Lending Club Case Study

Exploratory Data Analysis On Loan

Author – Ayan Mitra

Date – 24th Feb, 2024

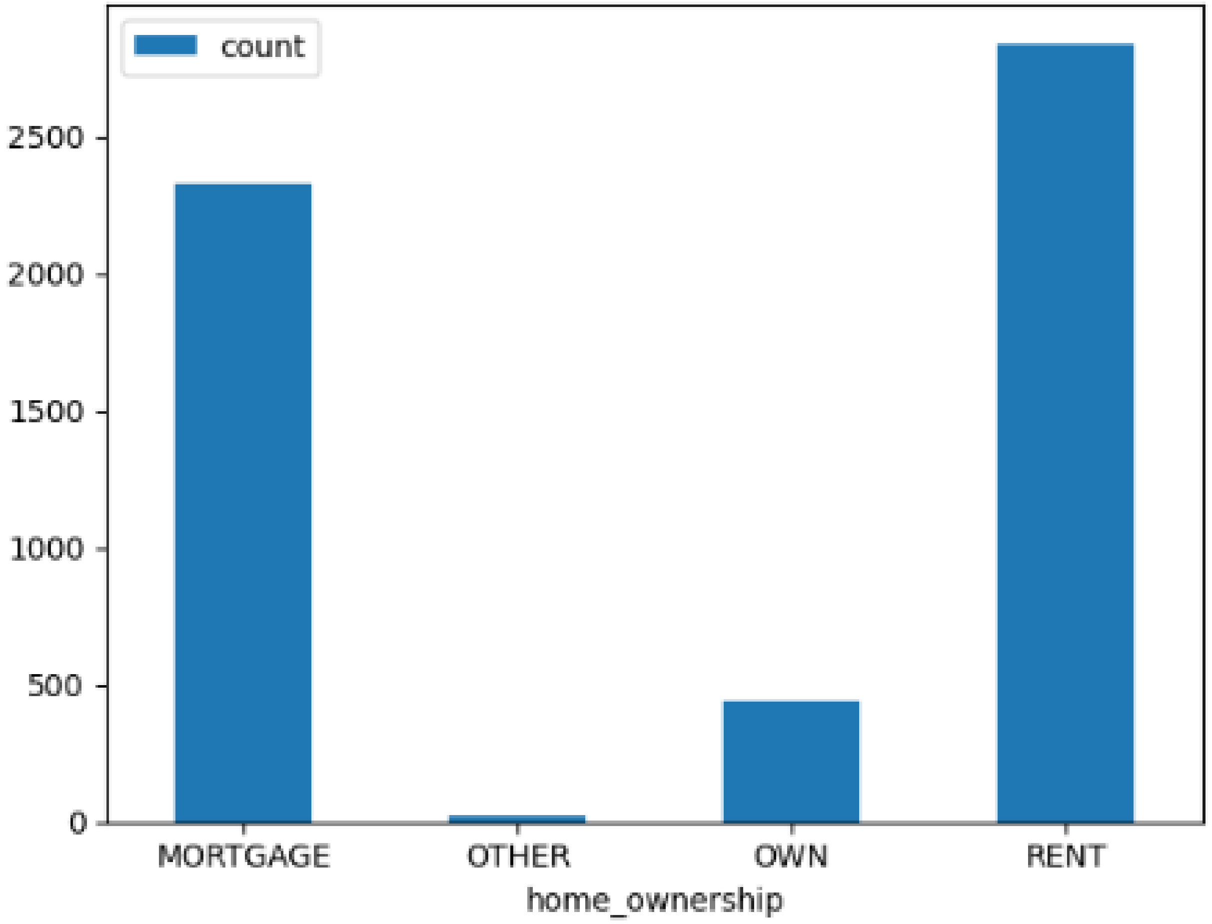
Genesis of the Analysis

- We have received ~40k loan records for analysis
- The data is cleaned by taking out the unnecessary columns, and by formatting important numeric and date columns
- Derived values are created before analysis
- A subset of data is taken by income groups for the defaulters to perform various analysis
- Various charts and graphs are produced to describe the data
- A conclusion is given at the end of each analysis

Analyzing Data for Defaulters

Analysis of Defaulters by Home Ownership

Objective – Find if people are failing to payoff their loan because of their home ownership status



Strategy:

- Grouped the defaulters by their home ownership and stored them into a different dataset
- Used the dataset to generate a bar chart

Findings:

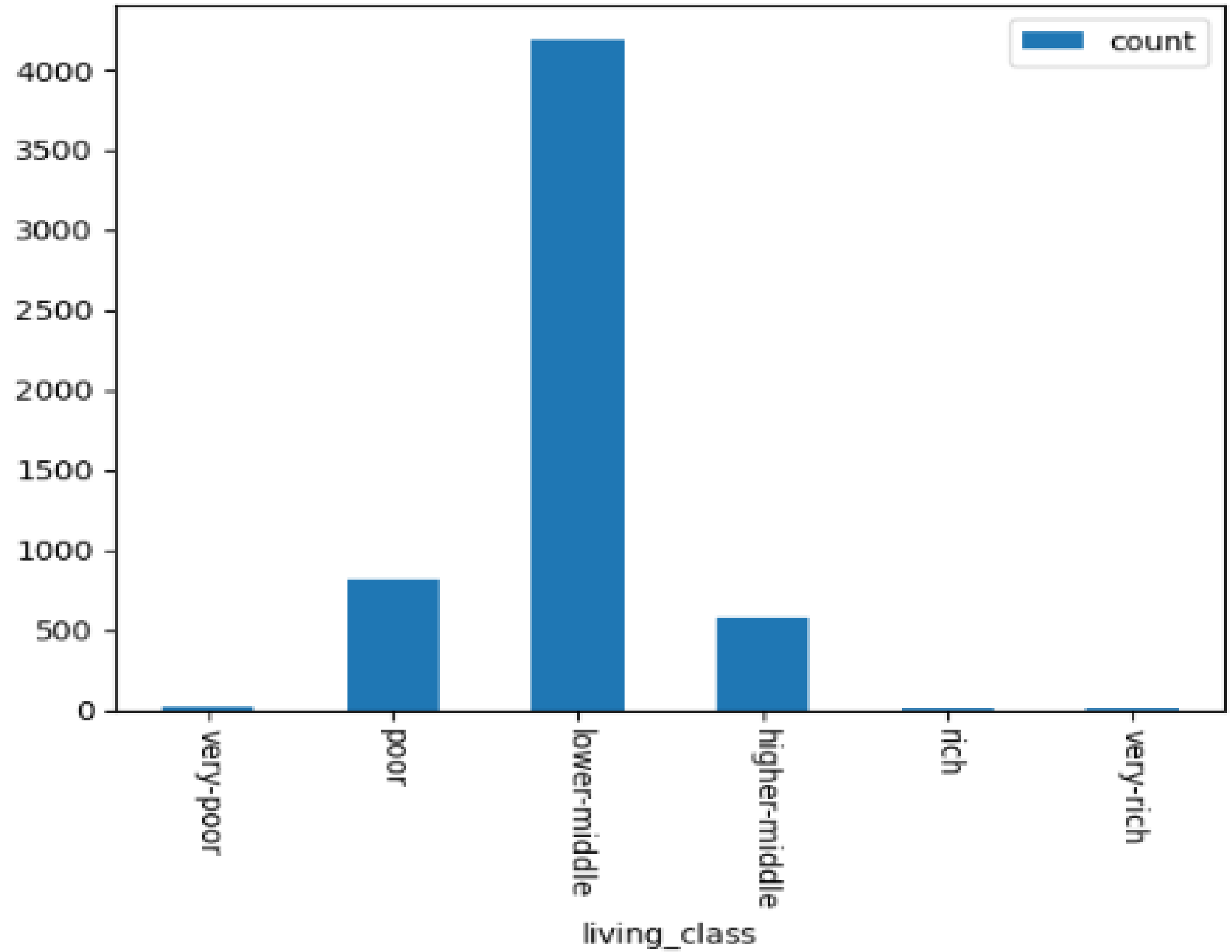
- People with rented and mortgaged house are defaulting their loan more than people with own house

Conclusion:

- The lending club should prefer giving loans to those who have their own house than people renting houses or having a mortgage on their home.

Analysis of Defaulters by Income Class

Objective – Find if people are failing to payoff their because of their income class



Strategy:

- Grouped the defaulters by their annual income category in 6 classes
  - Very poor (up to $10,000)
  - Poor ($10,001 to $30,000)
  - Lower-Middle ($30,001 to $100,000)
  - Higher-Middle ($100,001 to $500,000)
  - Rich ($500,001 to $1,000,000)
  - Very-Rich (Greater than $1,000,000)

Findings:

- People in the Lower-Middle Income class tends to default on their loan more than other income classes

Conclusion:

- Although, the number of loan-takers are more in this category, the lending club should pay caution while disbursing loan to people in this income range

Analysis of Defaulters in Lower-Middle Income Class w.r.t. Interest Rates

Objective – Since we know the largest population of loan defaulters are in lower-middle income category, does the interest rates play any role for defaulting the loan

int_range	
11-15	2023
16-20	1355
6-10	598
21-25	220
0-5	0

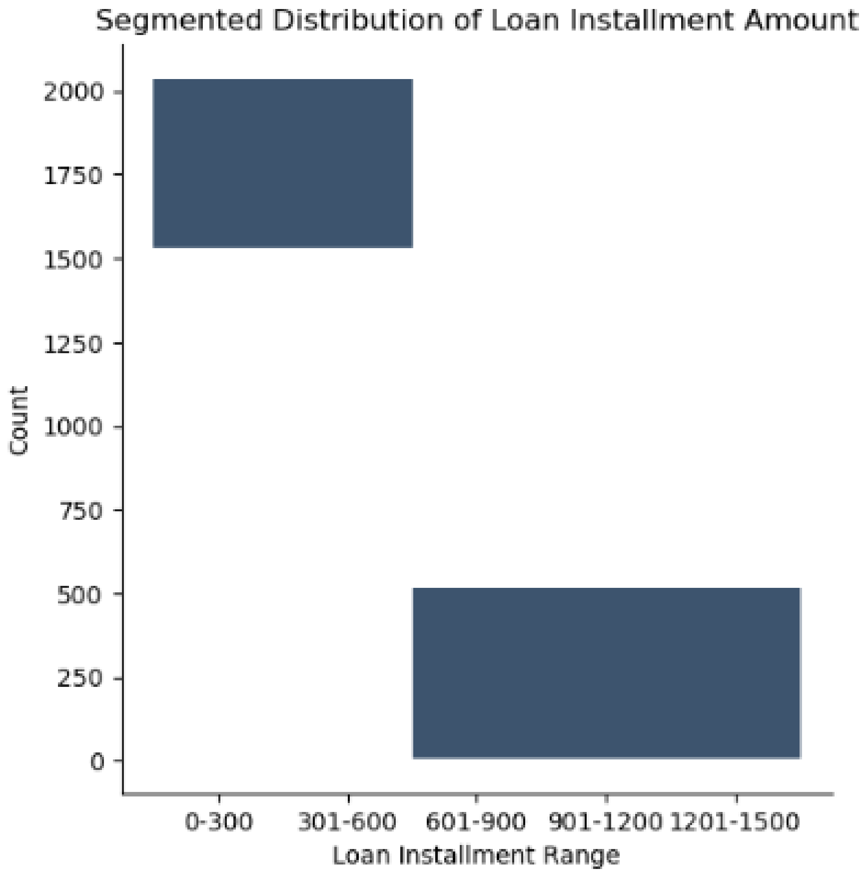
Strategy:
- Grouped the interest rates under which the loan is taken for the people in the lower-middle class income category in the following buckets
  - Upto 5%
  - 6% to 10%
  - 11% to 15%
  - 16% to 20%
  - 21% to 25%

Findings:
- People who have taken loan with a rate of interest between 11% to 15% are defaulting on their loan more

Conclusion:
- Although, the number of loan-takers are more with the rate of interest between 11% to 15%, but we can see the count from other categories is still higher.
- The lending club can be cautious deciding the rate of interest for loan-takers in the income category

Analysis of Defaulters in Lower-Middle Income Class w.r.t. Installment Amount

Objective – Since we know the largest population of loan defaulters are in lower-middle income category, does the installment amount play any role for defaulting the loan



Strategy:

- Grouped the installment payment for the lower-middle class income category in the following buckets
    - Upto $300
    - $301 to $600
    - $601 to $900
    - $901 to $1200
    - > $1200

Findings:

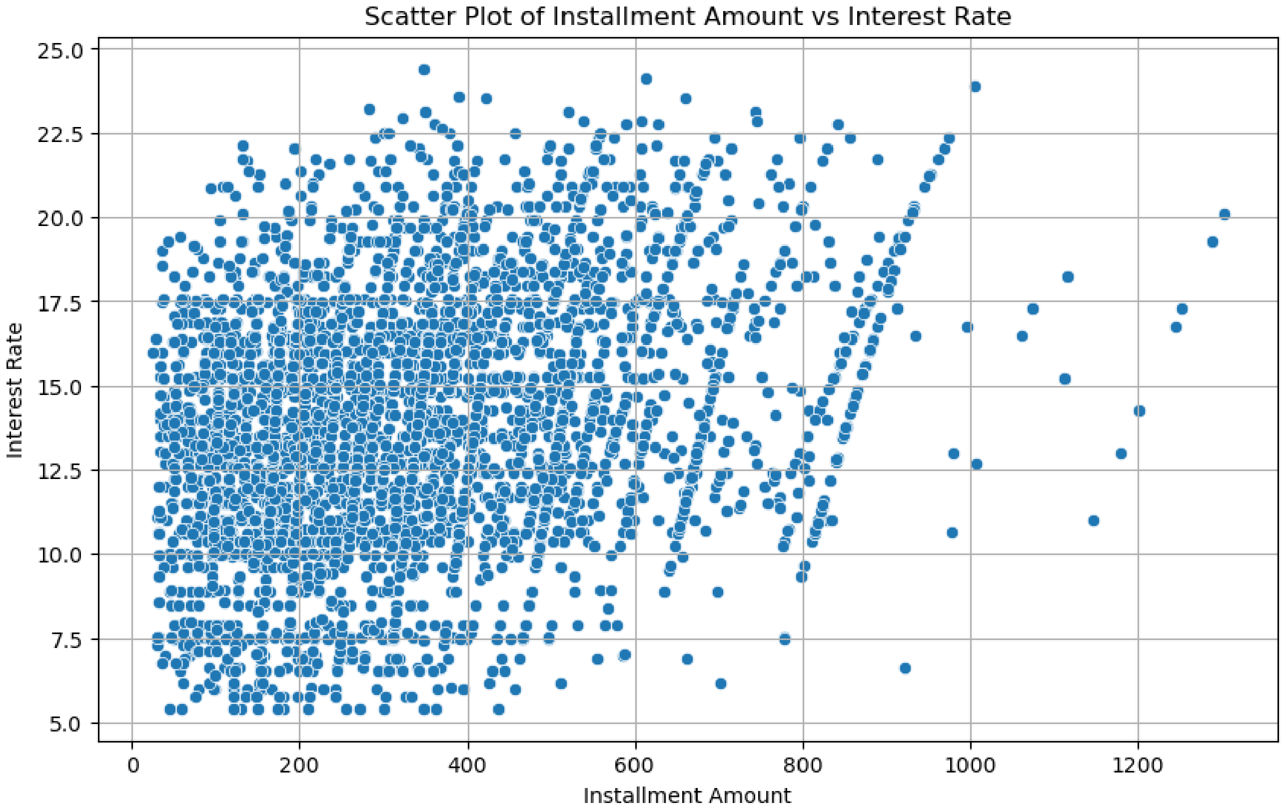
- Surprisingly, people with a smaller loan installment are defaulting the loan more

Conclusion:

- The results are a bit contradictory. It seems people with a smaller installment to pay are tending to default on their loan more than people with bigger installment to pay
- The lending club should recalibrate their installment payment formulas so that it stands >$600 per month

Analysis of Defaulters in Lower-Middle Income Class for a correlation between monthly installment and interest rate

Objective – Since we know the largest population of loan defaulters are in lower-middle income category, is there a correlation between the monthly installment amount and interest rate.



Strategy:

- Taken the installment amount and interest rates to plot a scatterplot to find the correlation

Findings:

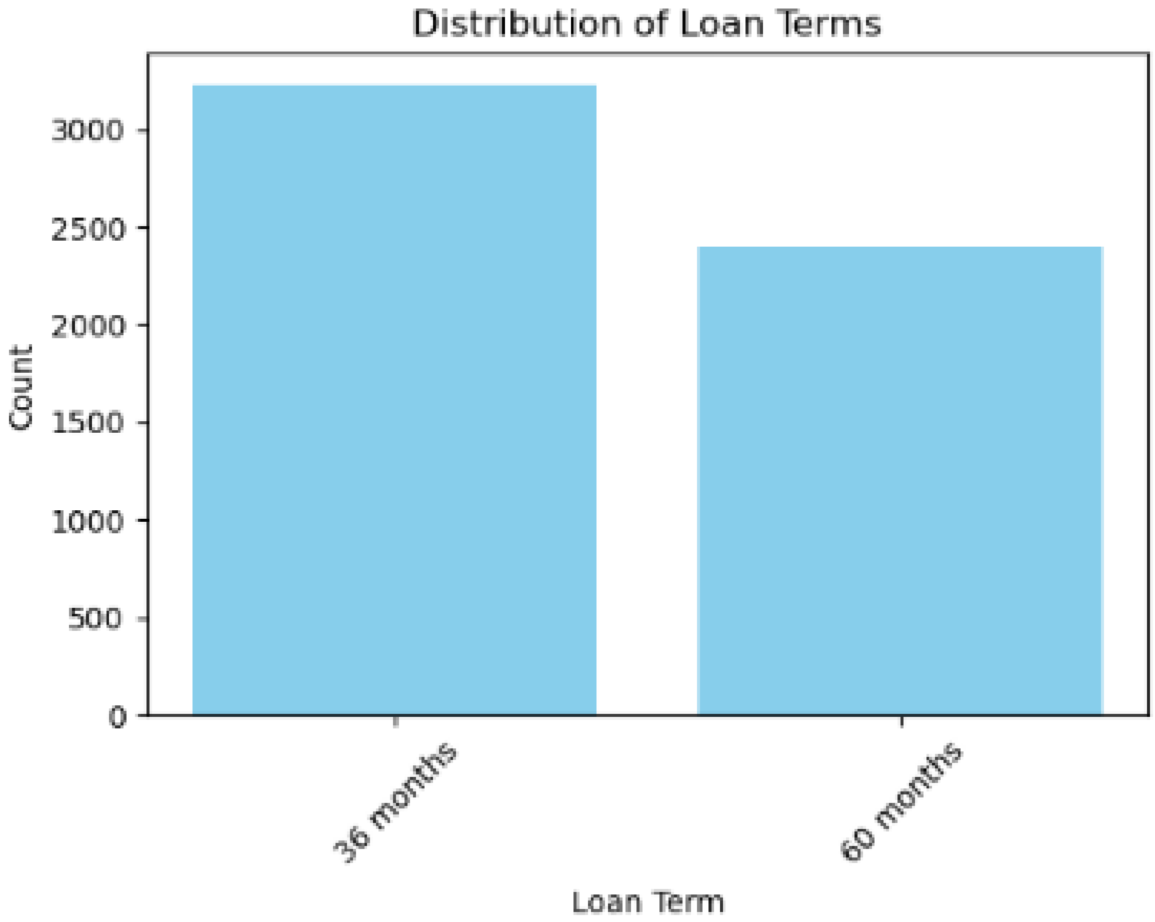
- The highest density was found $100 to $400 range with interests between 7.5% to 17.5%

Conclusion:

- Loan takers who typically pay a lower monthly installment with an interest rate between 10% to 17% are defaulting on their loan more than the rest of the group

Analysis of Defaulters on Loan-Terms

Objective – Find if the loan term makes any difference for defaulting the loan



Strategy:

- Take the loan-term field and plot a bar chart to see the distribution

Findings:

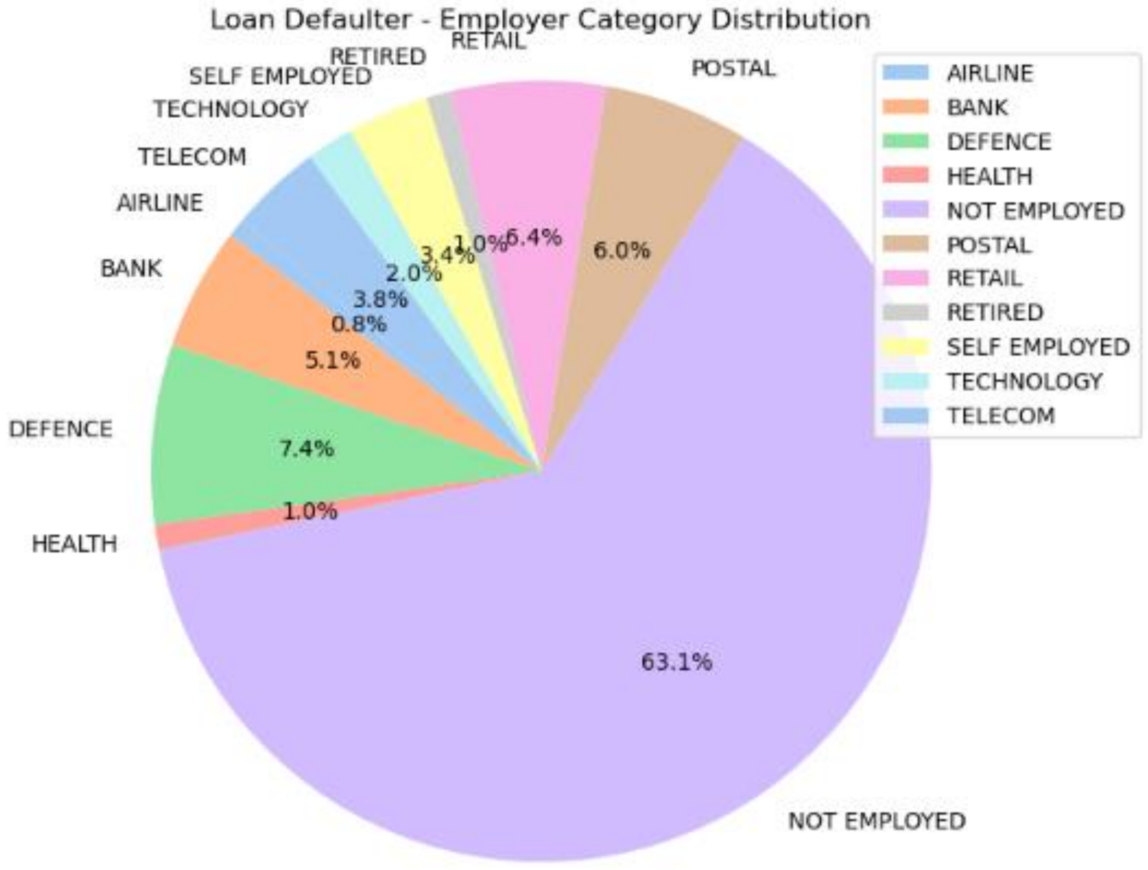
- The number of defaulters appeared to be slightly high in the 36 months loan term, but it is not very different from 60 months

Conclusion:

- The loan term doesn't seem to have an impact on defaulting a loan

Analysis on Employer Category

Objective – Find if the employer's category has any role on defaulting on loan



Strategy:

- For this analysis only those employers are taken where there are more than 5 loan defaulters
- Cleansed the employer title data for better analysis (e.g. employers like Walmart, US Postal Services etc. are named differently in various records)
- Next grouped the data by the employers and categorized them in 22 different buckets
- Finally plotted a pie chart to see the distribution

Findings:

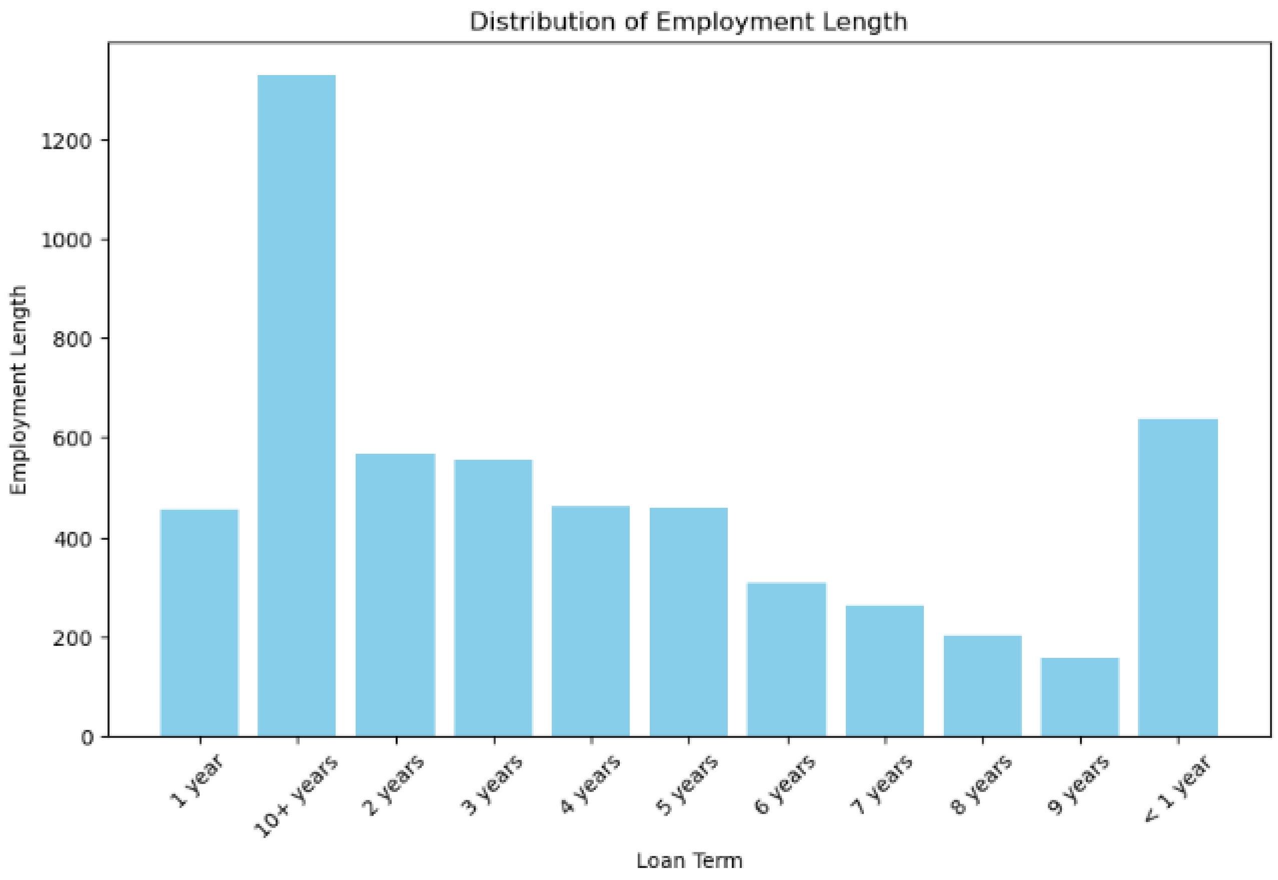
- People who are unemployed tends to be defaulting on their loans the most
- However, in the employed category, people whose employers are in Defense, Retail, and Postal service categories are defaulting more than the rest of the population

Conclusion:

- The lending club must be very careful granting loans to unemployed
- The lending club must pay caution while lending loans to those people who employers are in Defense, Retail, or Postal service

Analysis of Defaulters against their employment length

Objective – Find how the employment length impacts on loan defaulters



Strategy:

- Taken the employment length and plotted a bar chart to find the distribution

Findings:

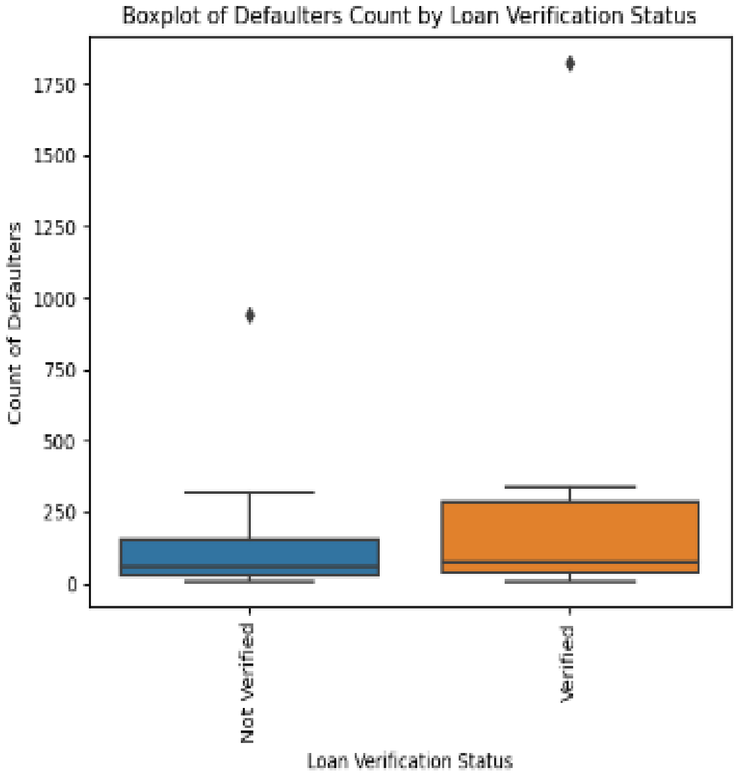
- People with 10+ years employment length are the highest loan defaulters
- In the group of people with less than 10 years of service, the highest loan defaulters falls into the <1 year of employment length category

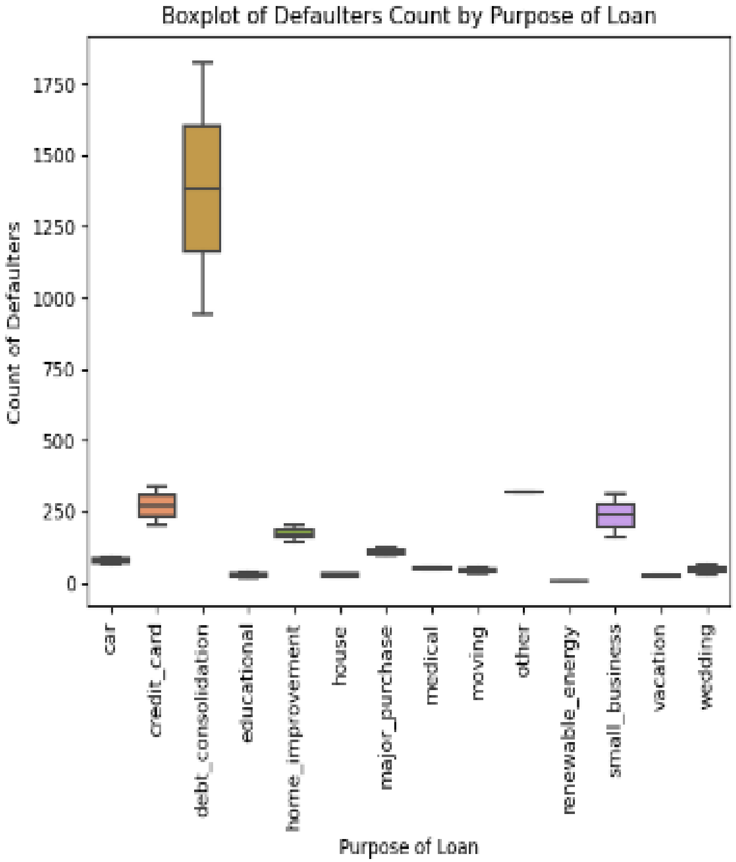
Conclusion:

- While the population of defaulters is largest in 10+ years employment length category, it is obvious that people are taking and defaulting on loan if they have <1 year of service.
- The lending club need to pay caution while lending loans to people with <1 year of employment
- People with 6 to 9 years of employment length tend to be defaulting less on their loan

Analysis of Loan Verification Status and Purpose

Objective – Find out the defaulters are distributed among the income verification status and the purpose for which the loan is being taken.





Strategy:

- Categorized the data by loan verification status and purpose of the loan
- Plotted a boxplot graph to see the distribution of the data

Findings:

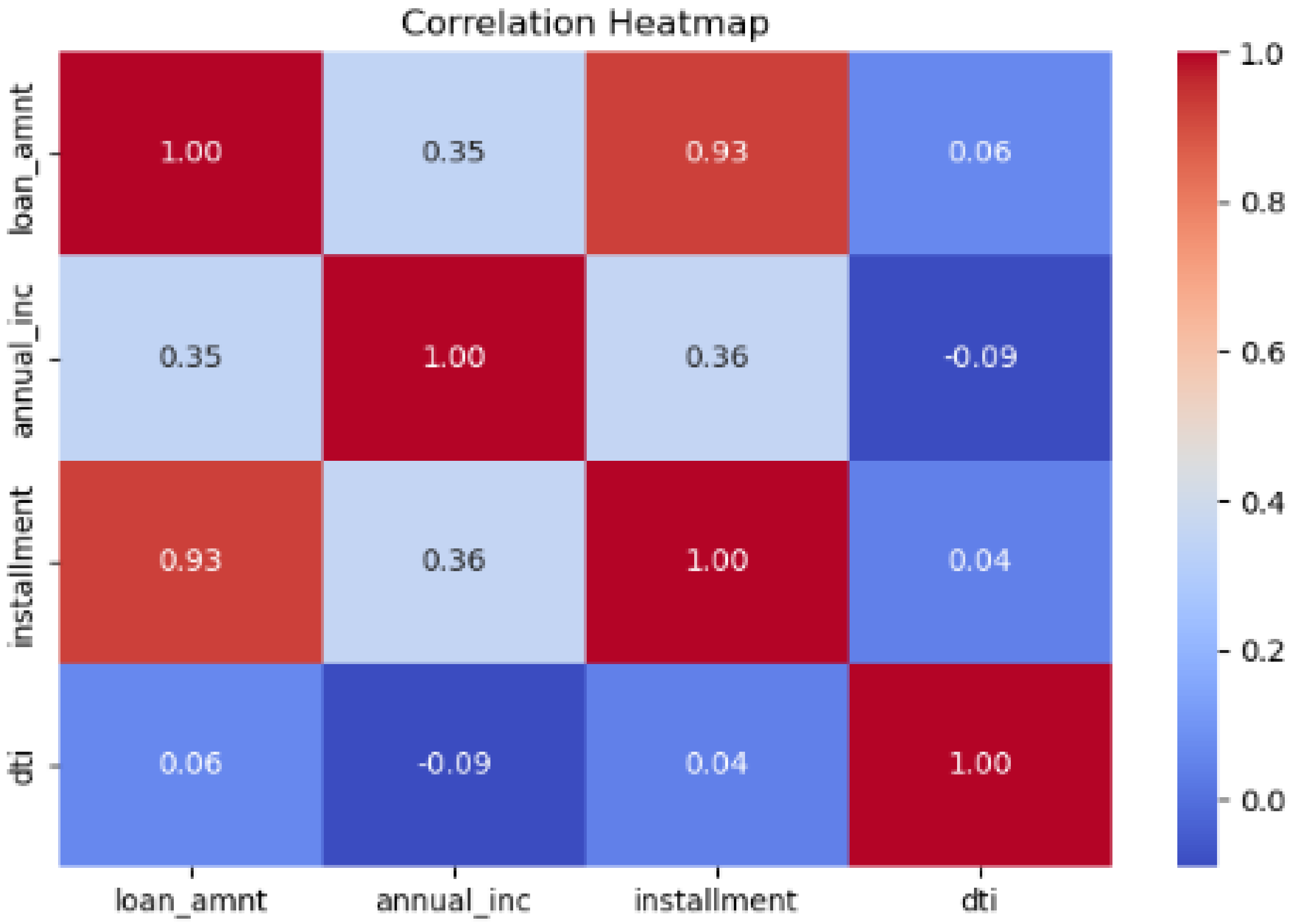
- Income verification seems to be not playing any major role on the loan being defaulted
- People taken loan for debit consolidation are the highest among defaulters
- The 25th and 75th quartiles of those defaulters who have taken loan for credit cards and small business are about the same

Conclusion:

- The lending club need to very careful while lending loan to those who are taking it for debit consolidation

Analysis between Loan Amount, Annual Income, Installment & DTI

Objective – Is there a correlation between Loan Amount, Annual Income, Installment & DTI among the defaulters group



Strategy:

- Taken the Loan Amount, Annual Income, Installment & DTI fields
- Derived the correlation between these fields
- Plotted a heatmap to find the correlation

Findings:

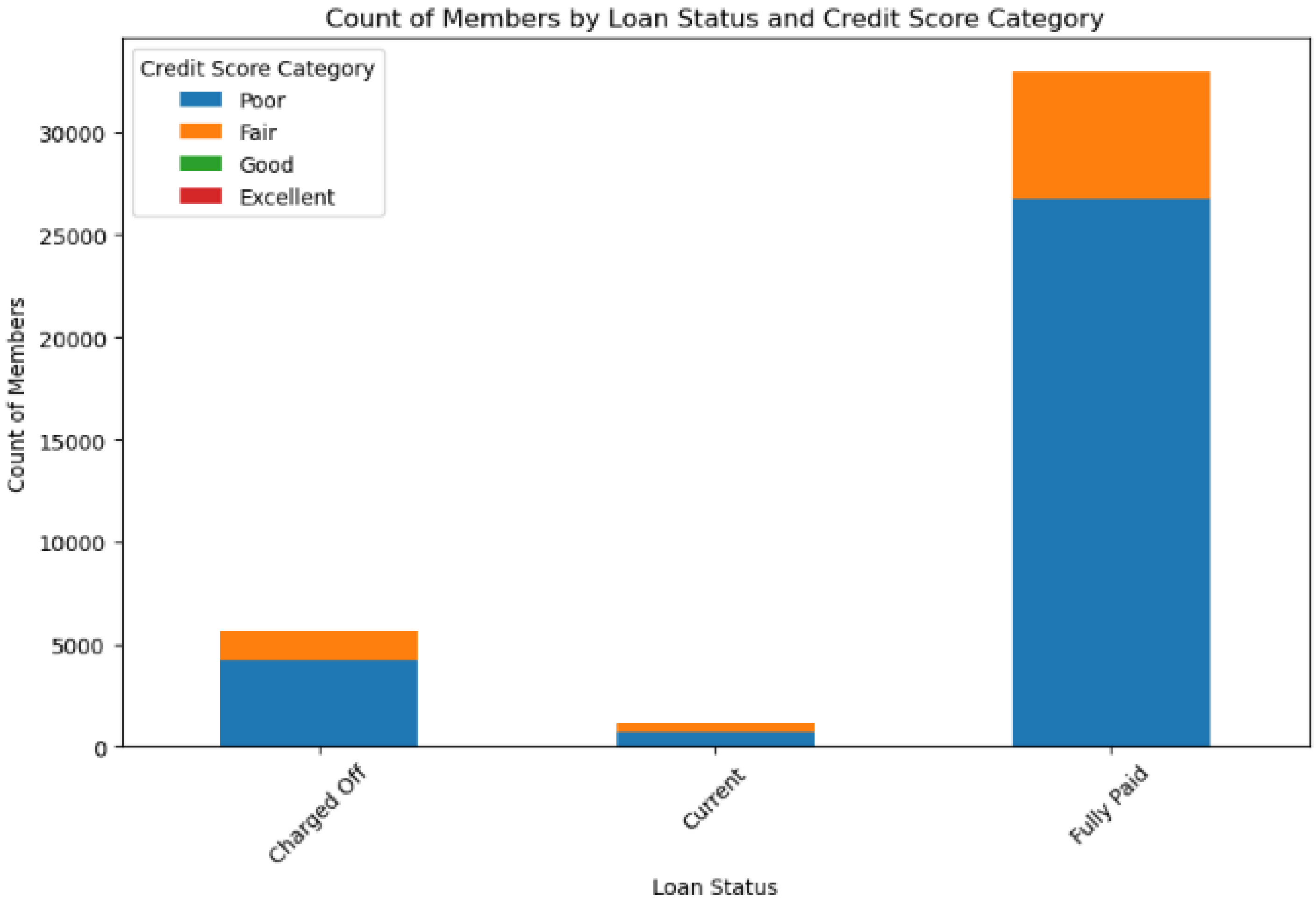
- Installment amount and loan amount are highly correlated
- Annual income and DTI are not correlated

Conclusion:

- The lending club need to very careful while determining the loan amount and the installment amount
- The installment amount is also correlated with annual income of the person

Analysis the data by determining a credit score

Objective – Determine a credit score and see the distribution among the complete dataset



Strategy:

- Taken the Loan Amount, Annual Income, Installment & DTI as individual dimensions
- Computed a credit score by normalizing the data in the above dimensions
- Determined a credit score category between Poor, Fair, Good and Excellent
- Plotted a stacked chart to find the distribution of credit rating

Findings:

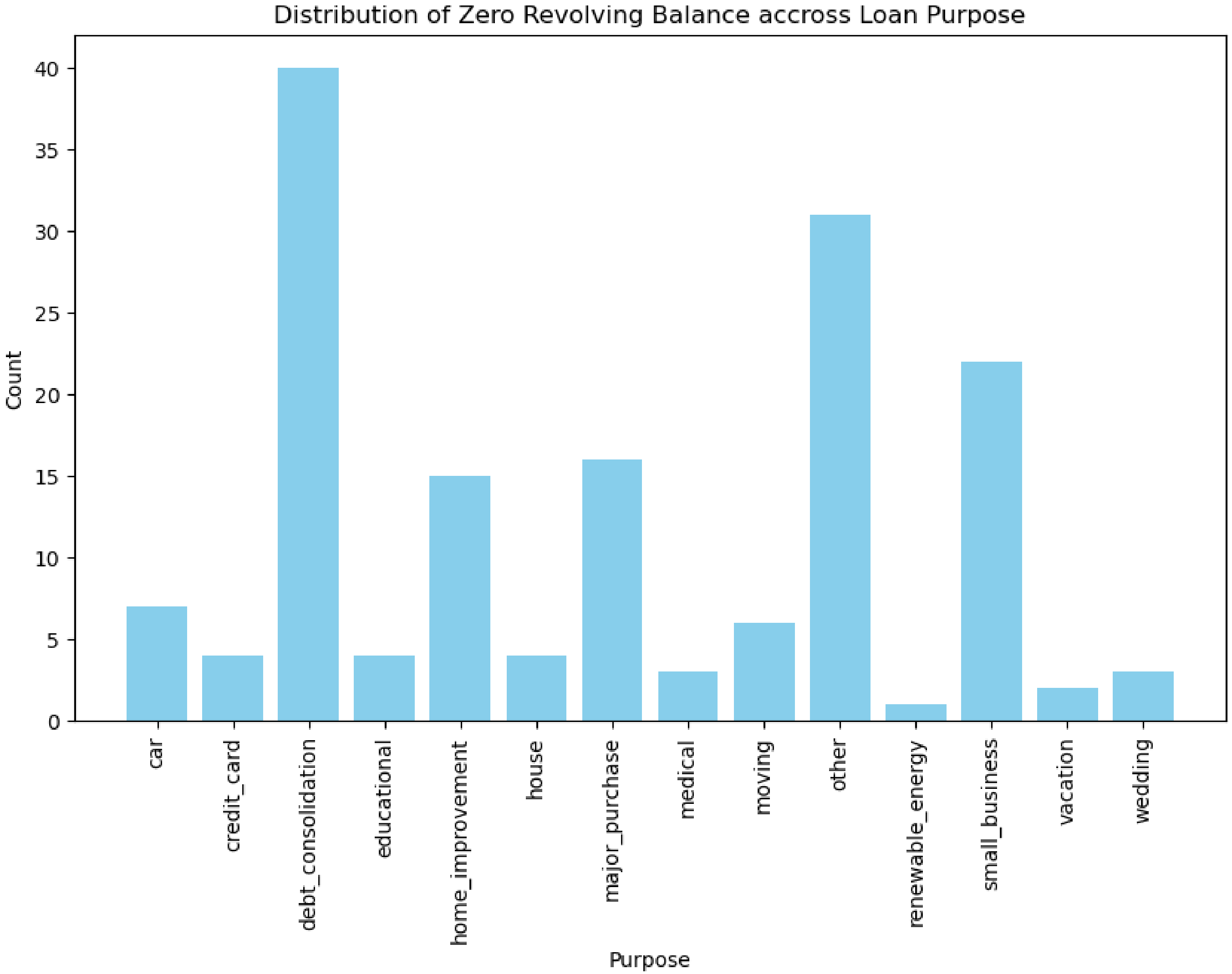
- There is a large number of members who are poorly rated on their credit but still granted a loan

Conclusion:

- The lending club must use a scoring mechanism (like credit rating) before granting a loan to its members

Analysis how the defaulters with zero revolving balance is spread across different loan purpose

Objective – Determine the distribution of defaulters with zero revolving balance across various loan purpose



Strategy:

- Taken all defaulters who has a zero revolving balance
- Plotted a bar chart with this count across different loan purpose

Findings:

- There is a large number of defaulters with a zero revolving balance has taken the loan for debt consolidation

Conclusion:

- There is a large number of defaulters with a zero revolving balance has taken for debt consolidation which seems obvious
- But it seems a large number of defaulters with zero revolving balance also falls into the category of home improvement, major purchase, and small business.
- This may indicate the lending club to check purpose the borrowers are taking the loan and their revolving balance at the time of taking the loan, and accordingly grant or reject the loan request.

Analyzing Data for Current Loan Accounts

Analysis on the loan collected

Objective – Determine how much of the current loan is already collected

	completed_term_percentage_group	group_count
0	0-25	0
1	26-50	0
2	51-75	0
3	76-99	1140

Strategy:

- Calculate the completed term percentage by taking total received principle divided by the funded amount.
- Then divide them in four buckets with ranges from 0-25%, 26%-50%, 51%-75%, and 76%-99%
- Take pivot on this buckets to find the counts

Findings:

- There are no loan where the term complete is less than 75%

Conclusion:

- 76% to 99% of all lend loan is already collected which is a good indication

Analysis on the outstanding and late fee to funded ratios

Objective – Determine outstanding to funded, and late fee to funded ratio in percentages to find out the risk profile of all current loans

	outstanding_per_bin	mem_count
0	0%-25%	1140
1	26%-50%	0
2	51%-75%	0
3	76%-100%	0

Outstanding Amount to Fund Ratio

	lat_fee_per_bin	mem_count
0	0%-25%	1140
1	26%-50%	0
2	51%-75%	0
3	76%-100%	0

Late Fee to Fund Ratio

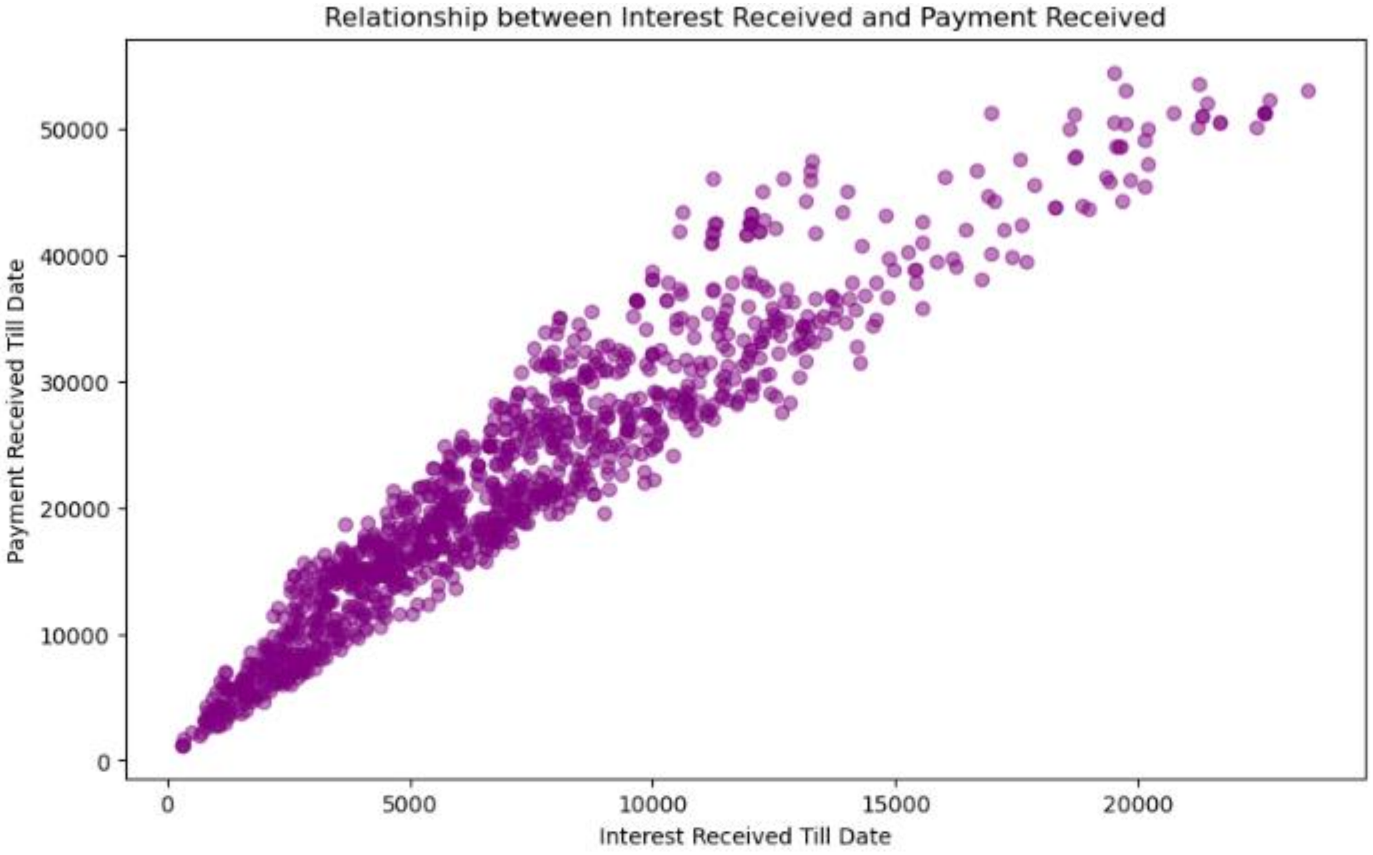
Strategy:
- Calculate the outstanding amount, and late fee to fund ratio by taking those amounts divided by the funded amount.
- Then divide them in four buckets with ranges from 0-25%, 26%-50%, 51%-75%, and 76%-100%
- Take pivot on this buckets to find the counts

Findings:
- There are no loan where the outstanding amount, and late fee ratio are greater than 25%

Conclusion:
- The outstanding amount to funded amount and late fee to funded amount ratios within 0%-25% indicates a low risk profile

Analysis on the payment received vs. interest received

Objective – Determine if the interests are received along with payments and they are correlated



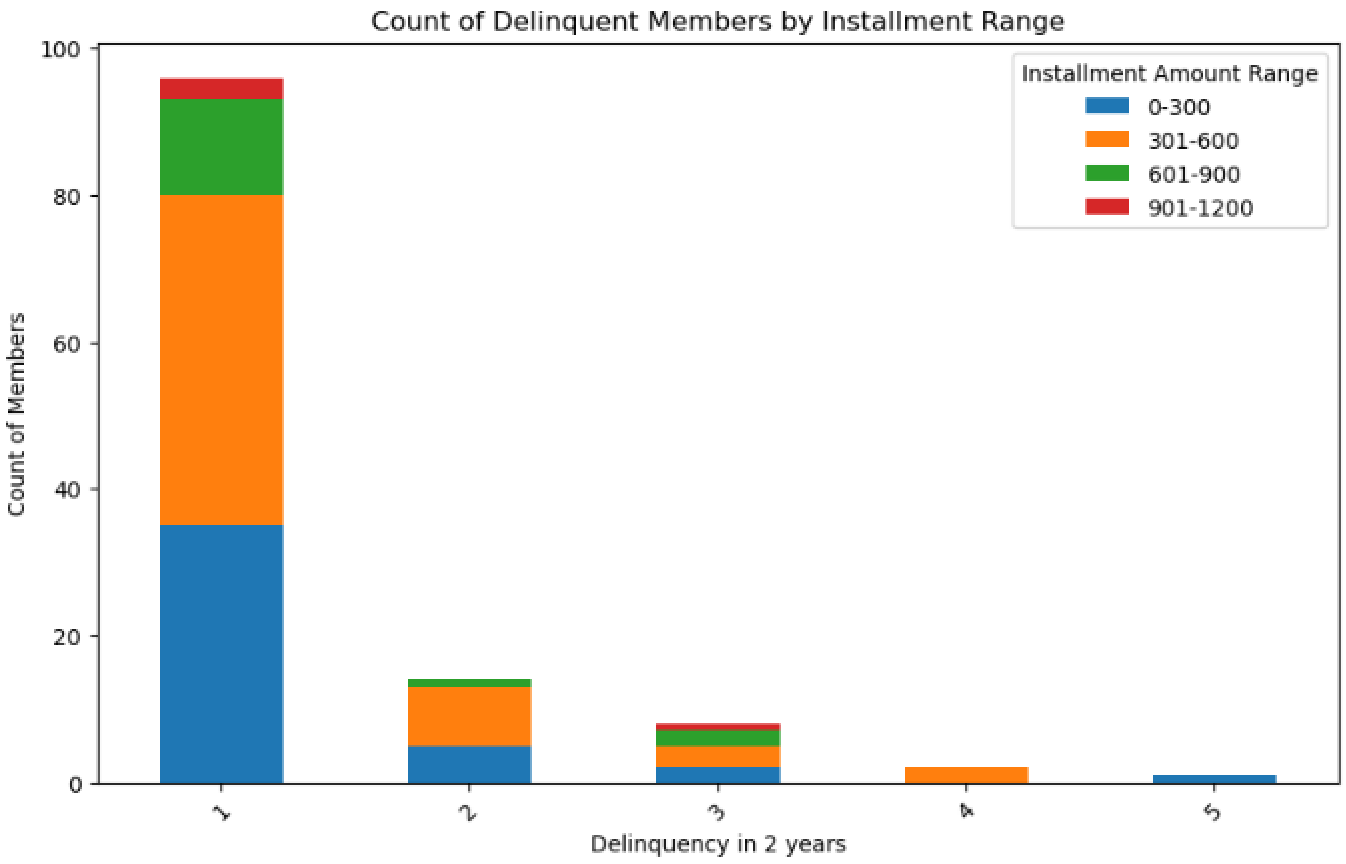
Strategy:
- Taken the total interest received and the total payment received columns
- Plotted a scatterplot to find the correlation

Findings:
- We can see the interests are matching with payment received and the scatterplot denotes almost a straight line.

Conclusion:
- It seems borrower has paid off all accrued interest charges up to the current date.
- This suggests that the borrower is making timely and sufficient payments to cover both the principal amount and the interest charges, which is a positive indicator of loan performance

Analysis Past 2 years Delinquency count w.r.t. Installment Payment

Objective – Determine if the number of times a borrower is being delinquent in the past 2 years has any bearing on their installment amount



Strategy:

- Taken the number of times members being delinquent in the past 2 years
- Grouped their installments in 4 buckets
- Plotted a stack bar chart to see the correlation

Findings:

- In the last 2 years, the highest number of times borrowers being delinquent is 1 time
- Borrowers who are paying an installment between 301 to 600 dollars are highest among the delinquents

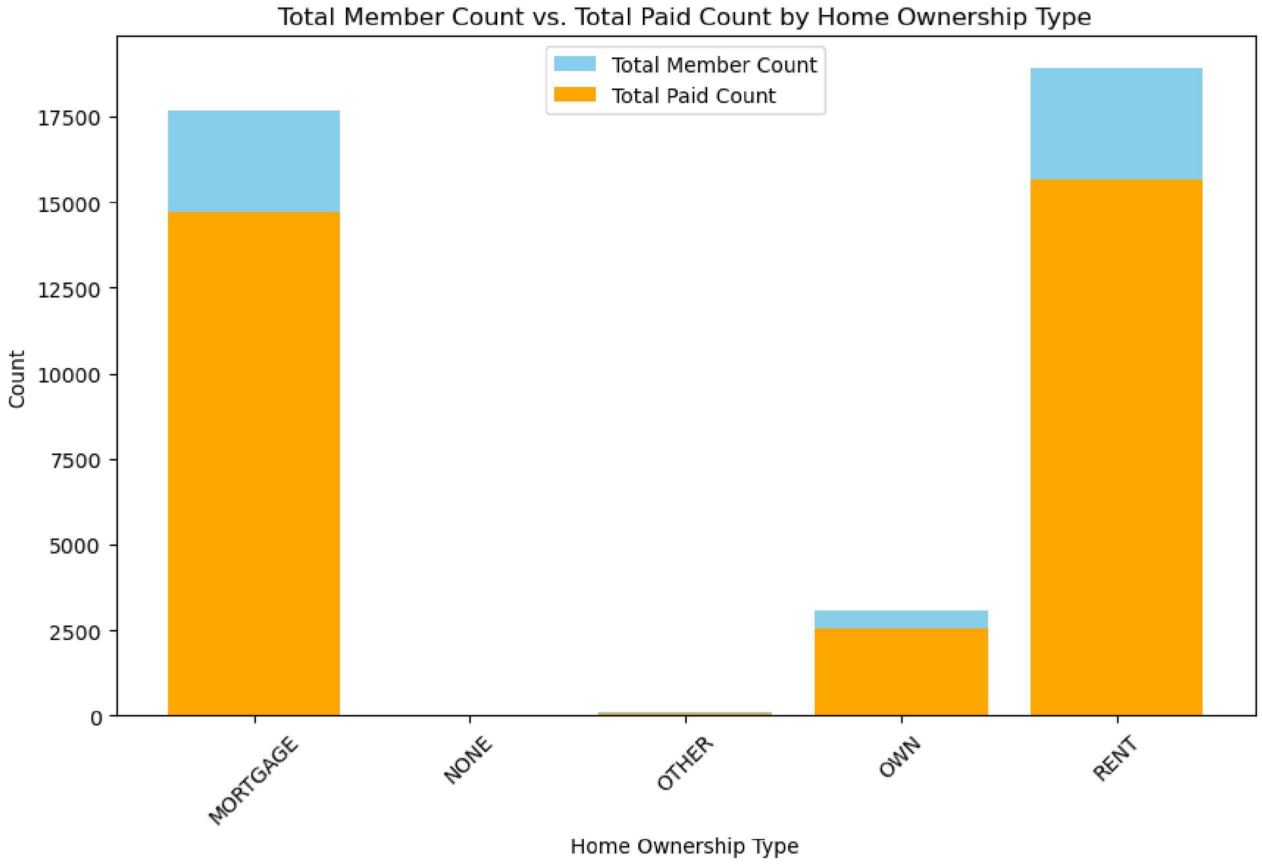
Conclusion:

- It seems borrowers who are paying an installment amount <=$600 are being delinquent at least once.
- The lending club may communicate the late /delinquency fee policies to such borrowers

Analyzing Data for Fully Paid Accounts

Analysis the home ownership of the fully paid loans

Objective – Determine how the home ownership impacts on the fully paid loans



Strategy:

- Taken all the paid off loans
- Grouped the data by home ownership on the paid of loan dataset
- Grouped the data by home ownership on the entire dataset
- Merged the datasets and plotted a bar chart

Findings:

- Borrowers are the largest where the home ownership is either Mortgage or Rent.

Conclusion:

- ~82% of all borrowers in each home ownership category have paid off their loans, which is consistent.

Analysis the employment length of the fully paid loans

Objective – Determine how the employment length impacts on the fully paid loans

	emp_length	mem_count_original	mem_count_paid	percentage
10	9 years	1258	1068	84.90
2	2 years	4388	3724	84.87
1	< 1 year	4583	3869	84.42
3	3 years	4095	3457	84.42
4	4 years	3436	2880	83.82
6	1 year	3240	2713	83.73
7	6 years	2229	1861	83.49
5	5 years	3282	2736	83.36
9	8 years	1479	1232	83.30
8	7 years	1773	1448	81.67
0	10+ years	8879	7157	80.61

Strategy:

- Taken all the paid off loans
- Grouped the data by employment length on the paid of loan dataset
- Grouped the data by employment length on the entire dataset
- Displayed the result

Findings:

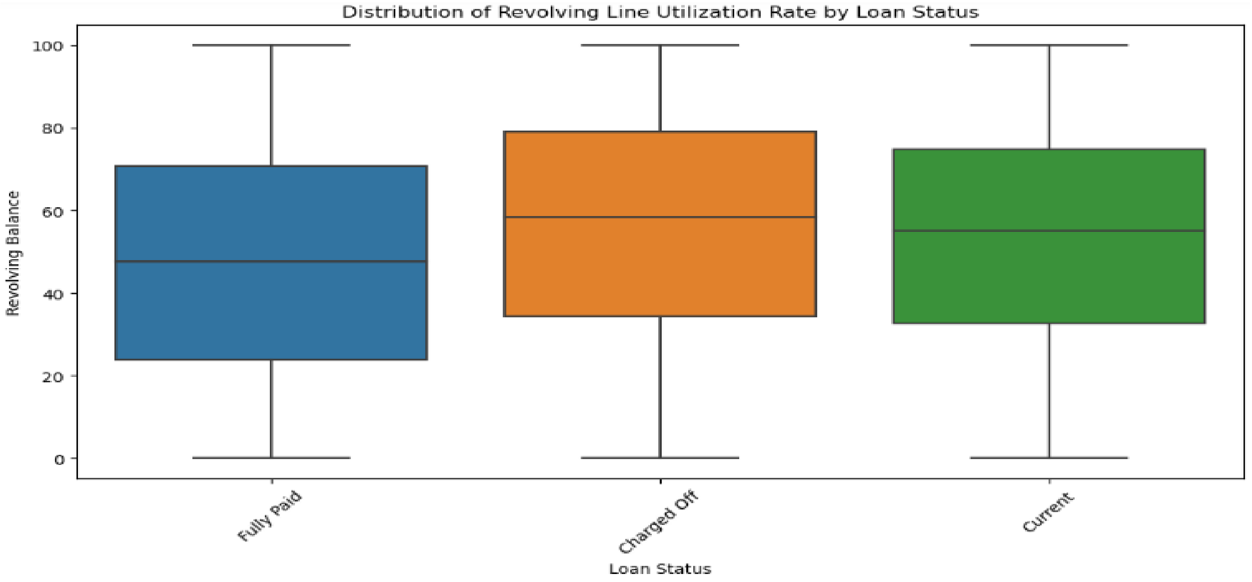
- Borrowers who have more than 10+ years of employment are the lowest to pay off their loans.

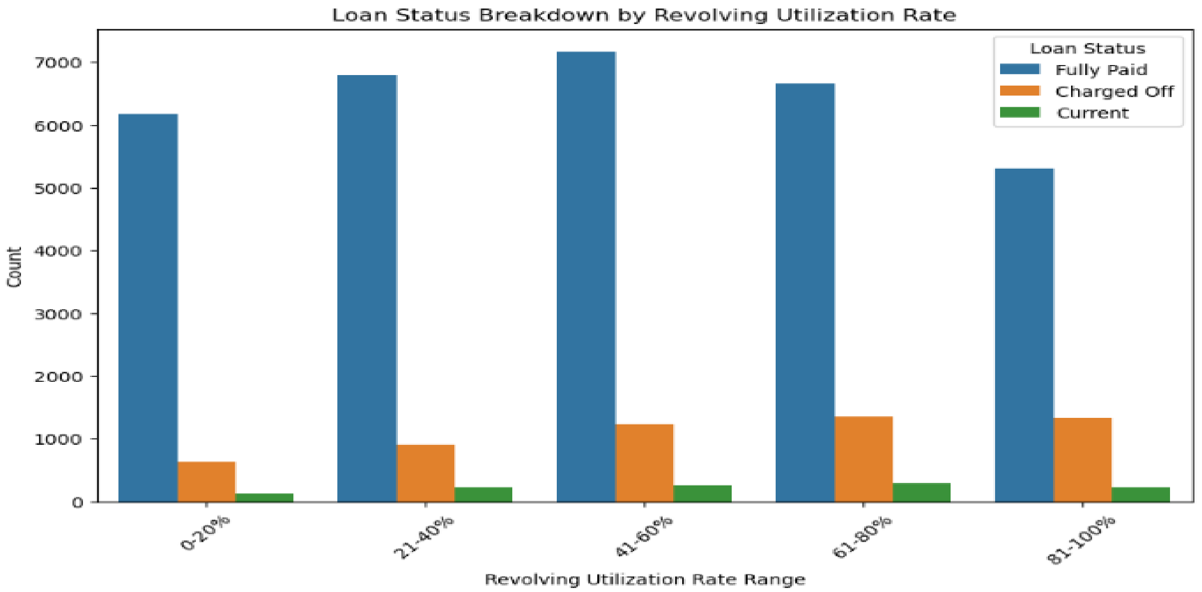
Conclusion:

- >80% of all borrowers in each employment length category have paid off their loans.

Analysis the revolving line utilization rate by loan status

Objective – Determine the distribution of the amount of credit the borrower is using relative to all available revolving credit under different loan status





Strategy:

- Taken all the records in the entire dataset
- Converted the revolving utilization rate to a float value
- Plotted a box plot and a bar chart under each loan status

Findings:

- Charged off loans are using the higher percentage of revolving line utilization rate

Conclusion:

- A revolving line utilization rate typically denotes the ratio of a person's credit debt to their total credit limit.
- We can see, the median of the revolving line utilization rate for the fully paid and current loans are almost same, however it is much higher for the charged off loans.
- As a result the lending club may pay caution while granting loan to those borrowers whose revolving line utilization rate is higher than 50%, because they are most likely become defaulters

Thank you