Lending Club Case Study

Exploratory Data Analysis On Loan

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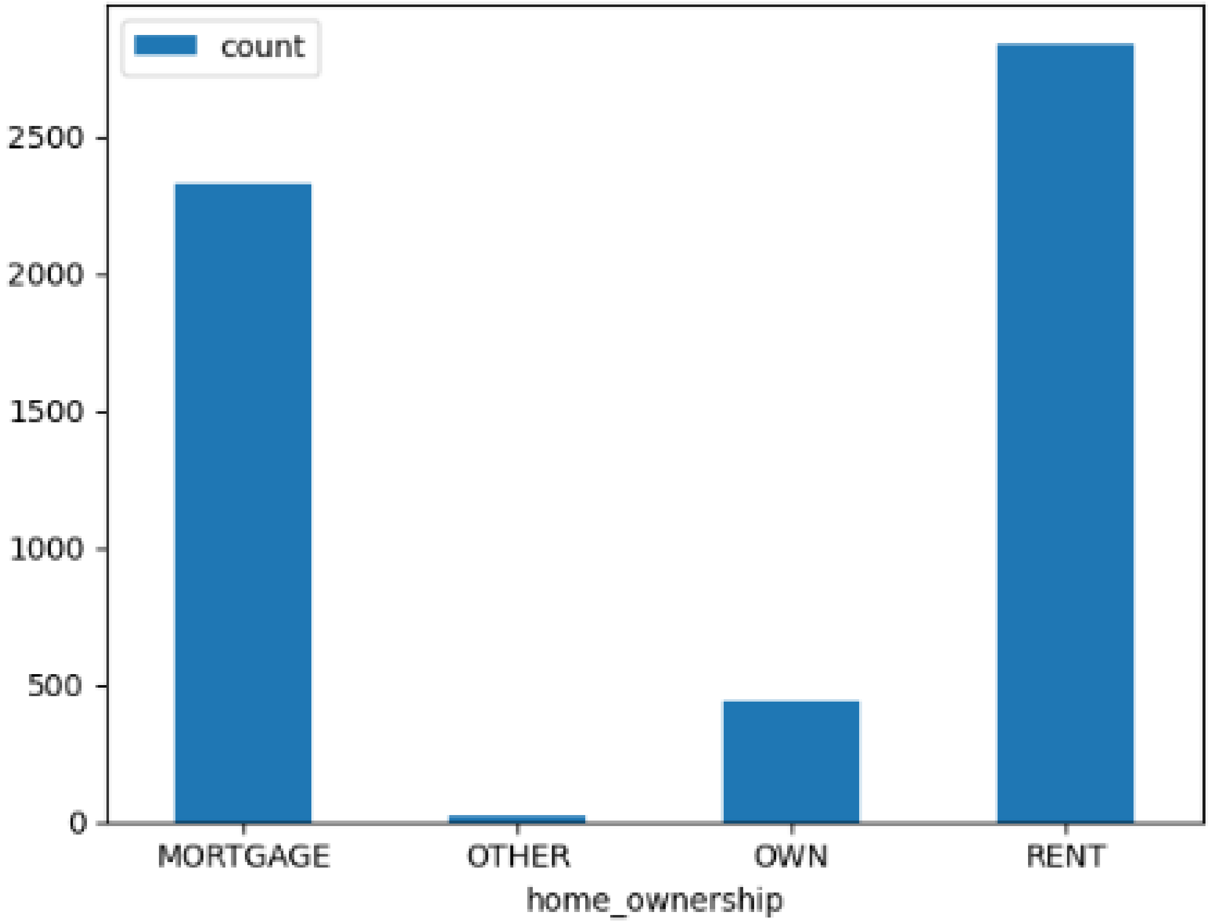
Genesis of the Analysis

- 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:

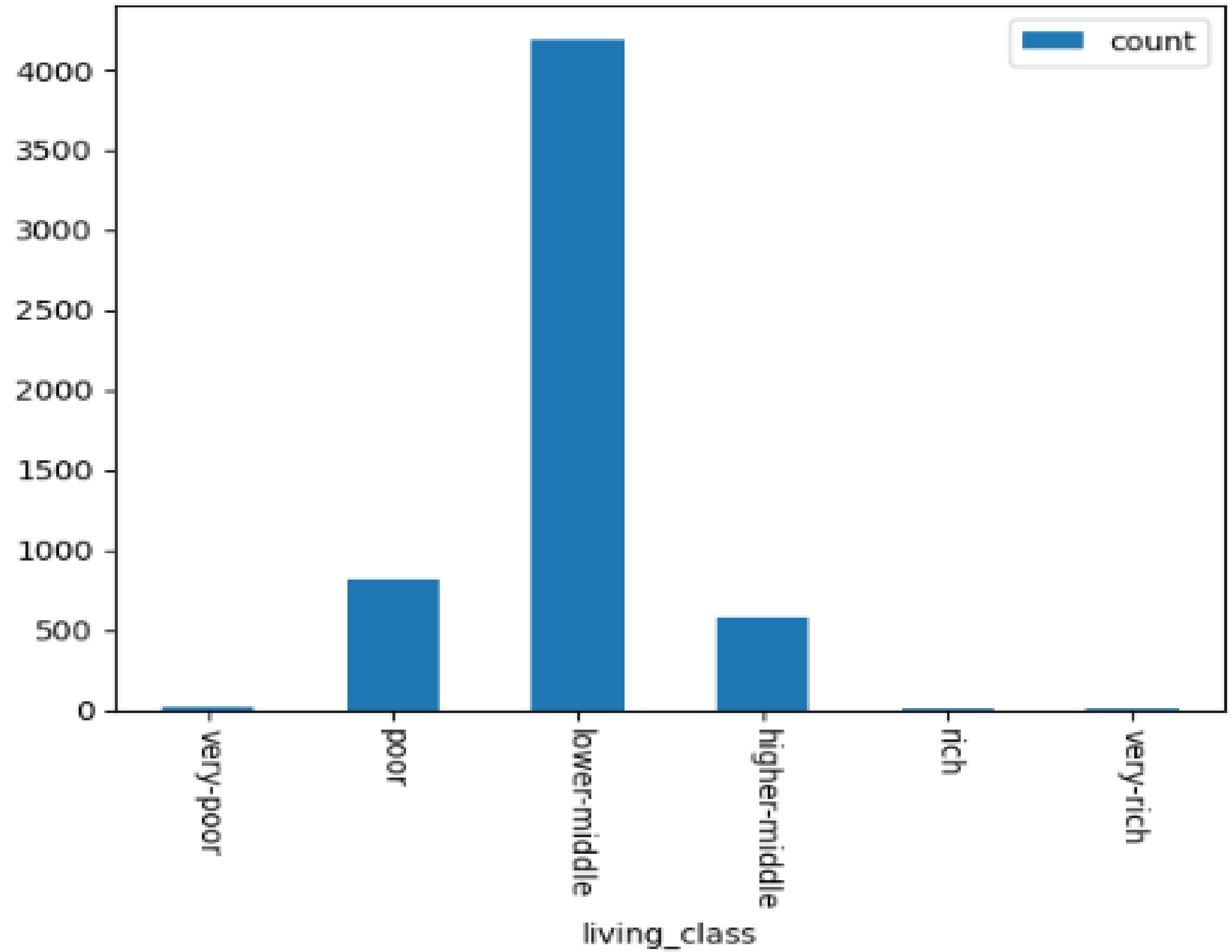
- People with rented and mortgaged house are defaulting their loan more than people with own house

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:

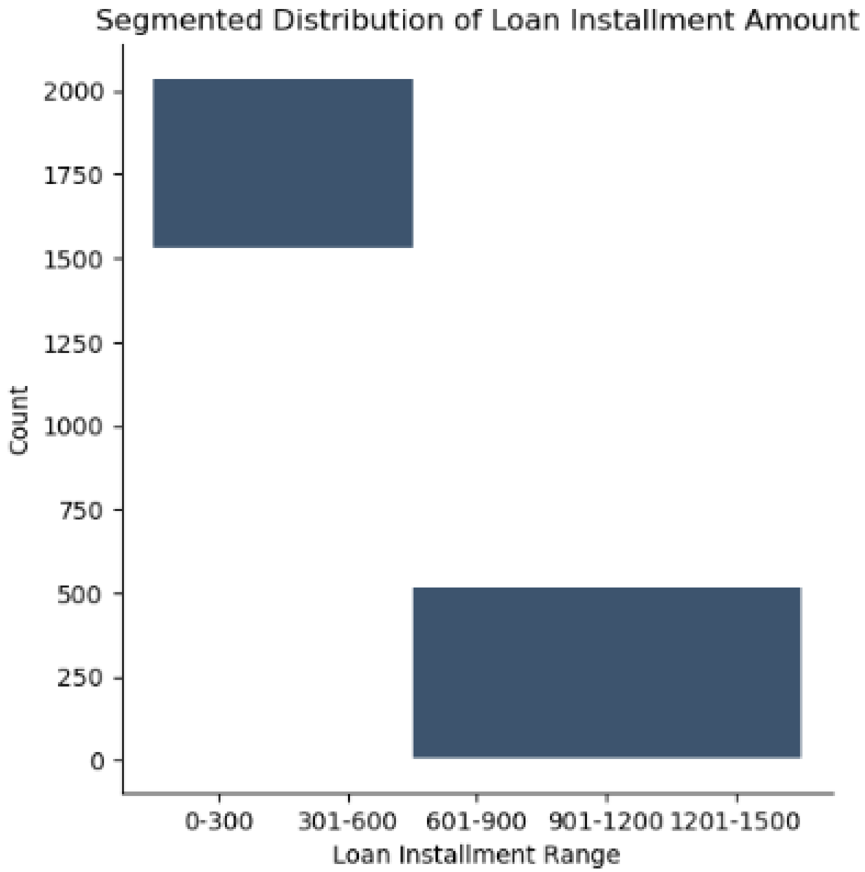
- People who have taken loan with a rate of interest between 11% to 15% are defaulting on their loan more

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:

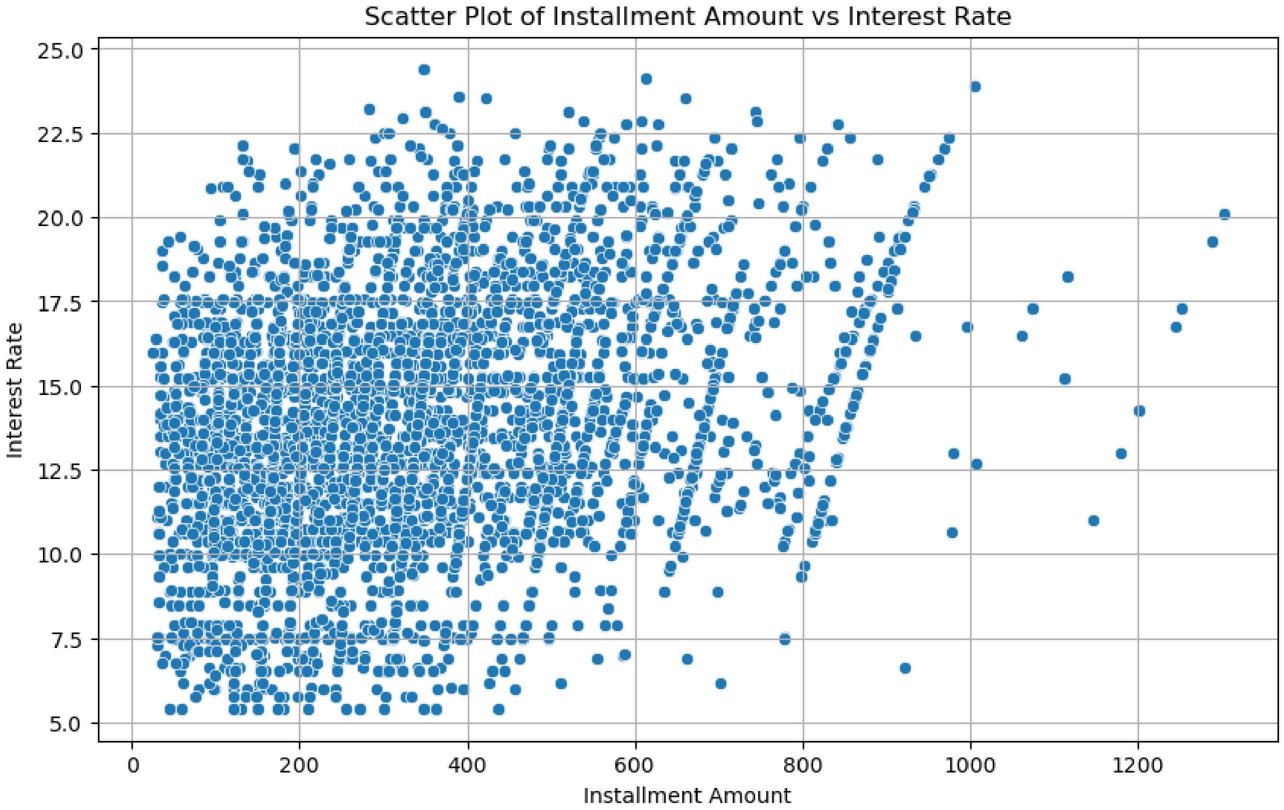
- Surprisingly, people with a smaller loan installment are defaulting the loan more

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:

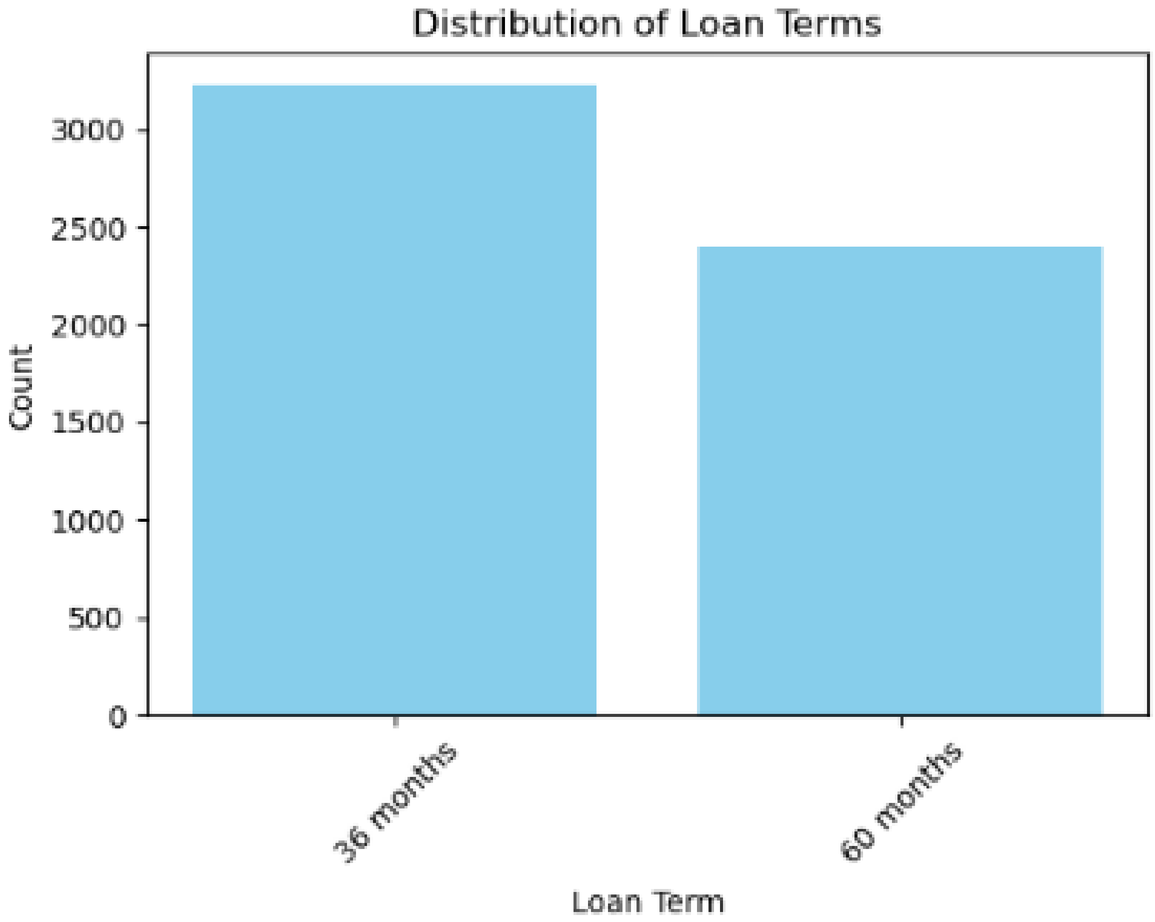
- The highest density was found \$100 to \$400 range with interests between 7.5% to 17.5%

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:

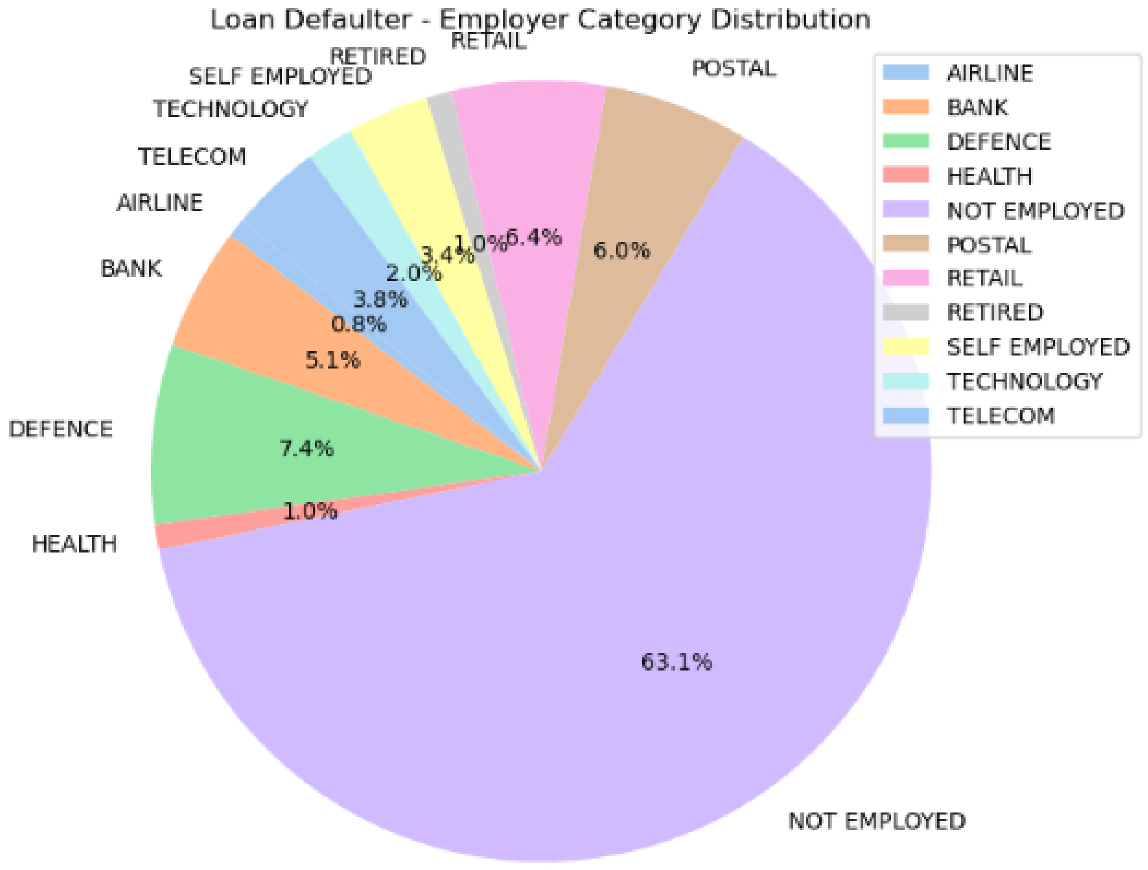
- The number of defaulters appeared to be slightly high in the 36 months loan term, but it is not very different from 60 months

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:

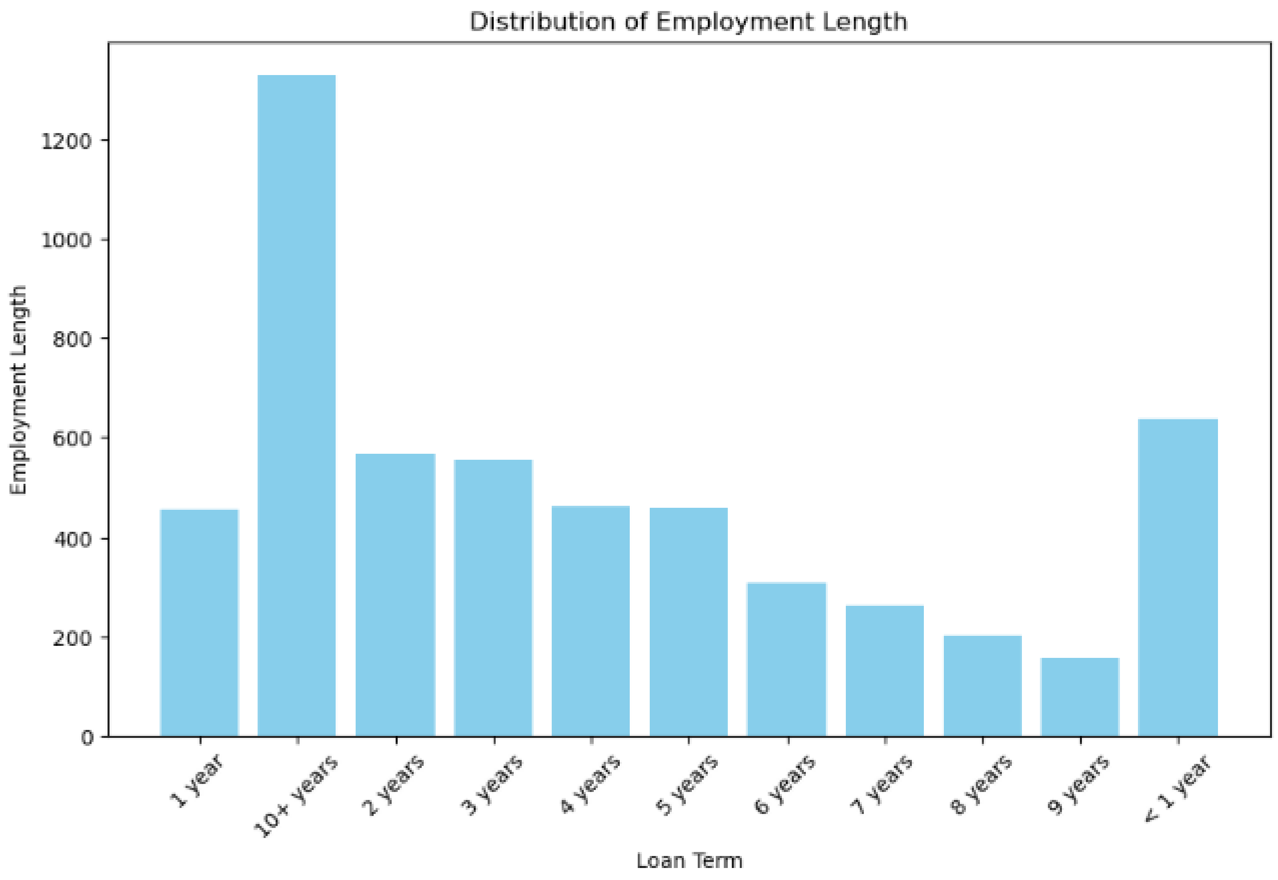
- People who are unemployed tends to be defaulting on their loans the most
- However, in the employed category, people whose employers are in Defense, Retail, and Postal service categories are defaulting more than the rest of the population

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:

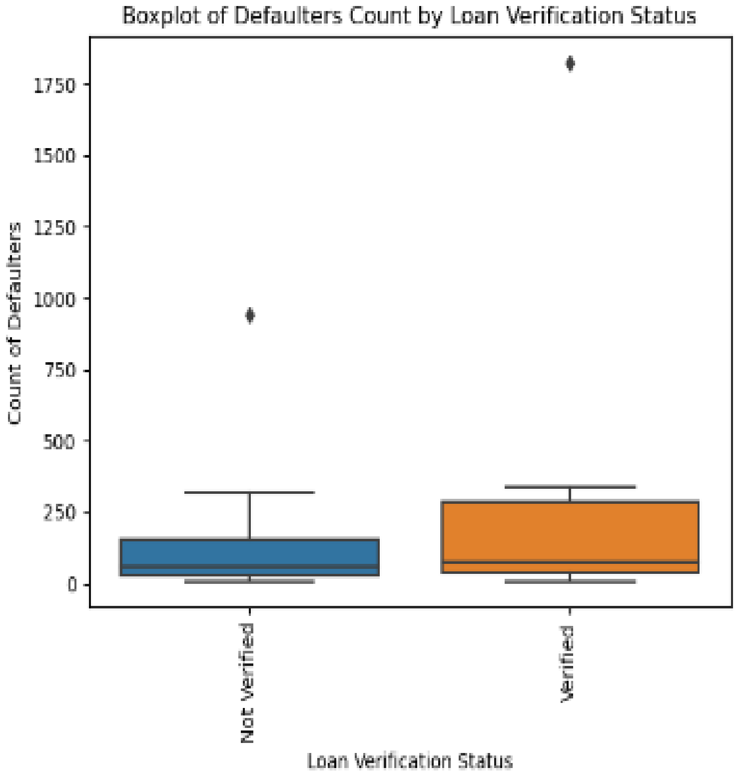
- People with 10+ years employment length are the highest loan defaulters
- In the group of people with less than 10 years of service, the highest loan defaulters falls into the <1 year of employment length category

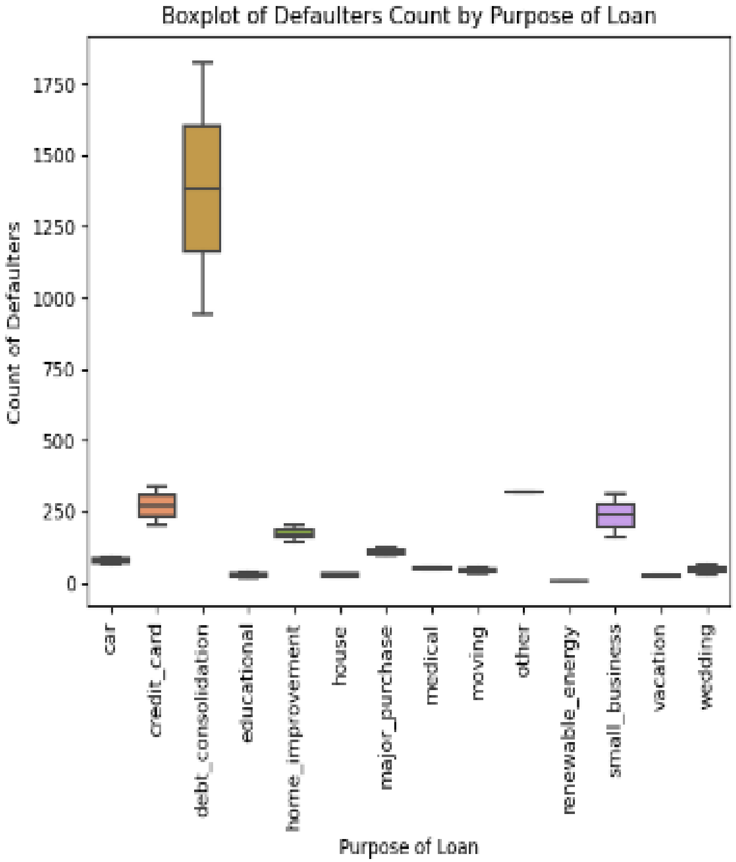
Conclusion:

- 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:

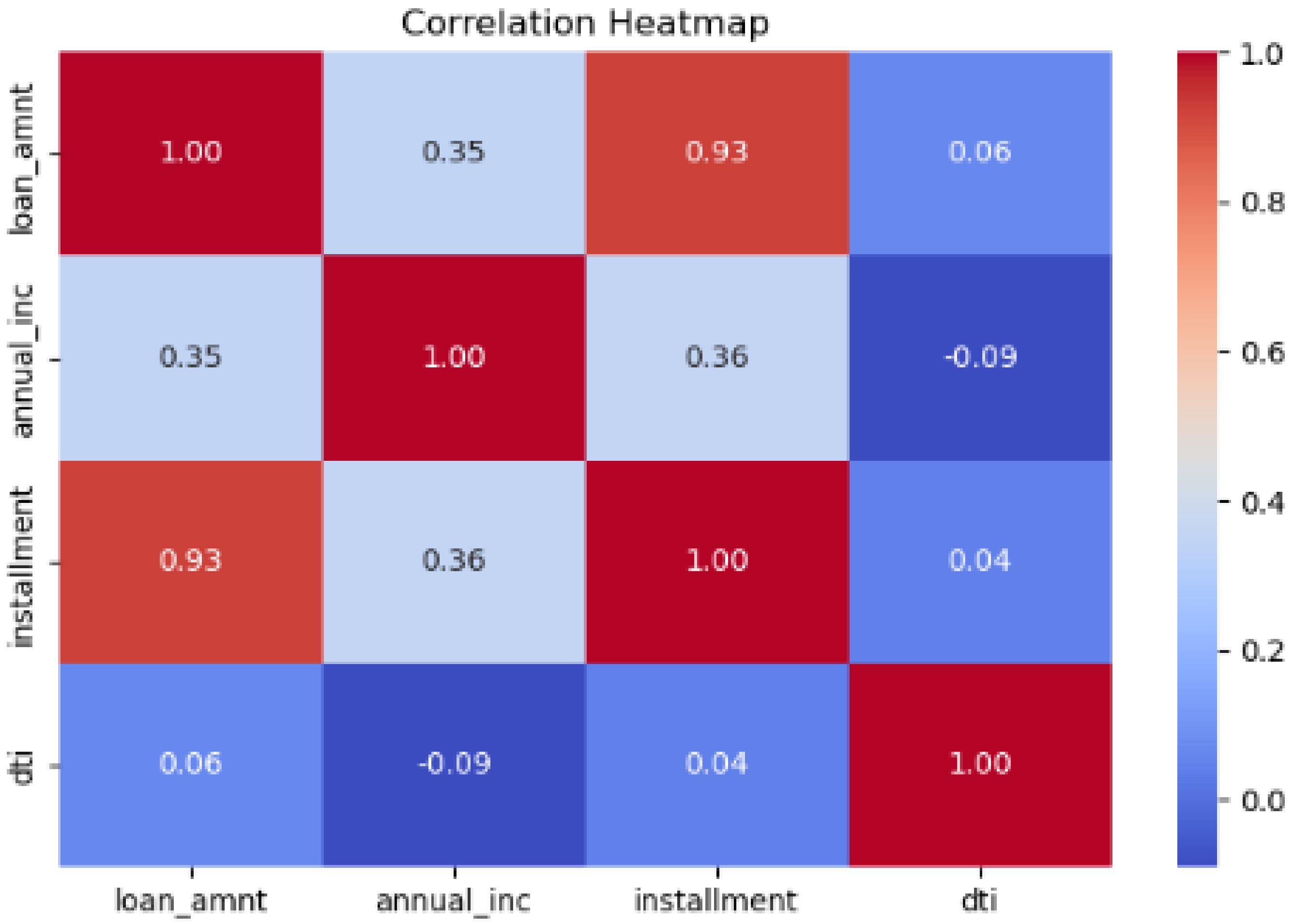
- Income verification seems to be not playing any major role on the loan being defaulted
- People taken loan for debit consolidation are the highest among defaulters
- The 25^{th} and 75^{th} quartiles of those defaulters who have taken loan for credit cards and small business are about the same

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:

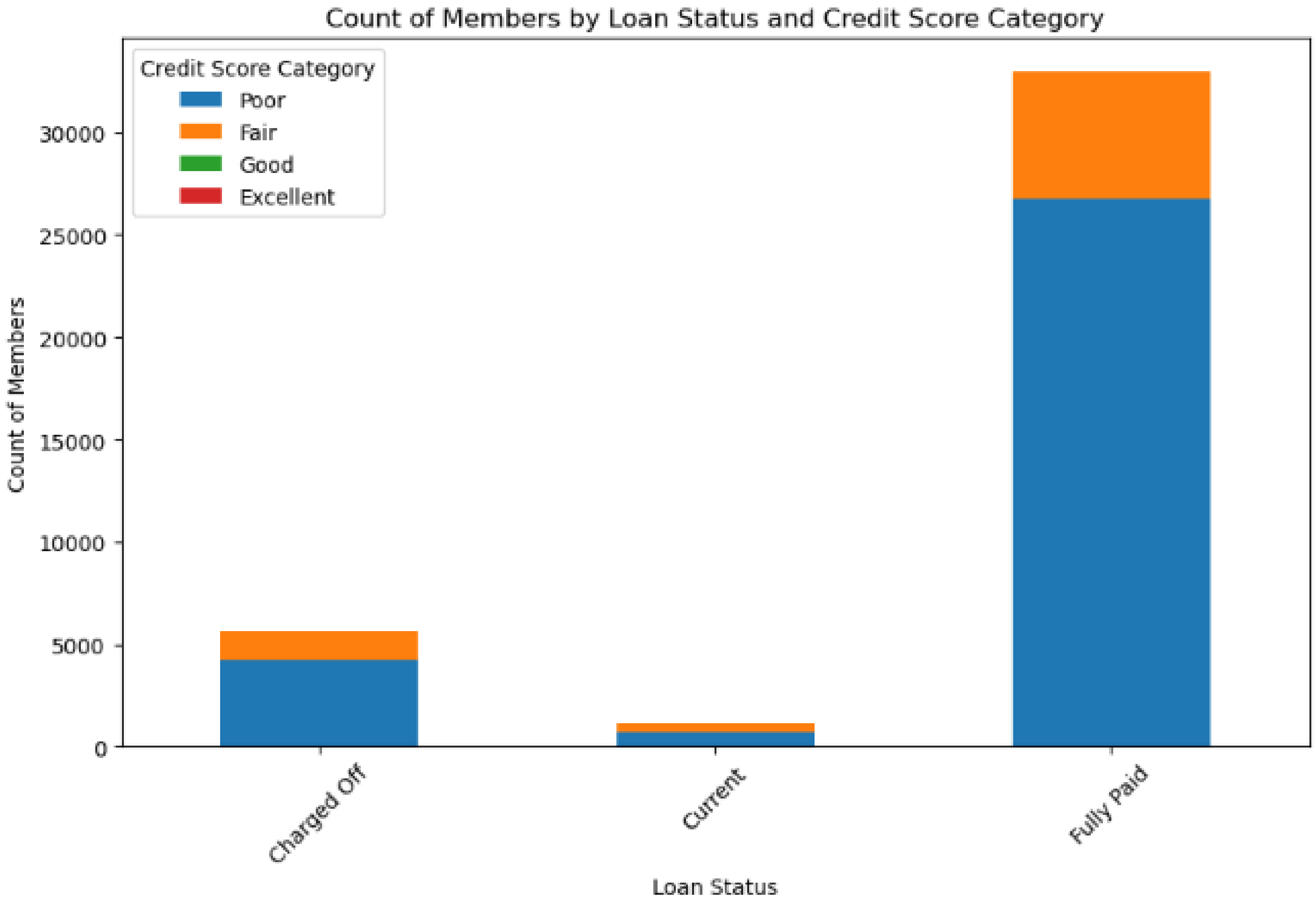
- Installment amount and loan amount are highly correlated
- Annual income and DTI are not correlated

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

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

<u>**Outstanding Amount to Fund Ratio**</u>

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

<u>**Late Fee to Fund Ratio**</u>

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:

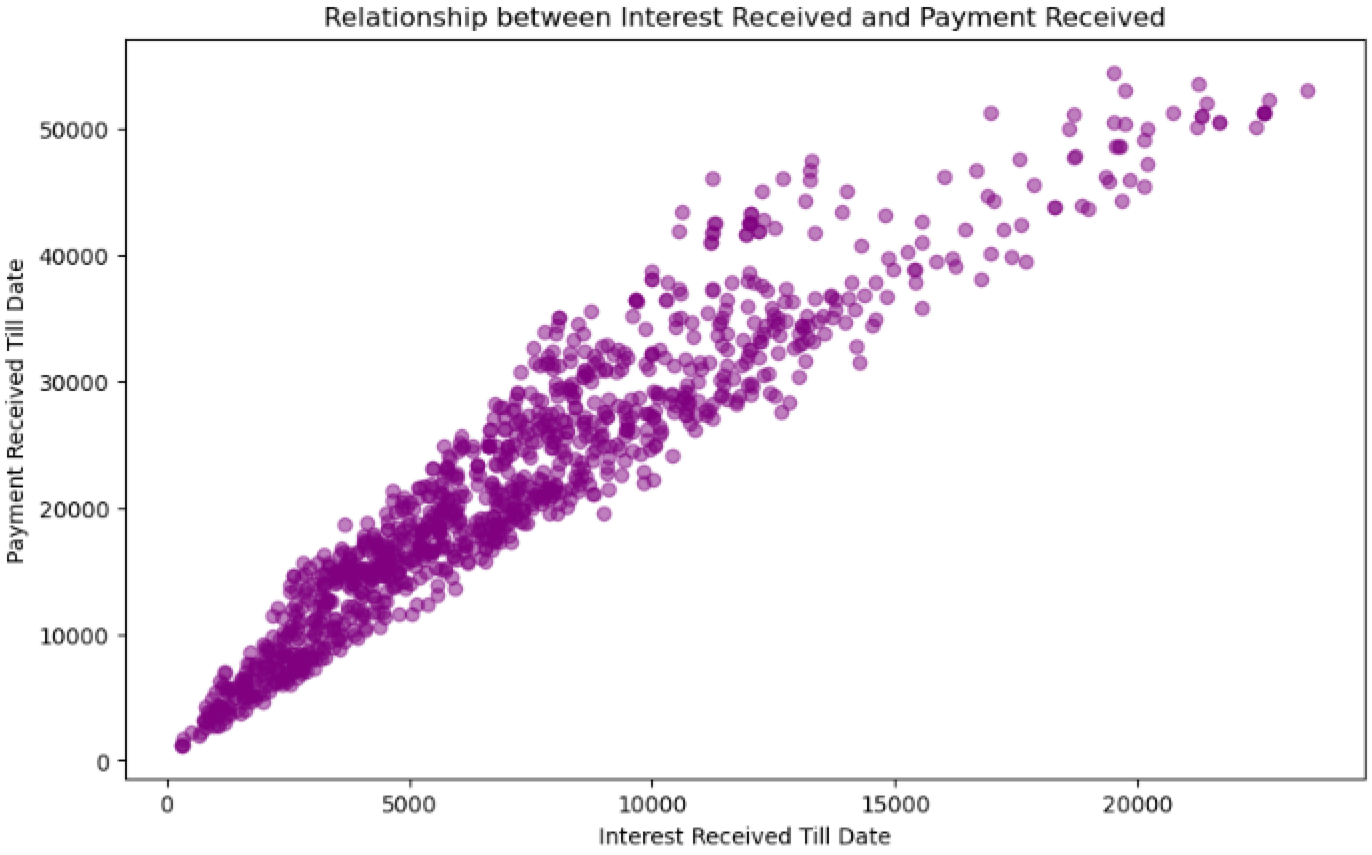
- There are no loan where the outstanding amount, and late fee ratio are greater than 25%

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:

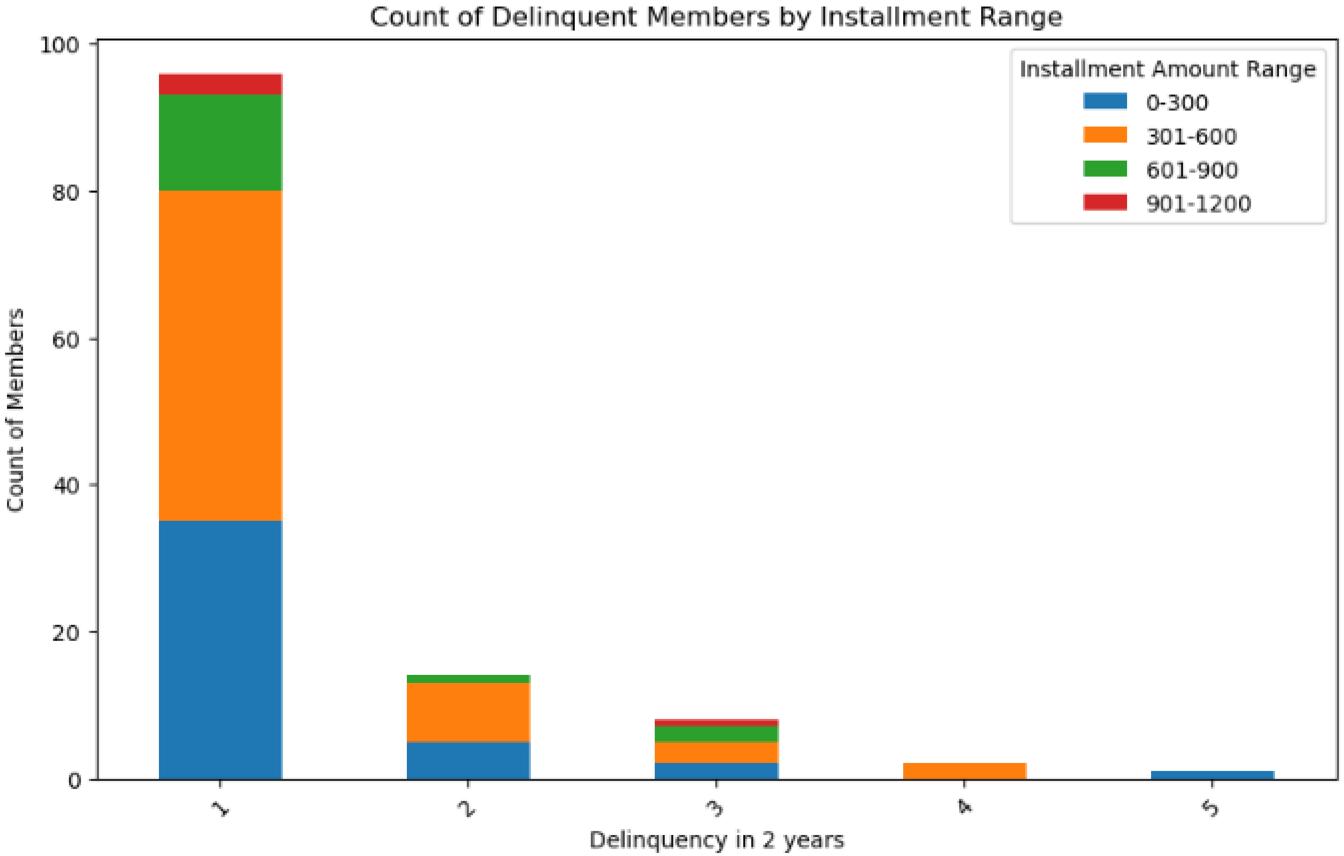
- We can see the interests are matching with payment received and the scatterplot denotes almost a straight line.

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

Thank you