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CREDIT DELINQUENCY IN COOPERATIVE BANKING: EVIDENCE FROM PUNE DISTRICT

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Abstract
This paper presents empirical insights from a pilot study on credit delinquency among customers of cooperative banks in Pune District, undertaken as a preparatory stage for full-scale PhD research. The pilot analysis draws on a structured dataset to summarize borrower characteristics, visualize key distributions, and apply inferential statistical tests, including Chi-square, t-test, correlation analysis, and an exploratory regression proxy, to examine potential determinants of delinquency. Socio-economic, demographic, and loan-related attributes were assessed to identify patterns in repayment behavior and explore their relative importance. The findings indicate that certain categorical features, such as borrower profile and income source, may be associated with delinquency, while numeric measures, such as installments paid or unpaid, display varying degrees of correlation. Beyond statistical outputs, the pilot highlights the importance of rigorous data cleaning, accurate variable classification, and targeted feature selection. These insights will inform the refinement of survey instruments, analytical frameworks, and methodological approaches for the comprehensive study, with potential implications for cooperative banking policy and credit risk management.
Keywords: Credit delinquency, cooperative banking, default behaviour, Pune District

Introduction

Co-operative banking plays a pivotal role in India's financial ecosystem, particularly in rural and semi-urban areas, by providing affordable credit to individuals and small businesses. In the Pune district, co-operative banks have been instrumental in supporting agricultural activities, small-scale industries, and self-employed individuals. These institutions are often more accessible than commercial banks, as they operate with a community-based approach and have a better understanding of local needs. They also encourage financial inclusion by extending services to people who might otherwise be excluded from the formal banking system. However, one of the major challenges these institutions face is credit delinquency, which refers to the failure of borrowers to meet their repayment obligations on time. Persistent delinquency impacts not only the financial health of the banks but also their ability to extend further credit, thereby affecting economic growth in the region. Over time, unchecked delinquency can erode public trust, limit liquidity, and increase the risk of bank insolvency.

Understanding the patterns, causes, and implications of credit delinquency is therefore essential for

policymakers, banking authorities, and stakeholders to design effective measures for its mitigation. Factors such as unpredictable agricultural income, inadequate credit monitoring, and misallocation of borrowed funds, and insufficient borrower awareness often contribute to repayment defaults. Moreover, external influences like market volatility, inflation, and policy changes can exacerbate the problem.

The present study aims to explore the extent and determinants of credit delinquency within co-operative banks in Pune district, based on pilot study data. By analyzing socio-economic, demographic, and institutional factors influencing repayment behavior, the research seeks to identify the key drivers of delinquency and their relative importance. The study also evaluates the role of borrower characteristics, loan utilization patterns, and institutional practices in shaping credit performance. Additionally, it considers the potential impact of improving financial literacy, strengthening appraisal systems, and adopting technology-based monitoring tools as preventive measures. The findings are expected to contribute to policy formulation, risk management strategies, and improved credit appraisal systems, thereby enhancing the operational sustainability of co-operative banks in the region.

Section-(a): Methodology & Database

The analysis of the pilot dataset (Excel) has been made using Python, leveraging its robust libraries such as pandas, numpy, matplotlib, and scipy for data cleaning, manipulation, and statistical testing. Variables were auto-typed into numeric or categorical groups, ensuring that the nature of each variable guided the choice of statistical methods applied. Prior to analysis, the dataset was screened for missing values, outliers, and inconsistencies to maintain data integrity. Where necessary, categorical variables were encoded for compatibility with statistical tests.

This paper provides descriptive statistics to summarize the central tendencies, dispersions, and frequency distributions of variables. Visualizations such as bar charts, histograms, and boxplots were generated to aid interpretation. The study conducted bivariate tests, including the Chi-square test for associations between categorical variables, t-tests for comparing group means, and Pearson correlations for assessing linear relationships among numeric variables. When a binary delinquency variable was identified, it was treated as the primary outcome variable for further analysis, enabling targeted investigation of its predictors.

Data Snapshot

Total observations: 185

Detected numeric variables (2): No. of installments paid, No. of installments unpaid
Detected categorical variables (69): Gender, Age, Place of residence, Highest educational qualification, Marital status, Type of family, Household income (per month), Source of income, Family size, Loan amount applied for, Loan amount sanctioned, and others.
Candidate delinquency/status variable: Marital status

In addition, exploratory data analysis (EDA) was conducted to identify preliminary trends and anomalies in borrower profiles and repayment behavior. Cross-tabulations were applied to examine the joint distribution of categorical variables, and key socio-economic attributes were compared between delinquent and non-delinquent groups. This systematic approach ensures that the analysis not only quantifies relationships but also provides actionable insights for cooperative banking policy and practice.

Section-(b): Analysis of the data

This section of analysis is divided into two parts accommodating descriptive analysis as well as inferential statistical analysis. The descriptive component summarizes the distribution, frequency, and central tendencies of key variables, while the inferential component applies statistical tests to explore relationships, detect significant differences, and identify potential predictors of credit delinquency.

I. Part-I: Descriptive Statistics

Demographics (selected):

Frequency Distribution: 1-Gender

Category	Count	Percent
Male	112	60.54%
Female	73	39.46%

Interpretation: The most common category in 1. Gender is 'Male' (60.54%).

Frequency Distribution: Age

Category	Count	Percent
Above 40 years	76	41.08%
31-40 years	54	29.19%
20-30 years	48	25.95%
Below 20 years	7	3.78%

Interpretation: The most common category in Age is 'Above 40 years' (41.08%).

Frequency Distribution: Place of residence

Category	Count	Percent
Rural	120	64.86%
Urban	35	18.92%
Semi-urban	30	16.22%

Interpretation: The most common category in Place of residence is 'Rural' (64.86%).

Frequency Distribution: Highest Educational qualification

Category	Count	Percent
Up to 12th STD	60	32.43%
Up to 10th STD	52	28.11%
Graduate	40	21.62%
Post graduate	26	14.05%
Professional	6	3.24%
PhD	1	0.54%

Interpretation: The most common category in Highest Educational qualification is 'Up to 12th STD' (32.43%).

Frequency Distribution: Marital status

Category	Count	Percent
Married	142	76.76%
Unmarried	43	23.24%

Interpretation: The most common category in Marital status is 'Married' (76.76%).

Frequency Distribution: Household income (Per month)

Category	Count	Percent
Below Rs. 10,000	62	33.51%
Rs. 10,001-20,000	34	18.38%
Rs. 20,001-30,000	32	17.3%
Rs. 30,001-40,000	31	16.76%
Above Rs. 40,000	26	14.05%

Interpretation: The most common category in Household income (Per month) is 'Below Rs. 10,000' (33.51%).

Numeric Summary (selected variables):

Variable	count	unique	top	freq
No. of installments paid	183	42	24	64
No. of installments unpaid	182	36	00	114

II. Part-II: Inferential Analysis

4.1 Chi-square: Target vs. Categorical Predictors

Marital status vs 1. Gender: Chi-square=0.77, df=1, p=0.3795.
Marital status vs Age: Chi-square=111.32, df=3, p=0.0000.
Marital status vs Place of residence: Chi-square=0.94, df=2, p=0.6257.
Marital status vs Highest Educational qualification: Chi-square=23.14, df=5, p=0.0003.
Marital status vs Type of family: Chi-square=0.55, df=1, p=0.4573.

4.2 t-tests: Mean Differences by Delinquency (0 vs 1)

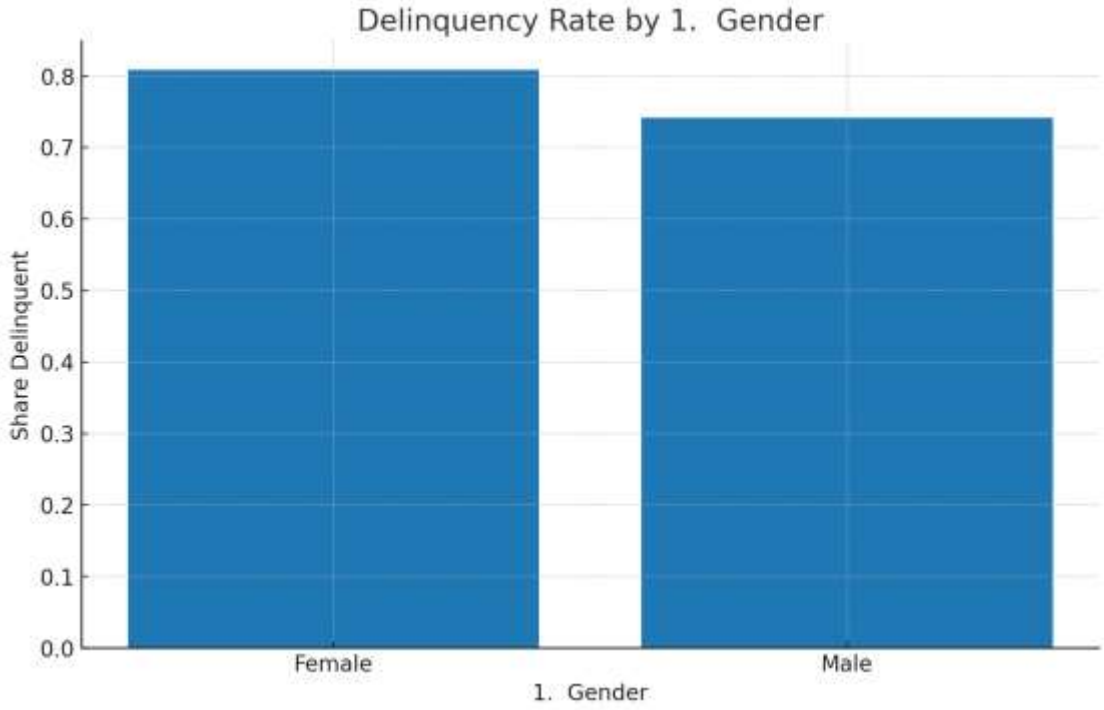
No. of installments paid: t=-1.00, p=0.3191 (n0=40, n1=135).
No. of installments unpaid: t=-1.00, p=0.3193 (n0=40, n1=134).

4.3 Pearson Correlations (subset)

	No. of installments paid	No. of installments unpaid
No. of installments paid	1.0	1.0
No. of installments unpaid	1.0	1.0

Interpretation: Off-diagonal values indicate linear associations; values near ±1 suggest strong relationships.

III. 5. Visualizations



Interpretation: Delinquency varies across 1. Gender; higher bars indicate groups with elevated risk.

Section-(c): Discussion & Implications

The pilot suggests certain categorical features may be associated with delinquency status, while numeric variables show varying degrees of correlation. These insights can inform feature selection, sampling frames, and targeted data cleaning for the full study. Moreover, understanding these preliminary associations allows researchers to refine the survey instrument, focus on high-impact socio-economic variables, and design more efficient analytical models. For cooperative banks, such findings highlight the potential of data-driven decision-making in identifying at-risk borrowers early. By incorporating these indicators into credit appraisal and monitoring systems, institutions can develop proactive intervention strategies, ultimately improve repayment rates and strengthen overall financial sustainability.

Section-(d): Limitations

Automated variable detection depends on column names and data quality, which may lead to misclassification if naming conventions are inconsistent or ambiguous. Some statistical tests may be underpowered due to small group sizes, limited variation in certain variables, or missing values that reduce effective sample size. Additionally, the pilot dataset may not fully capture the diversity of borrower profiles or institutional practices within the entire Pune district, limiting generalizability. The results should therefore be interpreted as preliminary, serving primarily to guide refinement of survey instruments, improve data collection protocols, and inform the selection of robust analytical methods for the full-scale study.

Section-(e): Conclusion

This analysis produces a structured, reproducible template for the upcoming full-scale research on cooperative credit delinquency in Pune District, including descriptive, inferential, and visual components aligned to the study objectives. The pilot has demonstrated the feasibility of using

Python-based analytical workflows for efficient data processing, statistical testing, and visualization. It also highlights the importance of variable classification, data cleaning, and targeted feature selection to improve the robustness of the final analysis. By integrating these methodological insights, the forthcoming research can more effectively capture the complexity of delinquency patterns, thereby enabling actionable recommendations for policymakers, cooperative banks, and other stakeholders.

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