cost, factoring cost, deferred payment, bad debts, credit outstanding, credit freeze, debt redemption mode, redemption period, foreclosure, loan swaps and forfaiting system.

Factor component test was applied to filter the secondary variables. Through interview schedule, 328 customers were surveyed, and they were asked to give their opinion on all of the secondary variables in a five point scale (1 = Completely disagree; 5 = Completely agree). The data collected were coded to perform factor analysis using SPSS. The null hypothesis, that the population correlation matrix is an identity matrix, was rejected by

the Bartlett's test of sphericity. The value of Kaiser-Meyer-Olkin statistics (0.623) is also greater than 0.5. The chi-square statistics value is 717.54, and it is significant at 95% level of confidence at degrees of freedom 171. Hence principal component analysis is appropriate for analyzing the correlation matrix of the nineteen variables. The number of factors was selected based on the eigen value. Four factors having eigen value greater than one was selected. All the four factors are accounted for cumulative variance of 64.2%.

Table – II: Factor Component Matrix of Credit Scoring Variables

Variables	Factor loading Component			
	Factor 1	Factor 2	Factor 3	Factor 4
Credit outstanding	-.504	-.227	-.110	.160
Character	.461	-.373	.075	-.047
Fast track payments	-.402	.331	-.141	.081
Referrals	.402	-.011	.292	-.230
Multiple Loans	.397	.282	-.111	-.254
Working Capital	.342	.103	.253	-.067
Aging Schedule	.340	.009	-.012	-.239
Credit History	-.319	-.258	-.150	-.087
Delinquency Cost	.242	.572	-.042	.279
Hidden Cost	.227	.563	.047	.185
Factoring Cost	-.233	.556	.185	.010
Deferred Payment	-.122	.013	.536	-.315
Bad Debts	.189	-.269	-.522	-.332
Freezing of Credit Limits	-.223	-.147	.516	.426
Debt Redemption	-.057	-.240	.483	.023
Redemption Period	.056	.034	-.480	.415
Foreclosure	-.355	.313	-.097	-.555
Loan Swaps	.340	-.131	.069	.439
Forfeiting	.188	-.079	-.175	.265

Source: Based on the primary data

The variables 'deferred payments', 'bad debts', 'freezing of credit limits', 'debt redemption', and 'redemption period' are highly correlated and contribute to a single factor which can be named as 'redemption indicator'.

The variables 'delinquency cost', 'hidden cost' and 'factoring cost' are highly correlated and contribute to a single factor which can be named as 'cost indicator'.

The variables 'foreclosure', 'forfeiting' and 'loan swaps' are highly correlated and contribute to a single factor which can be named as 'hedging'.

The variables 'working capital', 'credit history', 'credit outstanding', 'referrals', multiple loans', 'fast track', 'aging schedule' and 'character' are highly correlated and contribute to a single factor which can be named as 'redemption capacity'.

Conjoint analysis was applied to determine the relatively important factor among the four factors. The reliability of using conjoint analysis was measured by R-square. Since R-square was 0.67, conjoint analysis was appropriate one. Exhibit - I shows the relative emphasis towards the secondary variables as perceived by the loan borrowers.

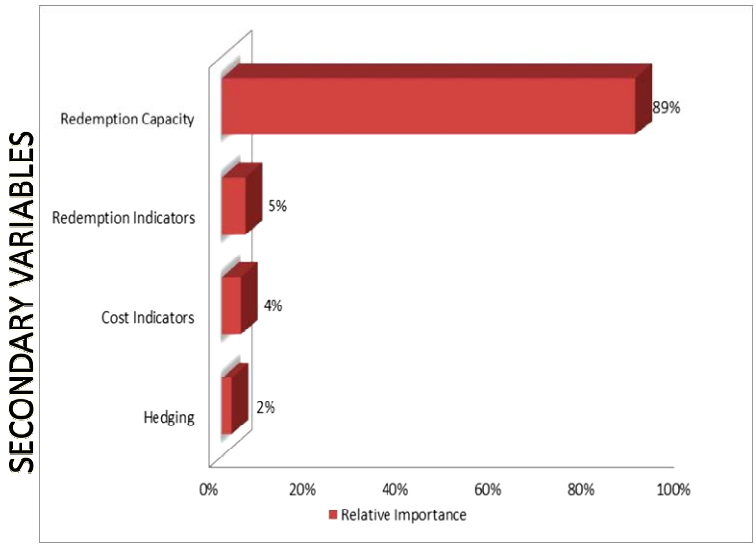

Exhibit I: Relative Important Factor

The retail loan borrowers are of the opinion that their redemption capacity was given priority by the bankers during the loan approval process. This will match with the credit score calculation process of CIBIL. Hence, the customer response is not in contradiction with the credit score calculations. We conclude that customers are courteous towards the credit scoring process. Thus, the CIBIL score is the appropriate one in designing the flexible interest rate grid.

6.2 Stage II - Dependent Factors

As pointed out earlier, in addition to CIBIL score, bankers can also consider primary loan approval factors while sanctioning the credit. Through interview schedule, we collected the annual income, outstanding deposit amount, asset holding value, investments value and collateral value of the customers. In the second stage, we wish to discover the primary loan approval process variables that coincide with the credit scores. We applied 'F' test to test the variation between and within the primary variables with the credit score. For the purpose of testing the hypothesis, the variables are grouped. The hypotheses are established as follows:

Null Hypothesis: There is no significant variation among the means of the primary loan approval factors and credit scores.

Alternative Hypothesis: There is a significant variation among the means of the primary loan approval factors and credit scores.

The independent variable is the credit score. To test the null hypothesis, one-way analysis of variance analysis is used. The result is interpreted with the associate 'F' probability value of 0.00 and the level of significance of 0.05. The results are displayed in table III.

Table III: Loan Approval constraints

ANOVA						
Primary Loan approval process variables		Sum of Squares	df	Mean Square	F	Sig.
Income of the Customer	Between Groups	400.598	199	2.013	171.781	0.000
	Within Groups	1.500	128	.012		
	Total	402.098	327			
Deposit made by the Customer	Between Groups	229.707	199	1.154	1.604	0.002
	Within Groups	92.119	128	0.720		
	Total	321.826	327			
Assets holdings	Between Groups	174.792	199	.878	1.140	0.211
	Within Groups	98.610	128	.770		
	Total	273.402	327			
Investments of the Customer	Between Groups	667.623	199	3.355	.769	0.951
	Within Groups	558.203	128	4.361		
	Total	1225.826	327			
Collateral made by the Customer	Between Groups	48.379	199	.243	1.004	0.494
	Within Groups	30.984	128	.242		
	Total	79.363	327			

The 'F' statistics value is greater than the critical value, with 199 and 128 degrees of freedom, resulting in a probability of 0.00 at 95% confidence level for the variable 'income of the customer'. The alternative hypothesis is accepted, and hence credit scoring relies on the income of the borrowers.

The 'F' statistical value is less than the critical value, with 199 and 128 degrees of freedom, resulting in a probability more than 0.00 at 95% confidence level for the variable 'deposit made by the customers, 'assets holdings', 'investments of customers' and 'collateral made by the customer'. The null hypothesis is accepted in all these cases.

There exists a strong relationship between income and credit score, though, the income is not considered by the CIBIL. Hence we conclude that the income should be considered as one of the variables in designing the flexible interest rate grid.

6.3 Stage III - Association with Interest rates

In the third stage, we aim to find out the significant association exists between credit scores and interest rate. Chi-square statistic is used to test the statistical significance exists among credit scores and interest rates. Credit score is grouped under six classifications in ascending order (300 to 400; 401 to 500; 501 to 600; 601 to 700; 701 to 800; 801 to 900). Interest rates are classified into four groups in descending order (18 and above, 17 to 17.9, 16 to 16.9, 15 to 15.9). Since we expect inverse relationship, the credit scores are classified in ascending order and interest rates are classified in descending order. The observations are cross tabulated in table-IV.

Table IV: Credit Score Vs. Interest Rate Cross tabulation

	Interest Rate	18 and above	17 to 17.9	16 to 16.9	15 to 15.9	Total
CIBIL's Credit Scores	300 to 400	21	0	0	0	21
	401 to 500	50	1	0	0	51
	501 to 600	25	45	0	0	70
	601 to 700	0	37	60	0	97
	701 to 800	0	0	22	37	59
	801 to 900	0	0	0	30	30
Total		96	83	82	67	328

The hypotheses are established as follows.

Null Hypothesis: There is no significant difference between the interest rate and the credit score.

Alternate Hypothesis: There is a significant difference between the interest rate and the credit score.

Table V: Associations between Credit Score and interest rate

Chi-Square Tests			
Parameters	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.536E2	15	0.000

Likelihood Ratio	596.214	15	0.000
Linear-by-Linear Association	269.702	1	0.000

The calculated value of chi-square is much higher than the table value at degrees of freedom 15. Hence the null hypothesis is rejected. We conclude that there is a significant difference between credit scores and interest rates. Since there is an inverse relationship between credit score and interest rate, the equilibrium level can be determined while designing the flexible interest grid.

6.4 Stage IV - Regressive factor

In the fourth stage, we explored the spill over between credit score and interest rate by identifying the stochasting trend based on the 'Threshold Vector Error Correction Model' (TVECM). The collinearity variation between these two variables is studied. The hetroscedasticity variables include the identification of factors; income and redemption chronicle. A Vector Error Correction Model (VECM) helps to understand a better understanding of the nature of any nonstationarity among the different component series. Threshold vector error correction model (TVECM) is used to identify the bidirectional causality. VECM modeling has been established with the help of the following equations.

$$\Delta Y_t = a_y z_{t-1} + \sum_{t=1}^{p} b_{yi}\, \Delta Y_{t-i} + \sum_{t=1}^{p} c_{yi}\, \Delta X_{t-i} + \varepsilon_{y,t} \quad \ldots (1)$$

$$\Delta X_t = a_x z_{t-1} + \sum_{t=1}^{p} b_{xi}\, \Delta Y_{t-i} + \sum_{t=1}^{p} c_{xi}\, \Delta X_{t-i} + \varepsilon_{x,t} \quad \ldots (2)$$

Where as ΔX_t, is the output series from Credit score and ΔY_t , is the output series from interest rate. b_{yi} , c_{yi}, b_{xi} and c_{xi} represents the short-run coefficients. $\varepsilon_{y,t}$ and $\varepsilon_{x,t}$ are residuals. The speed of adjustment in interest rate due to market information is determined by the coefficients a_x and a_y . When these coefficients are high, adjustment is rapid. Table-6 displays the estimates of the adjustments coefficients obtained by TVECM using equation (1) and (2).

Table -VI: TVEECM Co-efficient

Dependent: Credit score		*Dependent: Interest rate*	
VCM Co-efficient	F statistic Value	VCM co-efficient	F statistic Value
0.78	23.4	0.92	12.78

The error correction is significant in both equations, suggesting a bidirectional error correction. However, the error correction in the interest rate equation (Dependent – interest rate) is greater in absolute term than that of the credit score equation. It is the credit score that makes greater adjustment in order to re-establish the equilibrium. Hence, it may be conclude that the credit score leads the interest rate discovery. The estimated values are tested with the 'F' statistic. The F-statistics is also significant. In the bidirectional causality, credit scores are better predictors to determine the interest rate. Using the multivariate GARCH model, the pattern of information flow between the credit scores and interest rate are examined. The multivariate GARCH equation is expressed as follows:

$$\begin{pmatrix} H_{11,t} & H_{12,t} \\ H_{21,t} & H_{22,t} \end{pmatrix} = C'C + \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}' \begin{pmatrix} \varepsilon^2_{1,t-1} & \varepsilon_{1,t-1}\varepsilon_{2,t-1} \\ \varepsilon_{2,t-1}\varepsilon_{1,t-1} & \varepsilon^2_{2,t-1} \end{pmatrix} \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} + \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix}' \begin{pmatrix} H_{11,t-1} & H_{12,t-1} \\ H_{21,t-1} & H_{22,t-1} \end{pmatrix} \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix}$$

…(3)

Where as $H_{11,t}$ and $H_{22,t}$, are the conditional variances of the first and second serial orders. $H_{12,t}$ and $H_{21,t}$ are the conditional covariance between the two series. The C_{ij} are elements of a 2x2 symmetric matrix of constants *C*. The elements a_{ij} of the symmetric 2x2 matrix a_i measure the degree of innovation from rate *i* to rate *j*. The elements of b_{ij} of the symmetric 2x2 matrix b_i indicate the persistence of conditional volatility between credit score and interest rate. The values of b_{11}, b_{22}, b_{12} and b_{21} are listed in Table VII

Table-VII: Spill-over effect

Dependent: Credit score		*Dependent: Interest rate*	
$a\,b_{11}$	$a\,b_{12}$	$a\,b_{21}$	$a\,b_{22}$
0.76	-0.11	-0.41	0.956

The elements b_{ij} of the symmetric matrix b_i in the equation (3) states that all of the estimated coefficients are significant. For both credit score and interest rate, average persistence is high (b_{11} = 0.956 and b_{22} = 0.76). The spill over from credit score to interest rate is - 0.412 (b_{12}). The spill over from interest rate to credit score is - 0.11 (b_{21}). The spill over from credit score to interest rate is higher than that of the interest rate to credit score. The output of the

analysis suggests that a 100% increases in credit score decrease the interest rate by 0.412%. Hence, it may be conclude that a 100 points change in credit score will decrease the interest rate by 40 basic points. The results should be used with caution by considering the impact of credit worthiness of the borrower.

6.5 Stage V - Stratification

In the fifth stage, we decided to stratify the customers in to different segments. The purpose of stratification is to fix different prime lending rate to each category of borrowers. Since there is a strong association between credit score and interest rate, these two variables are considered to formulate a cluster problem. These two attitudinal variables are used to develop a cluster solution. Credit score is considered as the continuous variable and income is considered as the categorical variable. Akaike's information criterion is used to decide about the number of clusters. Cluster centroids are used to differentiate the clusters. Table VIII shows the cluster group based on the attitudinal variables.

Table VIII: Customers' Stratification

Cluster	Name	Frequency	Percent	Centroid
1	Modest Customers	67	20.4	4.5180E2
2	Striking Customers	96	29.2	5.9920E2
3	Stirring Customers	83	25.4	6.8768E2
4	Impressive Customers	82	25.0	8.0891E3
	Total	328	100	6.2102E2

The clusters were named based on the centroid values. The reference level for the credit score is 621 and for income is 588000. We conclude that customers may be classified in to four categories for the purpose of flexible interest rate system.

6.5 Stage VI - Findings and Grid construction

Customers believe that the bankers are considering the redemption indicator, hedging, cost indicator and redemption capacity while sanctioning the credits. From the customers' perspective, redemption capacity is the relative important variable considered by the bankers. CIBIL score is also based on the redemption capacity. Hence, the customers are courteous to the CIBIL scores and it can be used as a base for determining the flexible interest rate. The bankers also measure the credit worthiness of the borrower on the basis of income, even though the CIBIL is not considering the earning capacity of the customers. Hence there is a strong association between the credit scores and income. At the time of retail loan

sanctioning, the customer bargaining power is also considered by the banks. The banks are providing interest rate discounts to customers, who earned high credit scores, even though there is no transparent interest rate fixation system. The regressive model explained that, a hundred point surges in credit score decreases the interest rate by 40 basic points. Based on these findings, we have established the flexible interest rate grid for taking better credit lending decisions.

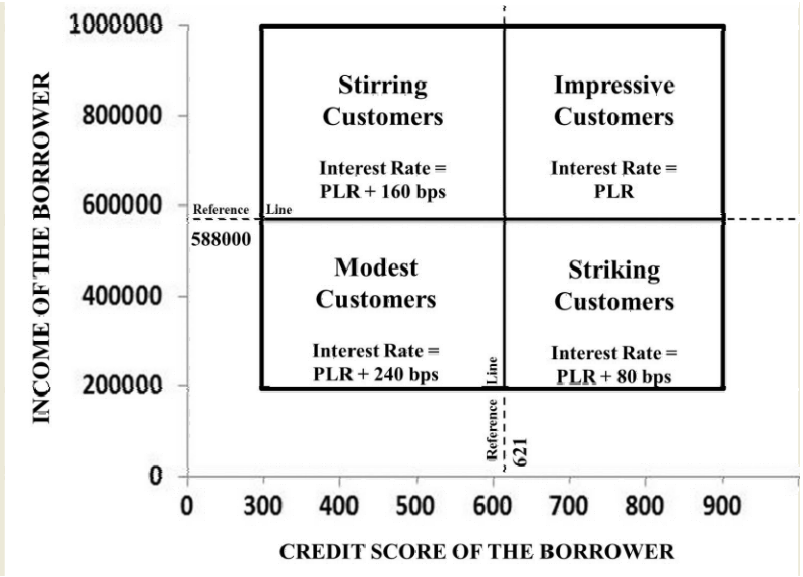

Exhibit II: Flexible Interest Rate Grid

In Indian situation, credit scoring and income earning capacity of the borrower are considered while sanctioning the credit. The research conducted among the 328 borrowers also proved that there is an inverse relationship between the interest rates and credit scores. From the customer perspective, they believe that banks are considering the income while granting the loan. Hence trivial relationship has been established among the credit scores, income and interest rate basic points. Based on the cluster analysis result, four types of customers segment were identified for the construction of grid. Credit scores are stratified based on reference value used in Cluster analysis. Income is also classified into two categories based on the reference value. The minimum interest rate has been fixed based on the 'spread' between the deposit rate and prime lending rate. Interest rates are measured in terms of basic points. A forty basic points have been adjusted with every 100 credit scores. The rate of interest for the first segment – impressive customers is equivalent to the prime lending rate; for the second segment- stirring customers, it is equivalent to the prime lending rate plus 80 basic points; for the third segment – striking customers, it is equivalent to the

prime lending rate plus 160 basic points and for the fourth segment – modest customers, it is equivalent to the prime lending rate plus 240 basic points. Loans will not be sanctioned for the customers having credit scores less than 300.

7.0 LIMITATIONS

The research is purely based on the responses of customers from a second-tier city. Hence the results may vary in other places. However, the process of constructing grid will be similar. The regional branches of banks can create their own flexible interest rate grids and achieve the customization strategy. The transparency system followed in creating such grids definitely enables to take quick and better decisions. We have considered only the retail loan borrowers and not business customers. Thus, the result will be applicable only to the retail loan segments and not to the capital infusion schemes of the development banking.

8.0 CONCLUSION

Banks can use credit scoring as a better tool to retain the existing customer base. The loan approval method is flexible enough to accommodate the credit score. Despite the hurdles in identifying the suitable lending system, banks are using income earning capacity as a primary tool. Since there is a linear relationship between credit scores and income, income indicators can be replaced with credit scores. While fixing the interest rate, the spread between the deposit rate and lending rate has to be maintained as constant. Data redundancy in maintaining the customer base can also be avoided because of the introduction of CIBIL data base. CIBIL's credit scoring system is a tool used for price discrimination but it could not be used as price control mechanism by the banks. The customer's participation in the commercialization activities of banking industries are rigid and is also further strengthened by their ability to sustain a standard livelihood.

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