Business Objective

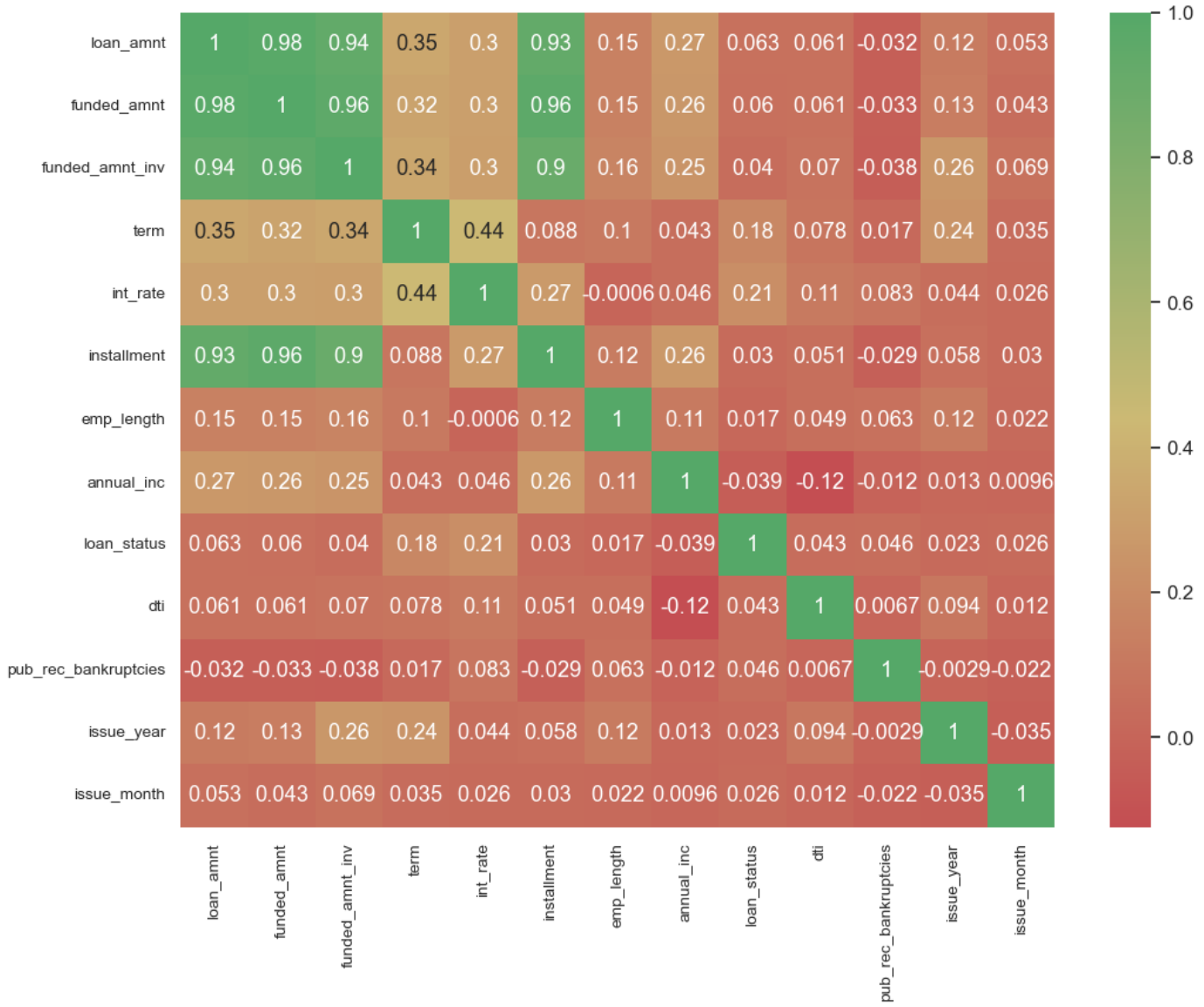
This company is the largest online loan marketplace, facilitating personal loans, business loans, and financing of medical procedures. Borrowers can easily access lower interest rate loans through a fast online interface. Lending loans to ‘risky’ applicants is the largest source of financial loss (called credit loss). Credit loss is the amount of money lost by the lender when the borrower refuses to pay or runs away with the money owed. In other words, borrowers who default cause the largest amount of loss to the lenders. In this case, the customers labelled as 'charged-off' are the 'defaulters'. If one is able to identify these risky loan applicants, then such loans can be reduced thereby cutting down the amount of credit loss. Identification of such applicants using EDA is the aim of this case study.

Data understanding and Clean up

- Totally 39717 Rows and 111 Columns
- Out of which
  - 56 columns have more than 90 percent missing values
  - 9 columns have the same value for the all rows
  - 22 columns are irrelevant
  - 7 columns are miscellaneous
  - Totally 94 columns are removed
- Final number of columns for analysis : 17
- Almost 85 % of the columns are filtered
- Row clean up : ‘Current’ Loan Status
- Loan Status : 0 Represent Full Paid, 1 Represent Charged-off
- Interest Rate : Percentage symbol % is removed

Correlation Matrix

- Observations
  - Let us take sample target variable as Loan status
  - The variables which are relatively higher correlation with respect to loan_status
    - Int_rate
    - term

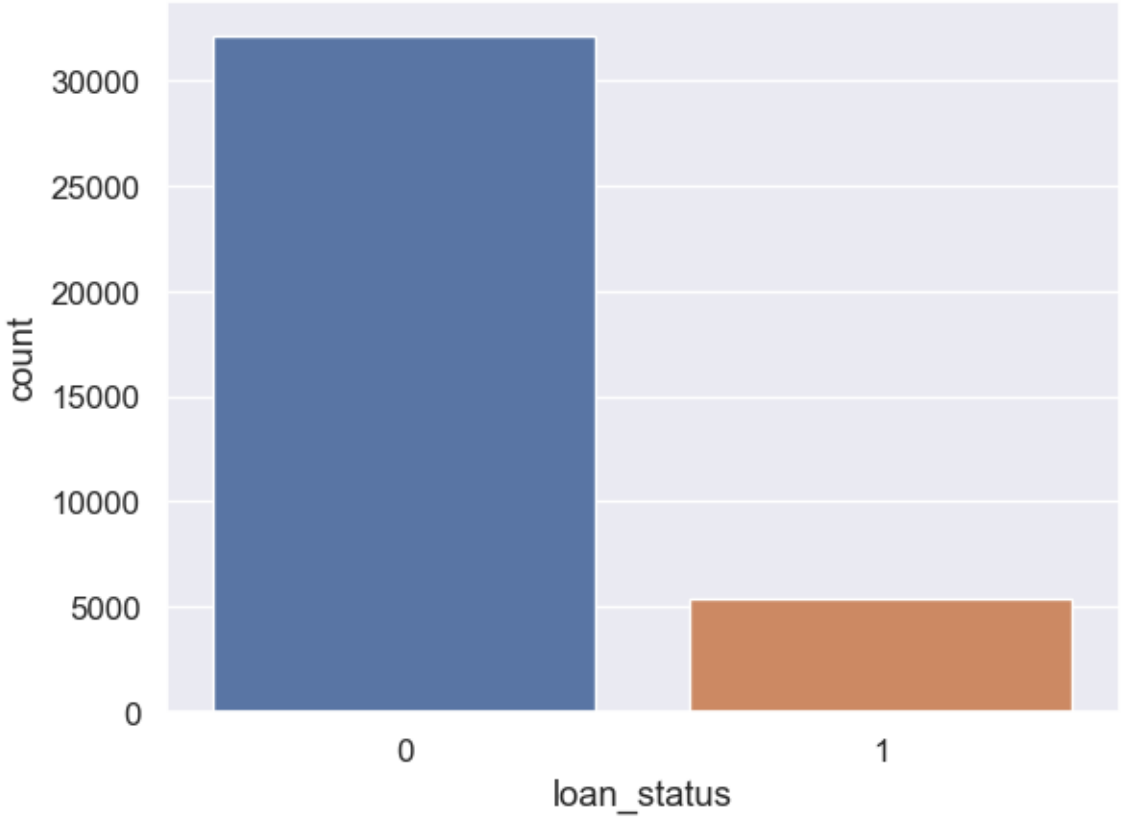


Loan status

- The loan status ‘current’ is filtered
- 'Fully Paid’ is represented as 0
- ‘Charged off’ is represented as 1

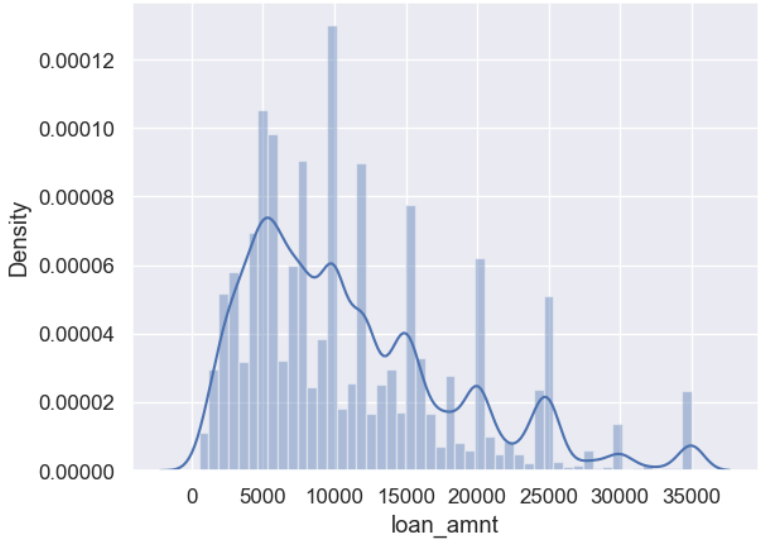
	Rows	Percentage after filtering
Fully Paid	32145	85.62
Charged Off	5399	14.38

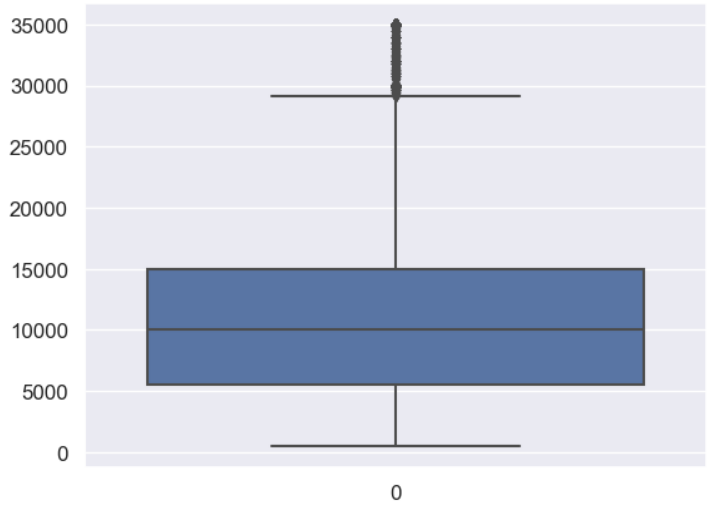
Fully Paid : Charged Off is almost 6 : 1



Loan Amount

count	37544.000000
mean	11119.329986
std	7354.098954
min	500.000000
25%	5500.000000
50%	10000.000000
75%	15000.000000
max	35000.000000

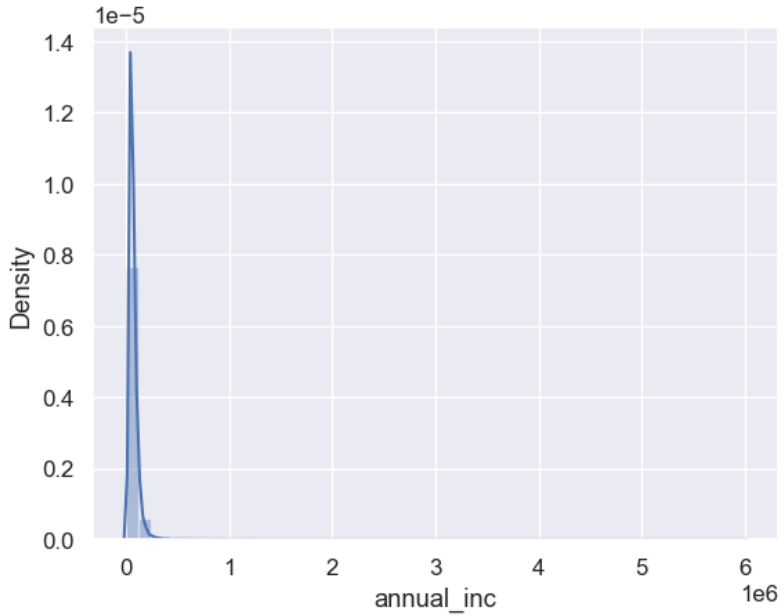




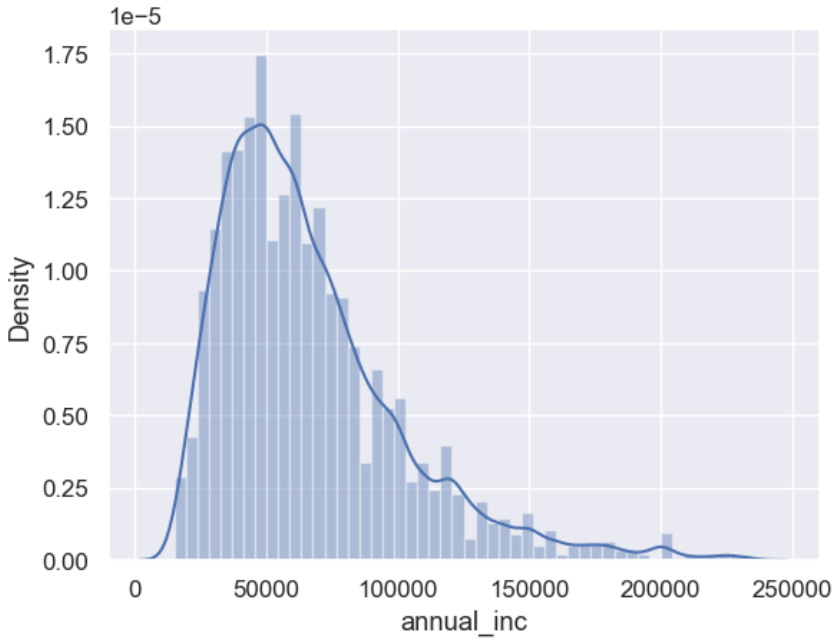
Observations

- Average Loan amount is 11119
- Most of the loan taken are in the range 5500 - 15000
- Maximum loan taken is 35000 and minimum is 500

Annual Income



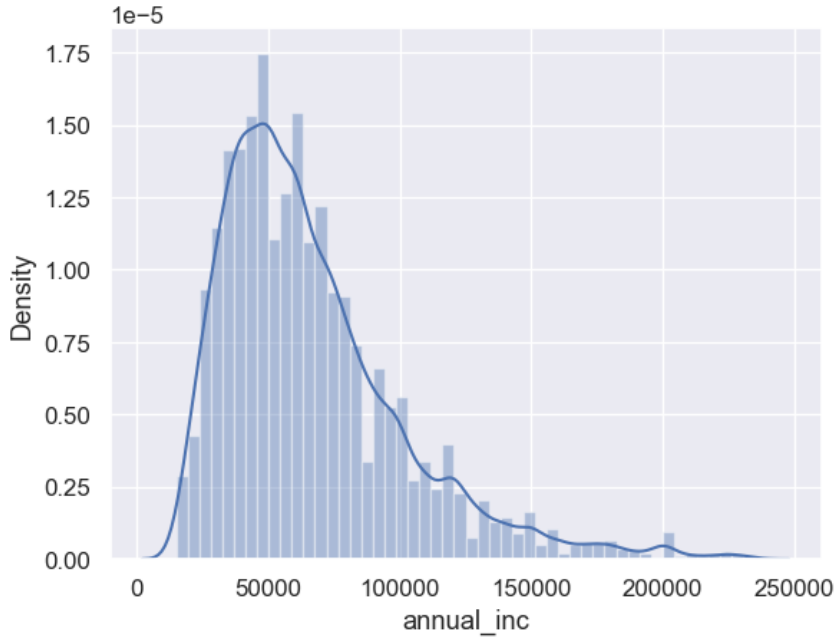
After removal of outliers

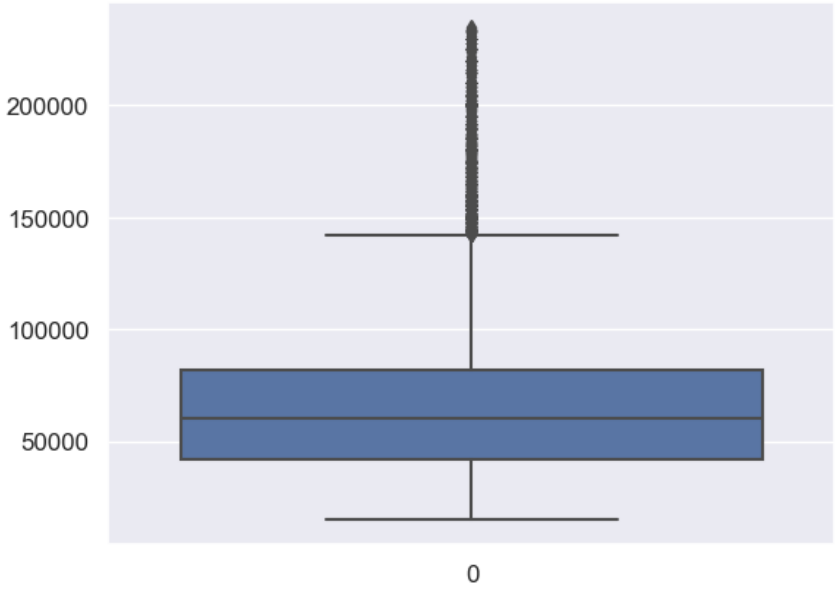


Annual Income

Findings

- Average salary is 69407
- Maximum salary is 6000000 and minimum is 4000
- Most applicants have salary range between 41000 and 83000

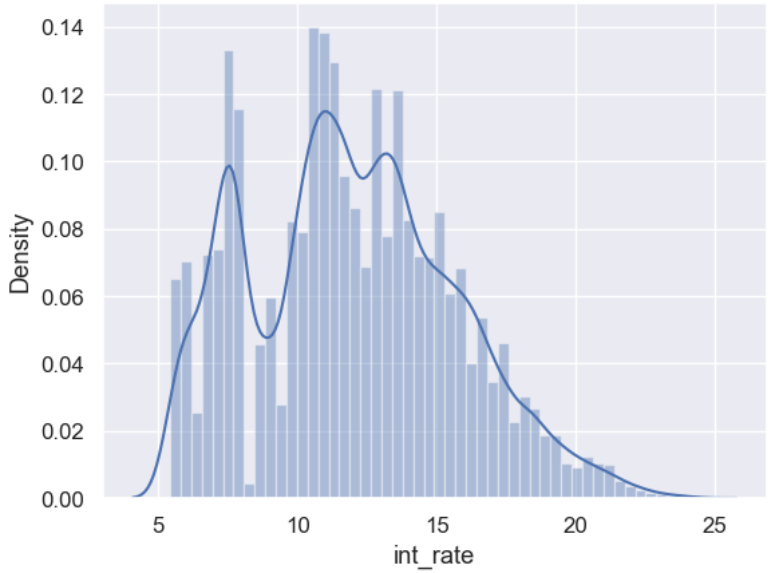


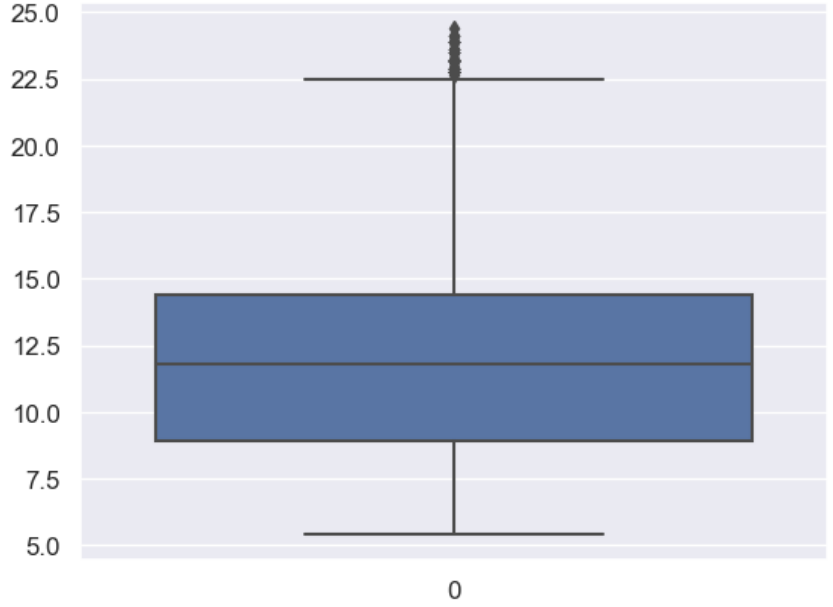


Int_Rate

Findings

- Average interest rate is 12%(approximately)
- Maximum interest rate is 24.4% and minimum is 5.42%
- Most loans have interest rate between 8.94% and 14.41%
- Bimodal, i.e likely two sets of interest rates
- No evident outliers





Ownership

Home Ownership	Percentage
RENT	48.12
MORTGAGE	44.36
OWN	7.26
OTHER	0.26
NONE	0.01

Findings

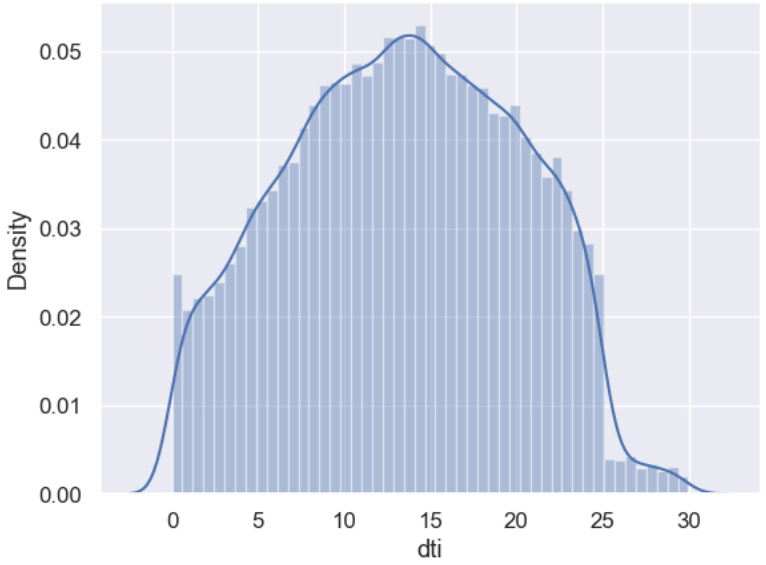
- Most people who take loans are staying at rented houses(48%) or have mortgaged their houses(44%).
- People with no houses generally doesn't take any loans(0.01%).

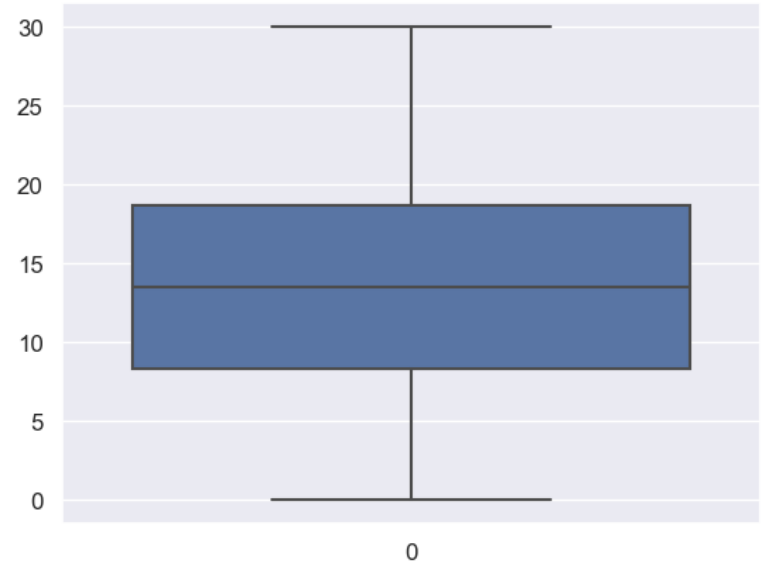
Debt to income ratio(DTI)

Findings

- Average DTI is 13(approximately)
- Maximum DTI is 30(approximately) and minimum is 0
- Most applicants have DTI between 8.29 and 18.62

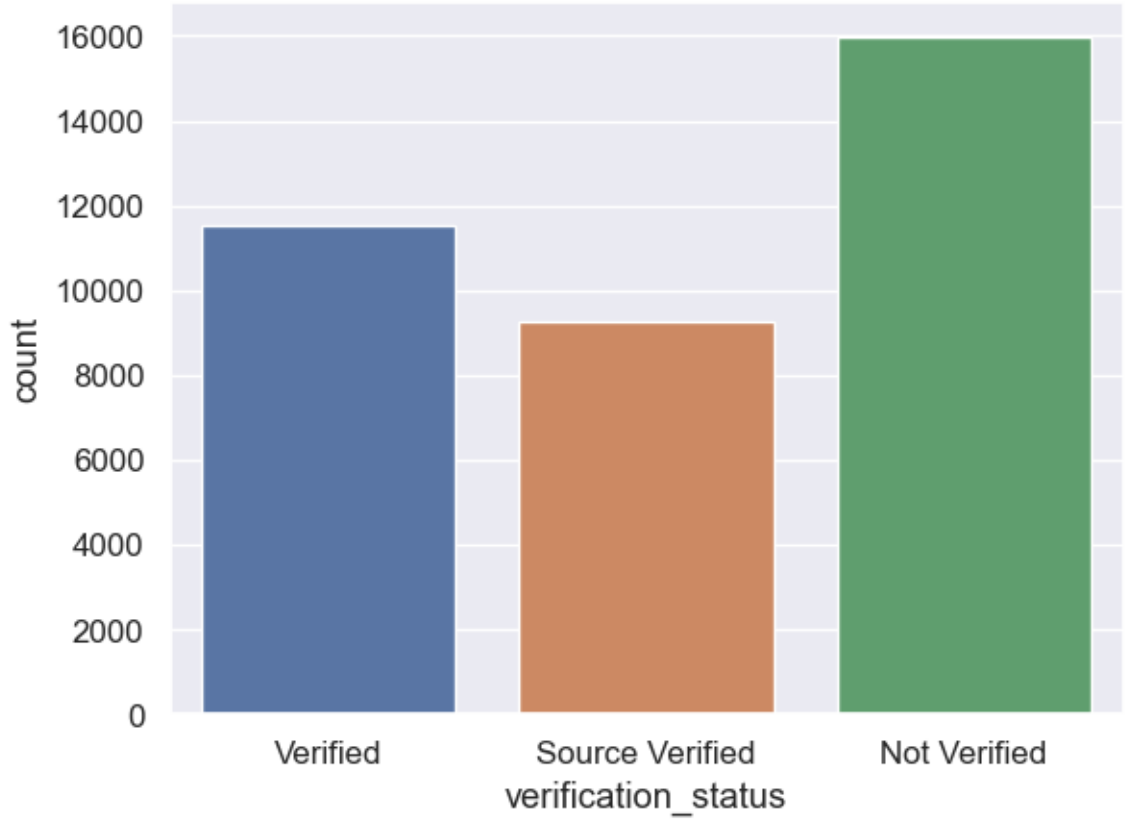
Parameter	Value
count	36762
mean	13.37523
std	6.638618
min	0
25%	8.29
50%	13.48
75%	18.62
max	29.99





Verification Status

Verification Status	Percentage
Not Verified	43.46
Verified	31.37
Source Verified	25.17

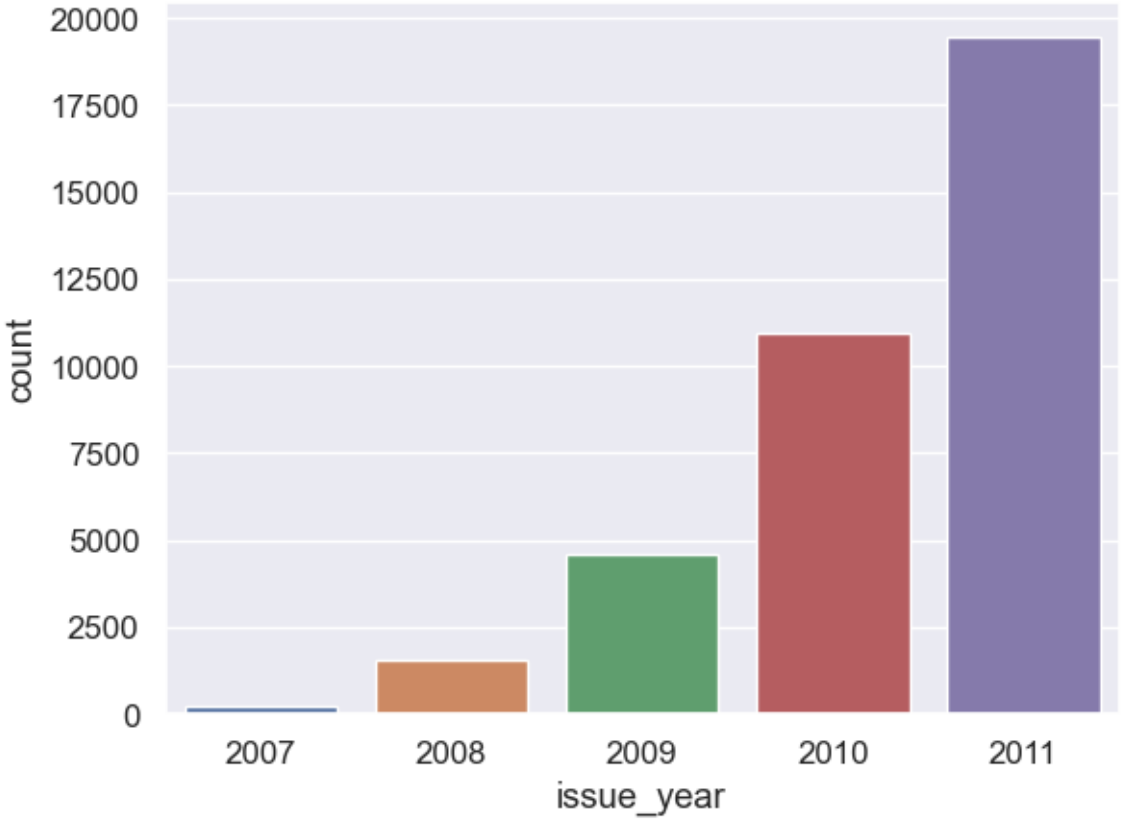


Findings

- Most of the loans taken are by verified people(25% + 31% = 56 %)
- Non verified people loans are around 43.5%

Year of issuance

Year	Perentage
2011	52.91
2010	29.8
2009	12.47
2008	4.17
2007	0.65

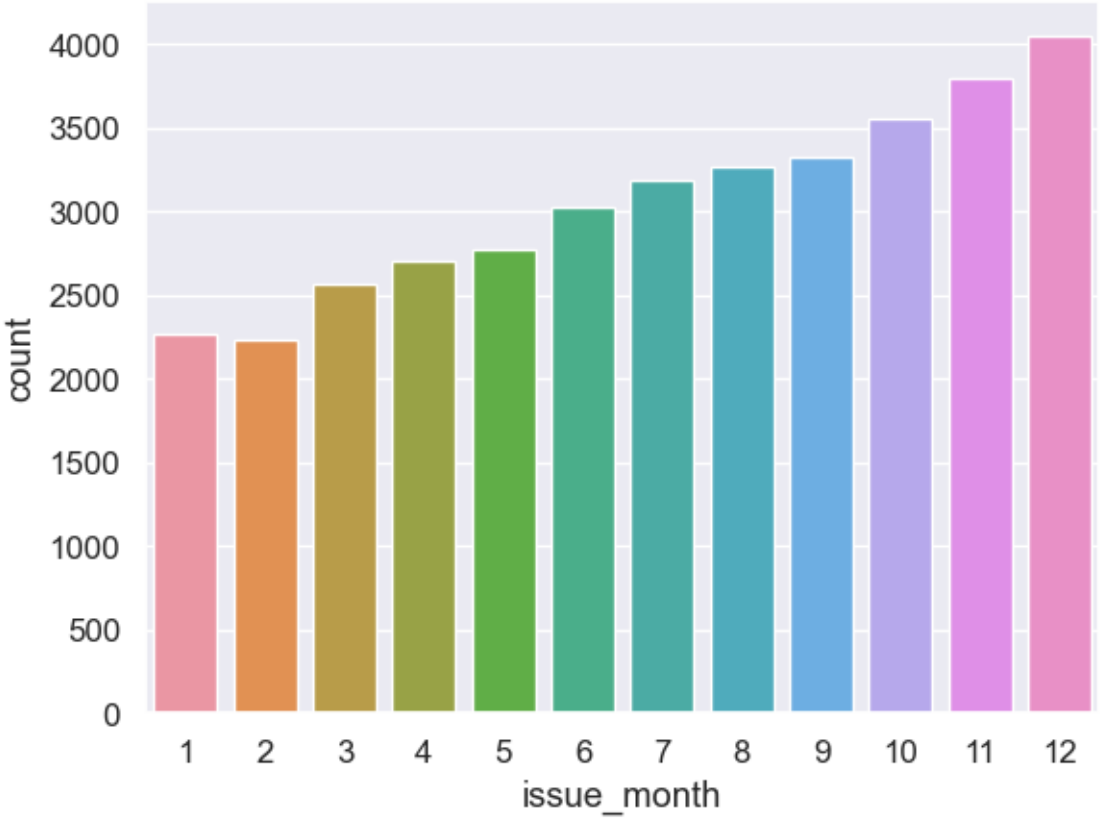


Findings

1. Most loans were taken in the year 2011
2. In 2007 people took least loans(Loan interest rate might be the reason for this. Maybe in 2007-2008 loan interest rates were high)

Month of issuance

Month	Percentage
12	11.02
11	10.33
10	9.66
9	9.06
8	8.88
7	8.66
6	8.24
5	7.56
4	7.36
3	6.98
1	6.18
2	6.08

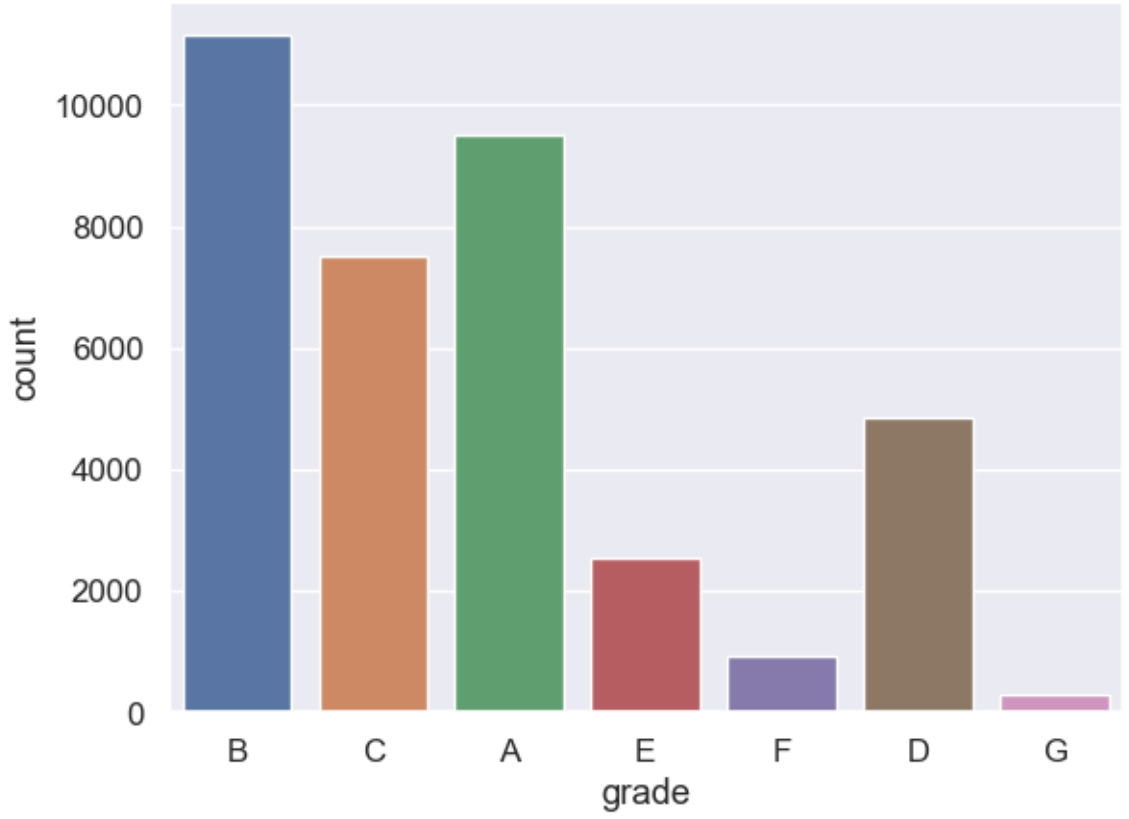


Findings

- At the start of the year people generally take lesser loans
- At the end of the year people generally seems to take more loans.

Grade

Grade	Percentage
B	30.31
A	25.83
C	20.4
D	13.2
E	6.93
F	2.54
G	0.78

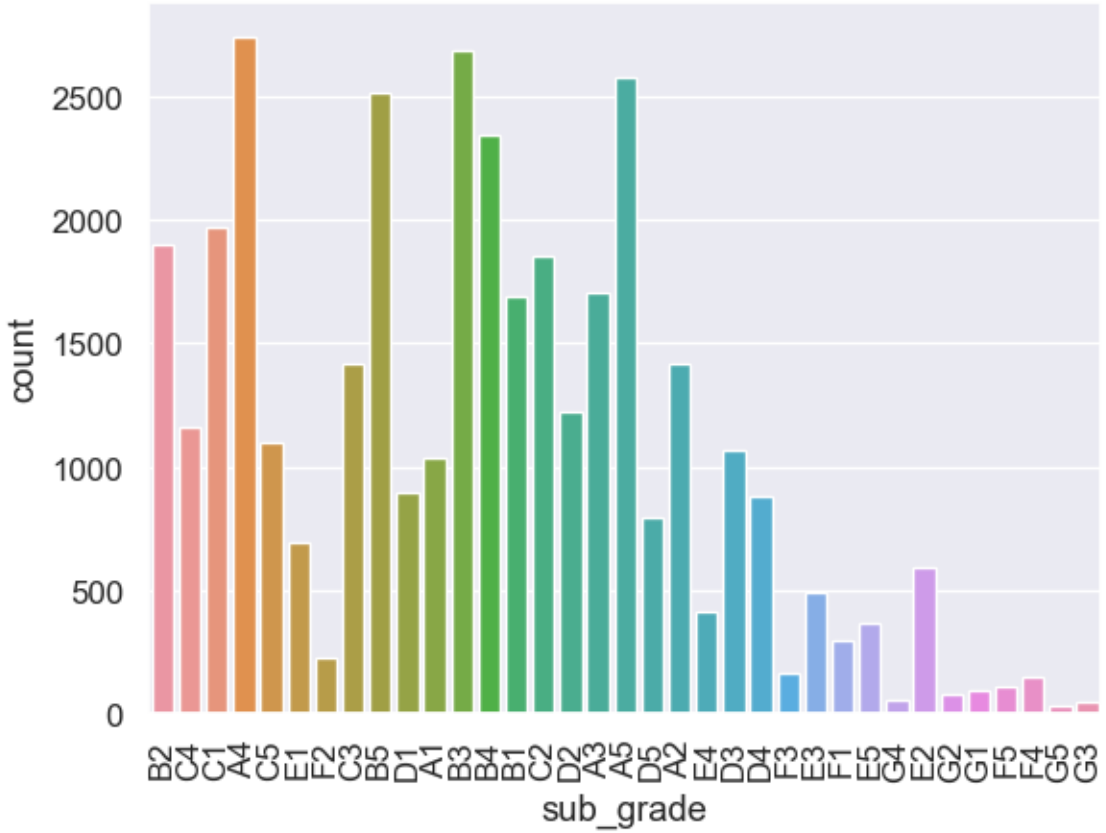


#Findings
#1. Grade B generally take more loans than any other grade followed by Grade A and Grade C respectively
#2. Grade F and Grade G applicants take comparatively much lesser loans.

Sub Grade

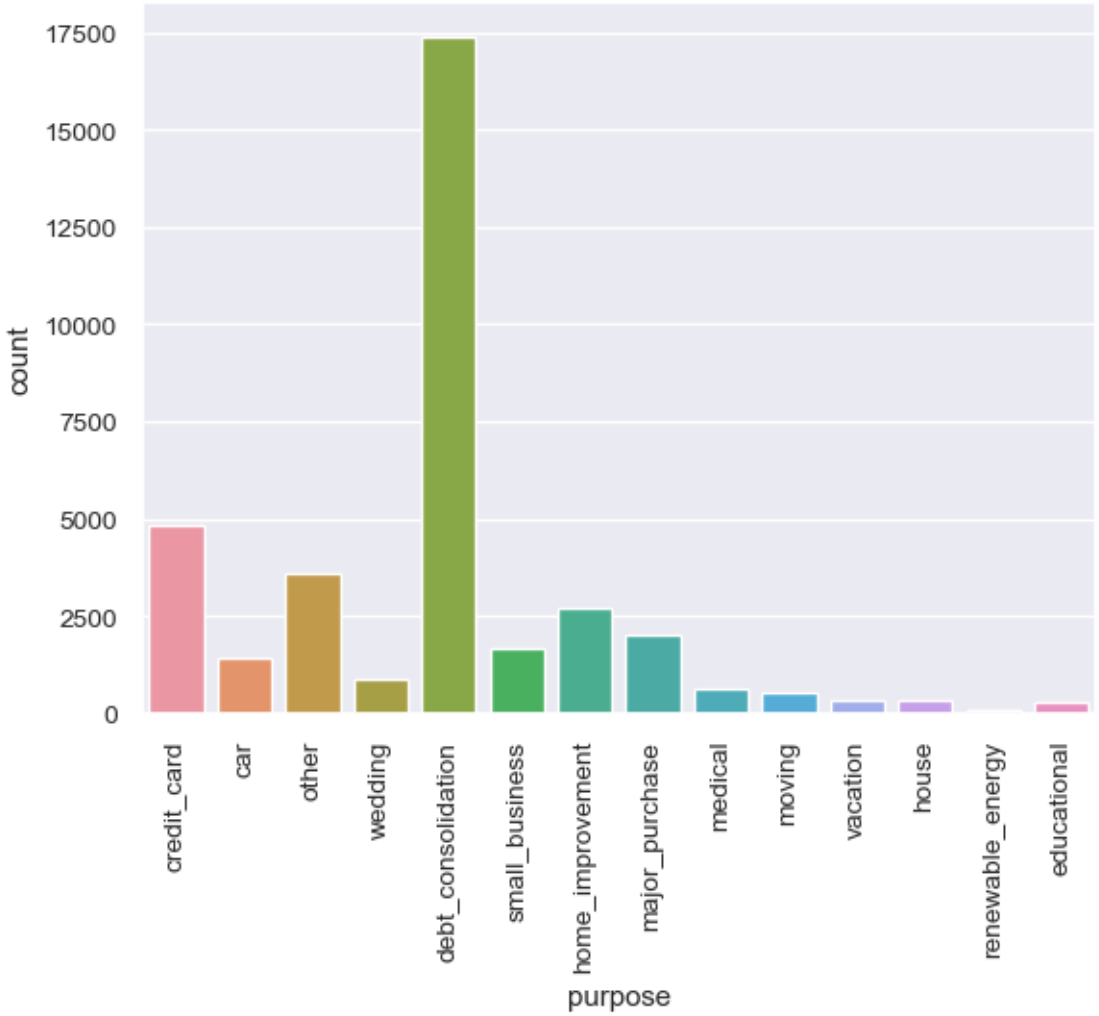
Findings

- Grade A4, B3, A5 take almost equal amount of loans and maximum number of loans.
- Grade G5 applicants take least amount of loans.



Purpose

Purpose	Percentage
debt_consolidation	47.33
credit_card	13.14
other	9.81
home_improvement	7.33
major_purchase	5.52
small_business	4.52
car	3.83
wedding	2.45
medical	1.74
moving	1.44
house	0.93
vacation	0.93
educational	0.77
renewable_energy	0.25

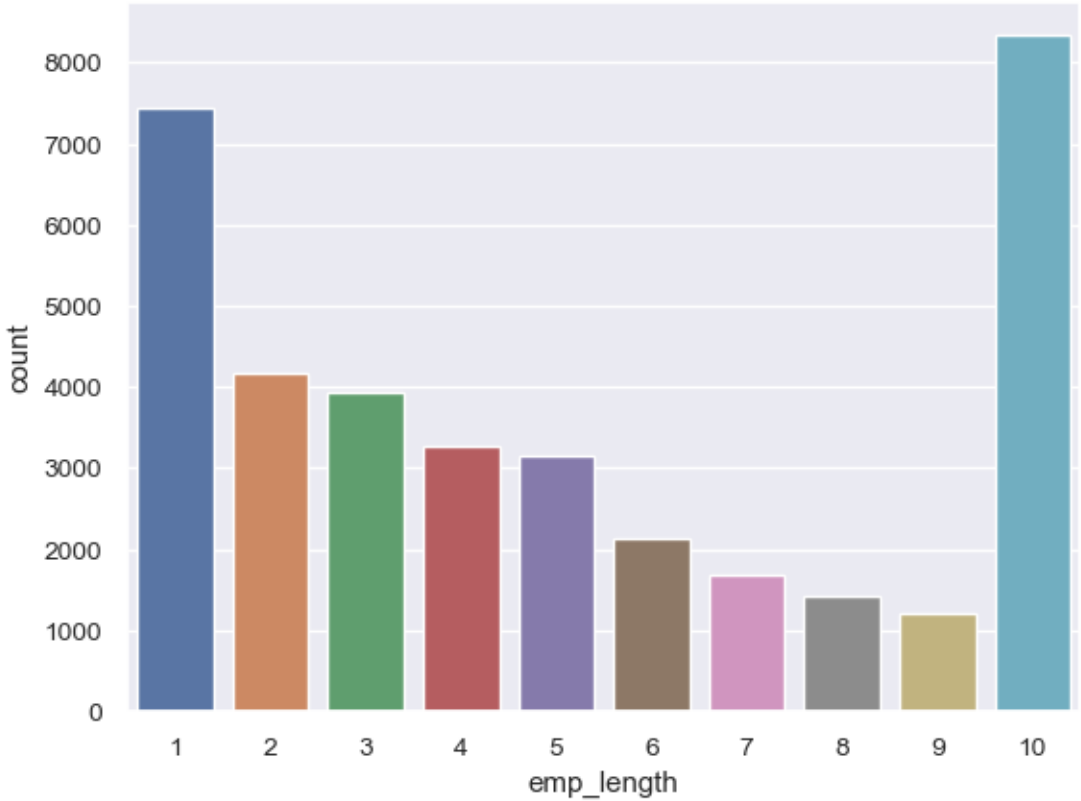


Findings

- almost 50% loans are taken to pay out existing loans.
- 13% loans are taken to pay credit card balances.

Employee Experience

Employee Length	Percentage
10	22.69
1	20.22
2	11.34
3	10.7
4	8.92
5	8.57
6	5.82
7	4.59
8	3.85
9	3.3

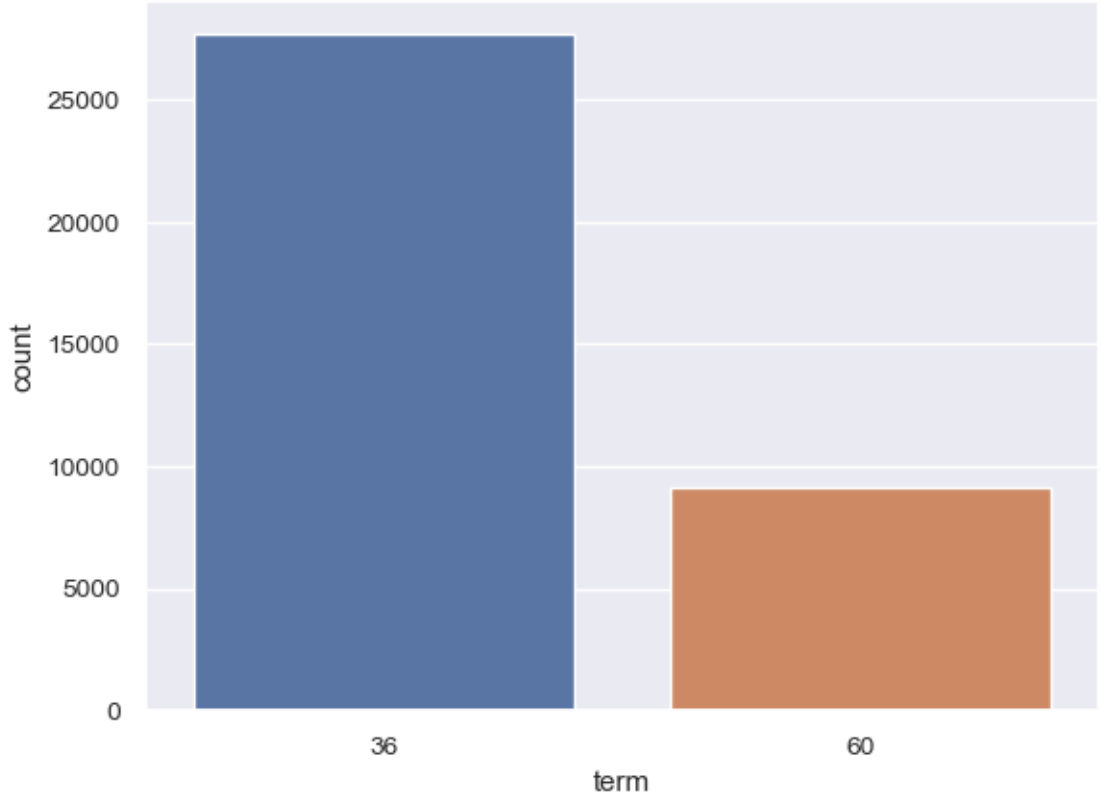


Findings

- People tend to take loans at the start i.e. 0-1 years of experience or after 10+ years of experience.
- for 5-9 years experienced the loans taken are least.

Term

Terms in months	Percentage
36	75.22
60	24.78



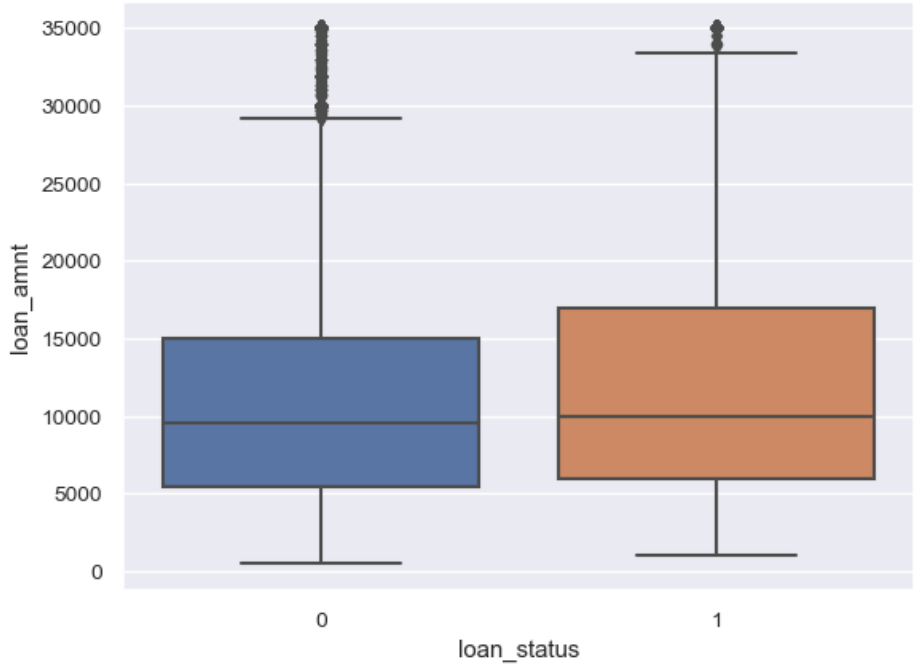
#Findings
#1. almost 75% loans are of lesser duration i.e. 36 months.
#2. long duration loans(60 months) are around 25%

Bivariate Analysis

Loan Status vs Loan Amount

Findings

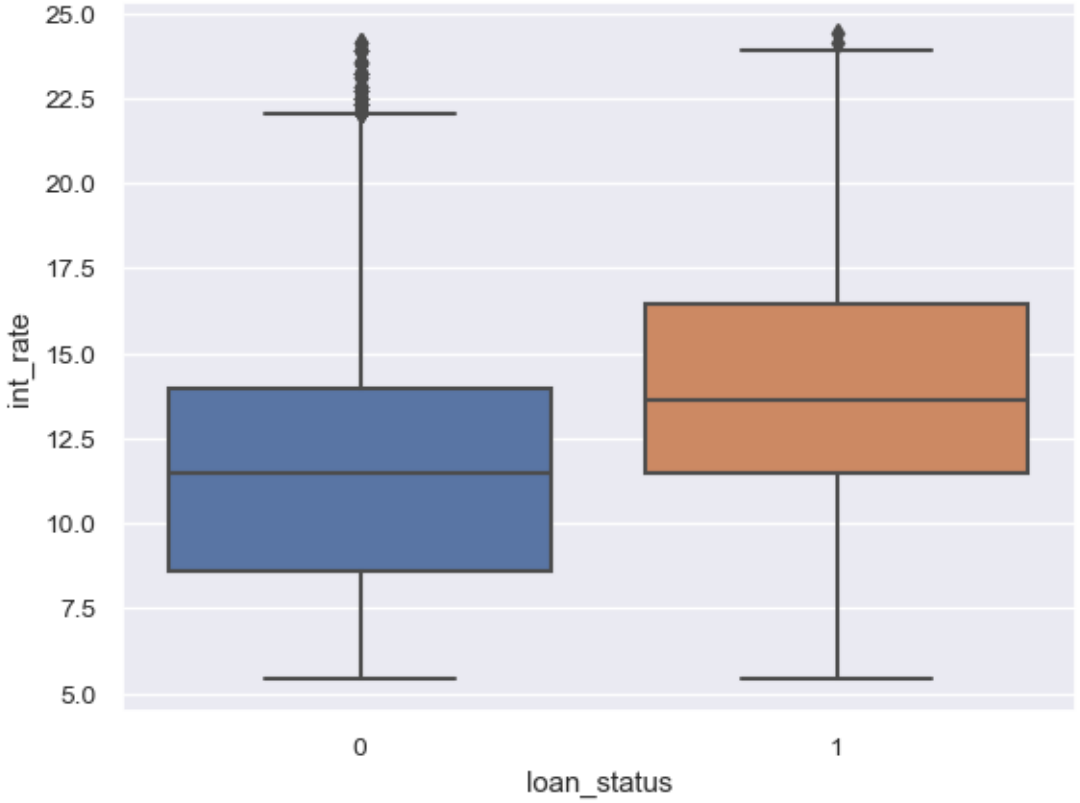
- Average loan amount of defaulter is slightly high
- There is no major difference in loan amounts of defaulters.



Loan Status vs Int Rate

Findings

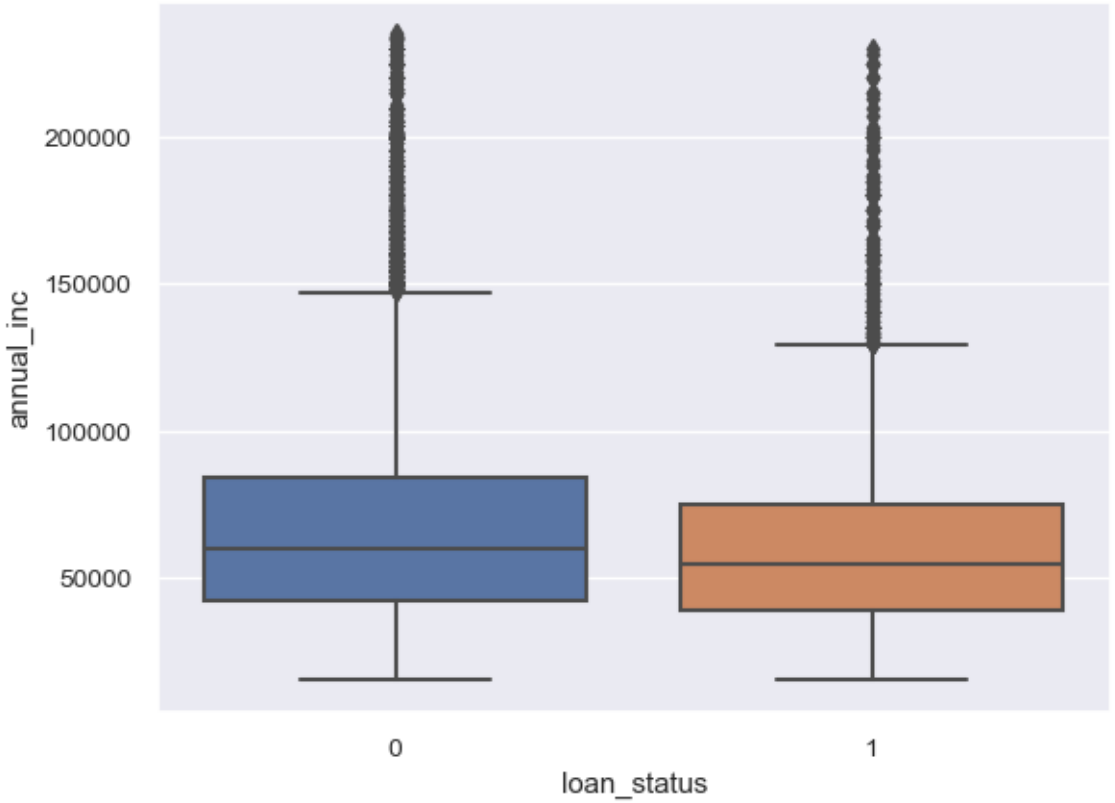
- Applicants with high interest rate seems to default more than lower interest rates.



Loan Status vs Annual Income

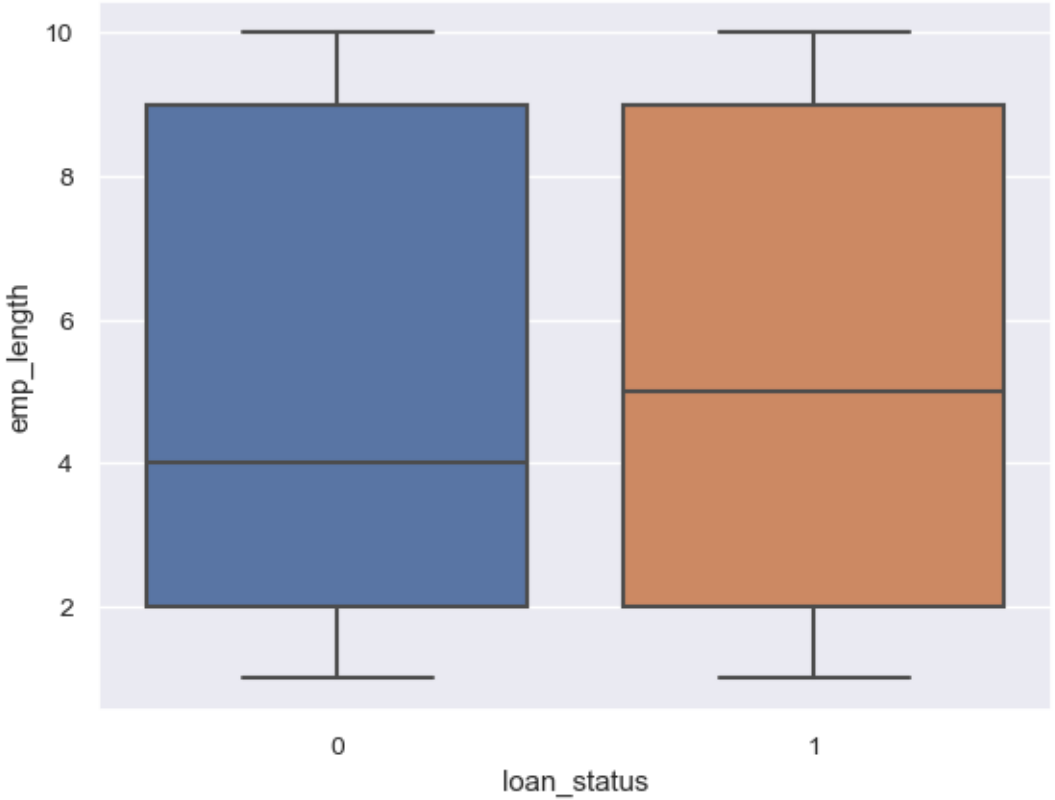
Findings

- Applicants with higher salary seem to default a little lesser.



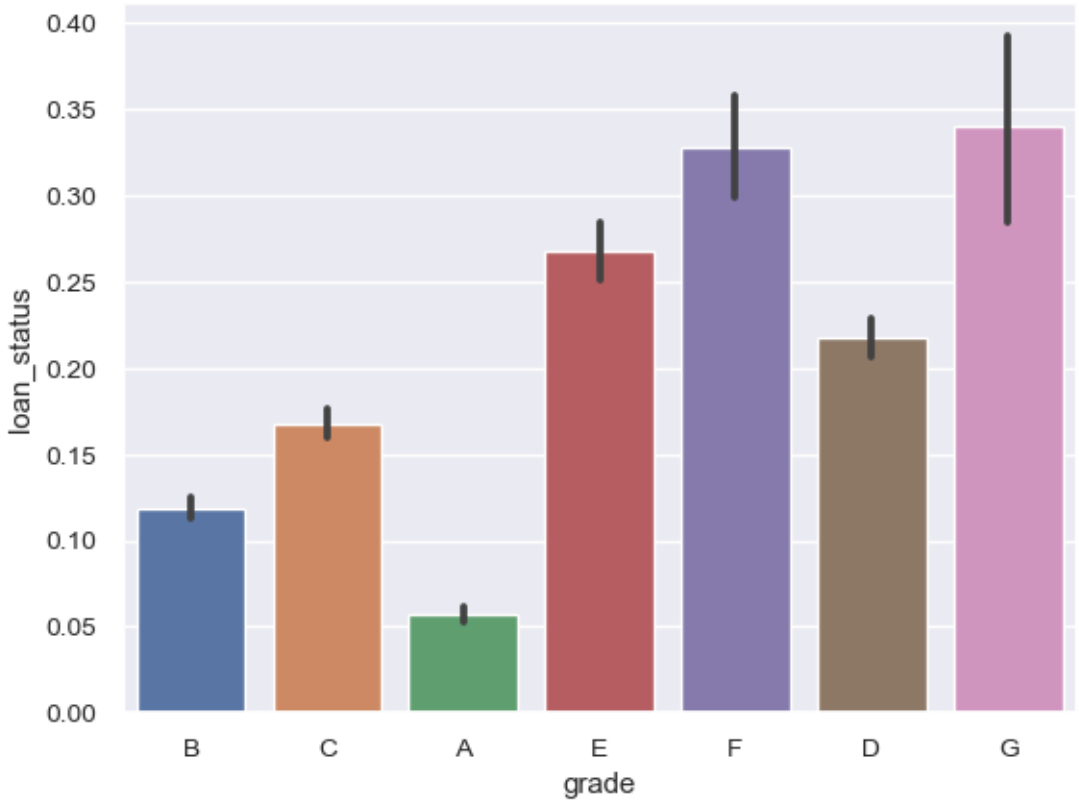
Loan Status vs Emp Length

#Findings
#1. Applicants with longer employment length seem to default higher.



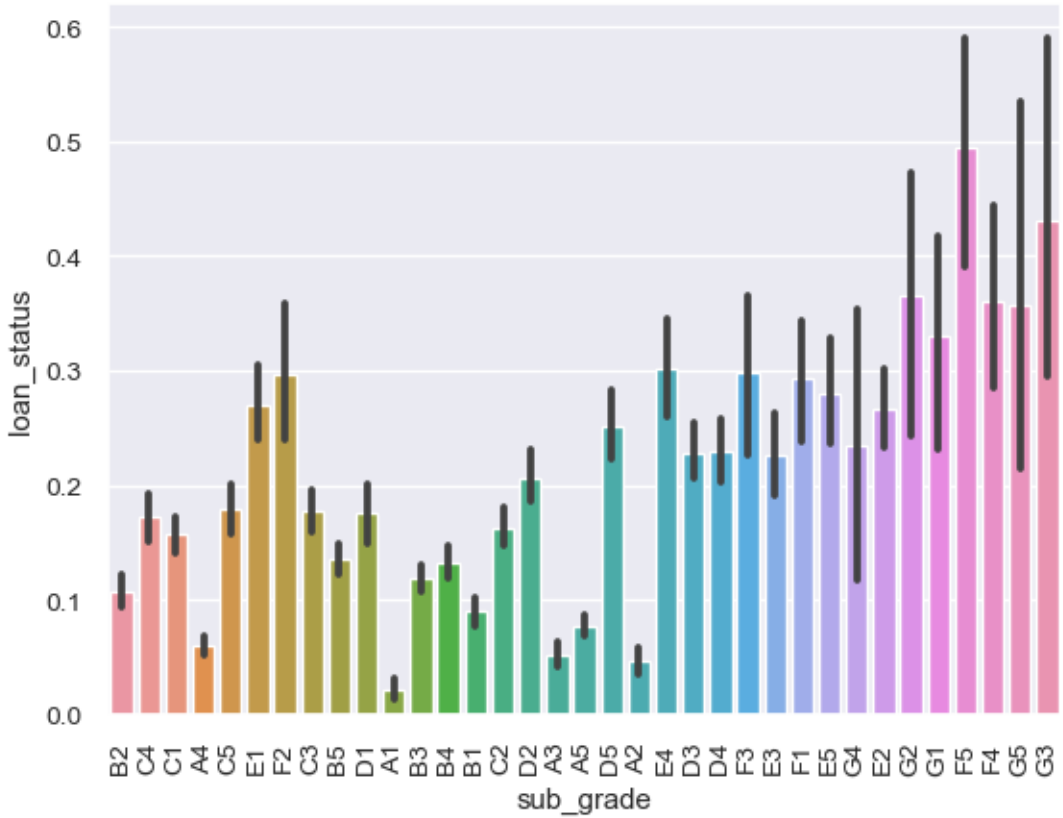
Loan Status vs Grade

#Findings
#Clearly, as the grade of loan goes from A to G, the increases.
#This is expected because the grade is decided by L based on the riskiness of the loan.



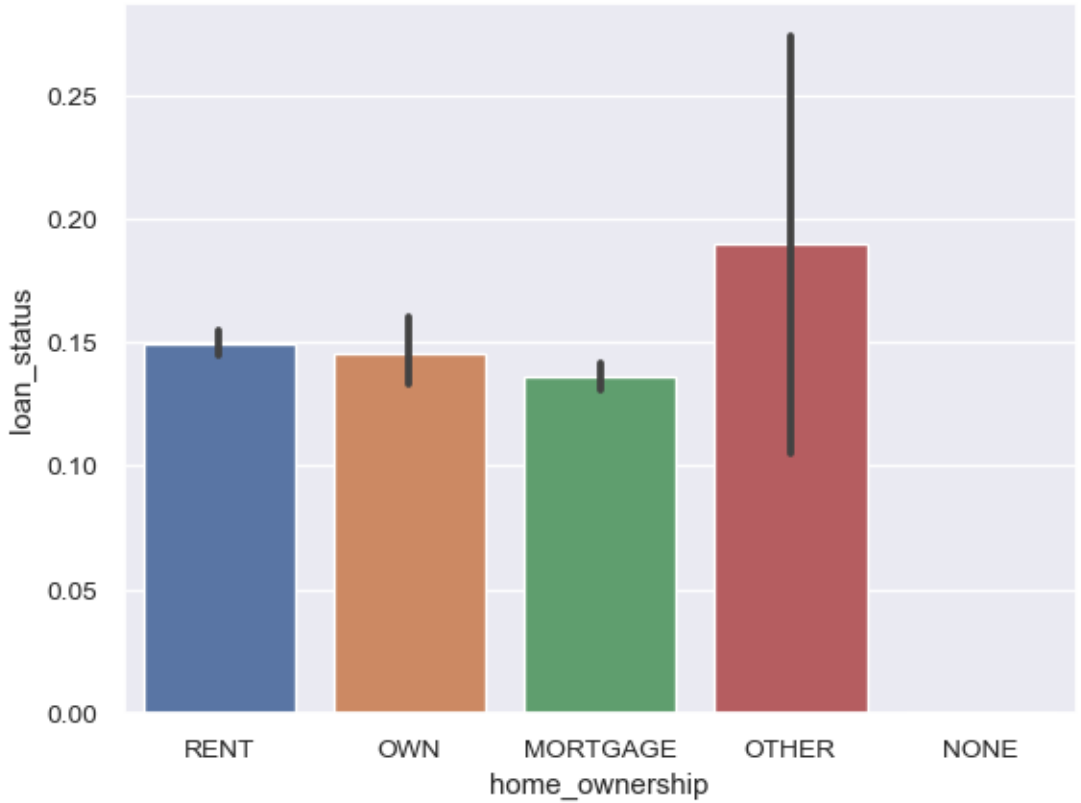
Loan Status vs Sub Grade

#Findings
#as expected - A1 is better than A2 better than A3 and so on



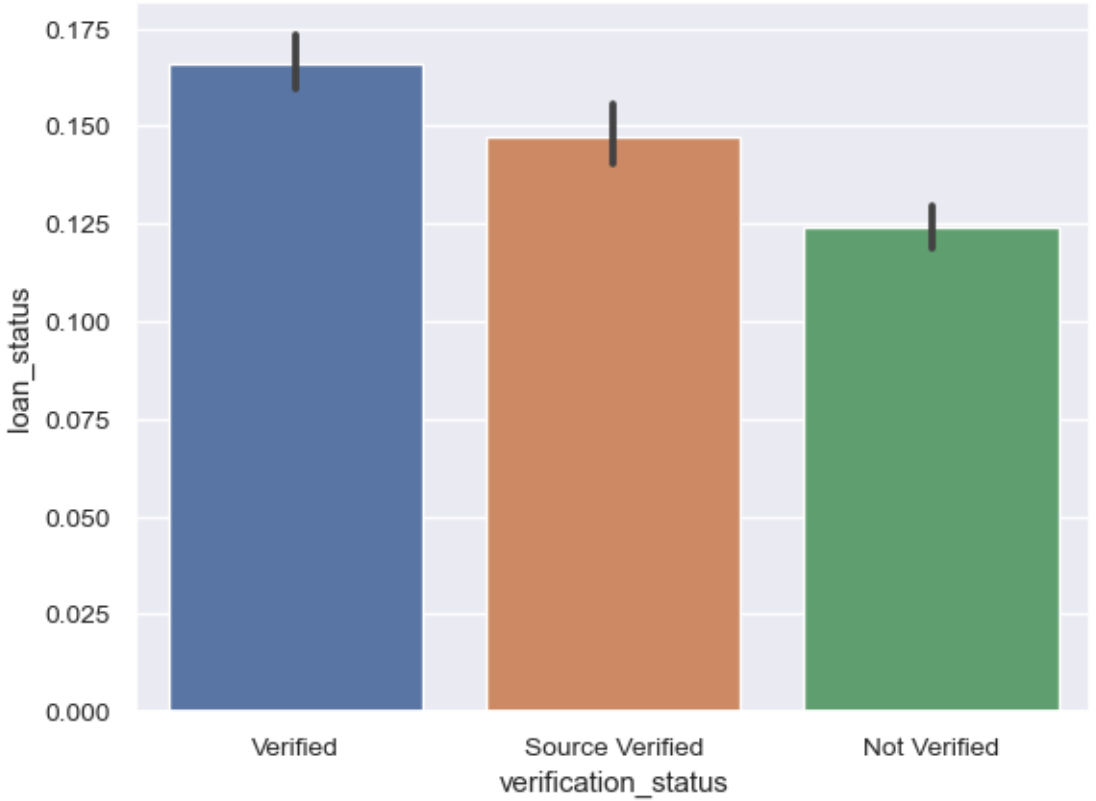
Loan Status Vs Home Ownership

#Findings
#home ownership: not a great discriminator



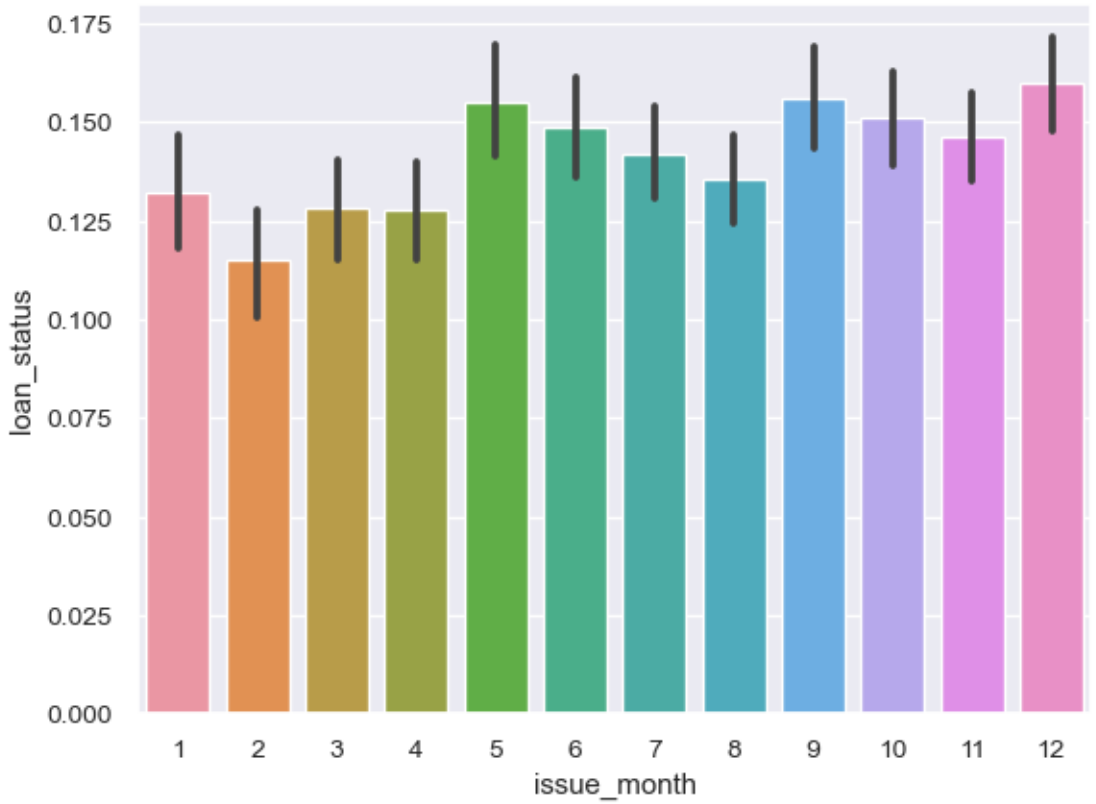
Loan Status Vs Verification Status

#Findings
#surprisingly, verified loans default more than not verified



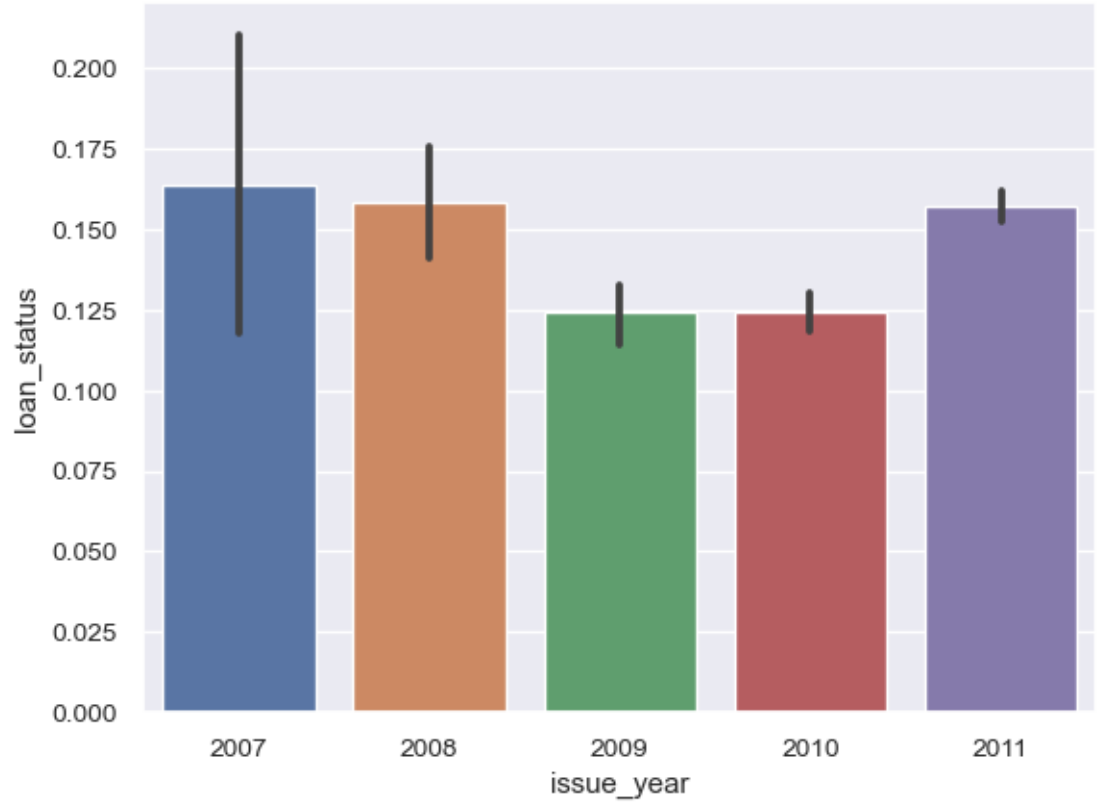
Loan Status Vs Issue Month

#Findings
#1. not much variation across months



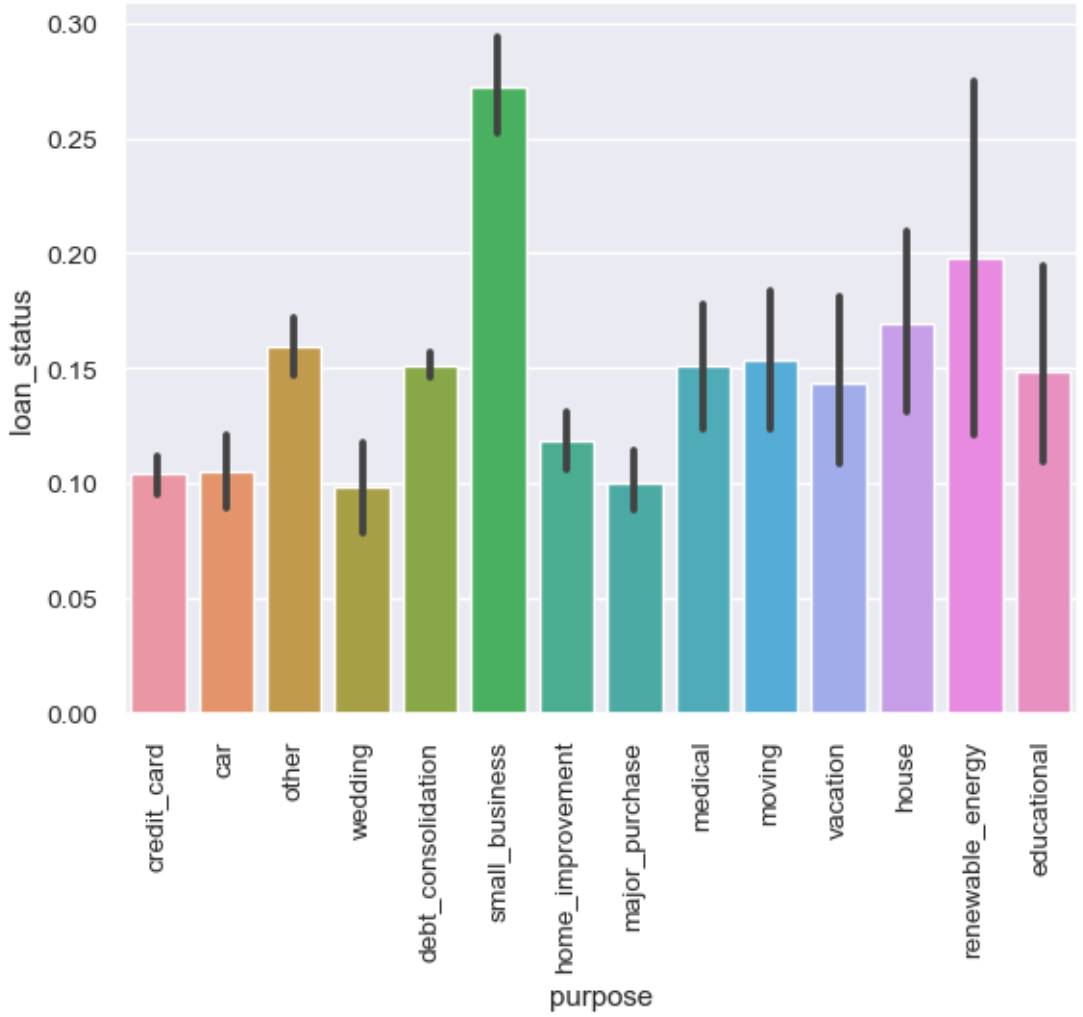
Loan Status Vs Issue Year

#Findings
#the default rate had suddenly increased in 2011, in spite of reducing from 2008 till 2010



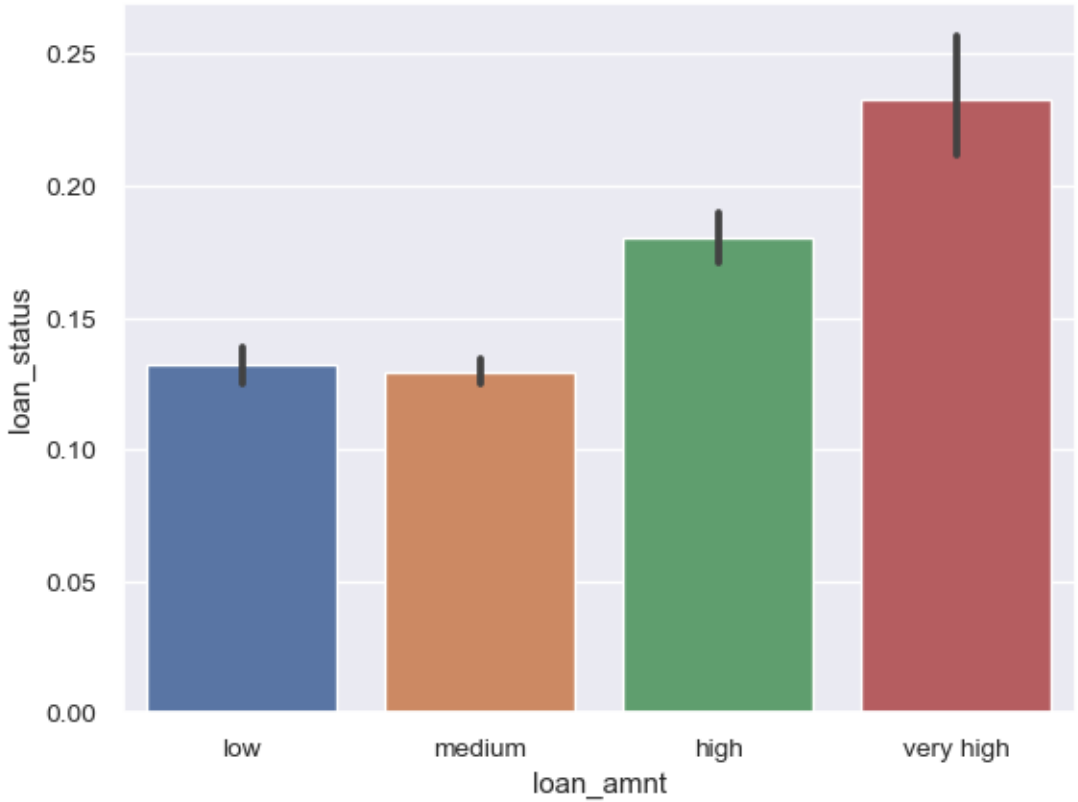
Loan Status Vs Purpose

#Findings
#Small business tends to default more



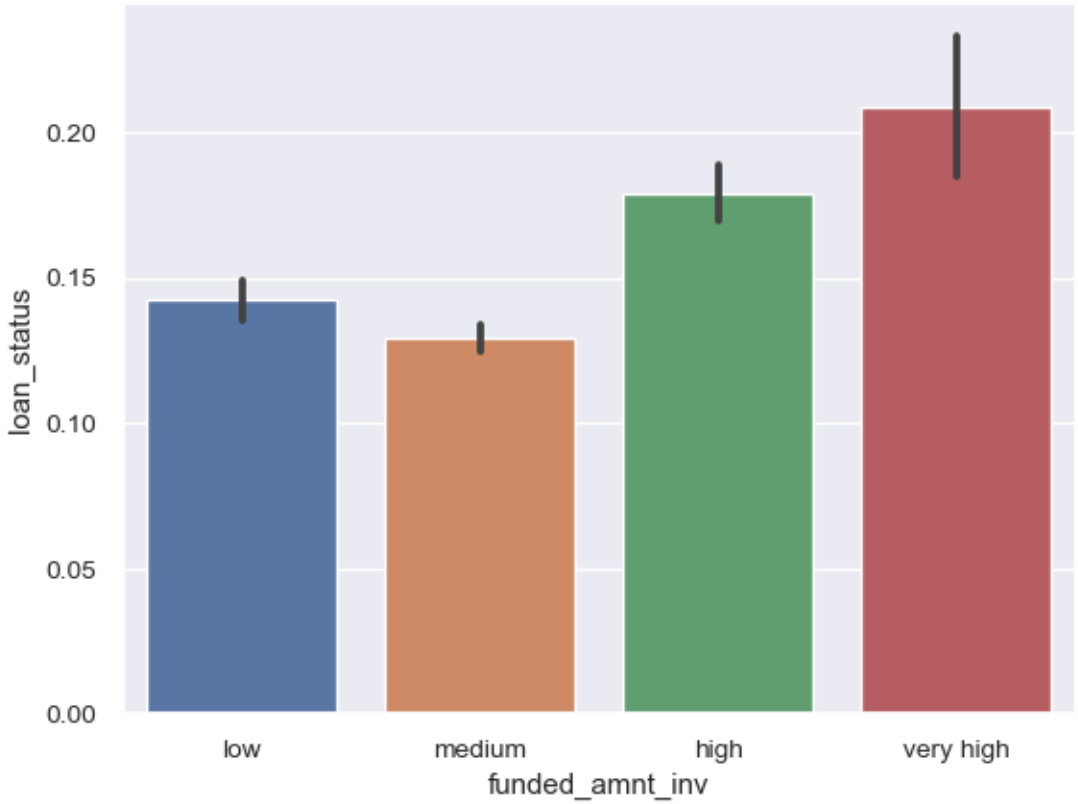
Loan Status Vs loan amount

#Findings
#higher the loan amount, higher the default rate



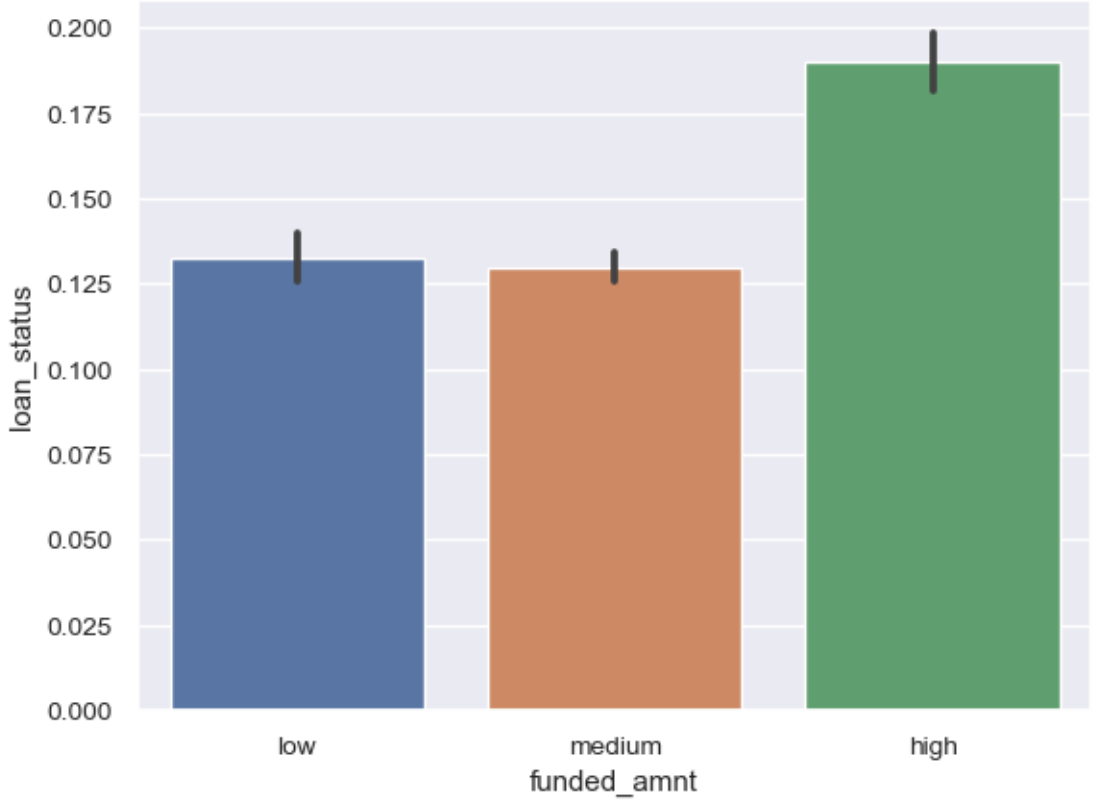
Loan Status Vs Funded_amnt_inv

#Findings
#higher the funded amount by investor,
higher the default rate
#a little dip can be seen from low to medium though



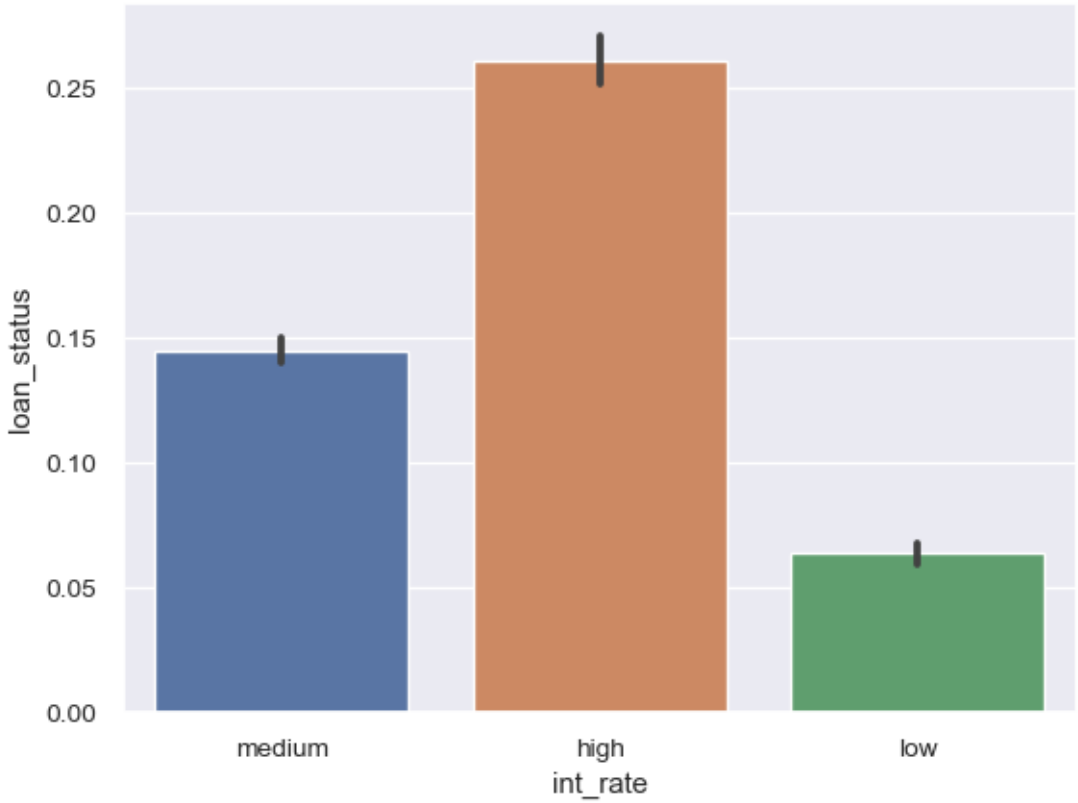
Loan Status Vs Funded_amnt

#Findings
#higher the funded amount, higher the default rate
#a little dip can be seen from low to medium though



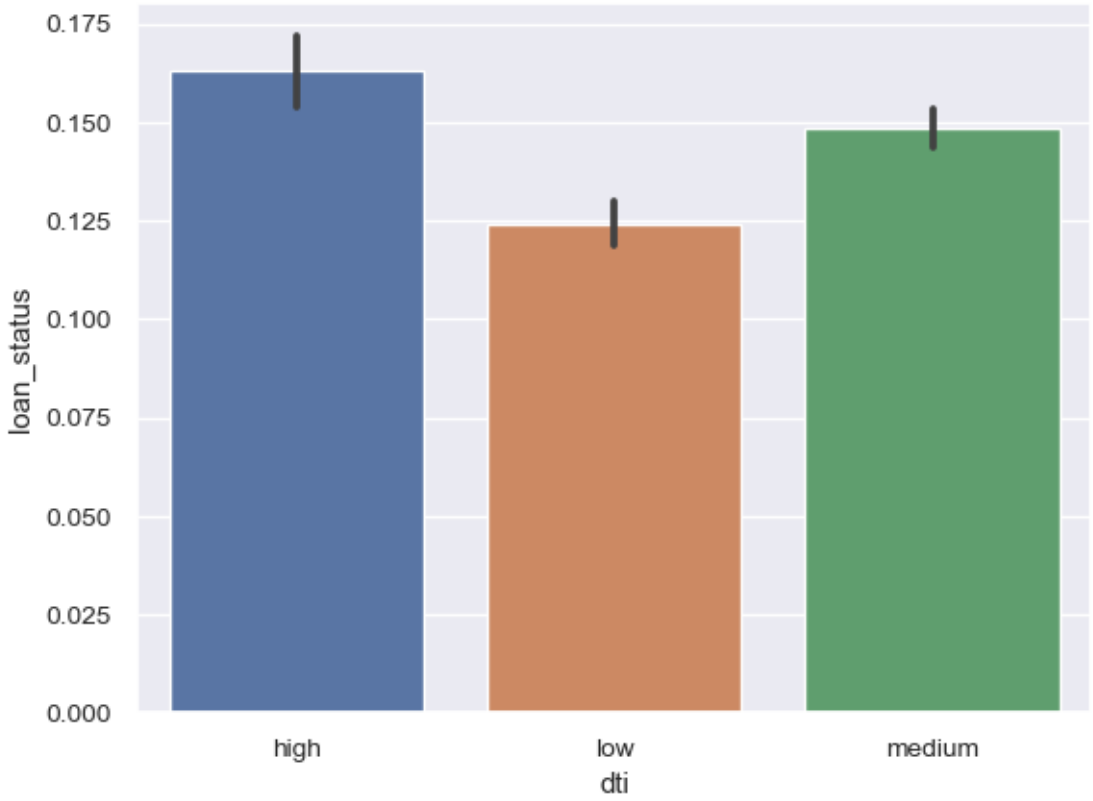
Loan Status Vs Int_Rate

#Findings
#high interest rates default more, as expected



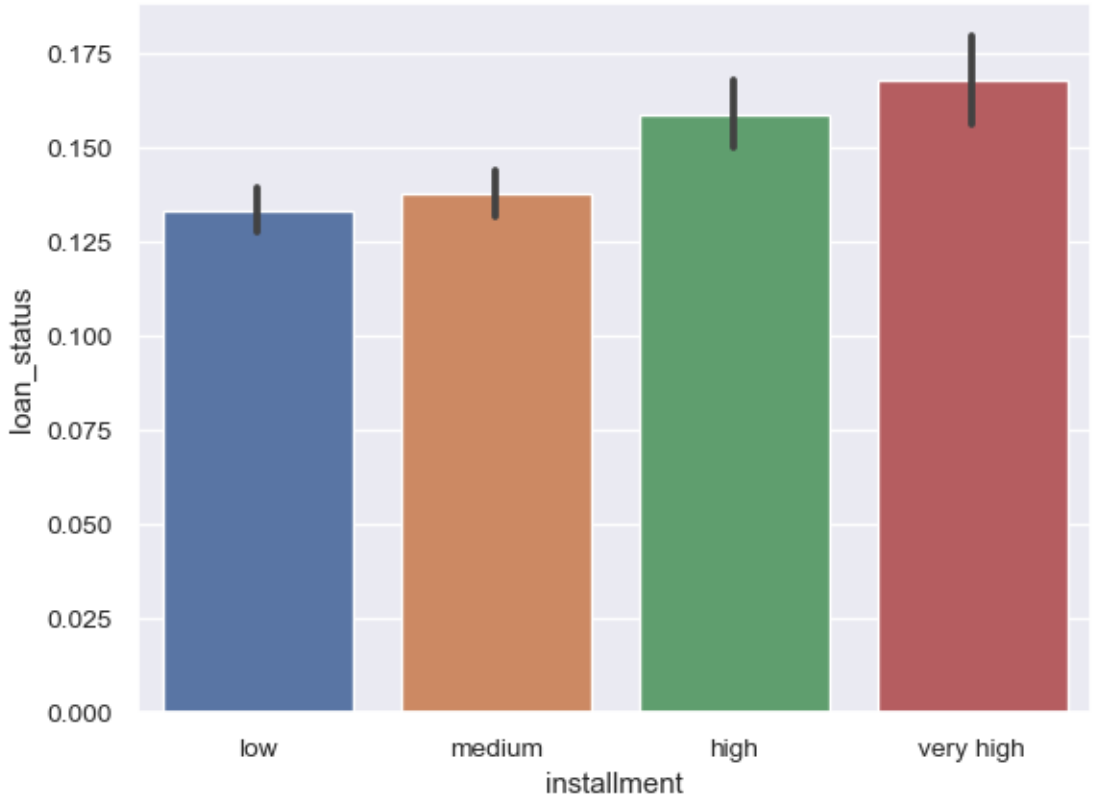
Loan Status Vs DTI

#Findings
#high dti translates into higher default rates, as expected



Loan Status Vs Installments

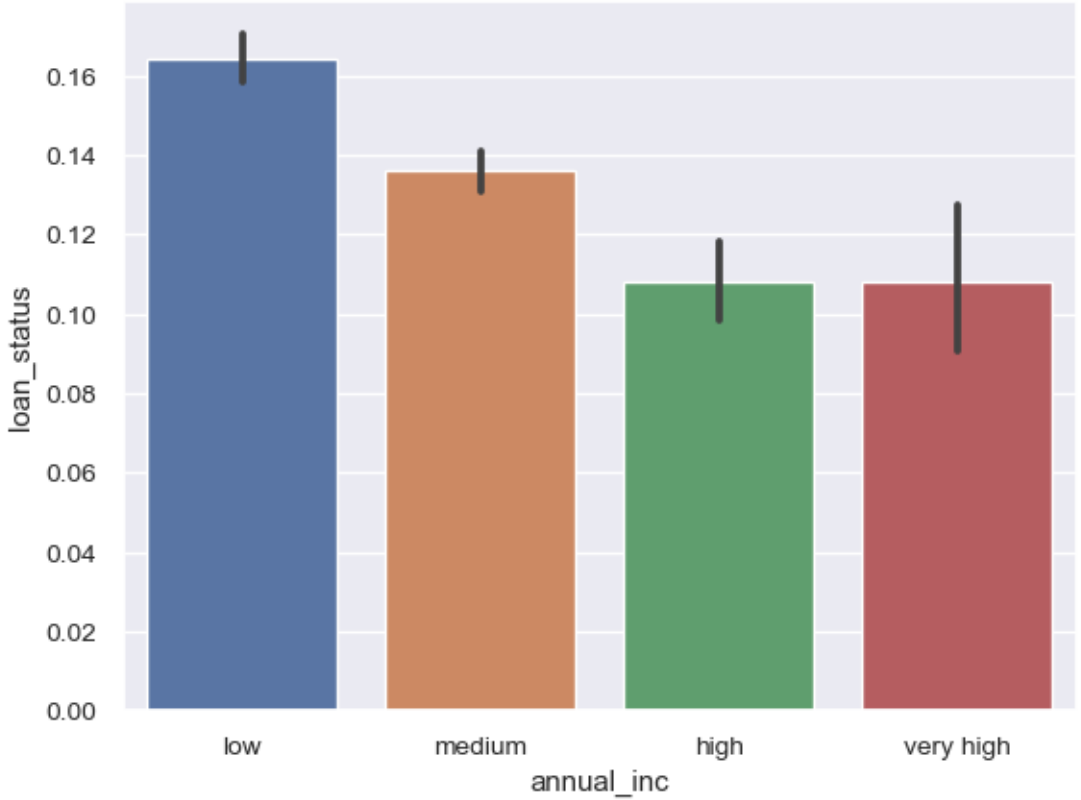
#Findings
#the higher the installment amount,
the higher the default rate



Loan Status Vs Annual Income

Findings

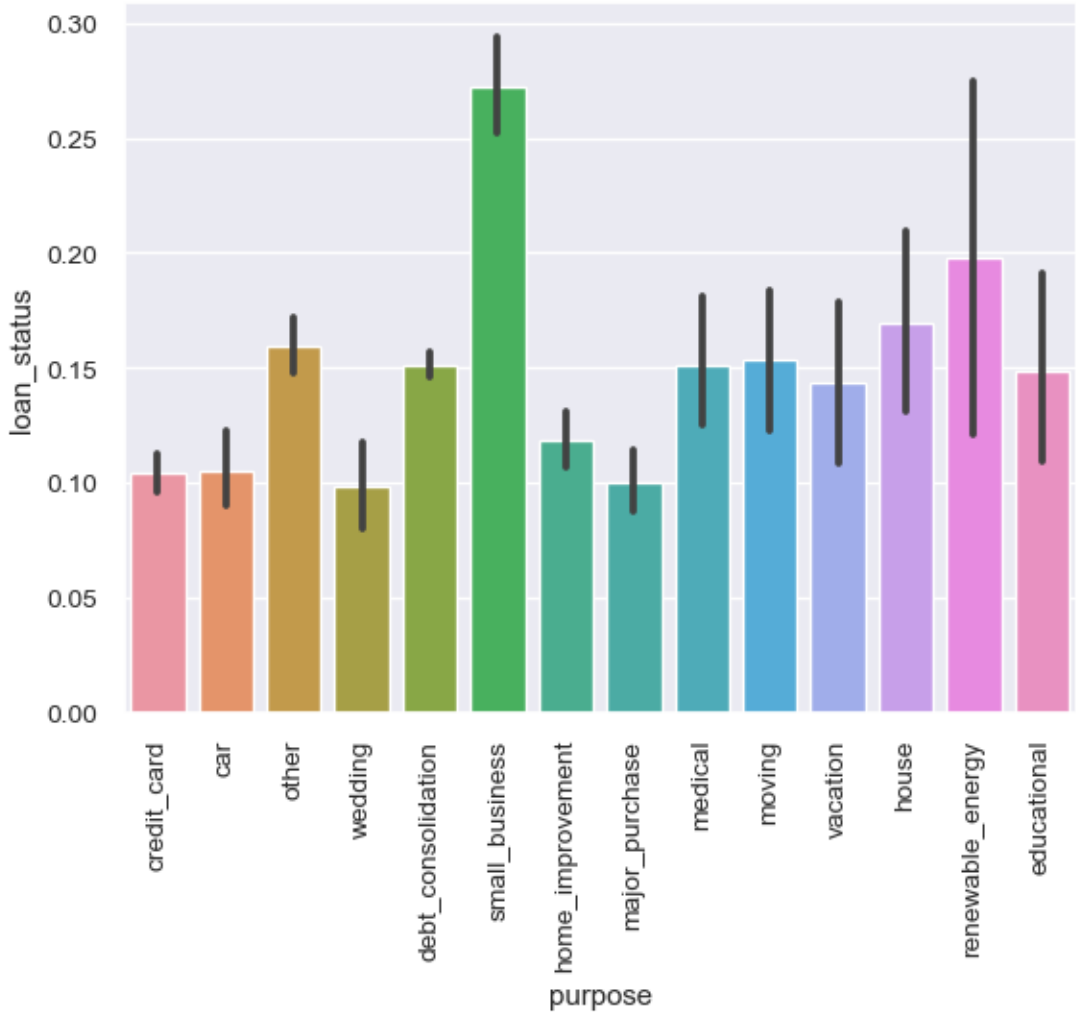
- lower the annual income, higher the default rate

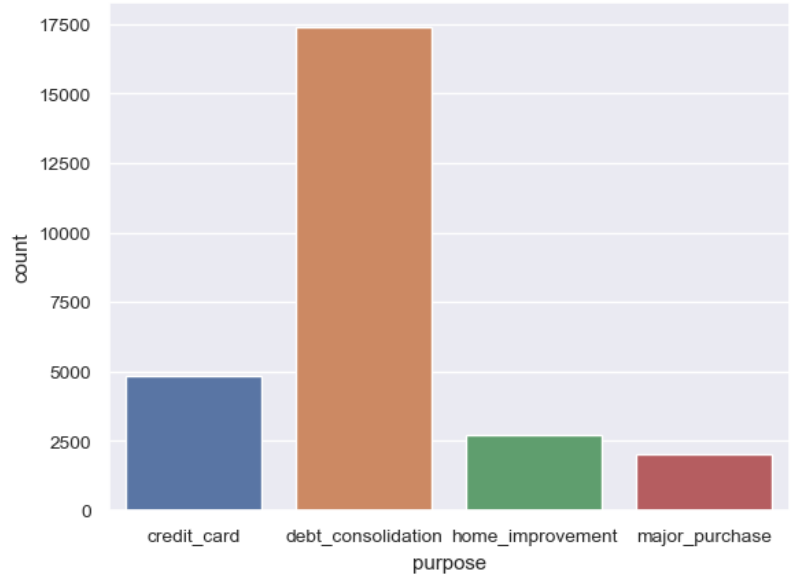


Segment Analysis

Segmented univariate analysis

- We have now compared the default rates across various variables, and some of the important predictors are purpose of the loan, interest rate, annual income, grade etc.
- In the credit industry, one of the most important factors affecting default is the purpose of the loan - home loans perform differently than credit cards, credit cards are very different from debt consolidation loans etc.
- This comes from business understanding, though let's again have a look at the default rates across the purpose of the loan.

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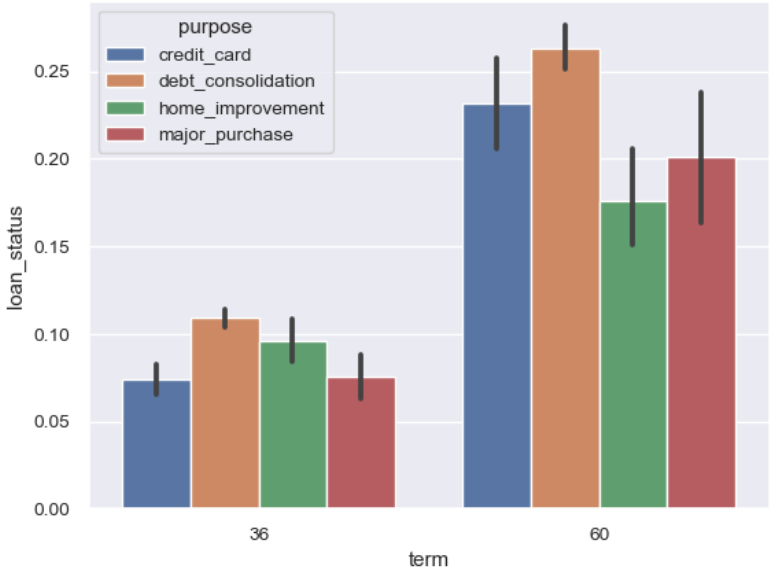
15000
12500
10000
7500
5000
2500
0
count
credit_card
debt_consolidation
home_improvement
major_purchase
purpose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home_improvement
major_purchase
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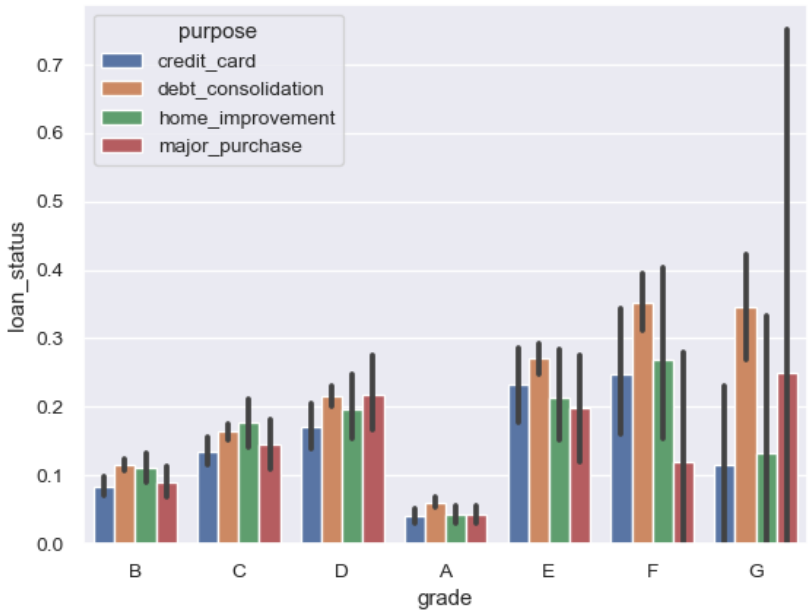
0.15
0.10
0.05
0.00
loan_status
36
60
term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debt_consolidation
home_improvement
major_purchase
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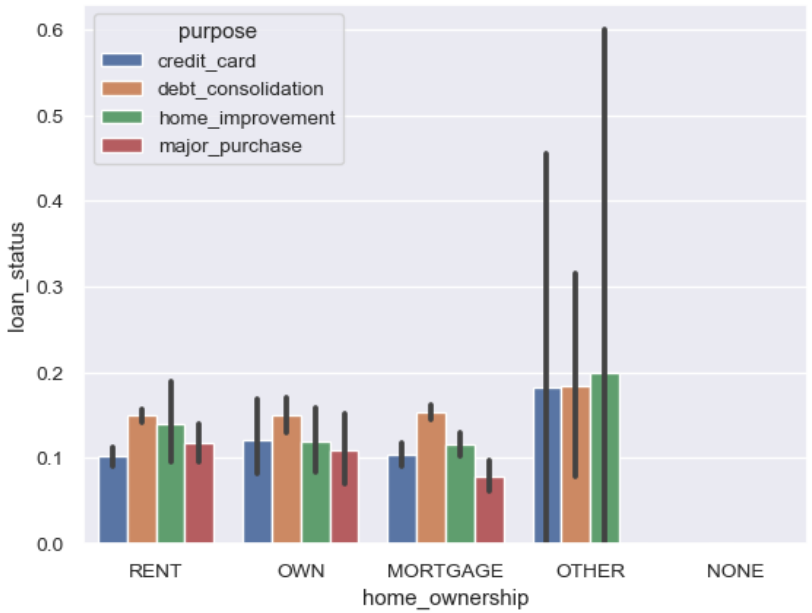
0.6
0.5
0.4
0.3
0.2
0.1
0.0
loan_status
B
C
D
A
E
F
G
grade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debt_consolidation
home_improvement
major_purchase
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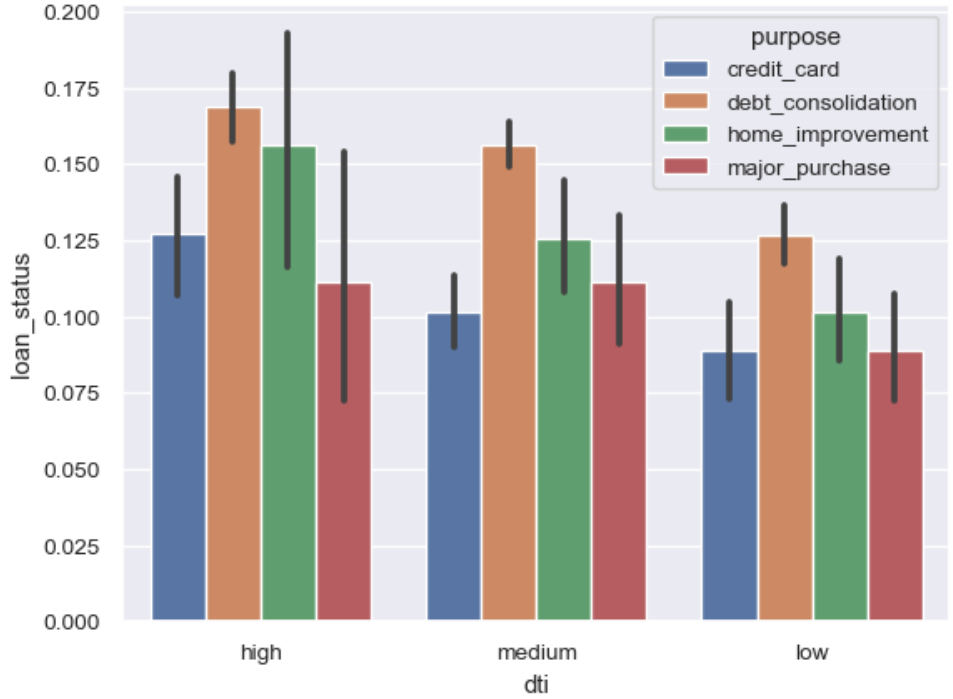
0.5
0.4
0.3
0.2
0.1
0.0
loan_status
RENT
OWN
MORTGAGE
OTHER
NONE
home_ownership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home_improvement
major_purchase
loan_status
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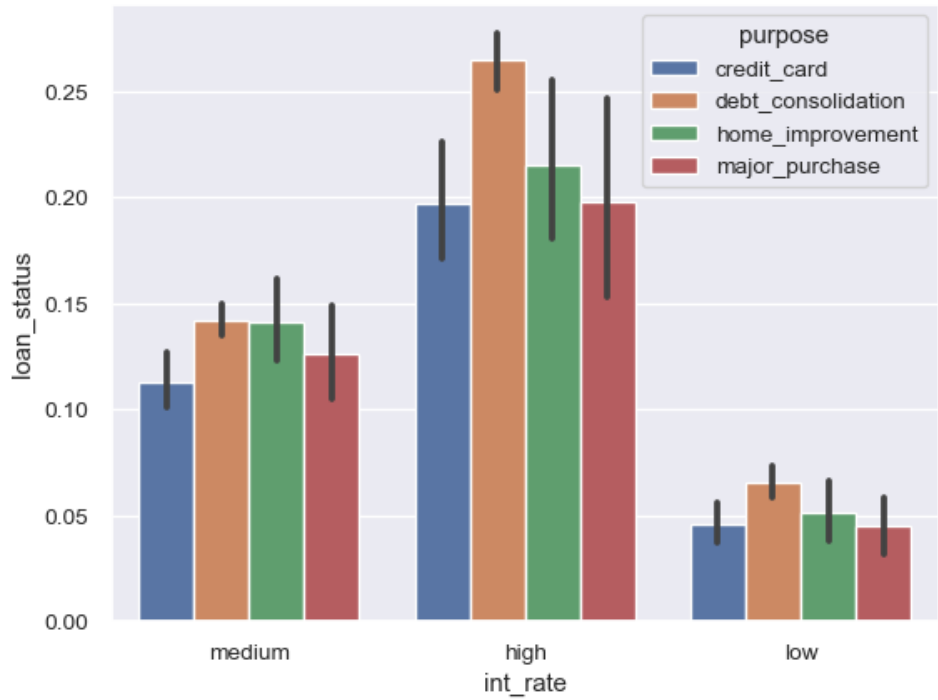
0.150
0.125
0.100
0.075
0.050
0.025
0.000
high
medium
low
dti


purpose
credit_card
debt_consolidation
home_improvement
major_purchase
loan_status
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0.20
0.15
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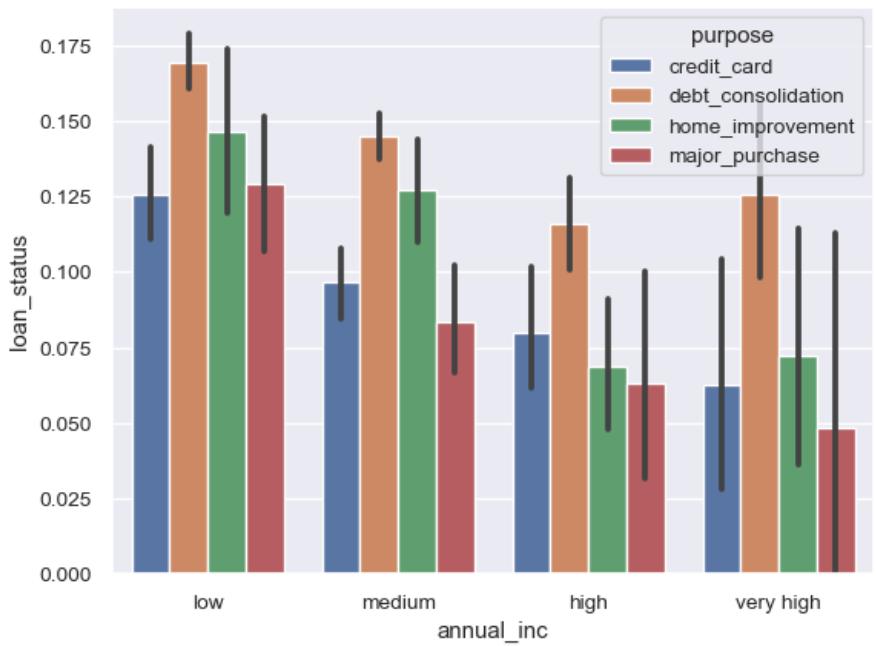
0.05
0.00
medium
high
low
int_rate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debt_consolidation
home_improvement
major_purchase
loan_status
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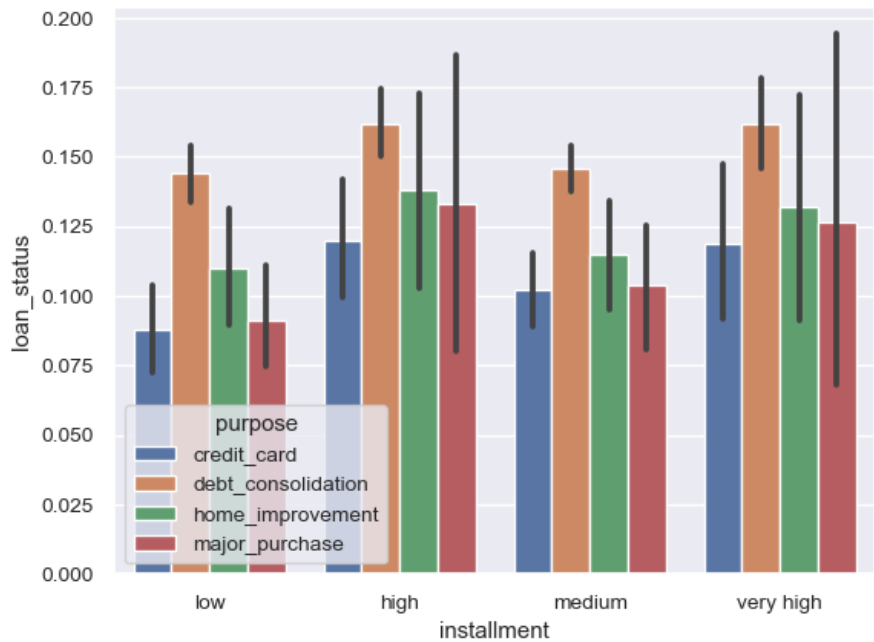
0.000
low
medium
high
very high
annual_inc


purpose
credit_card
debt_consolidation
home_improvement
major_purchase
loan_status
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0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
low
high
medium
very high
installment

Conclusion

- Higher the interest rate higher charged off ratio
- Higher the annual income higher the loan amount slightly
- Interest rate is increasing with loan amount increase this results in high charged off.
- Mostly applicants take loan for debt consolidation and hence the highest default rate is in the same category
- Surprisingly verified loans has more default rate than unverified default rates.

* Other findings – please see in the corresponding slides