# Lending Club Case Study

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# The problem

## Company

Lending Club is the largest online loan marketplace, facilitating personal loans, business loans, and financing of medical procedures.

Borrowers can easily access lower interest rate loans through a fast online interface.

## Context

Lending Club wants to understand the **driving factors** behind loan default, i.e. the **driver variables** which are strong indicators of default.

The company can utilise this knowledge for its portfolio and risk assessment.

## Problem statement

As a data scientist working for Lending Club analyze the dataset containing information about past loan applicants using EDA to understand how *consumer attributes* and *loan attributes* influence the tendency of default

# Analysis Approach

**Clean Data**

> Drop columns with null values, all random values or single category value
> Convert values to proper int, float, date representations

**Univariate Analysis**

> Check distributions and frequencies of various numerical and categorical variables
> Create derived variables

**Segmented Univariate Analysis**

> Analyze variables against segments of other variables
> Create derived variables

**Bivariate Analysis**

> Do correlation analysis
Check how two variables affect each other or a third variable
> Analyze joint distributions

**Summarize Results**

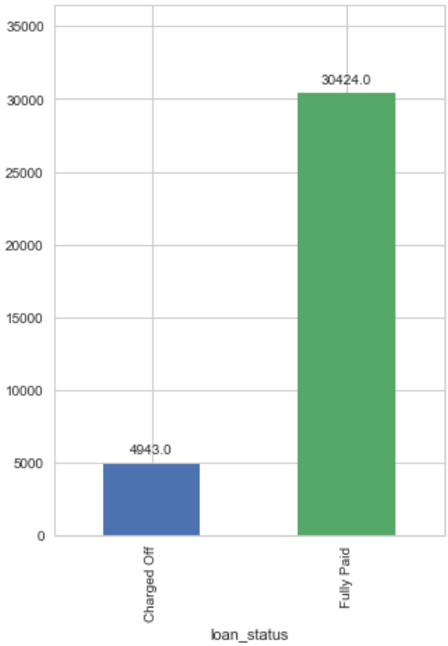
Publish insights and observations

# Analysis - Overall Loan Status

## Total Loans

Approximately 14% of loans are defaulted

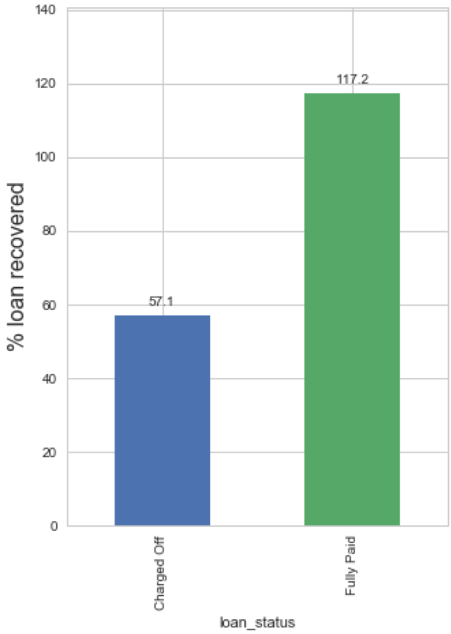
Any variable that increases percentage of default to higher than 16.5% should be considered a business risk.



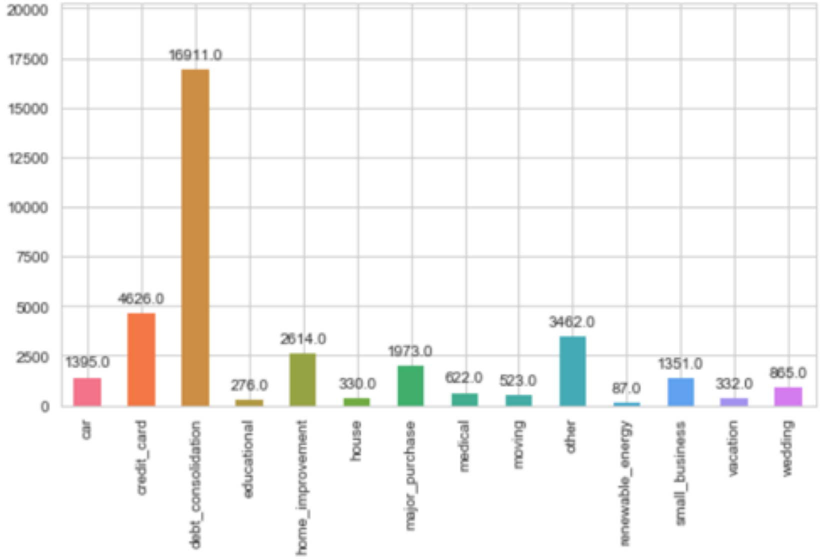

## Total Money Earned

Lending Club only recovers 57% of the loan amount when loans are **defaulted**.

On fully paid up loans, the company makes 17% profit.

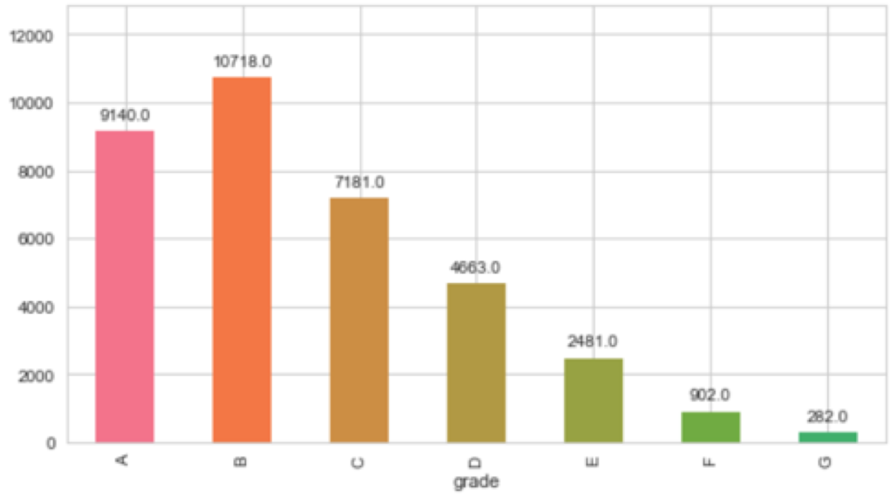


# Analysis - Understanding Loans




Maximum number of loans are for debt consolidation, followed by credit card

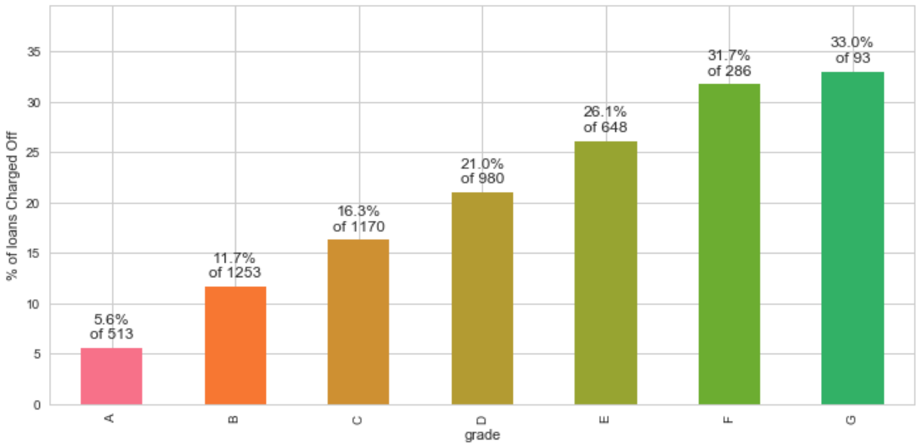
Most loans are high quality, with a grade of A or B

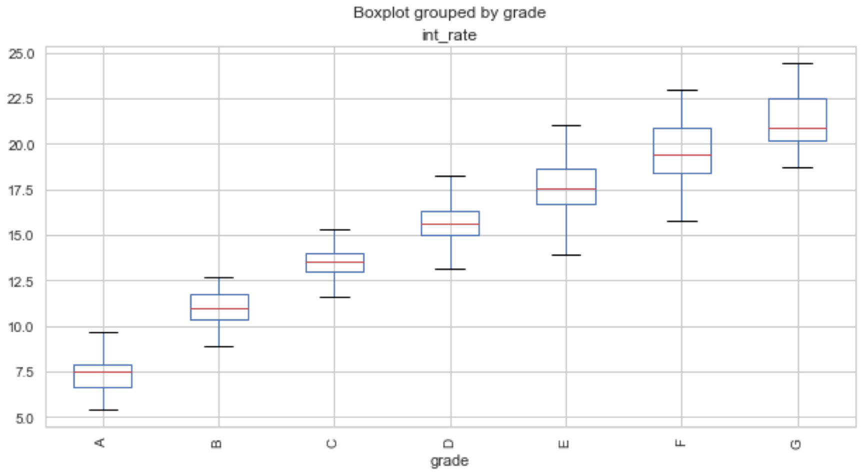


# Analysis - Understanding Loans Continued

Lower grades have higher incidence of defaults on loans.
The grading system is working!

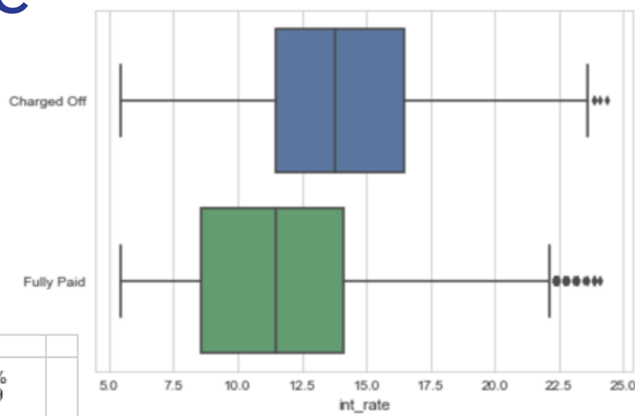
Lending Club charges higher interest rates as the grade of loan becomes worse.
However, as we will see on next slide - the driving variable for defaults is the higher interest rate.

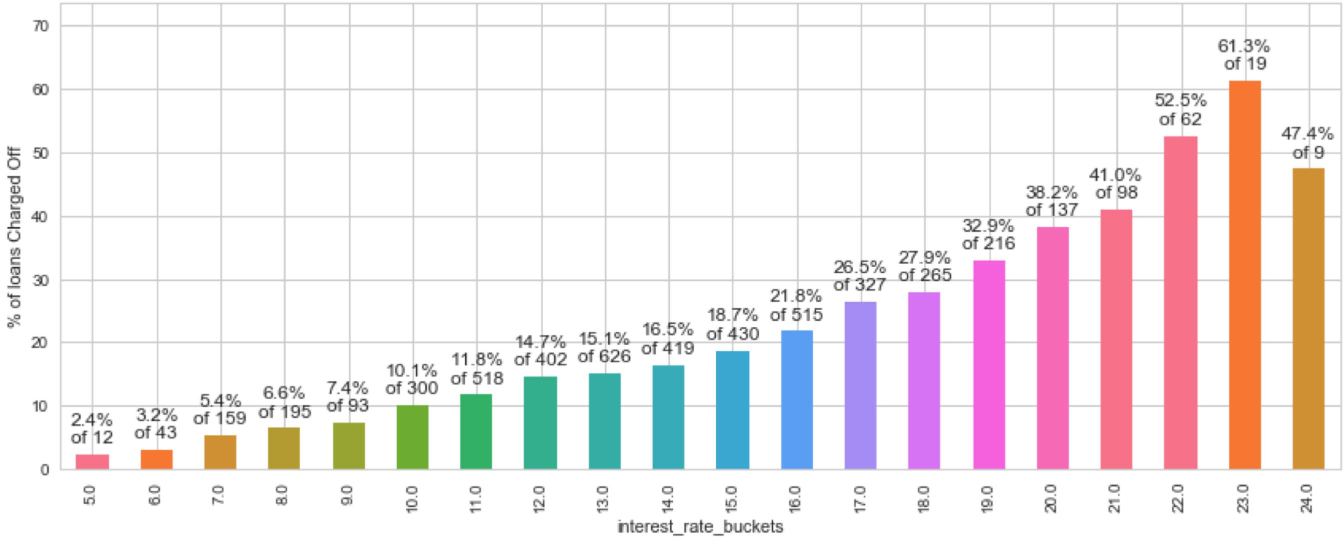


# Analysis - Defaults by Interest Rate

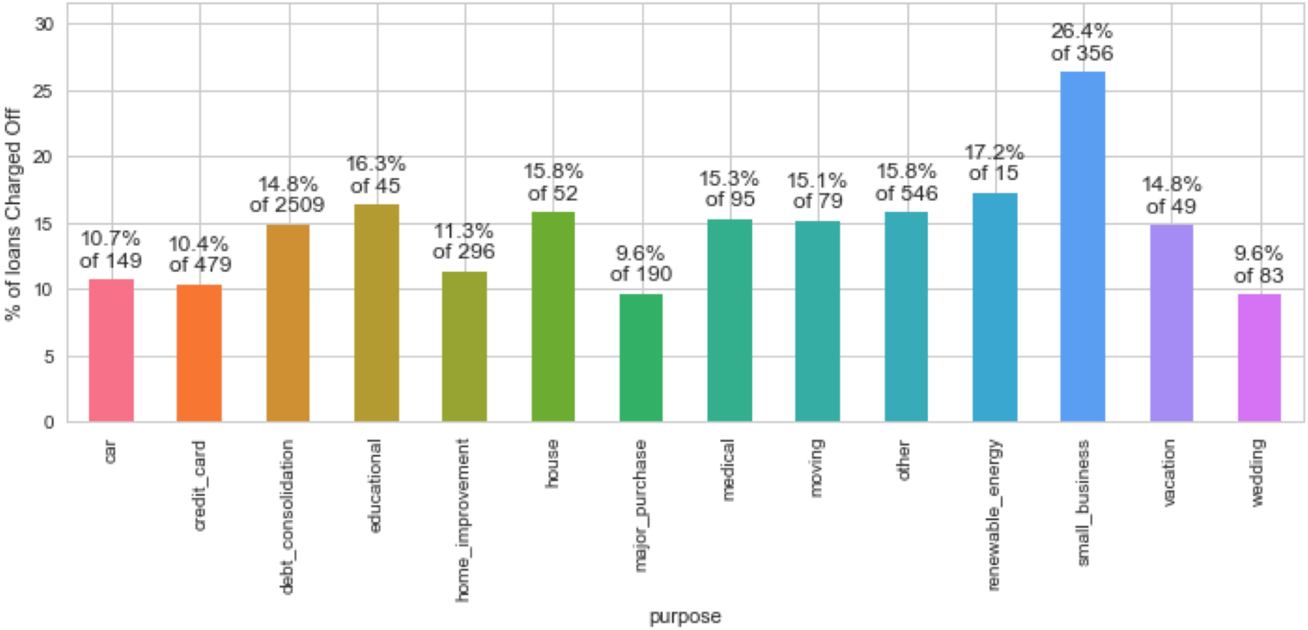
Percentage of Defaults increases monotonically with higher interest rates. At rates of 19% and above, more than 33% of loans are Charged Off.



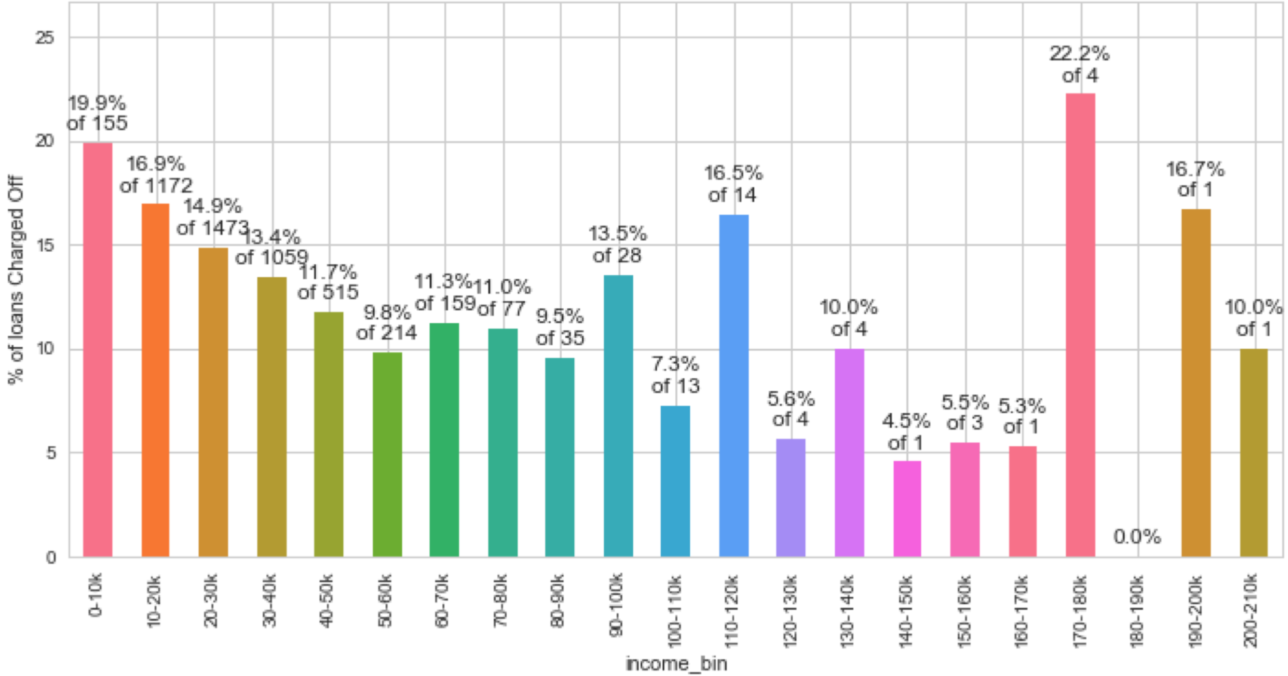
# Analysis - Defaults by Loan Purpose

More than a quarter of loans taken for the purpose of running a small business see defaults.

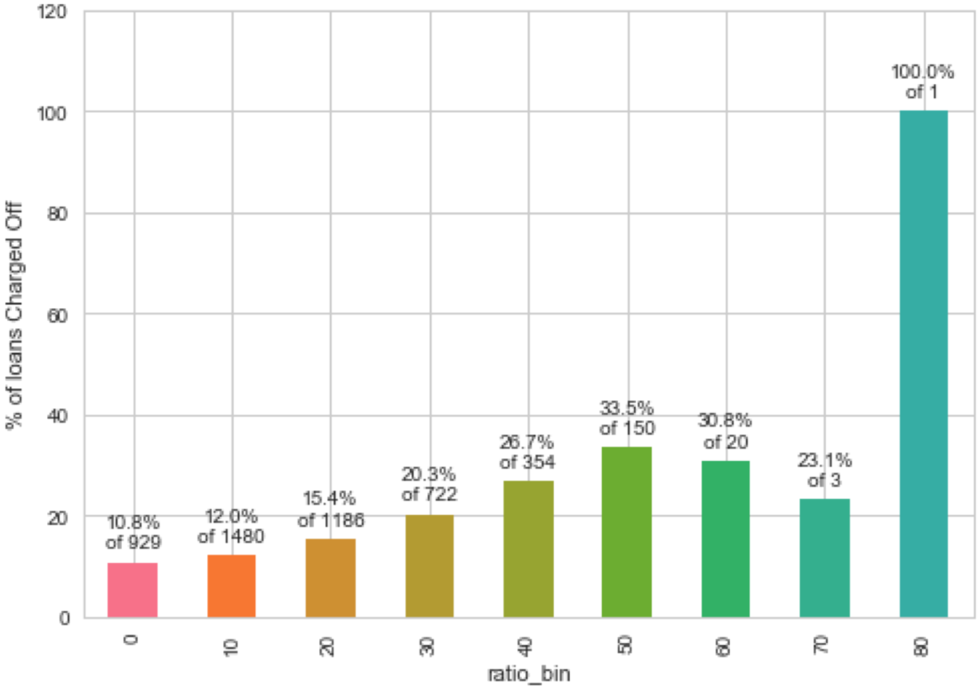


# Analysis - Defaults by Borrower's Income

Borrowers having annual income less than 20000 default on their loans at much higher rates.
Loan default decreases with higher annual income.
As we will see on next slide – the ratio of amount to income is more important.



# Analysis - Defaults by ratio of amount to income

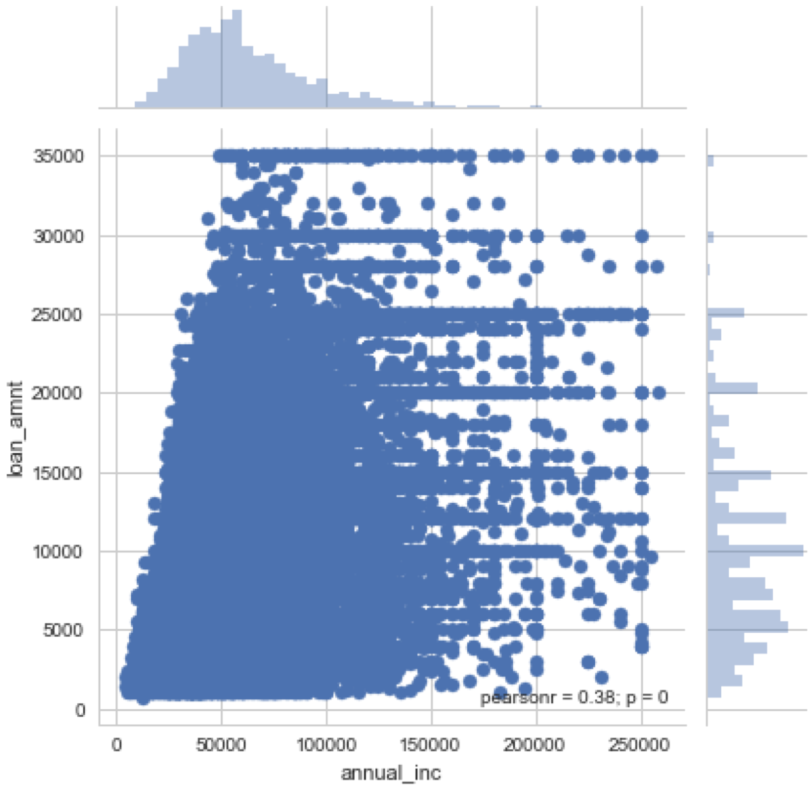



X-axis is the % of loan amount versus annual income

As long as loan amount is less than 20% of annual income, defaults are low.

Loan amounts of 30% of annual income or higher see a high rate of default.

# Analysis - Defaults by ratio Continued

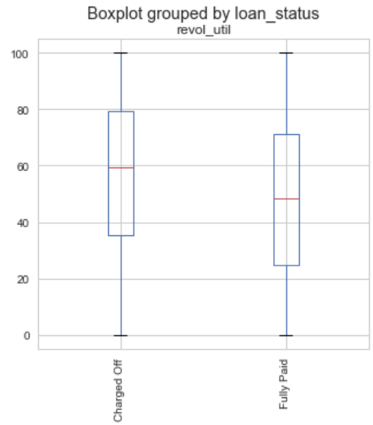



We see here that Lending Club has extended high-value loans to people with low income.

There are many cases of people with income 50000 or less getting loans of 25000 or more.

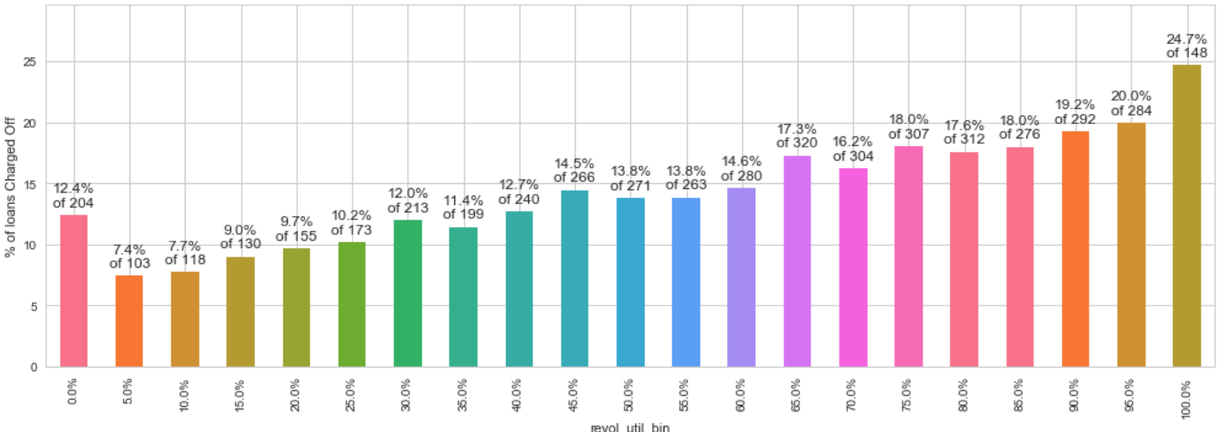
This practice should be curtailed.

# Analysis - Defaults by Revolving Line Util Rate

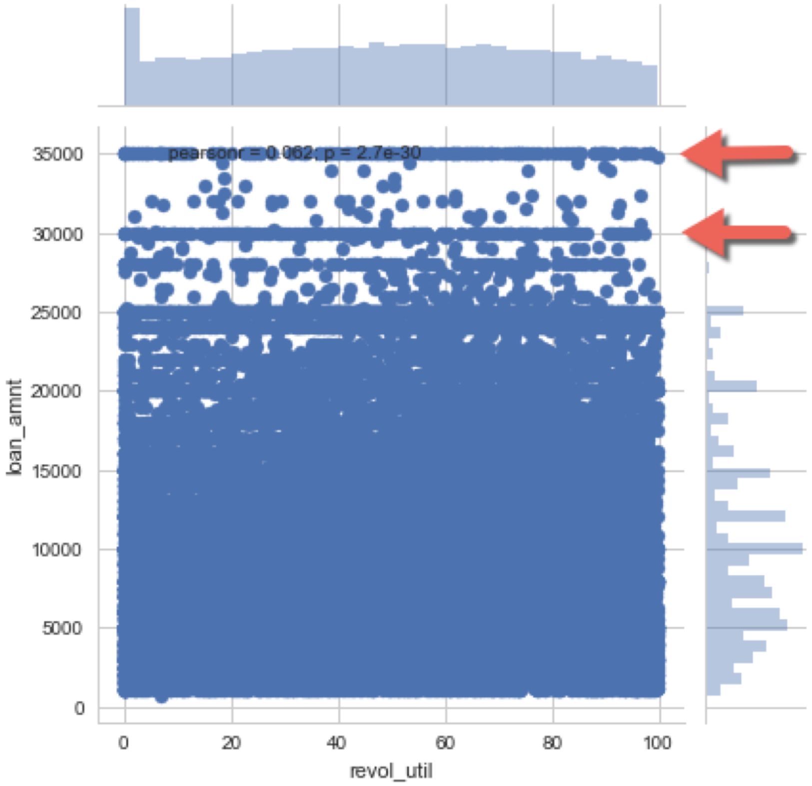



People with high utilization of Revolving Line of Credit at the time of taking loan default more.

Loans with utilization > 75% are risky.



# Analysis - Defaults by Rev Util Continued



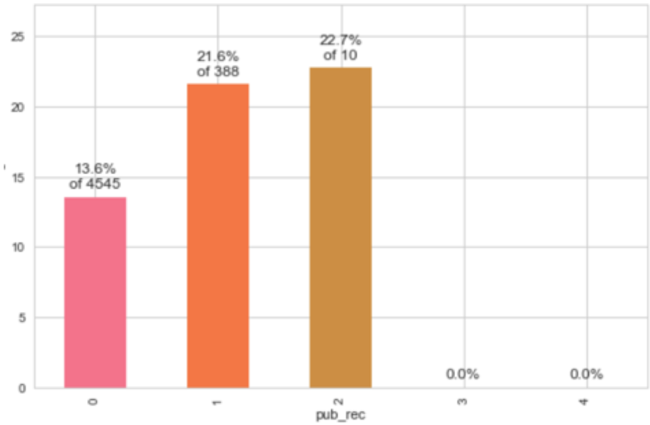

There have been some high value loans extended to borrowers with revolving line utilization rate of higher than 75%.

This practice should be stopped.

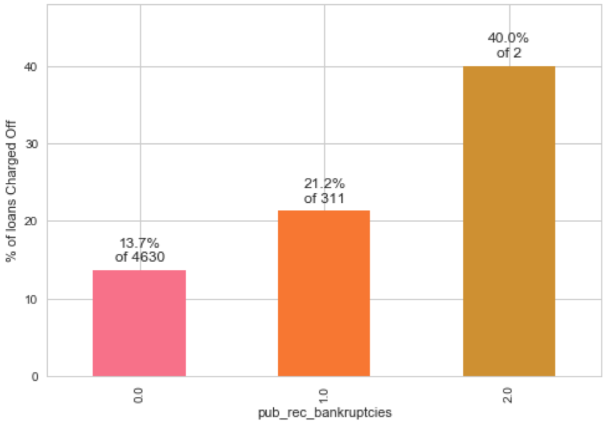
Density of low value loans is also high. They should be approved less often.

# Analysis - Defaults by prior bad record

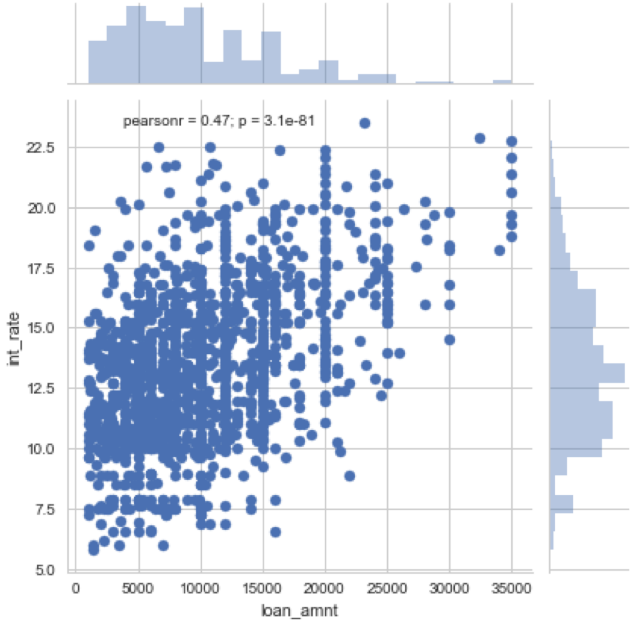
- 94% have no Public derogatory records.
- Having even 1 derogatory record increases the chances of Charge Off significantly.




- 96% have no bankruptcy record.
- Having even 1 bankruptcy record increases the chances of Charge Off significantly.
- Public Derogatory Record and Public Bankruptcy records have 83% correlation. We can use any one.



# Analysis by prior bad record - Continued




Data of people with >0 bad records

High value loans, as well as low interest loans have been extended to those with prior public derogatory records.

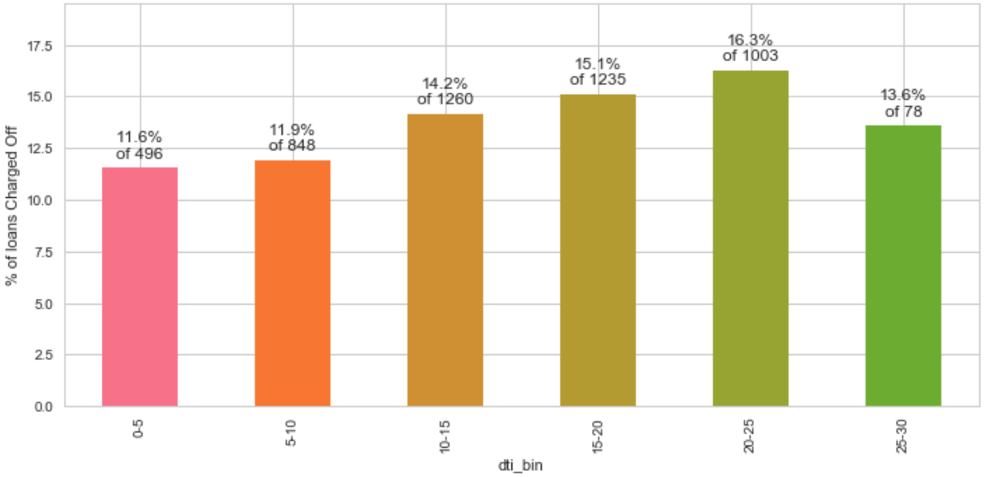
This practice can be stopped to improve business metrics.

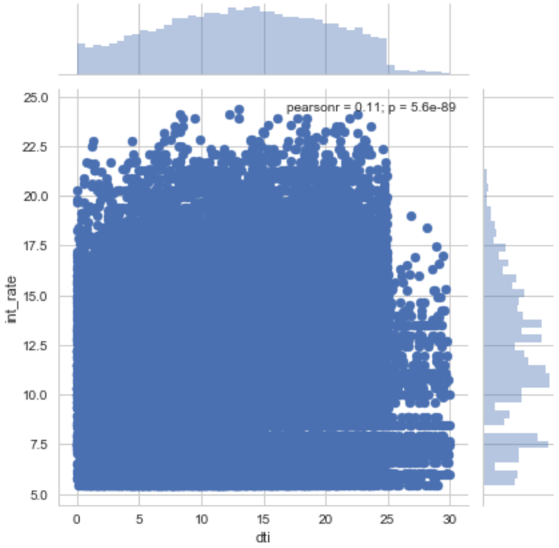
# Analysis – Defaults by Debt to Income Ratio

Percentage of default rises with dti ratio.

As the dti ratio rises above 20, the loans become risky.

Higher interest rates should be charged for higher dti, but we see spread across all values



# Recommendations

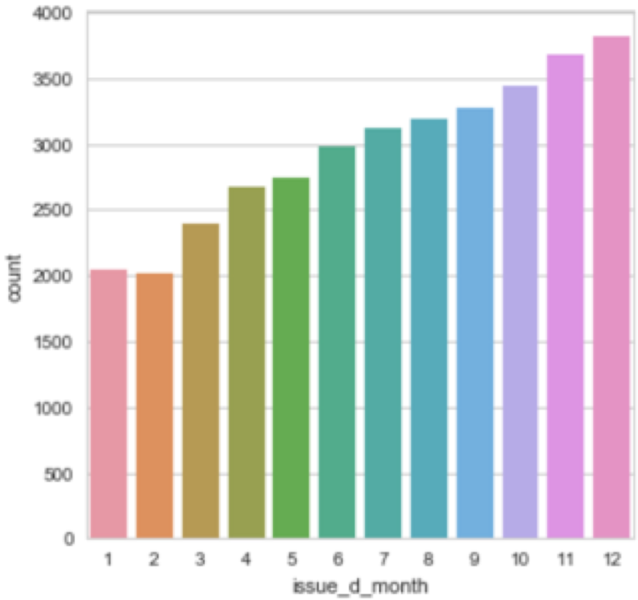
Better Quality Borrowers

1. Stop – approving loans where amount/income is higher than 30%
2. Reduce – number of approvals where purpose is small business
3. Stop – approving high-value loans when revolving line utilization rate greater than 75%
4. Stop – approving loans to people with prior bad record. Or at least stop approving high-value loans
5. Start – charging higher interest rates for loans with dti greater than 20

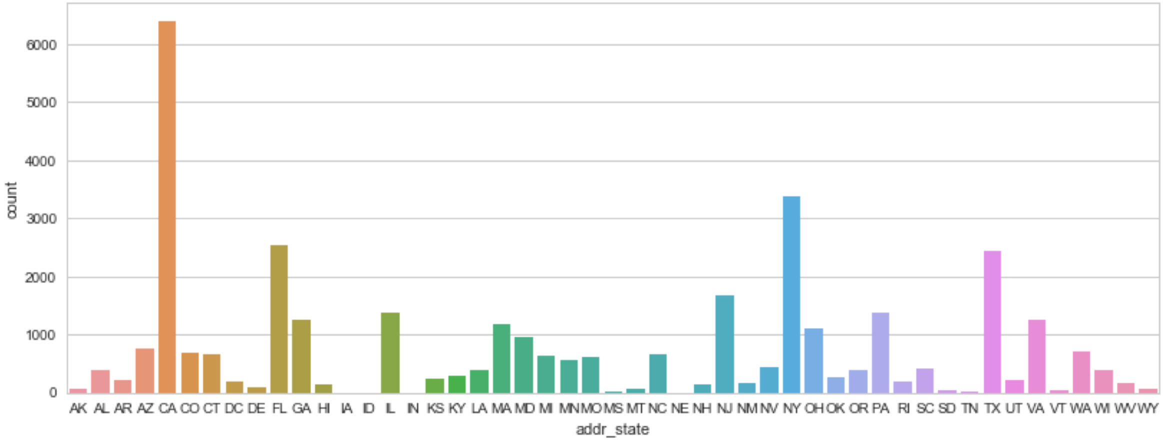
# The End! Questions?

# Appendix: Interesting tidbits

Loan numbers increase as months get closer to year-end. Are people trying to meet targets?



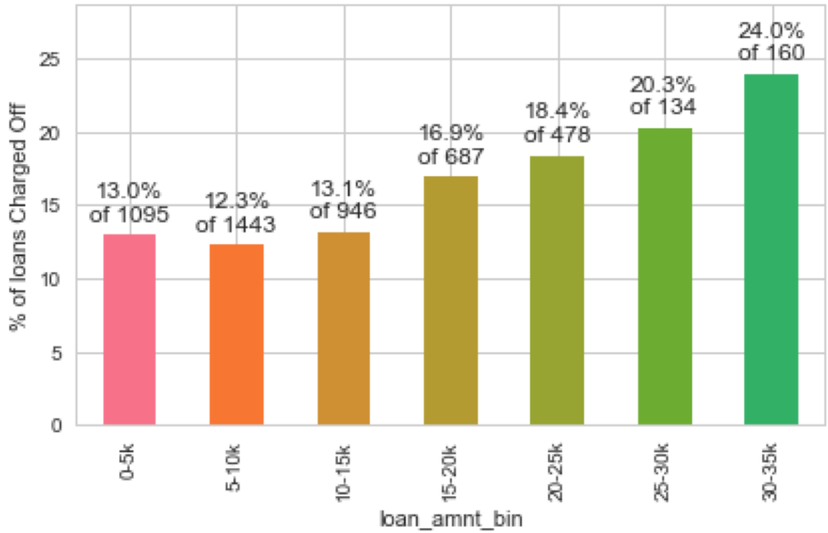

Maximum loans are in populous states, California, New York, Florida and Texas



# Appendix: Interesting tidbits

As the loan amount increases, the chance of default also increases.

**High value loans are being extended to questionable quality borrowers?**



# Appendix: Interesting tidbits

People who took their first loans just before an economic crisis, like the one in 1980 and the subprime crisis in 2008, have higher rates of default.
Presumably, these are young people who were affected by the economic conditions of their early career.