RISK ANALYTICS IN CONSUMER LENDING

Using EDA to Minimize Credit Loss

- Sanchita Patil
http://www.sanchitapatil.me

PROBLEM STATEMENT

- The finance company needs to assess loan applications effectively to minimize financial loss.
- Two primary risks: Loss of business from rejecting good applicants and financial loss from approving bad applicants.
- Objective: Identify patterns indicating loan default to inform better decision-making.

BUSINESS UNDERSTANDING

- Company: Largest online loan marketplace facilitating personal, business, and medical loans.
- Risk: Lending to risky applicants leads to significant financial losses.
- Goal: Understand the drivers of loan default to reduce credit loss.

DATA UNDERSTANDING

- **Dataset:** Information on past loan applicants from 2007 to 2011.
- **Analysis Focus:** Identify variables that indicate a higher risk of loan default.
- **Key variables:**

Category	Variables
Employment-related	Employment_Title, Employment_Length
Financial	Annual_Income, Debt_to_Income_Ratio
Credit History	Number_of_Delinquencies_in_the_Last_2_Years, Earliest_Credit_Line_Month, Number_of_Inquiries_in_the_Last_6_Months, Number_of_Open_Credit_Accounts, Number_of_Public_Records, Number_of_Public_Record_Bankruptcies
Loan-related	Loan_Amount, Loan_Term, Interest_Rate, Monthly_Installment, Credit_Grade, Credit_Subgrade, Income_Verification_Status, Loan_Purpose, Loan_Title, Revolving_Balance, Revolving_Utilization_Rate, Total_Number_of_Credit_Accounts, Home_Ownership_Status
Loan Status	Loan_Status • Fully Paid: The applicant has completely repaid the loan, including both the principal amount and the interest. • **Charged-off**: The applicant has failed to make payments for an extended period, resulting in the loan being classified as defaulted.

EXPLANATION OF KEY VARIABLES

Category	Variable Name	Description
Employment-related	Employment_Title	The title of the borrower's employment.
	Employment_Length	The length of the borrower's employment in years.
Financial	Annual_Income	The self-reported annual income of the borrower.
	Debt_to_Income_Ratio	The ratio of the borrower’s total monthly debt payments to their monthly income.
Credit History	Number_of_Delinquencies_in_the_Last_2_Years	The number of 30+ days past-due incidences of delinquency in the borrower's credit file for the past 2 years.
	Earliest_Credit_Line_Month	The month when the borrower's earliest reported credit line was opened.
	Number_of_Inquiries_in_the_Last_6_Months	The number of credit inquiries made in the past 6 months.
	Number_of_Open_Credit_Accounts	The number of open credit lines in the borrower's credit file.
	Number_of_Public_Records	The number of derogatory public records.
	Number_of_Public_Record_Bankruptcies	The number of public record bankruptcies.
Loan-related	Loan_Amount	The amount of money requested by the borrower in the loan application.
	Loan_Term	The duration of the loan in months.
	Interest_Rate	The annual interest rate charged on the loan.
	Monthly_Installment	The monthly payment owed by the borrower if the loan is originated.
	Credit_Grade	The grade assigned to the loan by the lending club.
	Credit_Subgrade	The subgrade assigned to the loan by the lending club.
	Income_Verification_Status	The status indicating if the income was verified by the lending club.
	Loan_Purpose	The purpose for which the loan was requested by the borrower.
	Loan_Title	The title of the loan provided by the borrower.
	Revolving_Balance	The total credit revolving balance.
	Revolving_Utilization_Rate	The revolving line utilization rate.
	Total_Number_of_Credit_Accounts	The total number of credit lines currently in the borrower's credit file.
	Home_Ownership_Status	The status of home ownership provided by the borrower.
Loan Status	Loan_Status	The current status of the loan (e.g., fully paid, charged off).

ANALYSIS APPROACH

STEP 1 Data Loading

STEP 2 Data Exploration

STEP 3 Data Cleaning

- Redundant Column Identification and Removal
- Eliminating Non-Essential Columns
- Dealing with missing values
- Dropping Columns not deemed essential for our analysis.
- Imputation with median/mode
- Data Transformation for Analysis Readiness
- Outlier Treatment Analysis
- Renaming Columns for Improved Understanding

STEP 4 Exploratory Data Analysis

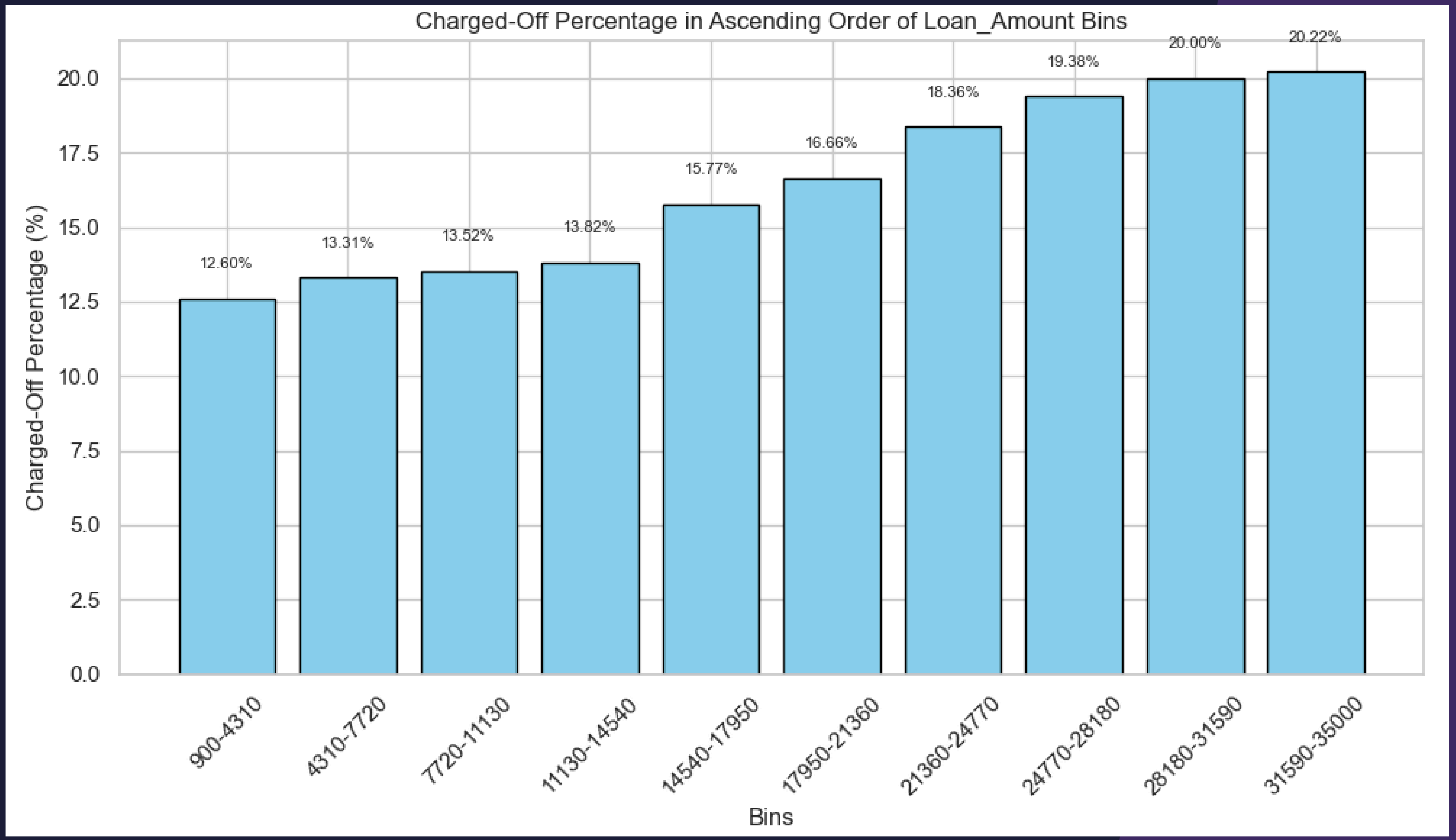
- Univariate Analysis
- Segmented Univariate Analysis
- Derived Metrics
- Bivariate Analysis

TOOLS - Python, Pandas, Seaborn, Matplotlib

UNIVARIATE ANALYSIS

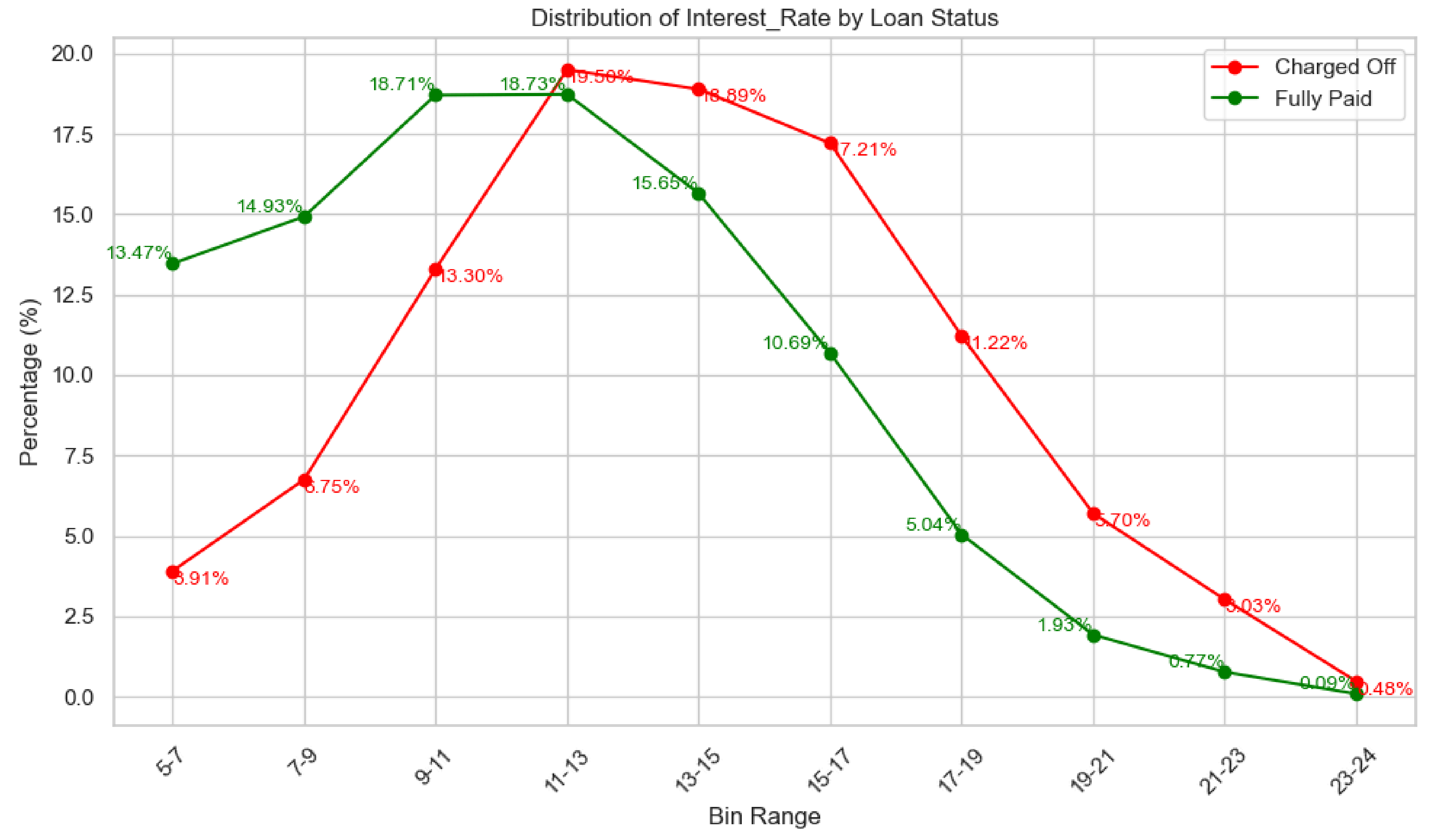
1. LOAN AMOUNT

Finding :
Default rates increase gradually as loan amounts rise, peaking at 20.22% for loans above $31,590.



2. INTEREST RATE

Finding :
Charged-off loans, especially those with lower credit grades (F and G), tend to have higher interest rates, notably in the 11–15% range. This underscores the importance of credit grades in assessing default risk.

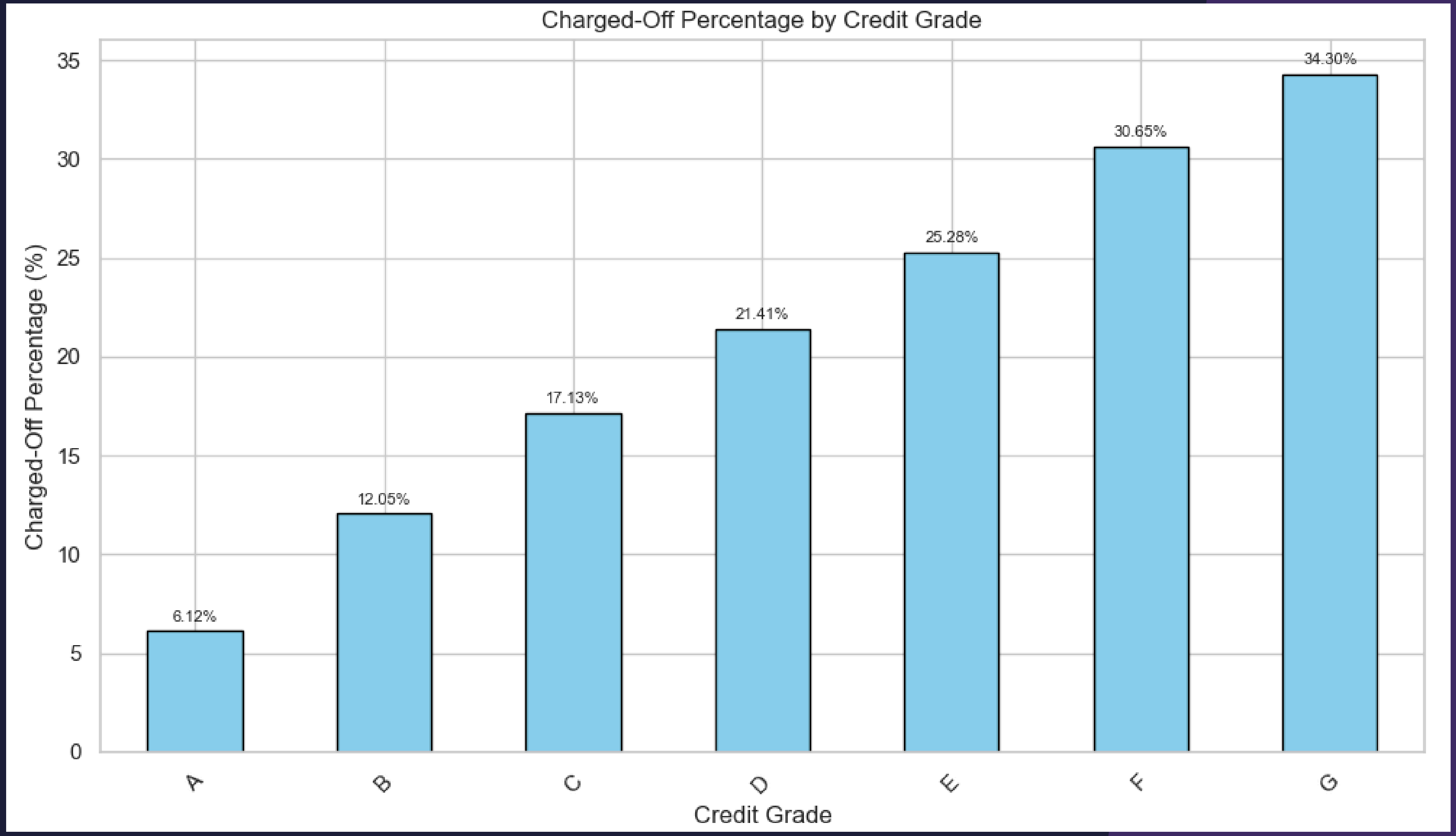


UNIVARIATE ANALYSIS

3. CREDIT GRADE

Finding :

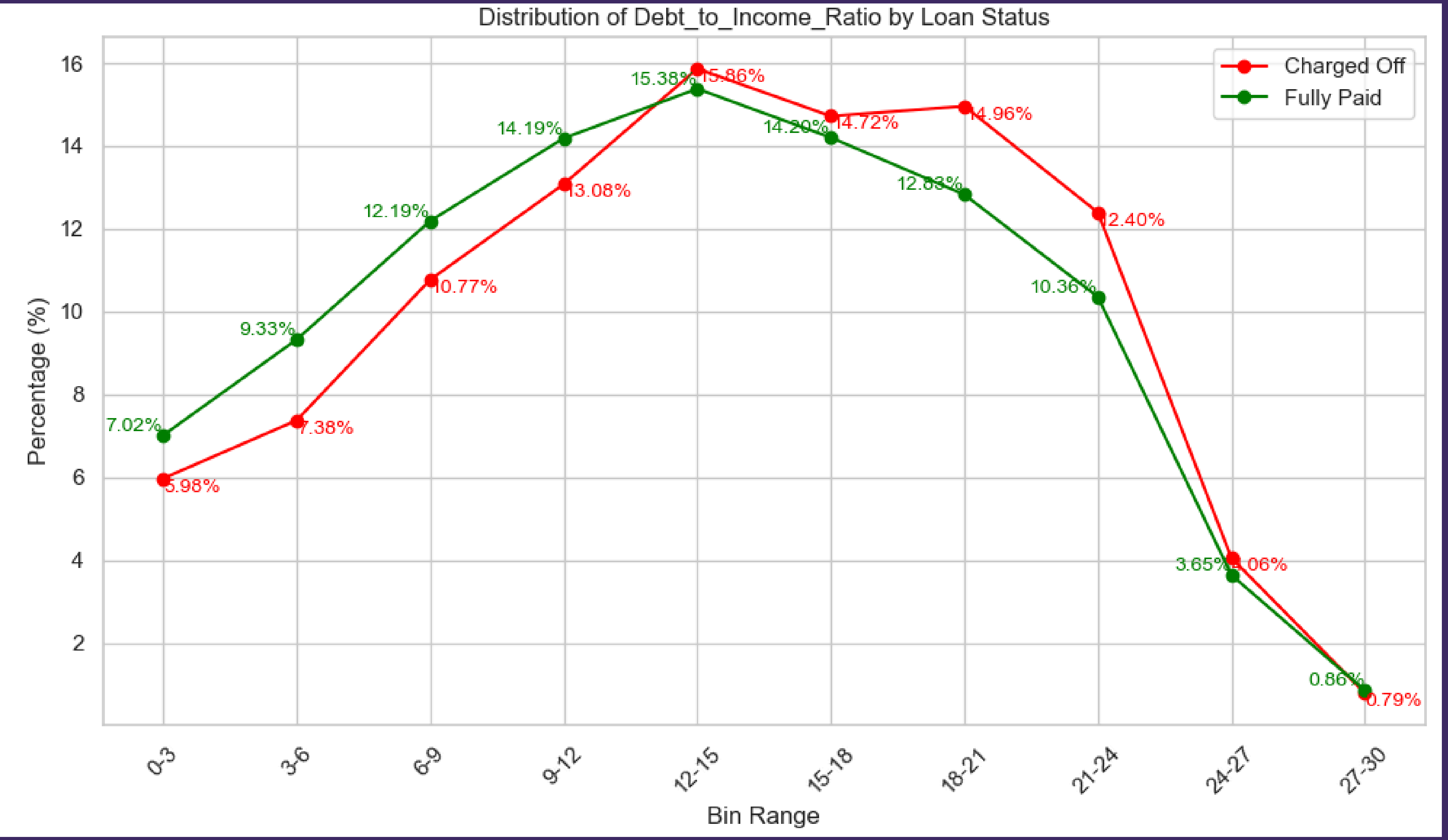
1. There's a clear trend indicating that as credit ratings decline, charged-off percentages increase.
2. Borrowers with lower credit grades, notably Grades F and G, exhibit significantly higher charged-off percentages, reaching up to 30.65% and 34.30% respectively.



4. DEBT-TO-INCOME RATIO

Finding :

1. There's a consistent pattern of increasing charged-off percentages as Debt-to-Income (DTI) bin ranges widen.
2. The DTI range of 12–21% exhibits higher default rates, indicating a potential threshold for heightened default risk.

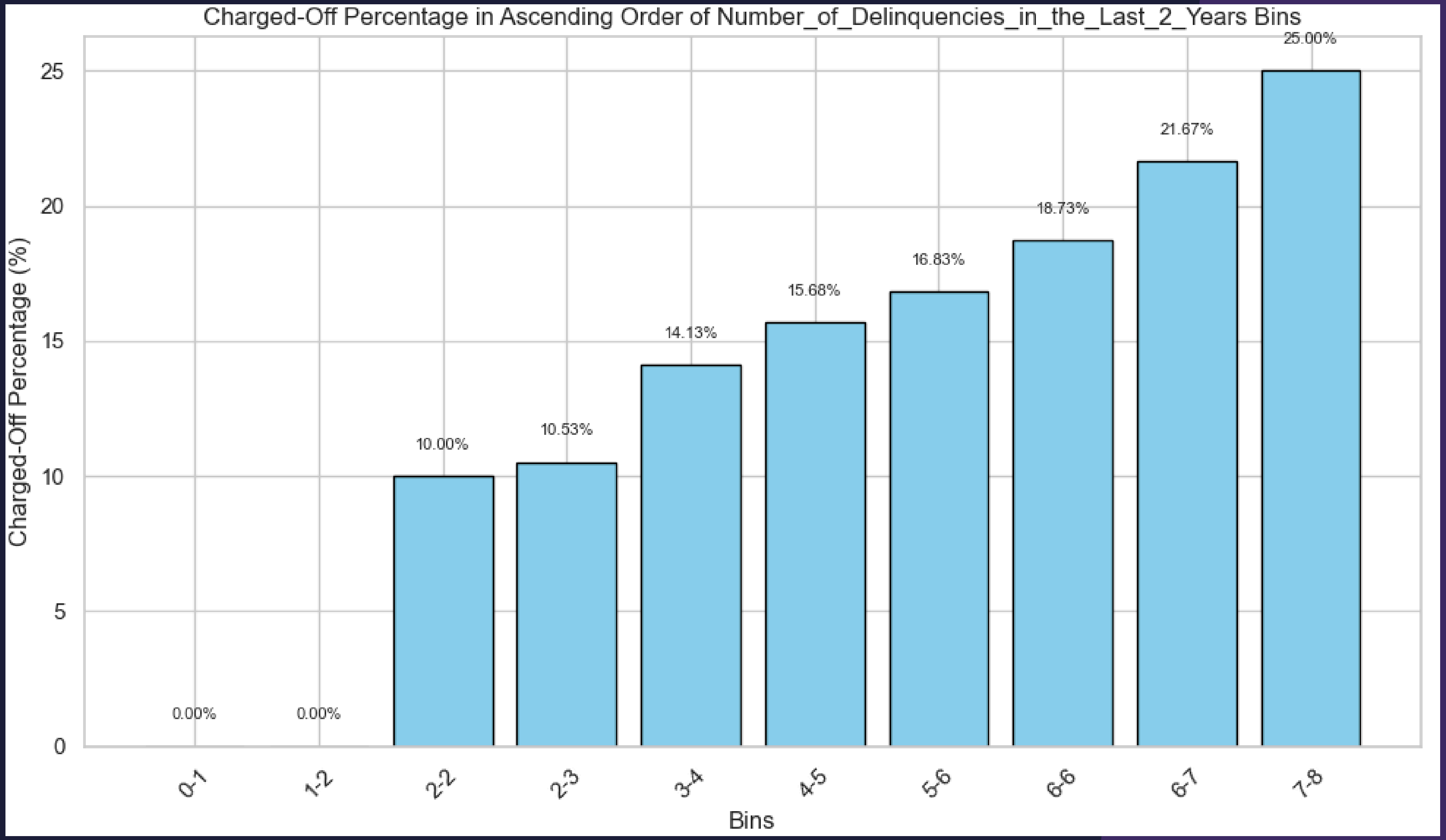


UNIVARIATE ANALYSIS

5. NUMBER OF DELINQUENCIES

Finding :

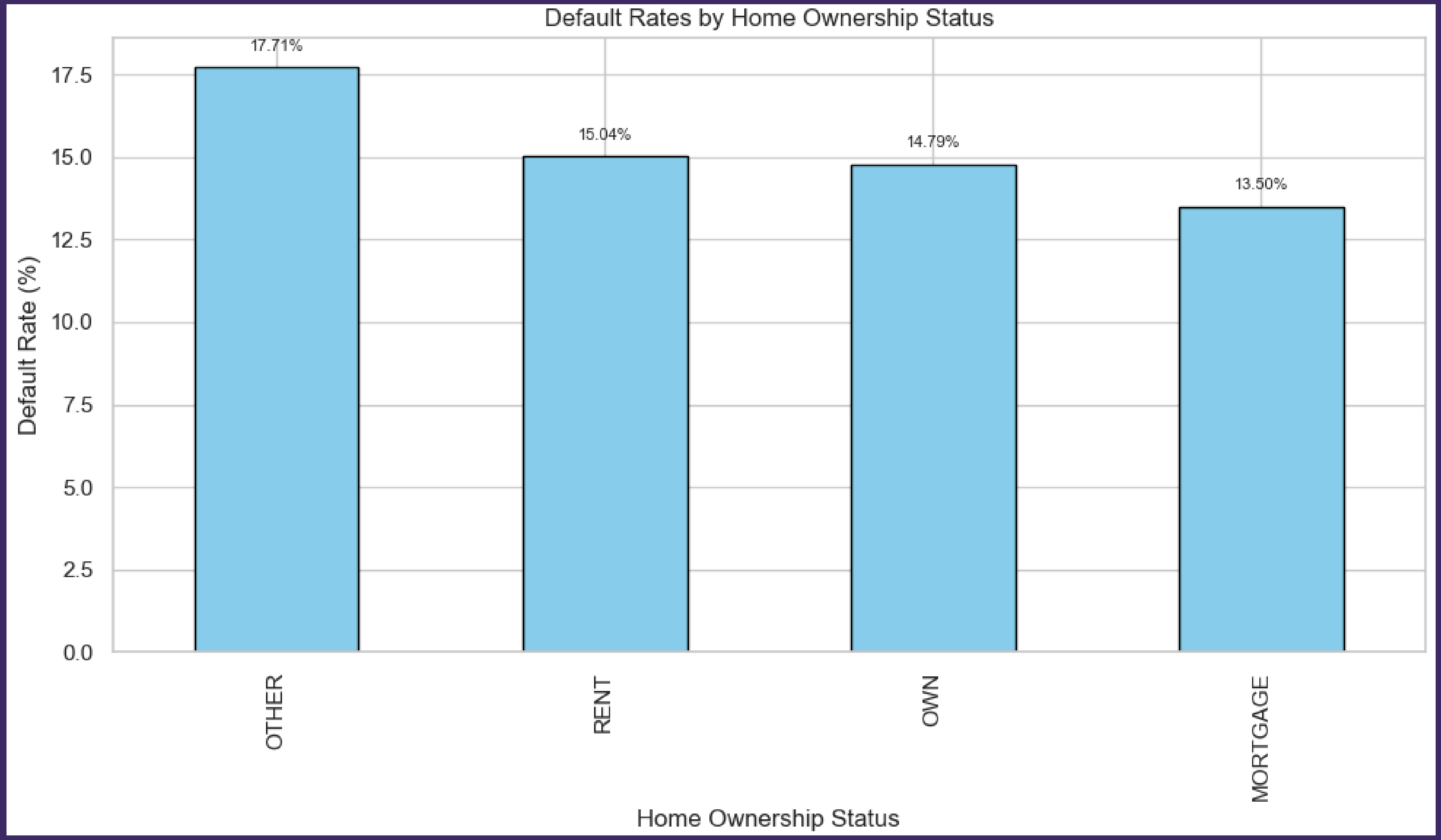
1. Charged-off percentages increase with the number of delinquencies, indicating a higher default risk for borrowers with a delinquency history.
2. Borrowers with six or more delinquencies show notably higher charged-off percentages, ranging from 18.73% to 25.00%.



6. HOME OWNERSHIP STATUS

Finding :

1. Borrowers in the 'RENT' category exhibit higher default rates (15.04%) compared to those who own homes or have mortgages.
2. Home ownership status can be considered a relevant factor in assessing loan default risk, with renters showing a higher likelihood of default.

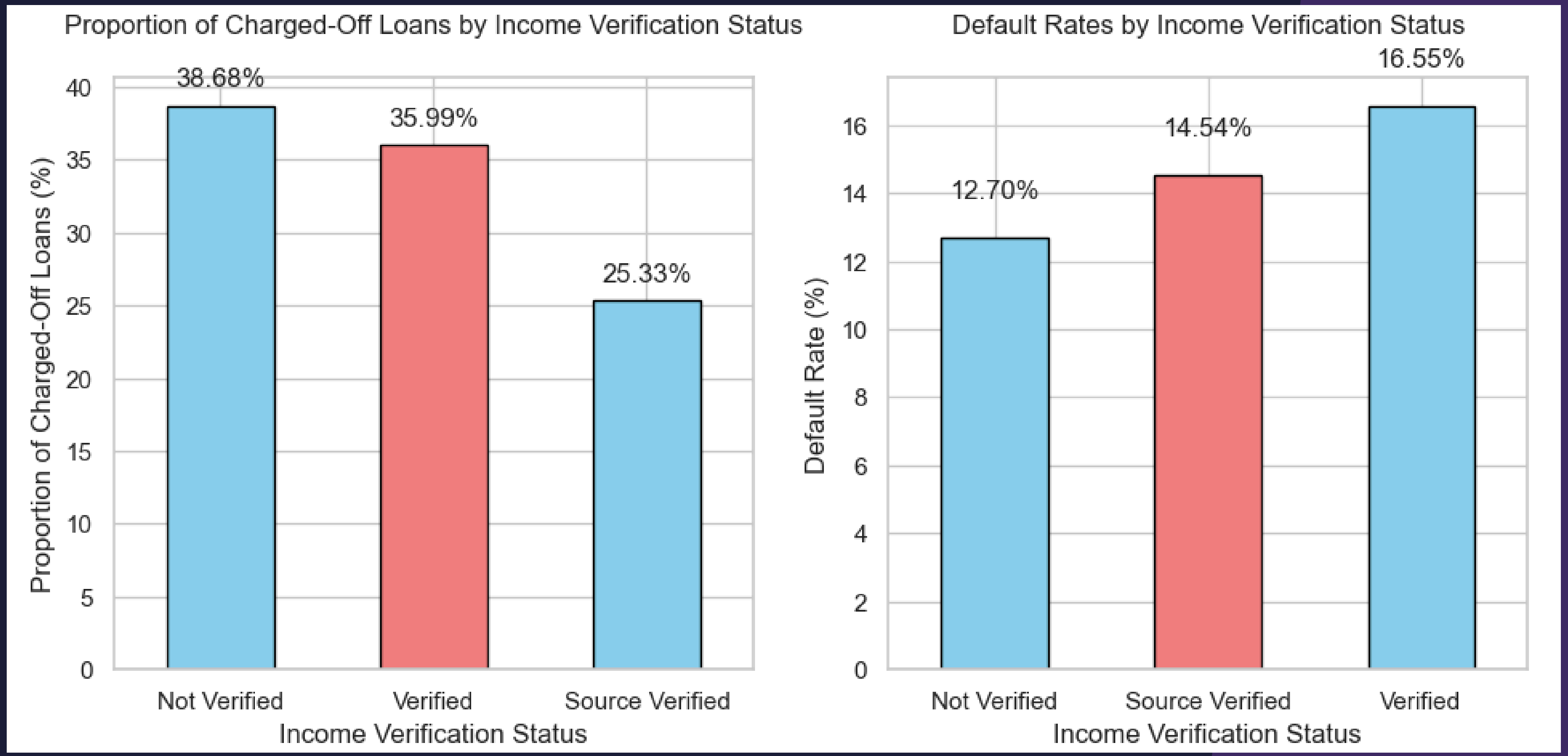


UNIVARIATE ANALYSIS

7. INCOME VERIFICATION STATUS

Finding :

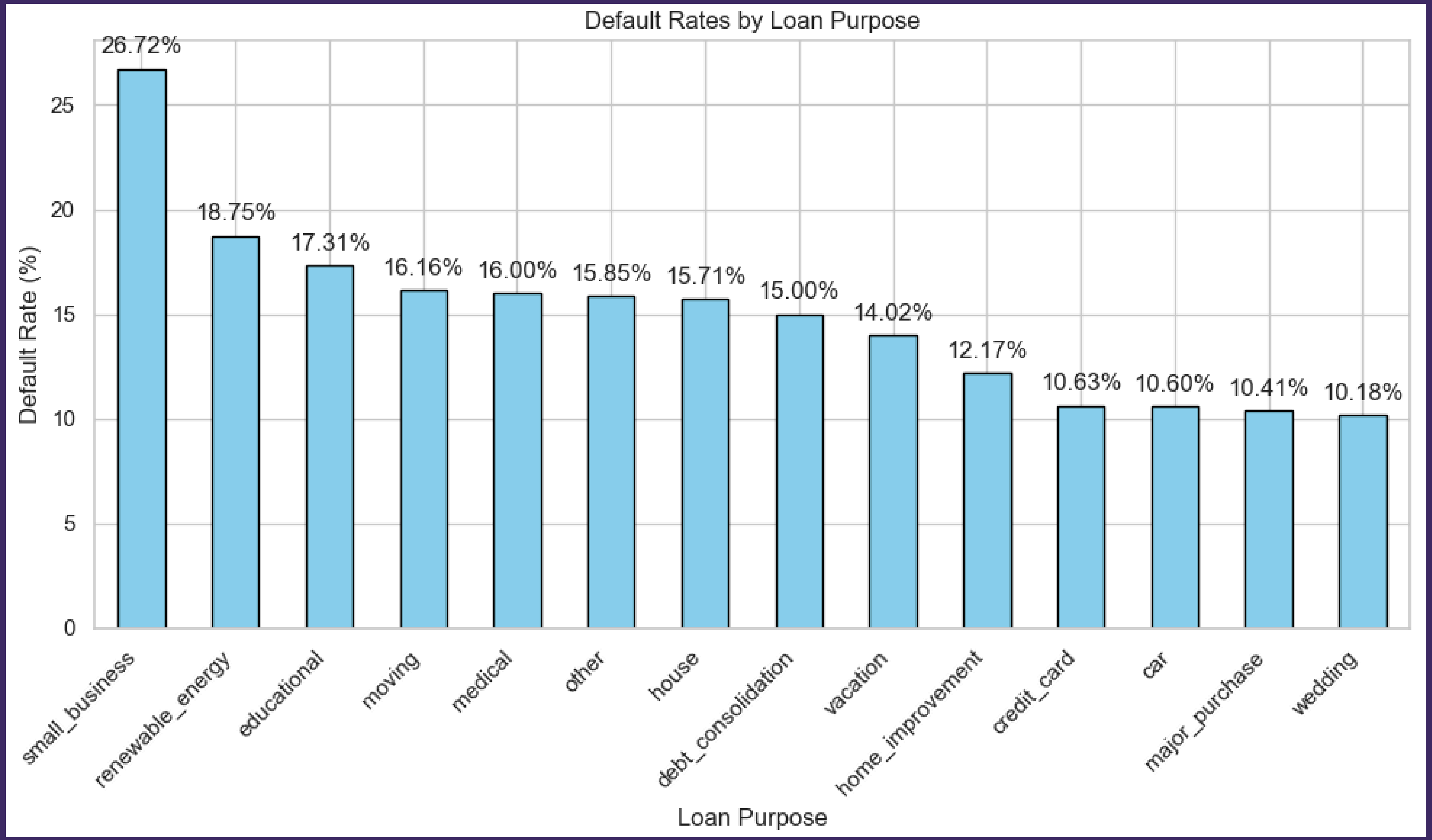
1. Borrowers with "Not Verified" income have a slightly lower default rate(12.70%) compared to " Source Verified" borrowers(14.54%), indicating a potential discrepancy in income reporting.
2. "Verified" borrowers exhibit the highest default rate(16.55%) among the three categories, suggesting a need for more rigorous income verification procedures.
3. Income verification status serves as a moderately strong indicator of loan default, highlighting its importance in assessing borrower risk.



8. LOAN PURPOSE

Finding :

1. Certain loan purposes, particularly "small_business", "renewable_energy", and "educational", are strongly correlated with increased default rates.
2. Understanding the underlying reasons for the elevated default risk in these loan categories is crucial for implementing targeted risk management measures.

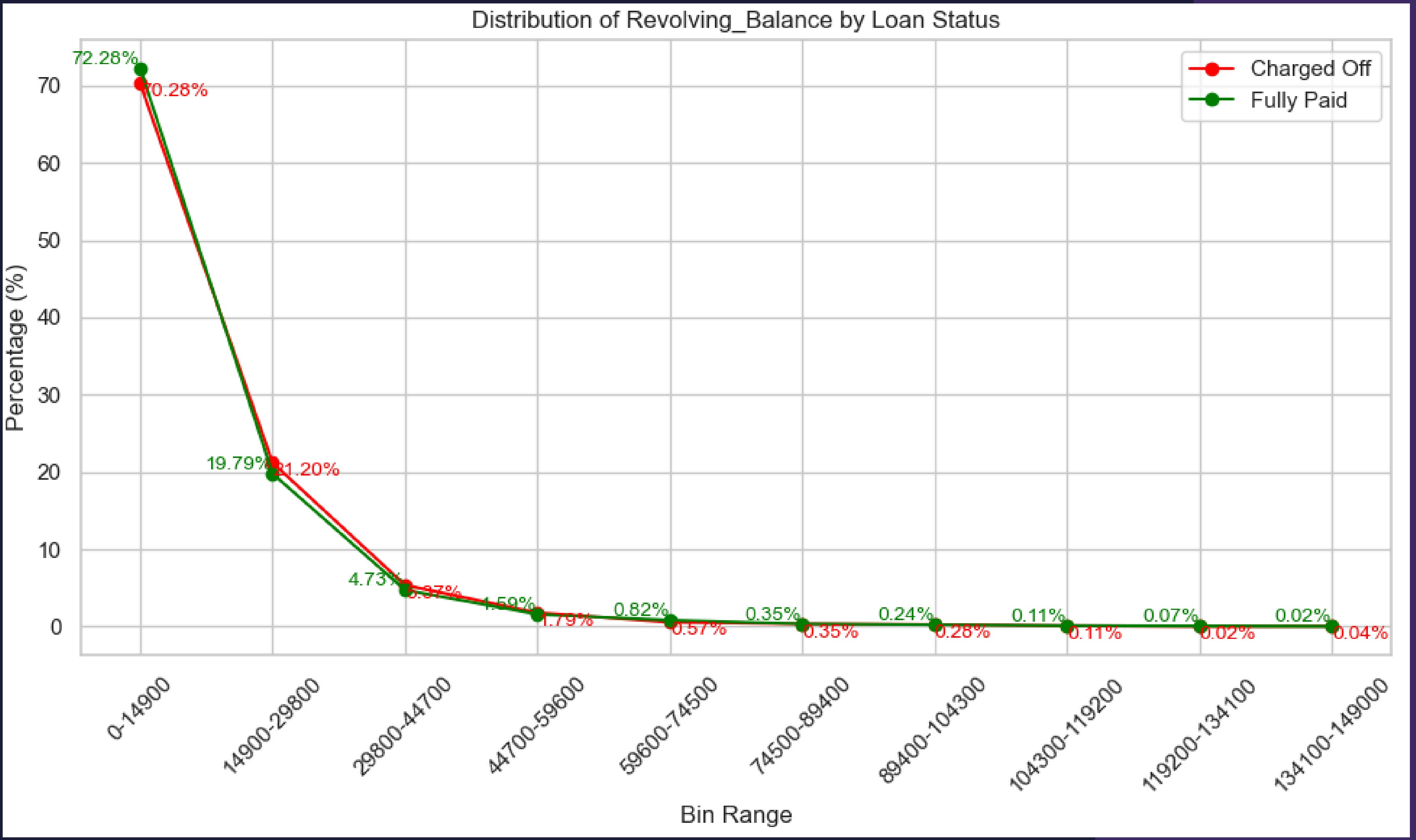


UNIVARIATE ANALYSIS

9. REVOLVING BALANCE

Finding :

- Borrowers with higher revolving balances are less prone to default, implying a potential correlation between financial stability and revolving balances.
- Understanding the dynamics of revolving balances can aid in refining risk assessment strategies and identifying borrowers with lower default probabilities.



OBSERVATION :

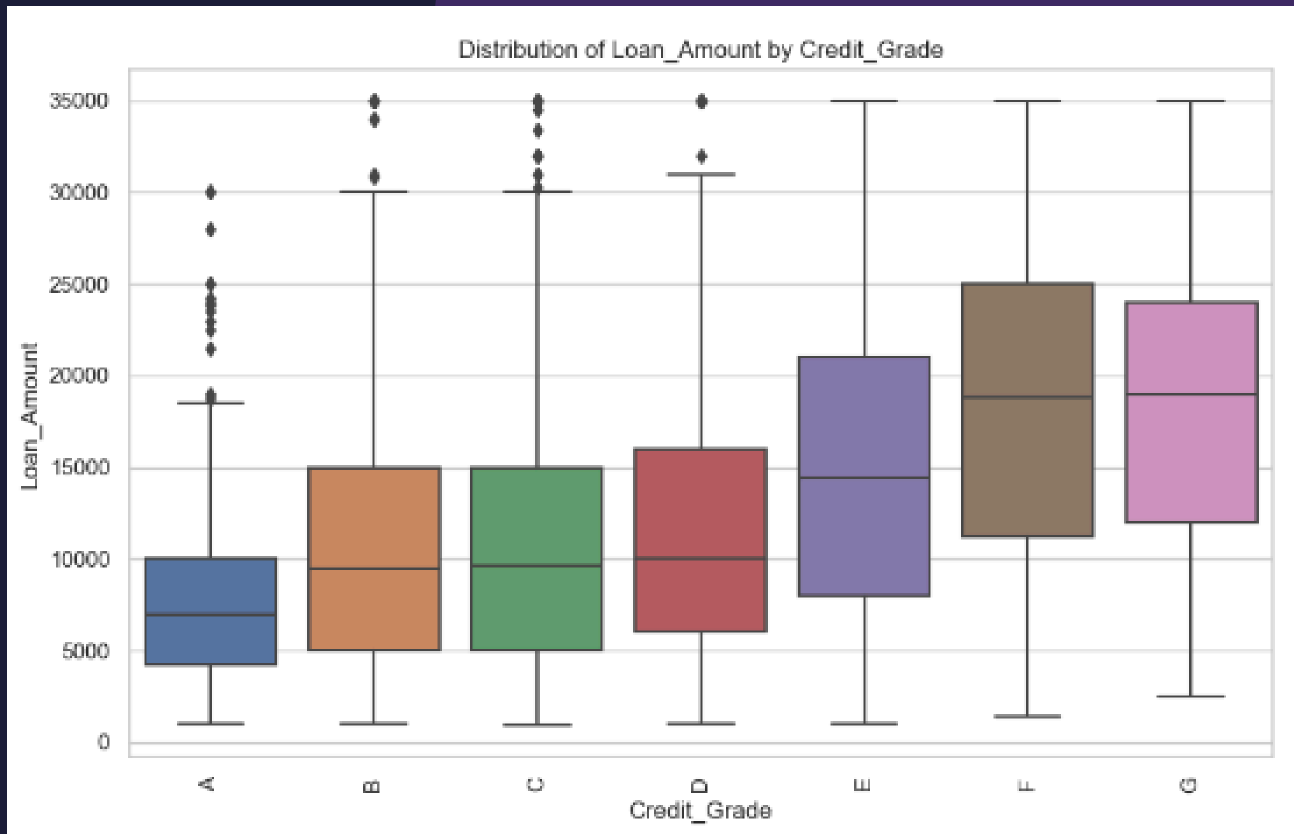
Variable	Risk Factor	Key Insight
Loan Amount	Higher loan amounts	Correlate with increased default risk
Interest Rate	11–15% interest rate range	Concentrated default risk
Credit Grade	Lower grades (F and G)	Significantly higher default percentages
Debt-to-Income Ratio	Higher DTI levels (12–21%)	Greater likelihood of default
Number of Delinquencies	Six or more delinquencies	Higher default rates
Home Ownership Status	Renters	Exhibit higher default rates compared to homeowners
Income Verification	"Verified" income	Highest default rate
Loan Purpose	"Small business", "renewable_energy", "educational"	High-risk purposes
Revolving Balance	Lower balances	Associated with higher default rates

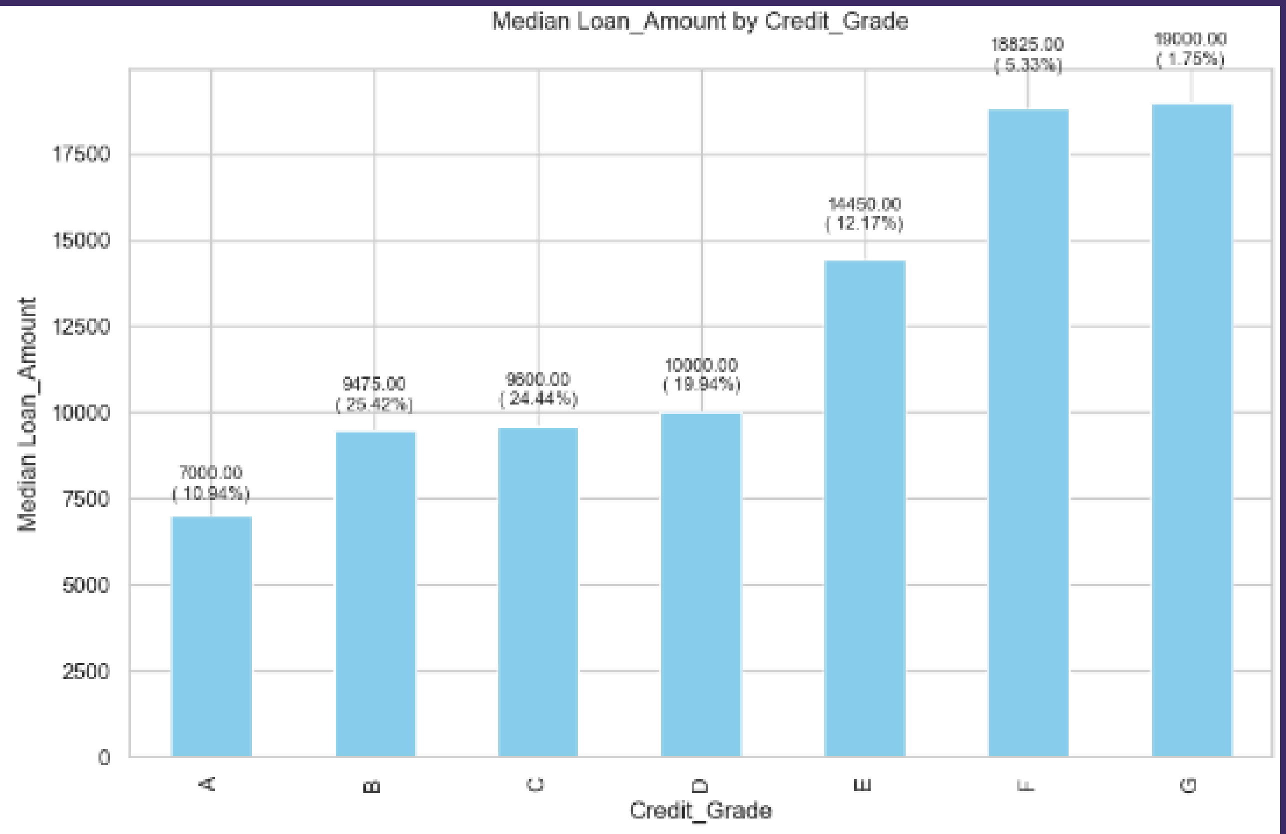
RECOMMENDATIONS:

Variable	Recommendation
Loan Amount	Implement stricter approval criteria for higher loan amounts
Interest Rate	Consider both interest rates and credit grades when assessing applications
Credit Grade	Focus on improving credit scores of applicants to reduce default risk
DTI	Monitor borrowers with higher DTI ratios more closely
Delinquencies	Consider past delinquencies as a strong predictor of default risk
Home Ownership	Exercise caution when lending to renters
Income Verification	Strengthen income verification processes, especially for "Source Verified" borrowers
Loan Purpose	Apply stricter criteria or higher interest rates for high-risk loan purposes
Revolving Balance	Pay closer attention to borrowers with lower revolving balances

SEGMENTED UNIVARIANT ANALYSIS

1. LOAN AMOUNT SEGMENTED BY CREDIT GRADE

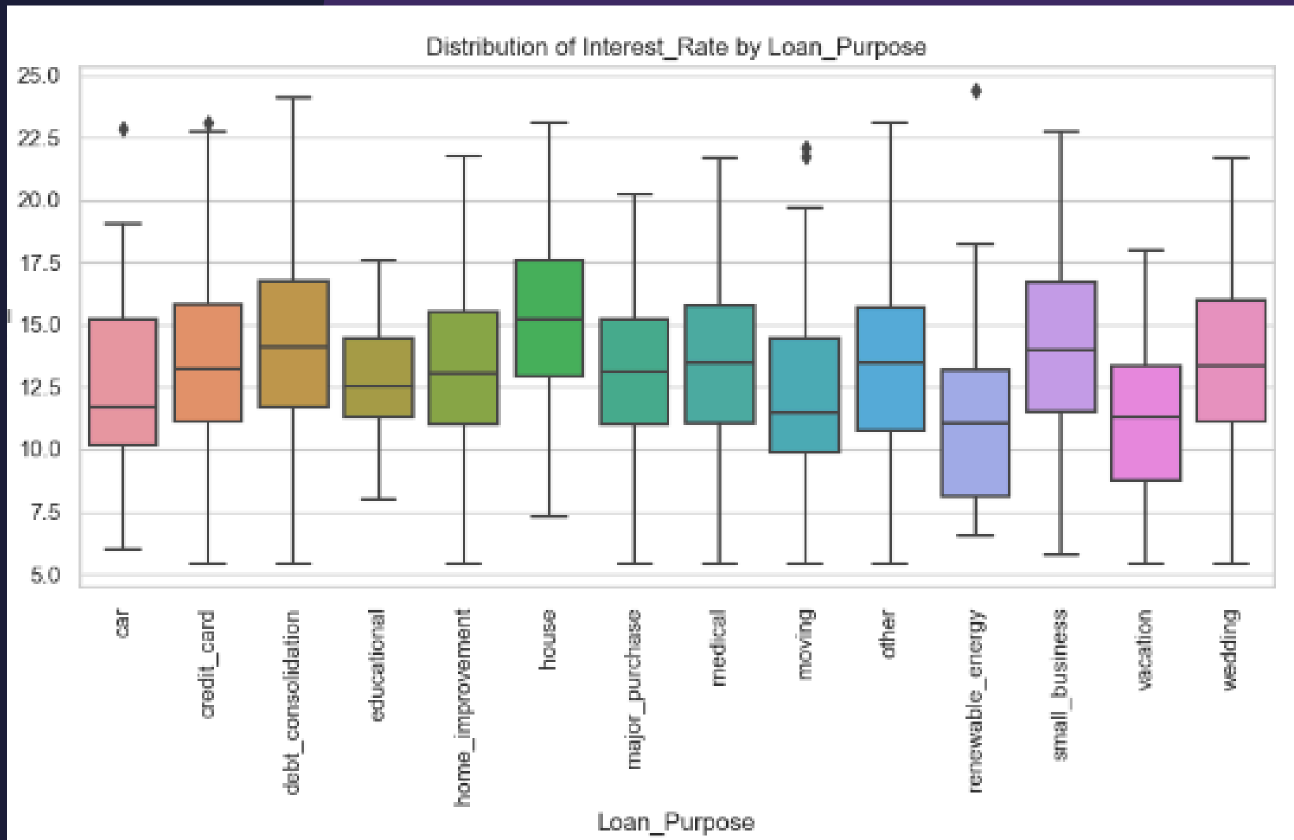


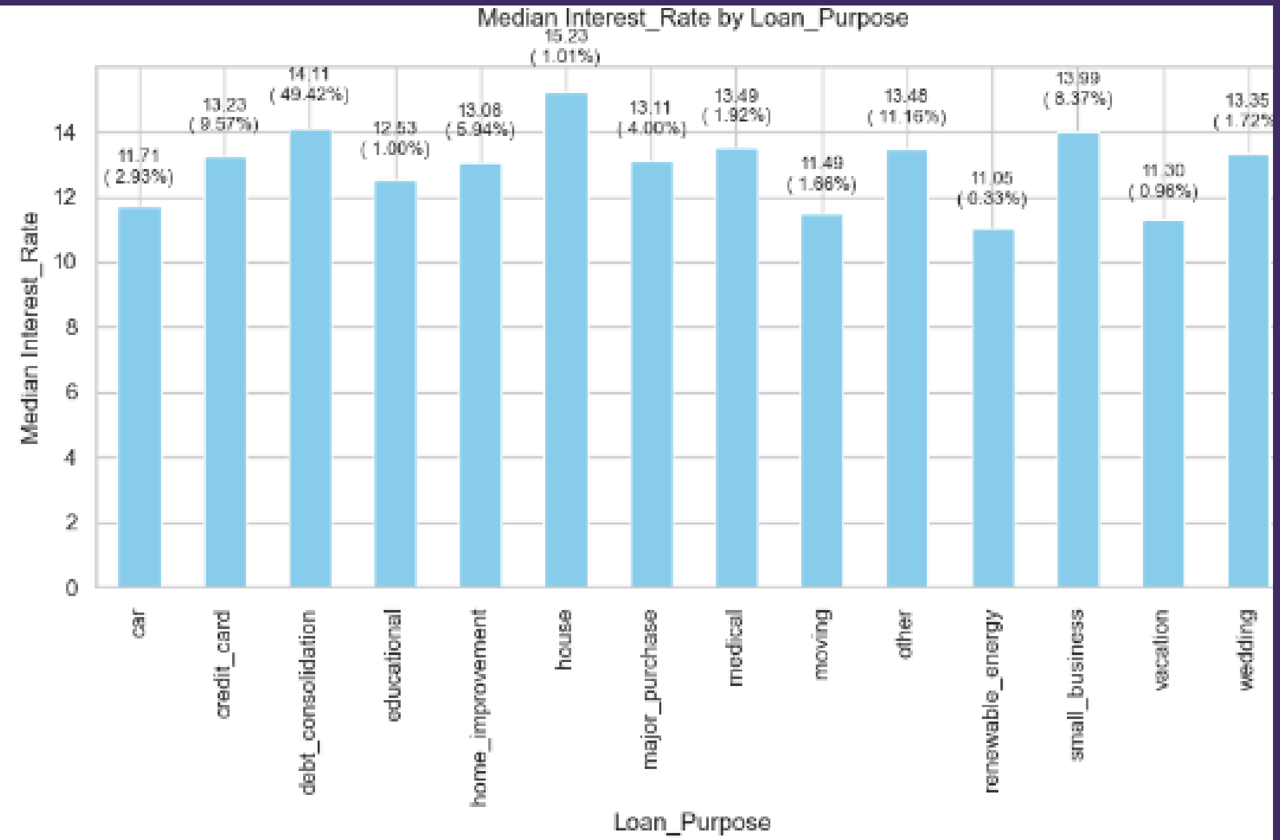


Finding :

1. Credit Grade and Loan Amount: As the credit grade decreases from 'A' to 'G', there is a trend of increasing median loan amounts, with lower credit grades typically associated with higher loan amounts.
2. Loan Amount Dispersion: There is greater dispersion in loan amounts among lower credit grades (E, F, G), B,C and D show high default rates .

2. INTEREST RATE SEGMENTED BY LOAN PURPOSE





Finding :

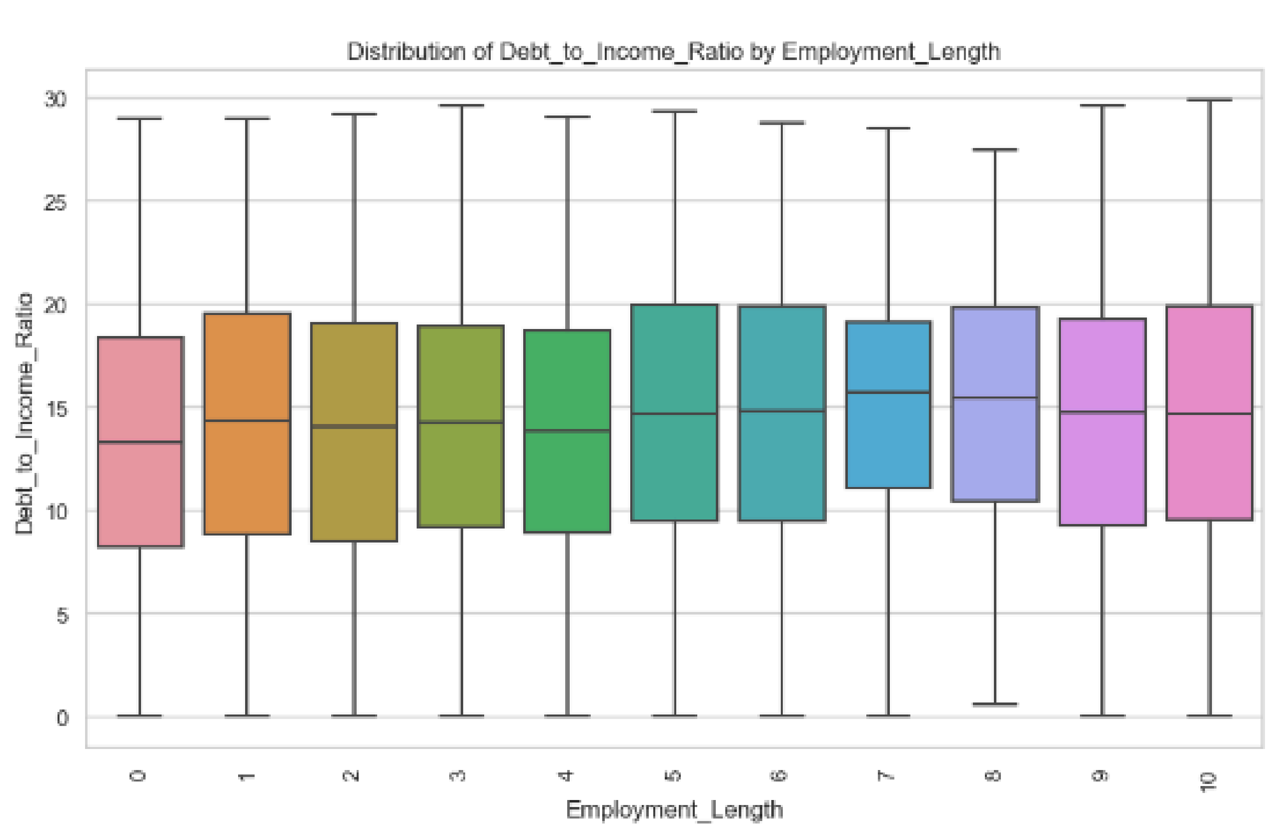
1. Interest Rate Variability: Interest rates range from approximately 11.56% for "vacation" loans to 15.16% for "house" loans. "Debt_consolidation" loans have the highest median interest rate at 14.11%, followed by "small_business" loans at 13.99%.
2. Default Rates and Loan Purpose: "Debt_consolidation" loans exhibit the highest default rate of 49.42%, despite having high median interest rates. Conversely, "renewable_energy" loans have a lower median interest rate of 11.05% and a low default rate of 0.33%.

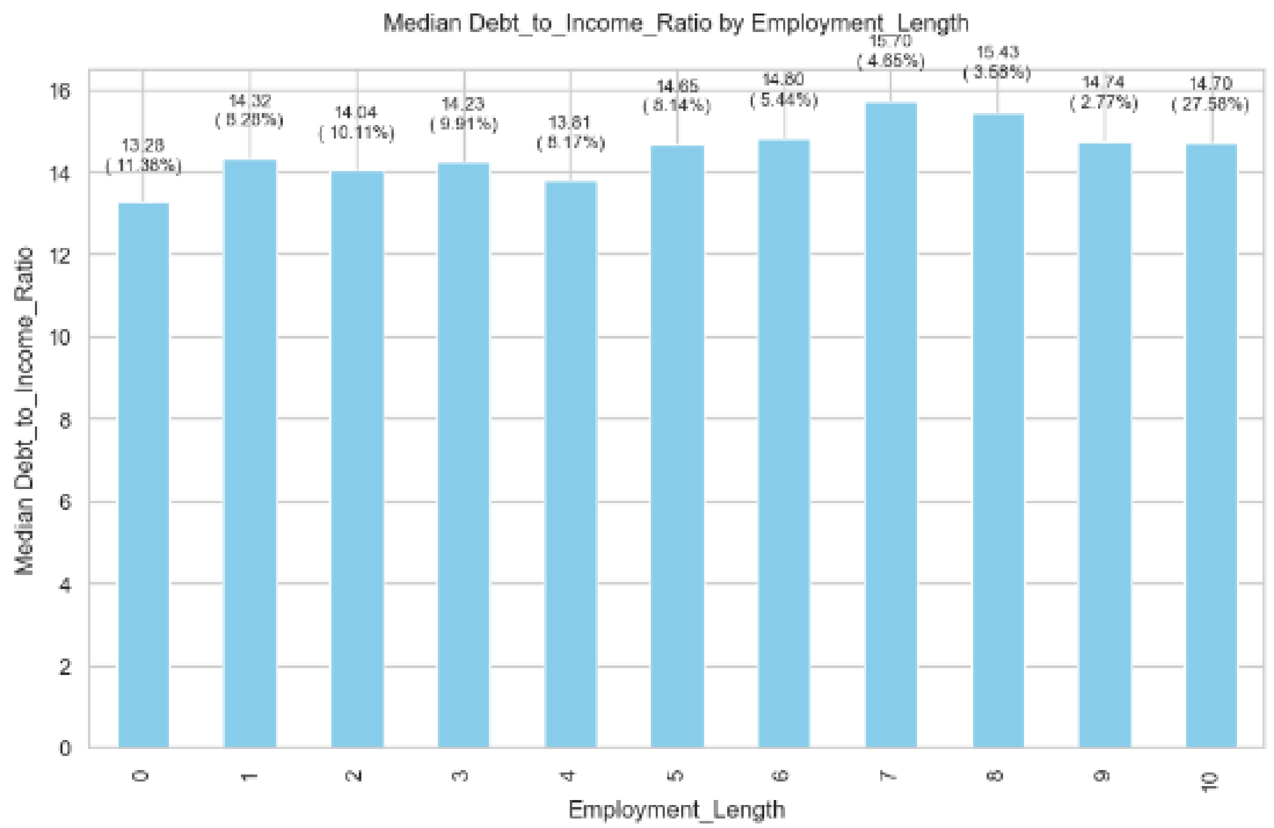
SEGMENTED UNIVARIANT ANALYSIS

3. DEBT-TO-INCOME RATIO SEGMENTED BY EMPLOYMENT LENGTH

Finding :

1. Short Employment Length Risk: Borrowers with less than 1 year of employment have higher default rates, indicating short employment length as a risk factor.
2. Stable Employment: Default rates decrease with longer employment, showing that stable employment histories reduce default risk.
3. Anomalous High Default Rate: The high default rate for borrowers with exactly 10 years of employment requires further investigation.

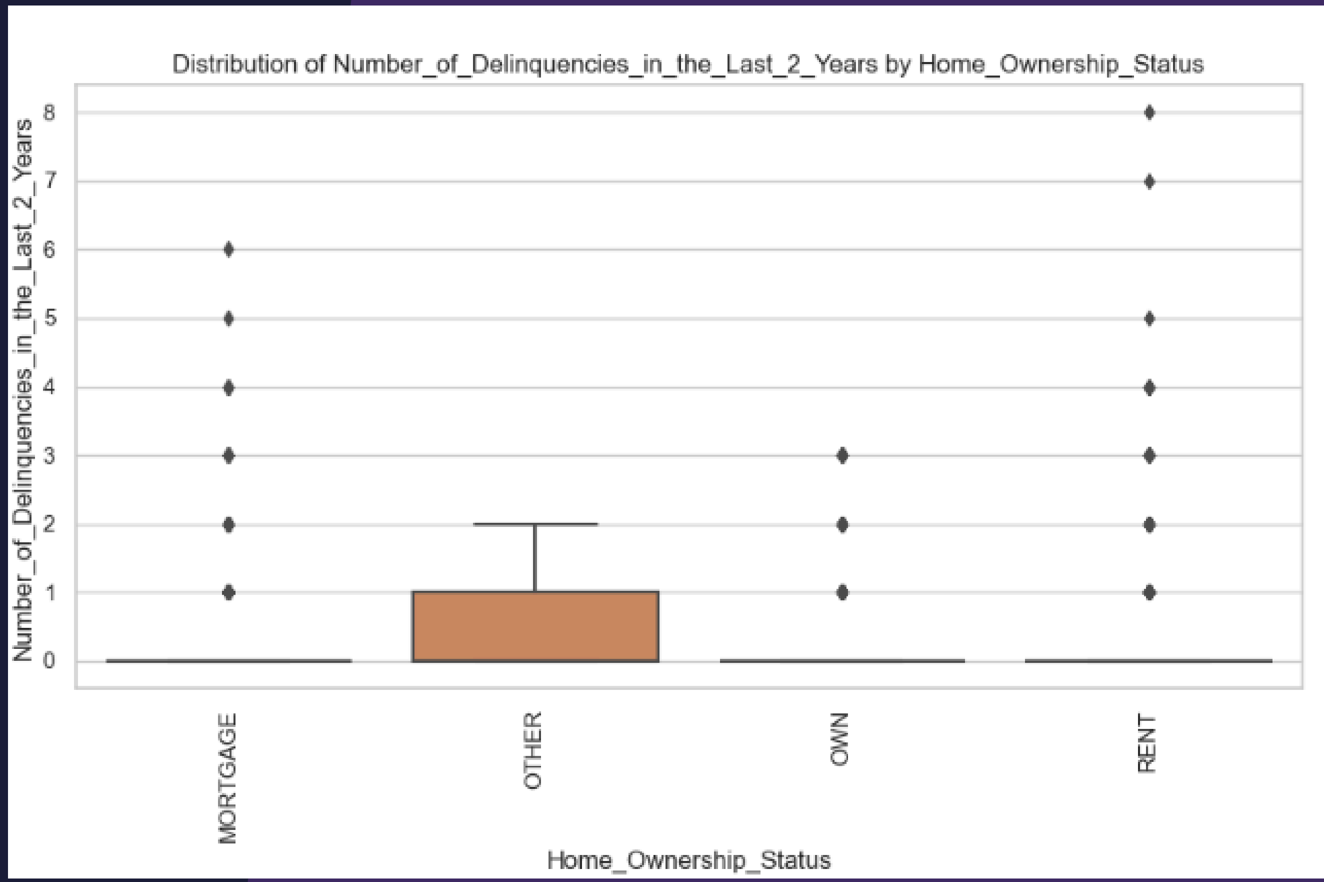


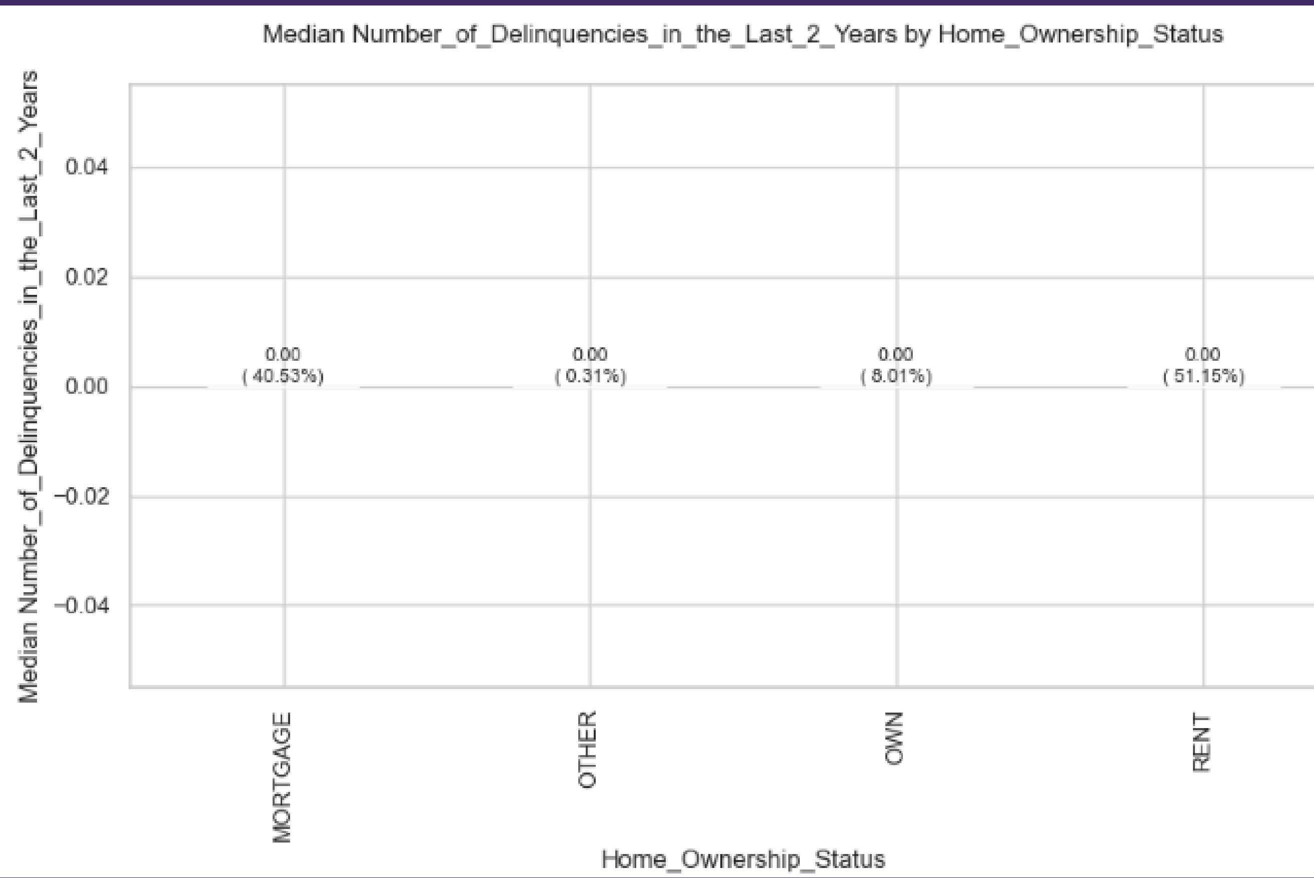


4. NUMBER OF DELINQUENCIES SEGMENTED BY HOME OWNERSHIP STATUS

Finding :

1. Borrowers with a 'RENT' status exhibit the highest median number of delinquencies at 0.00, yet they also have the highest default rate of 51.15%. This suggests that despite having a lower median number of delinquencies, renters are more likely to default on their loans compared to borrowers with other home ownership statuses.
2. The distribution of delinquencies varies across different home ownership statuses. While 'RENT' and 'MORTGAGE' categories have similar median delinquency values (0.00), the default rates differ significantly, indicating that factors other than the number of delinquencies may influence default risk.



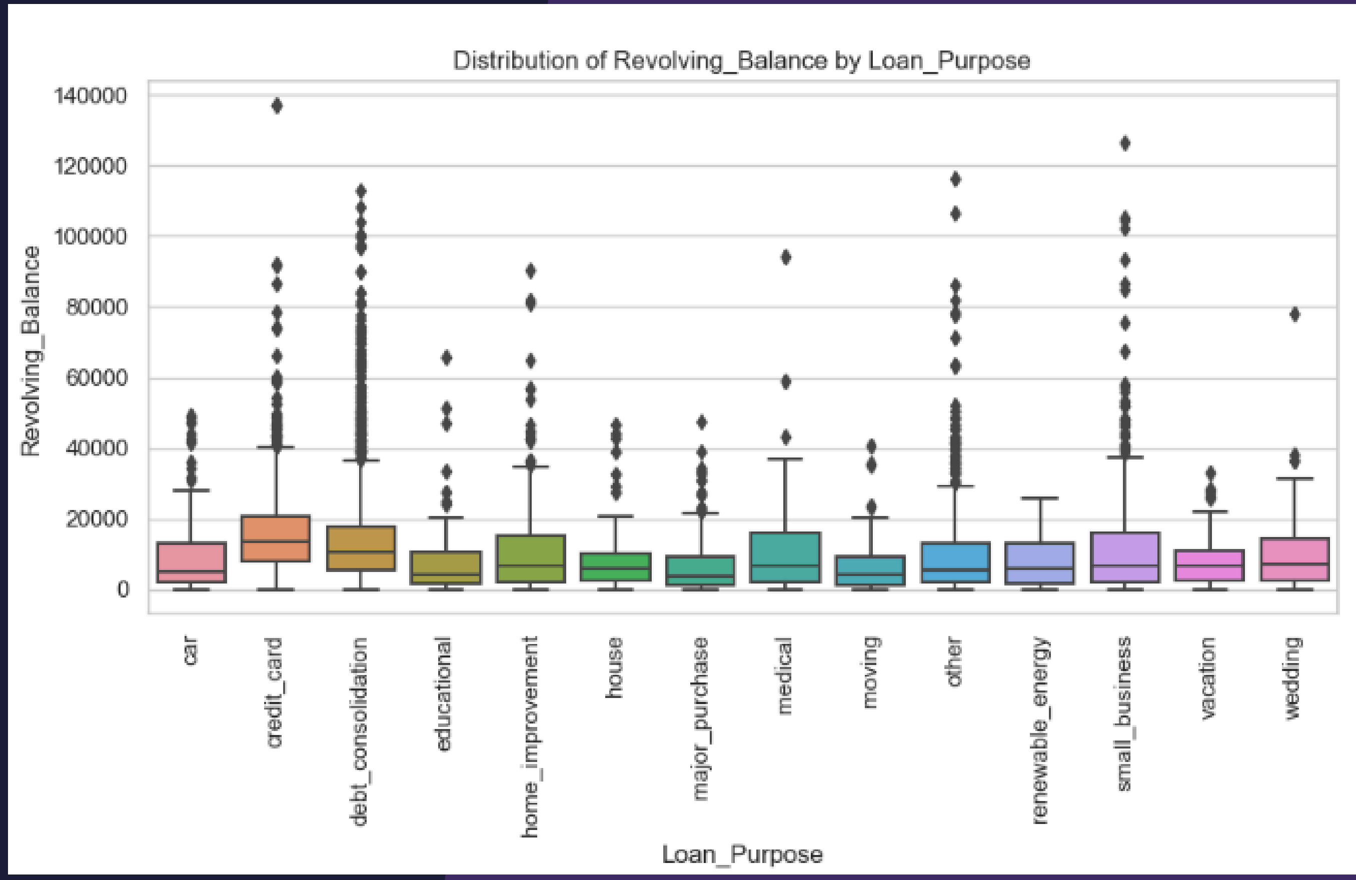


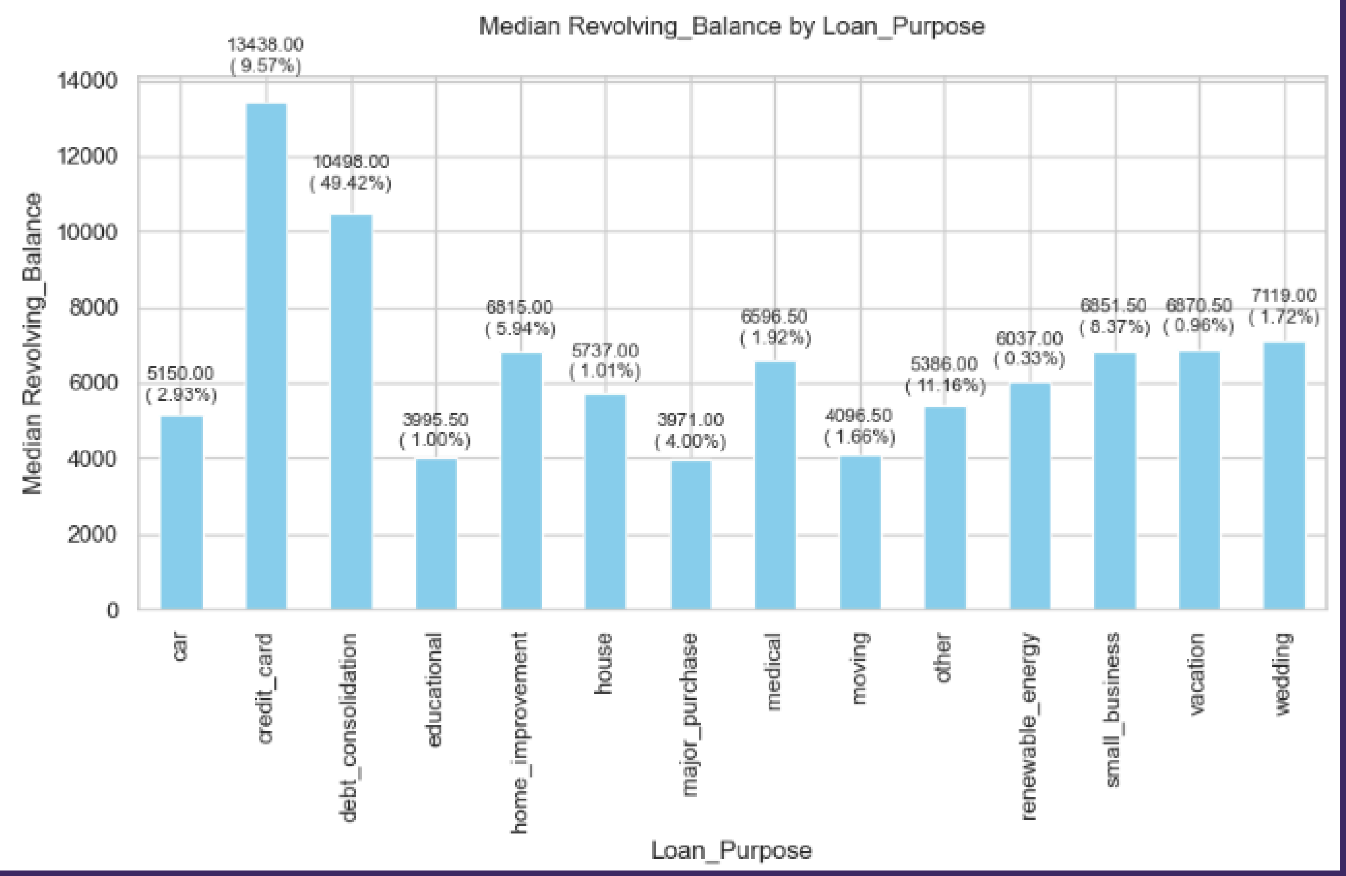
SEGMENTED UNIVARIANT ANALYSIS

5. REVOLVING BALANCE SEGMENTED BY LOAN PURPOSE

Finding :

1. High Balances, High Risk: Loan purposes associated with high median revolving balances, such as "credit_card" and "debt_consolidation", also exhibit higher default rates (9.57% and 49.42% respectively), indicating potential risk associated with higher borrowing amounts.
2. Low Balances, Low Risk: Conversely, loan purposes with lower median revolving balances, like "renewable_energy" and "vacation", have lower default rates (0.33% and 0.96% respectively), suggesting that borrowers with lower revolving balances may be less likely to default on their loans.

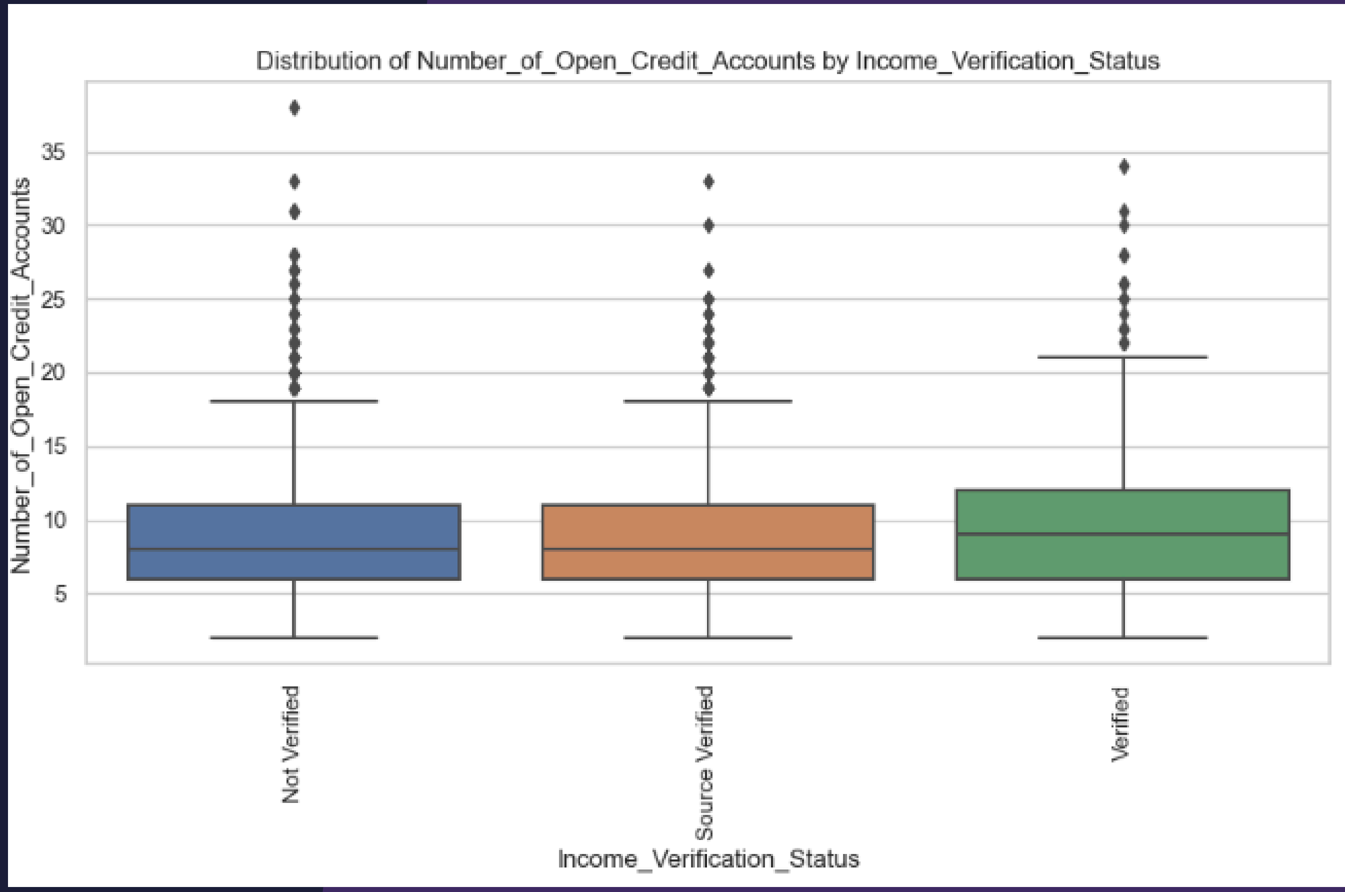


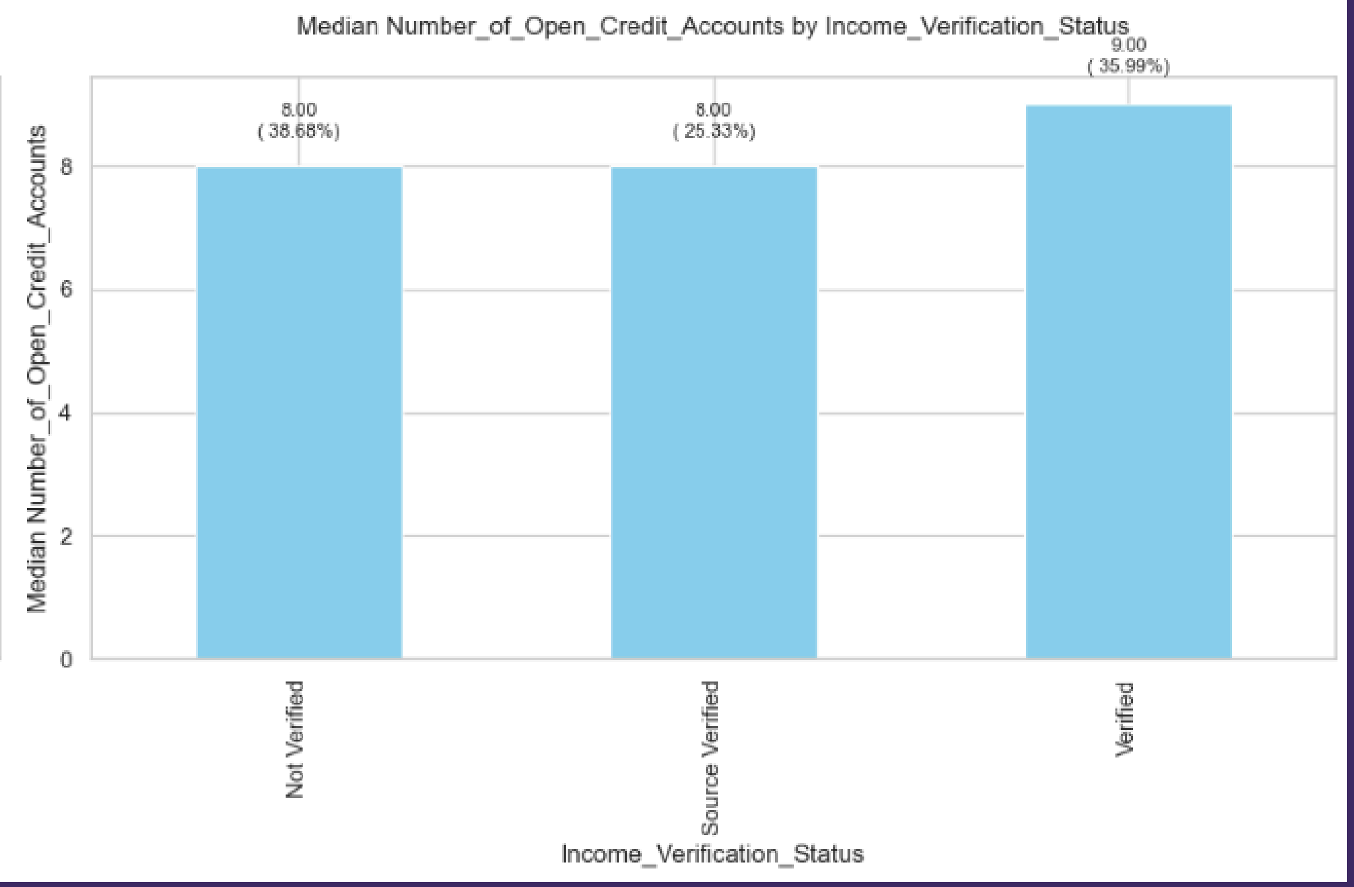


6. NUMBER OF OPEN CREDIT ACCOUNTS SEGMENTED BY INCOME VERIFICATION STATUS

Finding :

1. Not Verified: These borrowers have the highest default rate at 38.68%, despite having a similar number of open credit accounts as Source Verified .
2. Source Verified: These borrowers have the lowest default rate at 25.33%, indicating that source verification is an effective measure in reducing default risk.
3. Verified: Borrowers with fully verified income have a default rate of 35.99%, slightly lower than those with unverified income but still relatively high.
4. This suggests that income verification status is a more significant predictor of default than the number of open credit accounts.





OBSERVATION :

Variable	Segment	Risk Factor	Key Insights
Loan Amount	Credit Grade	Higher credit grades(B,C,D)	Higher default rates are associated with credit grades B,C,D.
Interest Rate	Loan Purpose	High-risk loan purposes	Loan purposes such as "Debt Consolidation" and "Small Business" have higher default rates despite higher interest rates. Conversely, "Renewable Energy" exhibits lower interest rates and lower default rates, suggesting a safer borrowing option.
Debt-to-Income Ratio	Employment Length	Shorter employment length	Borrowers with less than 1 year of employment have higher debt-to-income ratios and higher default rates, indicating that shorter employment lengths are a risk factor for loan defaults. Borrowers with longer employment lengths tend to have lower default rates, highlighting the importance of employment stability.
Number of Delinquencies	Home Ownership Status	Renters	Borrowers who own homes have lower default rates compared to renters. Renters exhibit higher default rates. any number of delinquencies greater than 0 increases the likelihood of default, especially for renters
Revolving Balance	Loan Purpose	High-risk loan purposes	Loan purposes such as "credit_card" and "debt_consolidation" have higher revolving balances and higher default rates. "Renewable_energy" and "vacation" loans have lower balances and lower default rates. Encourage borrowers to use loans for purposes with lower default rates, such as "renewable_energy" and "vacation".
Number of Open Credit Accounts	Income Verification Status	Higher number of open credit accounts	Borrowers with "Verified" income have a median of 9 open credit accounts and a high default rate of 35.99%. "Not Verified" and "Source Verified" borrowers have a median of 8 open credit accounts, with default rates of 38.68% and 25.33%, respectively.

RECOMMENDATIONS:

Variable	Segment	Recommendation
Loan Amount	Credit Grade	Focus on offering larger loans to borrowers with higher credit grades, as they are less likely to default.
Interest Rate	Loan Purpose	Implement stricter approval criteria or higher interest rates for high-risk loan purposes.
Debt-to-Income Ratio	Employment Length	Provide financial counseling or tailored loan terms to borrowers with shorter employment lengths to ensure manageable debt levels and reduce default risk.
Number of Delinquencies	Home Ownership Status	Offer financial education or assistance programs to renters to help reduce the likelihood of default.
Revolving Balance	Loan Purpose	Encourage borrowers to use loans for purposes with lower default rates, such as "renewable_energy" and "vacation".
Number of Open Credit Accounts	Income Verification Status	Implement stricter monitoring and approval criteria for borrowers with higher numbers of open credit accounts, especially those with "Not Verified" income statuses to reduce default risk.

KEY DRIVER VARIABLES OF LOAN DEFAULTS

Based on our comprehensive univariate and segmented univariate analysis, we have identified five critical variables that are strong indicators of loan defaults:

Variable	Univariate Analysis	Segmented Analysis	Key Insight	Recommendation
Credit Grade	Lower grades (F and G) associated with higher default rates.	Lower credit grades consistently show higher default rates.	Credit grade is a robust predictor of default, with lower grades indicating higher risk.	Implement stricter approval criteria for lower credit grades and provide financial counseling to improve creditworthiness.
Income Verification	"Not Verified" income: 12.70% default rate. "Verified" income: 14.54% default rate.	"Source Verified" income: 16.55% default rate.	Strong income verification correlates with lower default rates.	Strengthen income verification processes to ensure accurate assessment of borrower risk.
Debt-to-Income Ratio	Higher DTI ratios (12–21%) linked with increased default risk.	Higher DTI ratios(13.28 - 15.70) and shorter employment lengths correlate with higher default rates.	Monitoring and managing DTI ratios can mitigate default risk.	Closely monitor borrowers with higher DTI ratios and offer tailored loan terms to ensure manageable debt levels.
Interest Rates	11–15% interest rate range associated with higher default risk.	Higher interest rates (13.23 -14.11) particularly risky for "debt_consolidation" and "small_business" loans.	Interest rates are significant determinants of default risk, especially when combined with loan purpose.	Adjust interest rates based on loan purpose and borrower credit profile to mitigate default risk.
Home Ownership Status	Renters exhibit higher default rates compared to homeowners.	Renters show highest default rate despite similar delinquency rates.	Home ownership status is critical in assessing default risk, with renters being particularly high-risk.	Exercise additional caution when lending to renters, possibly incorporating more stringent criteria or higher interest rates.

DERIVED COLUMNS

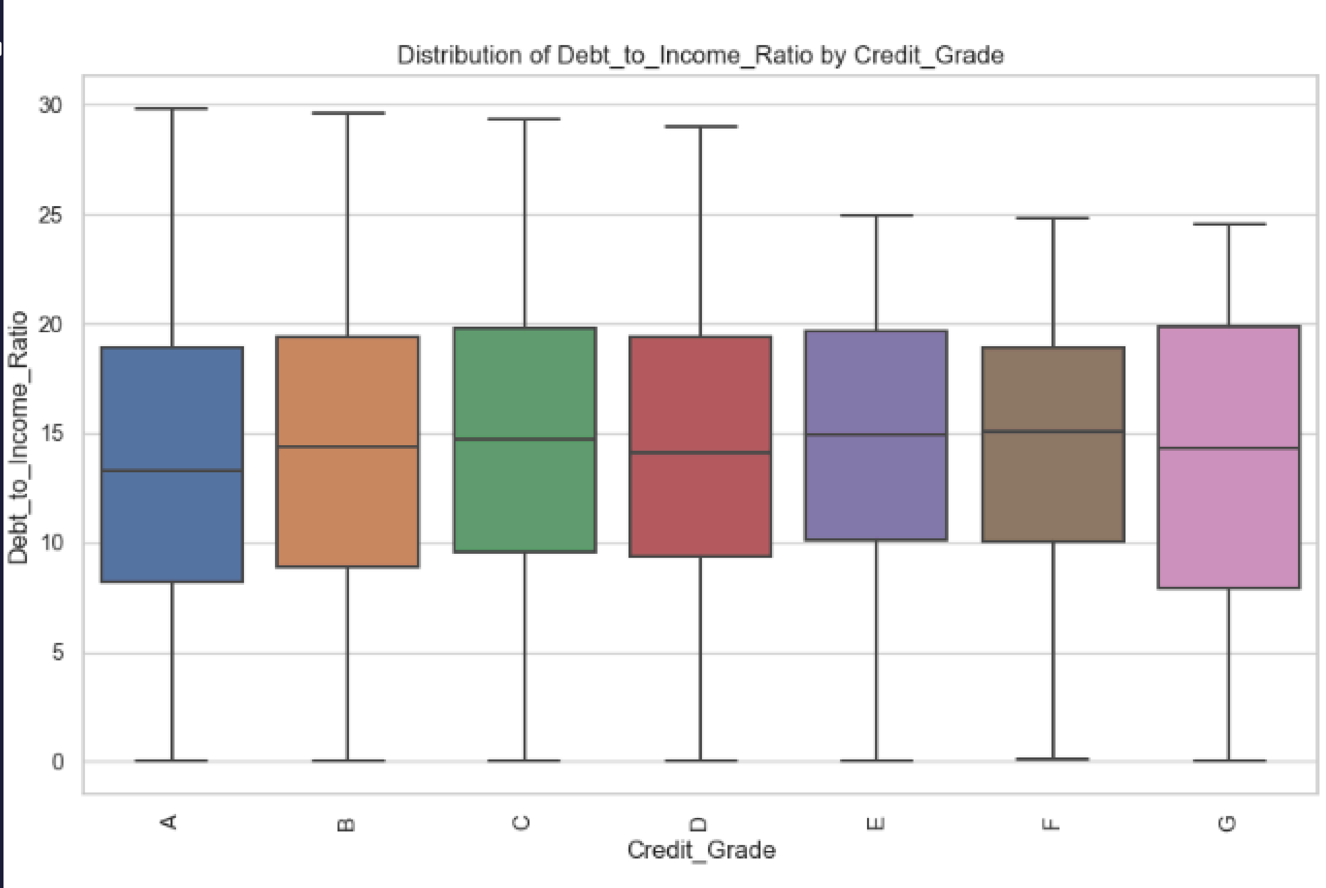
Derived Column	Definition	Importance	Calculation	Insight
Credit Utilization Ratio	Reflects the proportion of available credit being used.	Indicates financial strain and potential default risk.	Total credit card balances divided by total credit card limits.	Higher ratios suggest higher utilization and may indicate financial instability.
Number of Inquiries per Credit Account	Reflects the borrower's recent credit-seeking behavior.	May indicate financial instability and potential default risk.	Total number of credit inquiries divided by the number of credit accounts.	Higher inquiry rates may suggest frequent borrowing and financial distress.
Public Records per Credit Account	Provides insight into the borrower's financial history and any legal issues.	Impacts the borrower's ability to repay loans and indicates potential default risk.	Total number of public records (e.g., bankruptcies, liens) divided by the number of credit accounts.	Presence of public records may signal financial challenges and increase default risk.
Number of Delinquencies per Credit Account	Provides insight into the borrower's payment history.	Indicates the likelihood of default based on past delinquencies.	Total number of delinquencies divided by the number of credit accounts.	Higher delinquency rates suggest a history of missed payments and increased default risk.

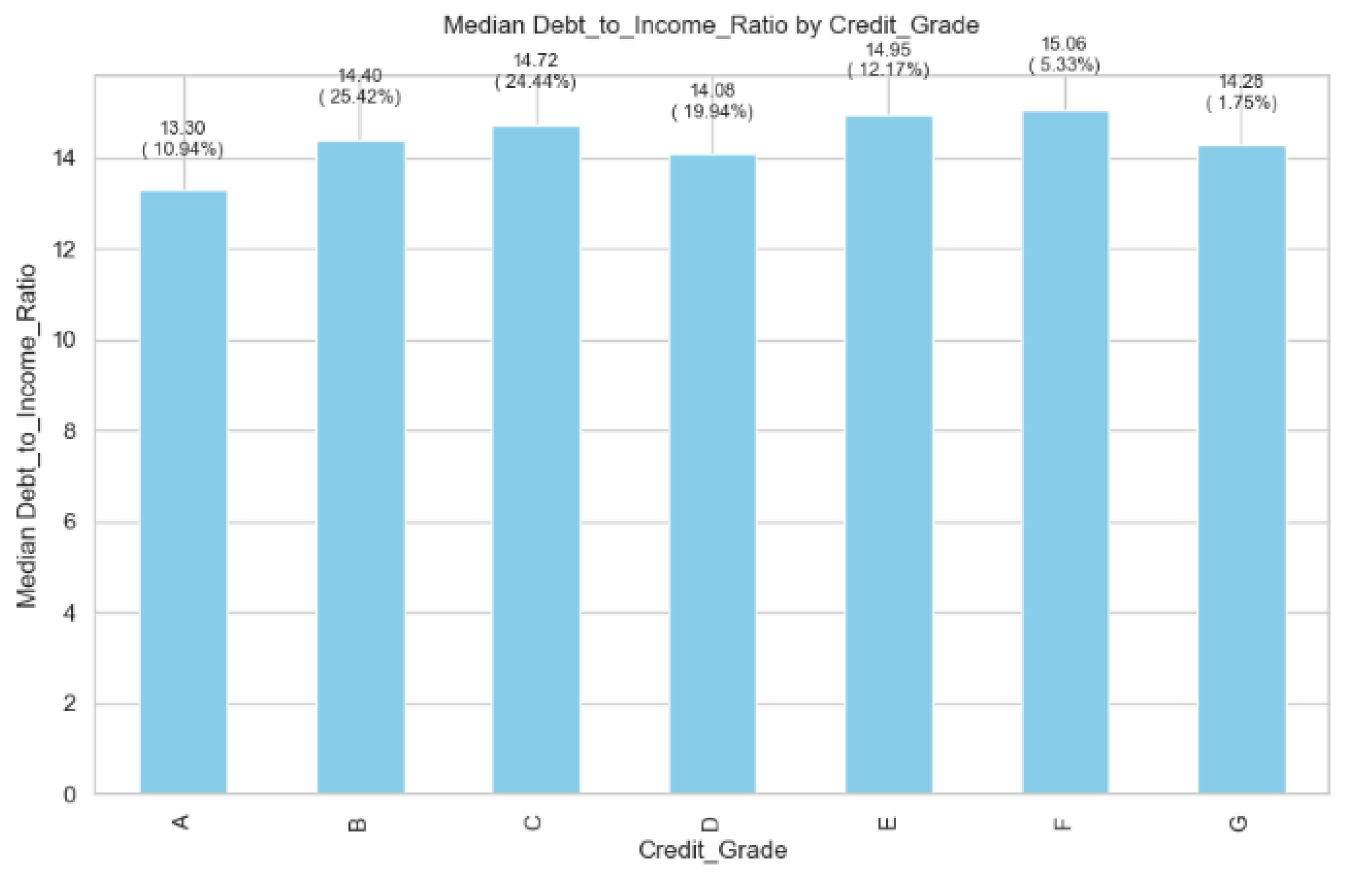
BIVARIATE ANALYSIS

1. CREDIT GRADE VS. DEBT-TO-INCOME RATIO

Finding :

1. While there's a general trend of increasing debt-to-income ratio with lower credit grades, the default rates don't strictly follow this pattern.
2. Credit grades B and C exhibit higher default rates (25.42 and 24.44) despite having slightly lower mean debt-to-income ratios compared to grades A and E.
3. These grades show higher median DTI values(> 13) and higher default rates that reflects the higher default risk associated with these credit grades.

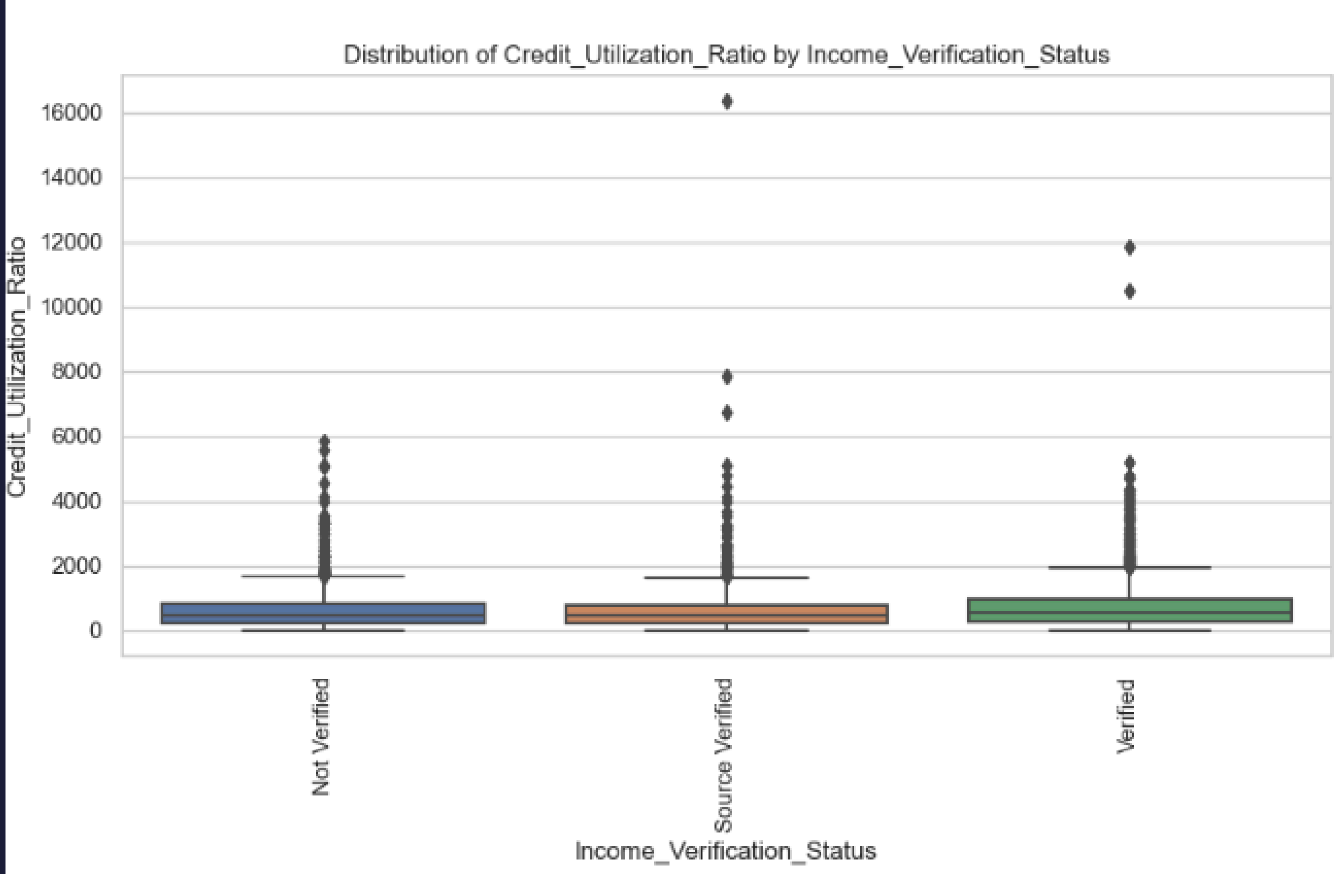


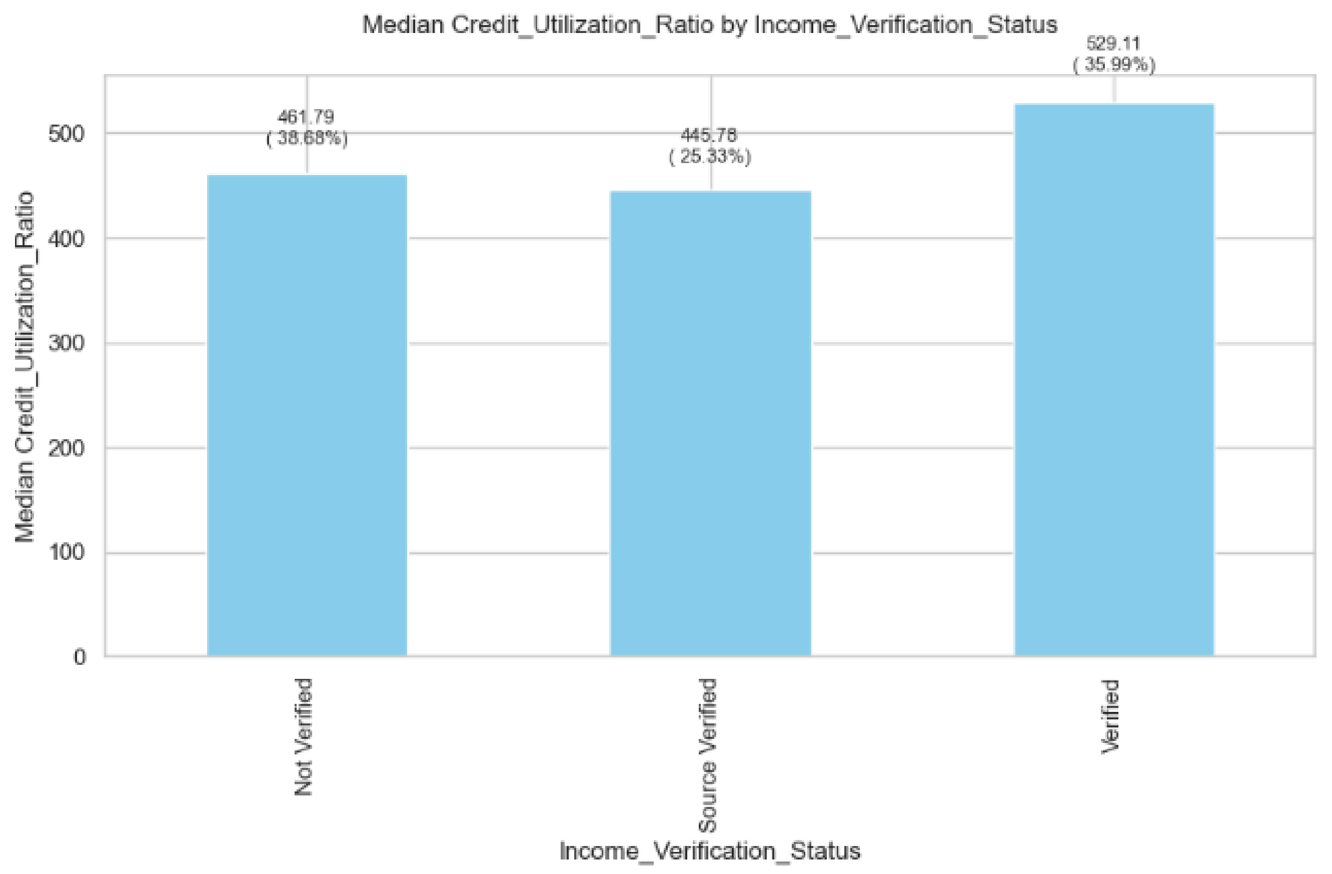


2. INCOME VERIFICATION STATUS VS. CREDIT UTILIZATION RATIO

Finding :

1. Borrowers with "Verified" income tend to have slightly higher median credit utilization ratios (529.11) compared to "Not Verified" (461.79) and "Source Verified" (445.78) borrowers.
2. Despite the differences in credit utilization ratios, all income verification statuses exhibit relatively high default rates, with "Not Verified" having the highest default rate (38.68%).



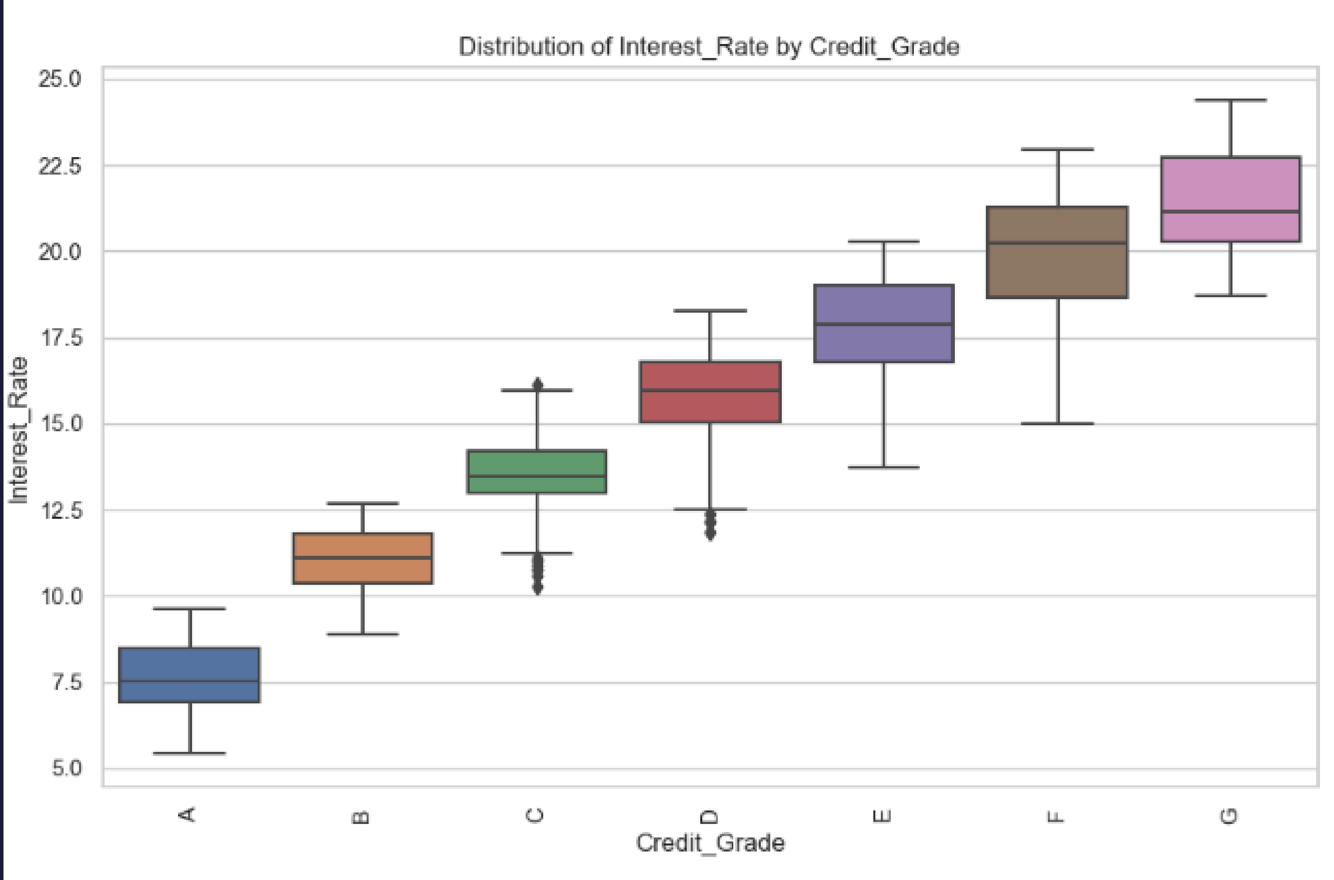


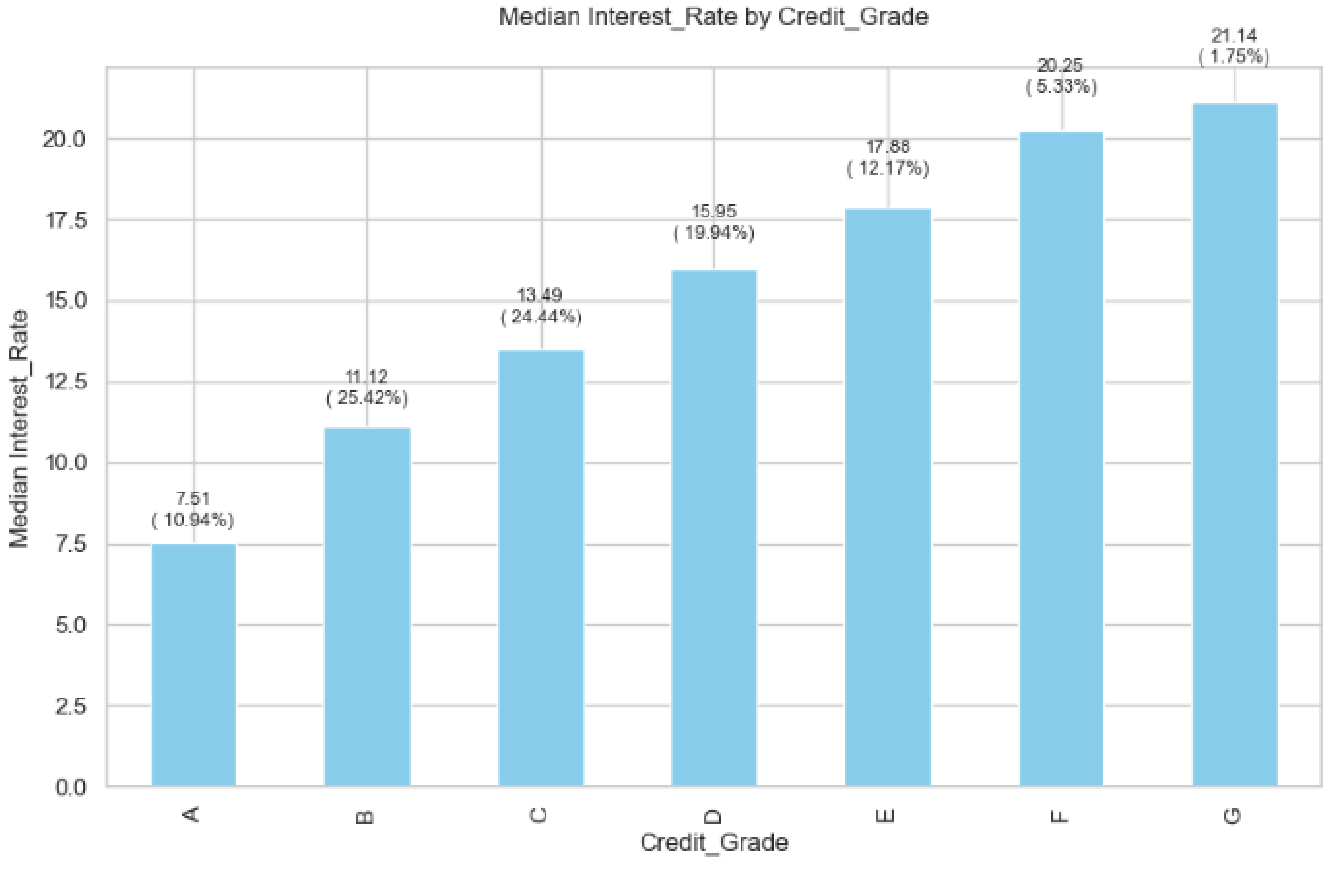
BIVARIATE ANALYSIS

3. CREDIT GRADE VS. INTEREST RATES

Finding :

1. There is a clear positive correlation between credit grade and interest rates. As the credit grade decreases from 'A' to 'G', the median interest rates increase consistently.
2. Borrowers with lower credit grades (e.g., 'F' and 'G') tend to have significantly higher interest rates compared to those with higher credit grades ('A' and 'B').
3. Despite the variation in interest rates, default rates also follow a similar pattern, with higher default rates observed among borrowers with lower credit grades.

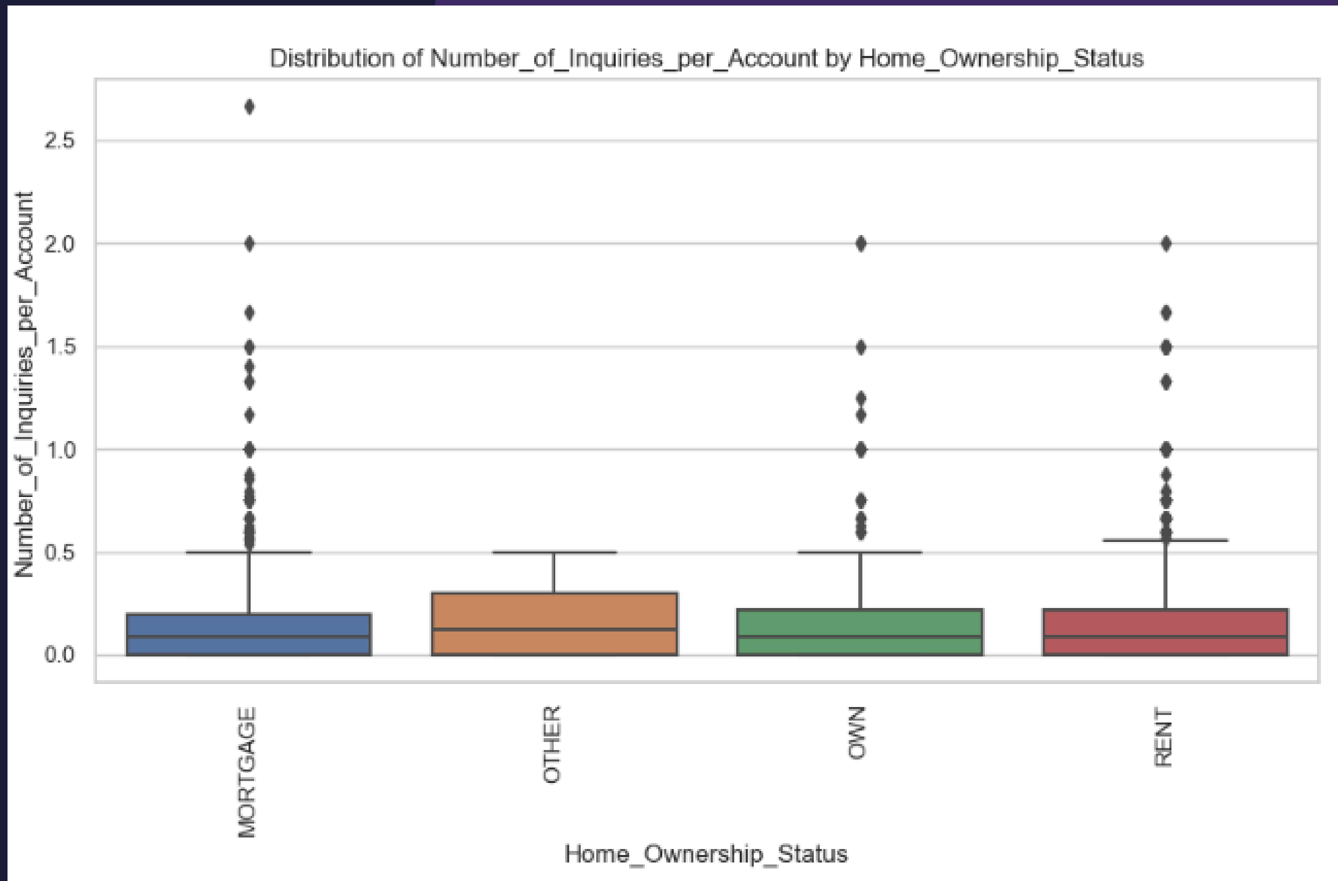


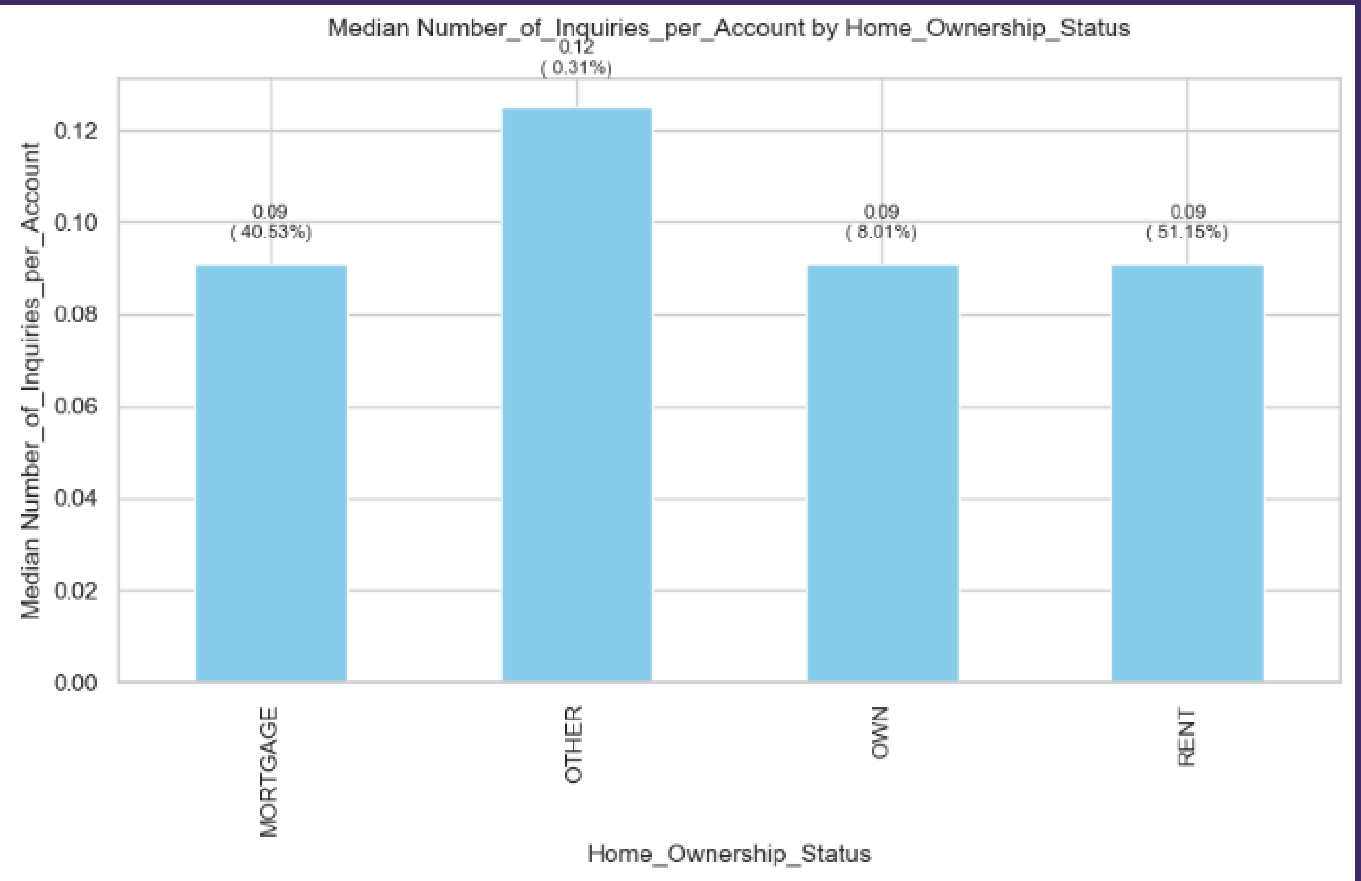


4. HOME OWNERSHIP STATUS VS. NUMBER OF INQUIRIES PER CREDIT ACCOUNT

Finding :

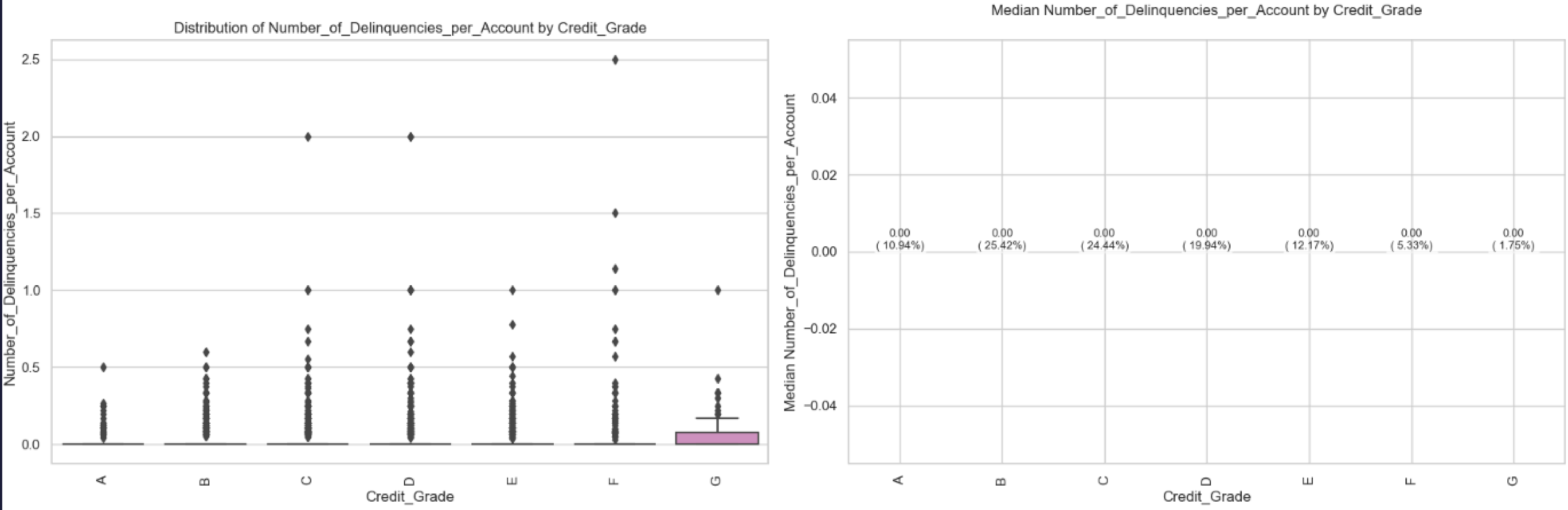
1. Given that the median number of inquiries for both high-risk groups (RENT and MORTGAGE) is 0.09, we can infer that any number of inquiries greater than this value increases the likelihood of default, especially for these categories.
2. Borrowers who rent their homes have the highest default rate (51.15%), followed by those with mortgages.(40.53%)





BIVARIATE ANALYSIS

5. CREDIT GRADE VS. NUMBER OF DELINQUENCIES PER CREDIT ACCOUNT

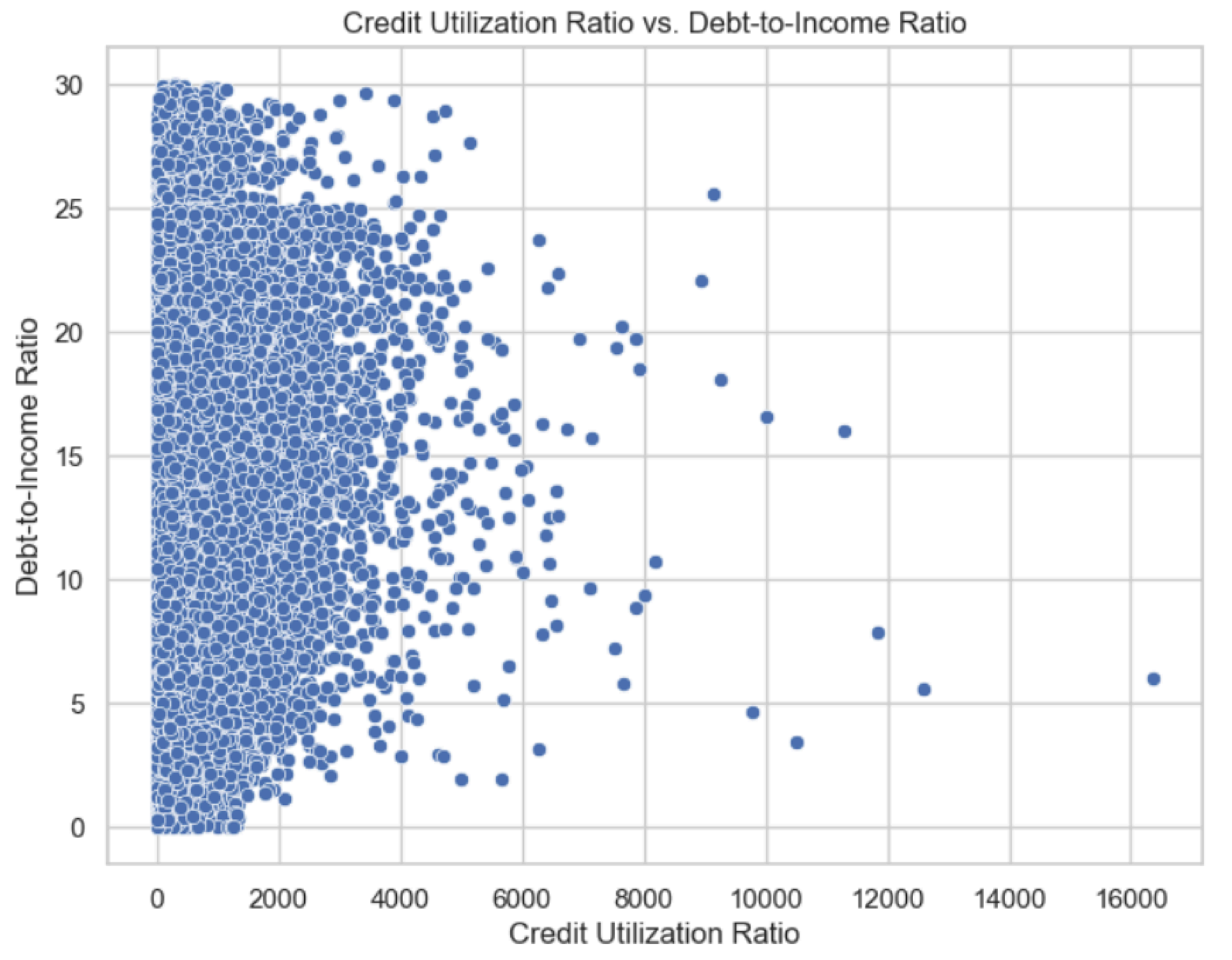


Finding :

1. There is a clear positive correlation between credit grade and interest rates. As the credit grade decreases from 'A' to 'G', the median interest rates increase consistently.
2. Borrowers with lower credit grades (e.g., 'F' and 'G') tend to have significantly higher interest rates compared to those with higher credit grades ('A' and 'B').
3. Despite the variation in interest rates, default rates also follow a similar pattern, with higher default rates observed among borrowers with lower credit grades.

BIVARIATE ANALYSIS

6. CREDIT UTILIZATION RATIO VS. DEBT-TO-INCOME RATIO



Finding :

1. There is a positive correlation between credit utilization ratio and debt-to-income ratio, indicating that borrowers who utilize a higher proportion of their available credit tend to have higher debt-to-income ratios.
2. Higher debt-to-income ratios are associated with increased default risk, as borrowers may struggle to manage their debt obligations relative to their income.

OBSERVATION :

Variable	Segment	Risk Factor	Key Insights
Credit Grade	Debt-to-Income Ratio	High Debt-to-Income Ratio > 13	Borrowers with higher credit grades tend to have lower debt-to-income ratios on average. As credit grade decreases, the mean debt-to-income ratio tends to increase, indicating higher financial strain among borrowers with lower credit grades.
Income Verification Status	Credit Utilization Ratio	High Credit Utilization Ratio > 0.6	Borrowers with "Verified" income status tend to have higher credit utilization ratios on average (Mean: 714.39) compared to those with "Not Verified" (Mean: 606.78) or "Source Verified" (Mean: 608.96) status. Higher credit utilization ratios may indicate increased financial risk.
Credit Grade	Interest Rates	High Interest Rate	Lower credit grades are associated with higher interest rates on loans. As credit grade improves, there is a general trend of decreasing interest rates, indicating that borrowers with better creditworthiness receive more favorable loan terms
Home Ownership Status	Number of Inquiries per Credit Account	High Number of Inquiries per Credit Account	Given that the median number of inquiries for both high-risk groups (RENT and MORTGAGE) is 0.09, we can infer that any number of inquiries greater than this value increases the likelihood of default, especially for these categories.
Credit Grade	Number of Delinquencies per Credit Account	High Number of Delinquencies per Credit Account	Lower credit grades are associated with a higher median number of delinquencies per credit account, indicating a higher likelihood of missed payments or default among borrowers with poorer credit history (e.g., A: 13.30, B: 14.40, C: 14.72, D: 14.08, E: 14.95, F: 15.06, G: 14.28).
Credit Utilization Ratio	Debt-to-Income Ratio	High Debt-to-Income Ratio (>0.6) ie DTI Ratio > 13	Borrowers with higher credit utilization ratios tend to have higher debt-to-income ratios on average. This suggests that borrowers who utilize more of their available credit may also have higher overall debt relative to their income.

RECOMMENDATIONS:

Variable	Recommendation for Lending Companies
Credit Grade vs. Debt-to-Income Ratio	For borrowers with lower credit grades and higher debt-to-income ratios, consider offering financial education programs or debt consolidation options to help them manage their debts more effectively.
Income Verification Status vs. Credit Utilization Ratio	For borrowers with verified income status and high credit utilization ratios, consider offering credit limit increases or financial counseling to help them better manage their credit card balances.
Credit Grade vs. Interest Rates	Review loan pricing strategies to ensure that interest rates are aligned with borrowers' credit risk profiles. Consider offering incentives for borrowers to improve their credit scores over time.
Home Ownership Status vs. Number of Inquiries per Credit Account	Adjust loan pricing for borrowers with a high number of credit inquiries per credit account. Consider offering pre-approval options to minimize the need for multiple credit applications.
Credit Grade vs. Number of Delinquencies per Credit Account	Consider offering flexibility in payment arrangements for borrowers facing temporary financial hardships.
Credit Utilization Ratio vs. Debt-to-Income Ratio	Implement risk-based pricing strategies to account for borrowers' credit utilization ratios and debt-to-income ratios when determining loan eligibility and interest rates.

CONCLUSION:

CRITERIA USED TO IDENTIFY POTENTIAL DEFAULT RISK IN LOAN APPLICATIONS

Criteria	Description
Credit Grade	Grades B, C, D, E, F, G selected based on historical default rates.
Debt-to-Income Ratio (DTI)	DTI > 13 indicates potential financial strain.
Income Verification Status	Not Verified status implies income uncertainty.
Home Ownership Status	Renters or Mortgage holders provide stable housing situations.
Number of Delinquencies	Any delinquencies suggest past payment issues.(>0)
Credit Utilization Ratio	High ratios (> 0.6) indicate potential financial stress.
Interest Rate	Rates between 13.23% and 14.11% associated with higher defaults.
Number of Inquiries per Account	High inquiries (> 0.09) may signal financial distress.
Loan Purpose	High-risk purposes like debt_consolidation, credit_card, small_business, other
Employment Length	Short (< 2 years) or long (>= 10 years) lengths suggest instability.
Number of Open Credit Accounts	More than median indicates higher credit exposure. (>8)