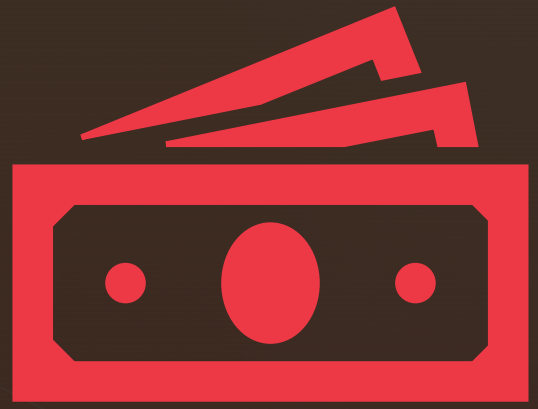


Interest Rate Prediction For Loans

By Danny Hua

Summary

Create a regression model to predict the interest rate applicants will receive. It will help applicants understand how their rate was calculated so we can advise on what they should work on in order to improve their rate if they choose to re-apply later in the future.

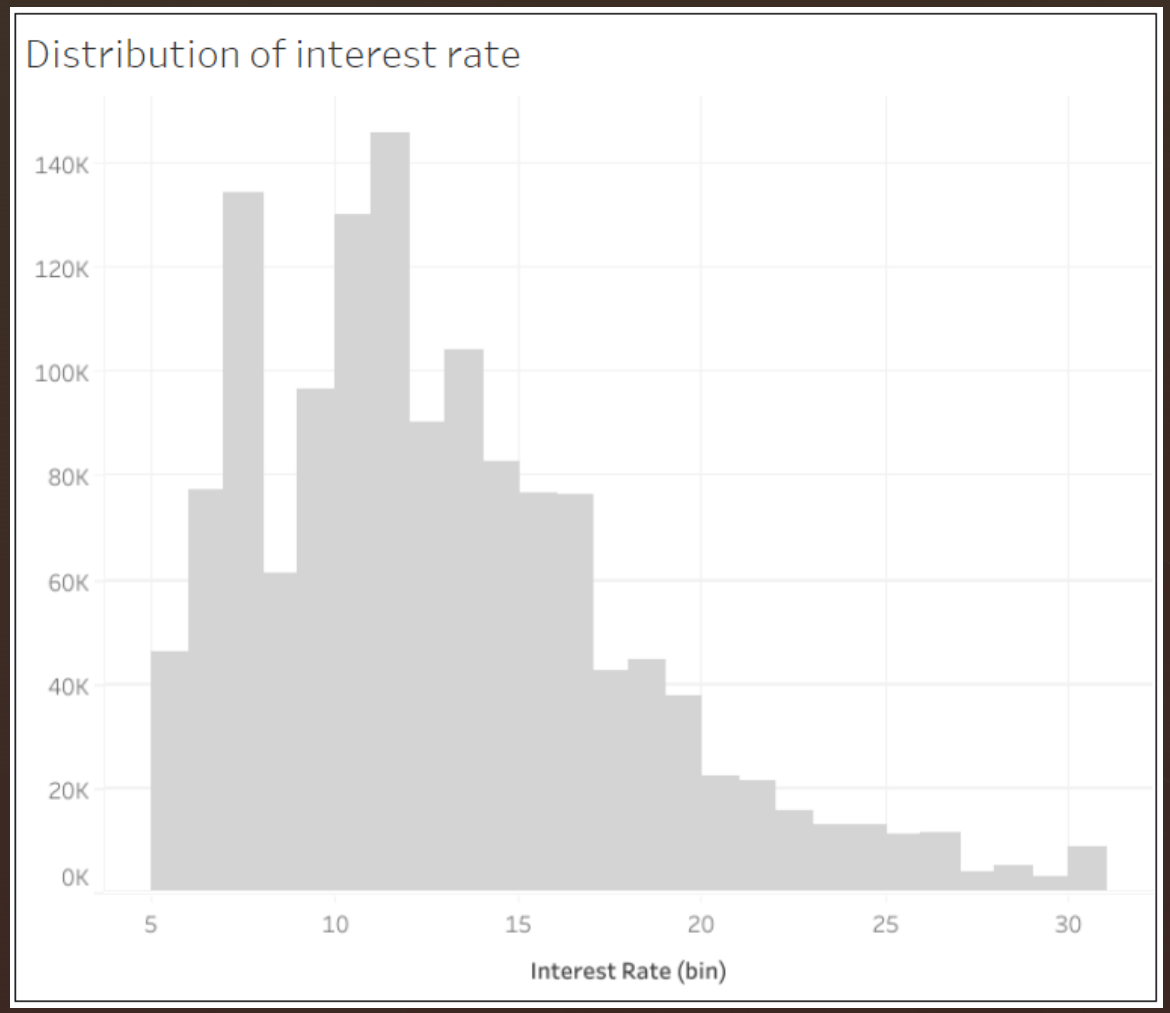
This is a great tool to improve customer experience and it may help save time/money trying to acquire new customers.

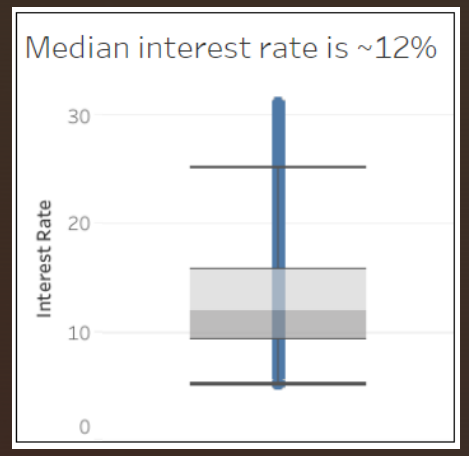
The Lending Club loan application data being looked at is from 2016 to 2018.

Descriptive and Inferential statistics analysis were done to identify variables to use for the regression model

Regression model produced an R-Squared of 0.447

We are looking to improve customer experience for customers who may have received an offer they did not like due to high interest rate. The median rate is 12%, but there are also those who have accepted rates as high as 30%

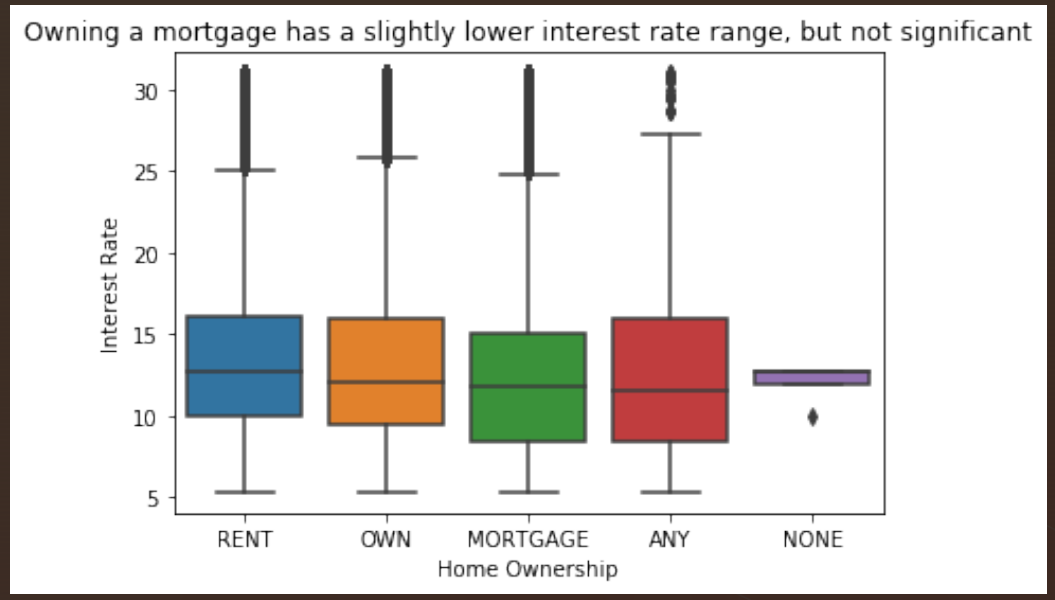


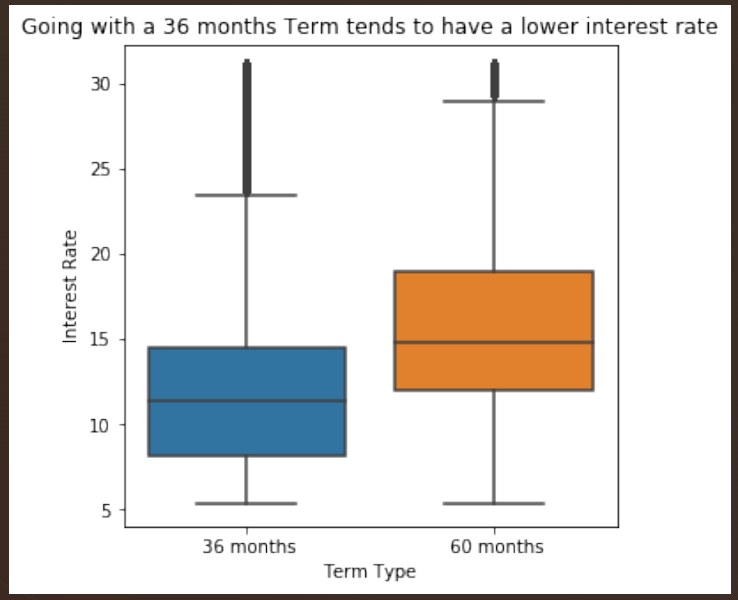


Insights

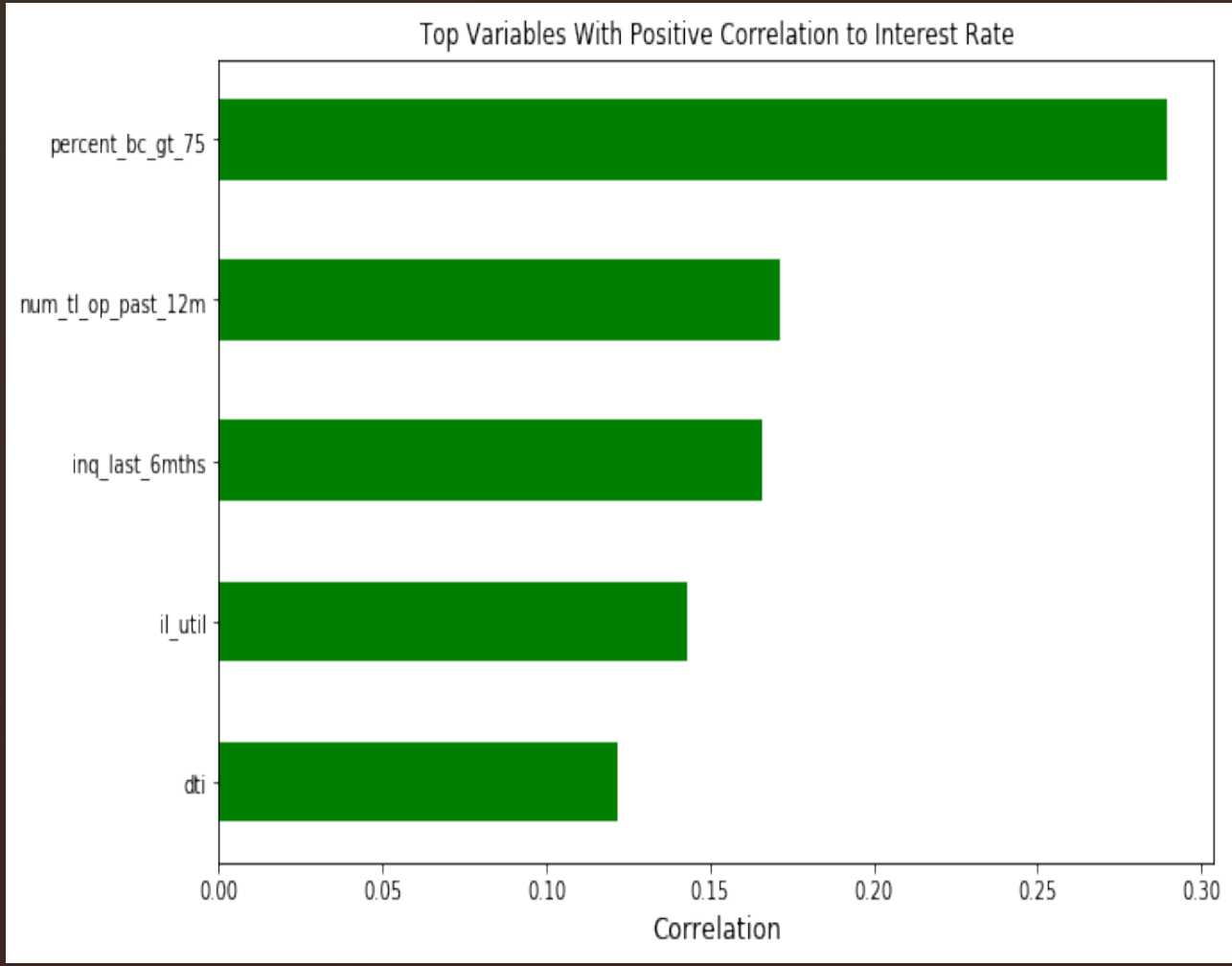
1) Most of our customers have interest rate between 11% - 16%
2) There are applicants who accepted offers with rates as high as 30%.
3) Applicants with high rates are the ones we want to focus on as part of our re-targeting campaign and to improve overall customer experience.

Besides from FICO score, we expected having a joint applicant, years of employment, annual income, owning a mortgage, and loan amount to be the top variables linked to interest rate, but that was not the case in this dataset.



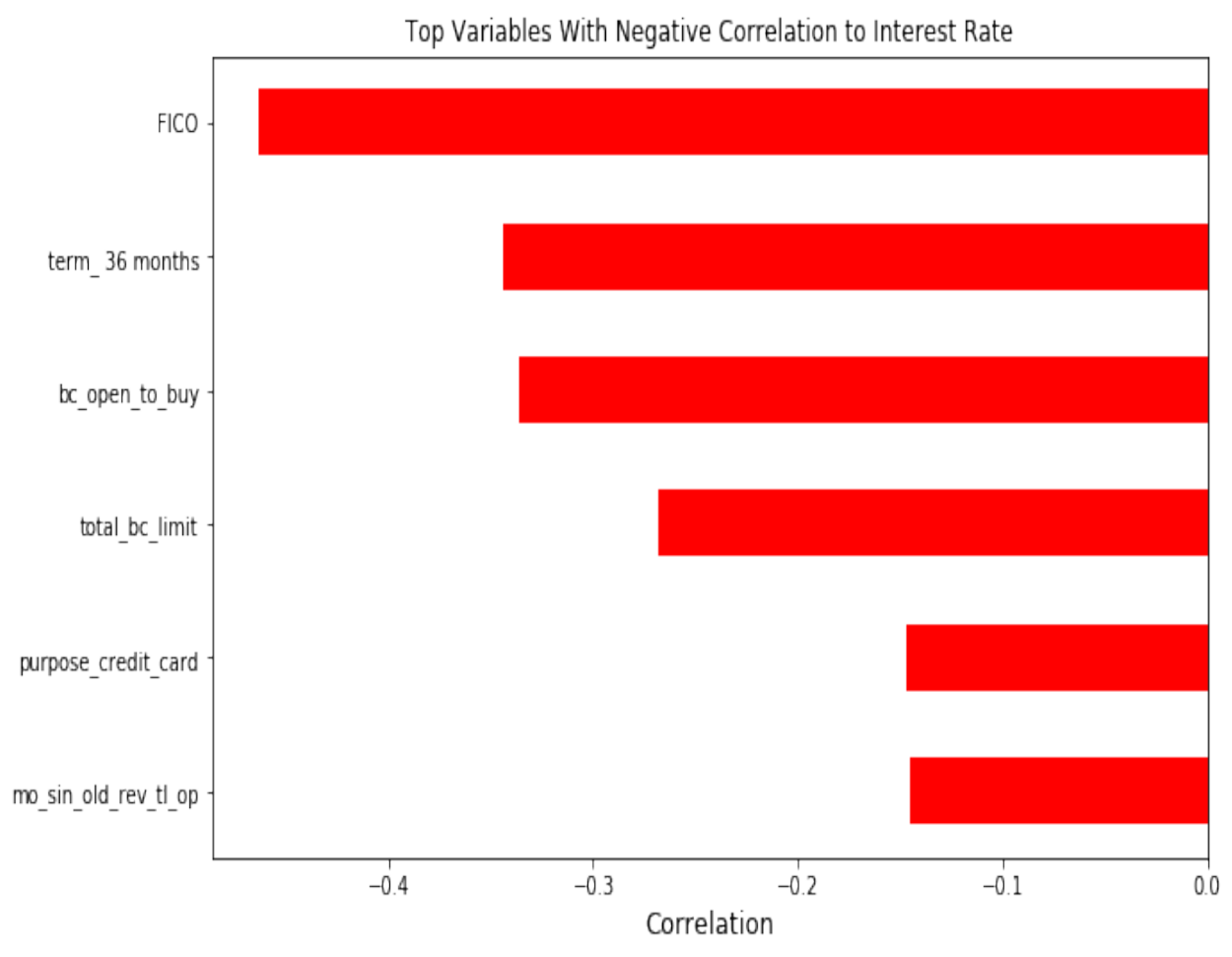


These are the top variables that showed positive correlation to interest rate. In other words these variables will lead to a higher interest rate. For example if the applicant has applied for several credit card/loans within the last 6 months, even if they are checking their rate, their interest rate tends to be higher.



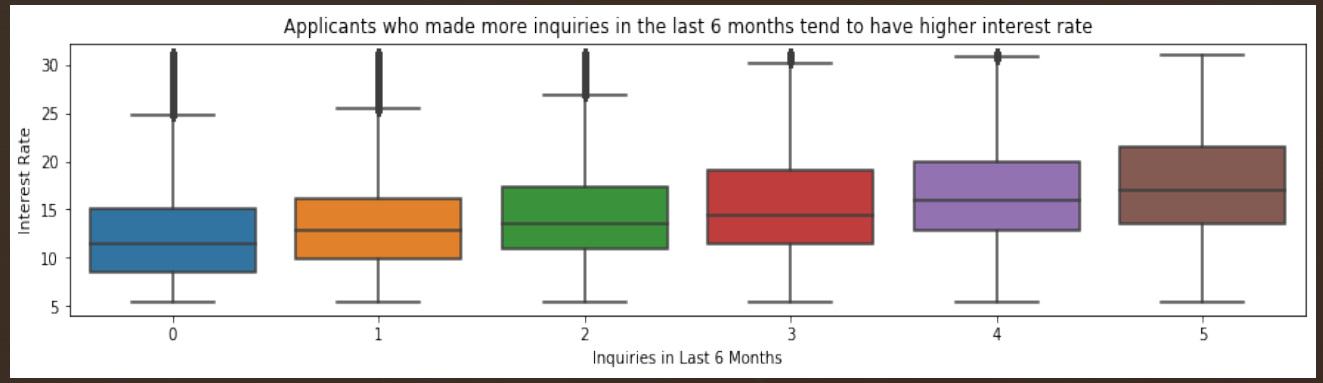
1. **percent_bc_gt_75**
   - Percentage of all credit cards greater than 75% of limit
2. **num_tl_op_past_12m**
   - Total number of accounts opened in the last 12 months
3. **inq_last_6mths**
   - Number of inquiries in the last 6 months
4. **il_util**
   - Ratio of total current balance to credit limit on all installment accounts (i.e. car loan, student loan, etc…)
5. **dti (Debt-to-Income Ratio)**
   - Total monthly debt payments, excluding mortgage, divided by monthly income

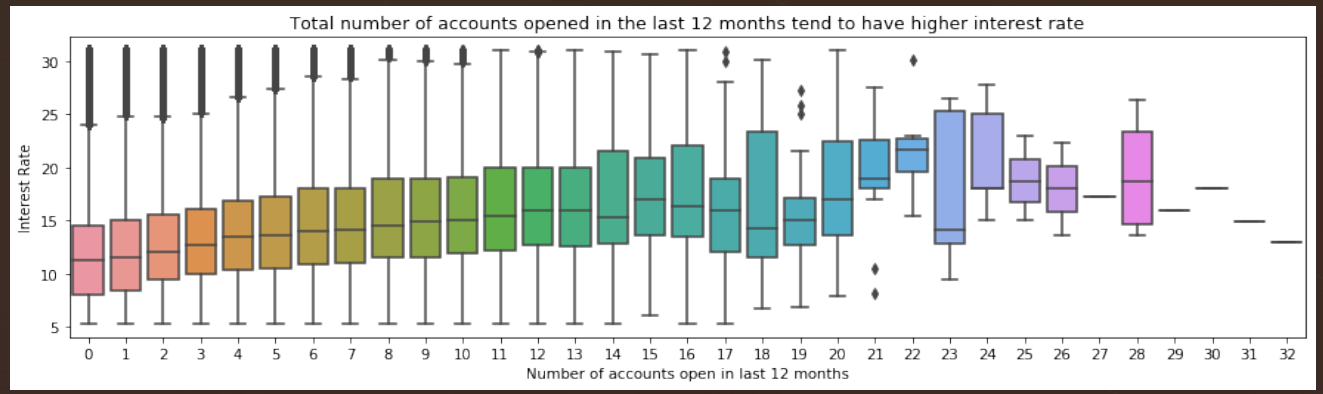
These are the top variables that showed negative correlation to interest rate. In other words these variables will lead to a lower interest rate. For example, the more credit the applicant has available for spending on all credit cards the lower the interest rate tends to be.

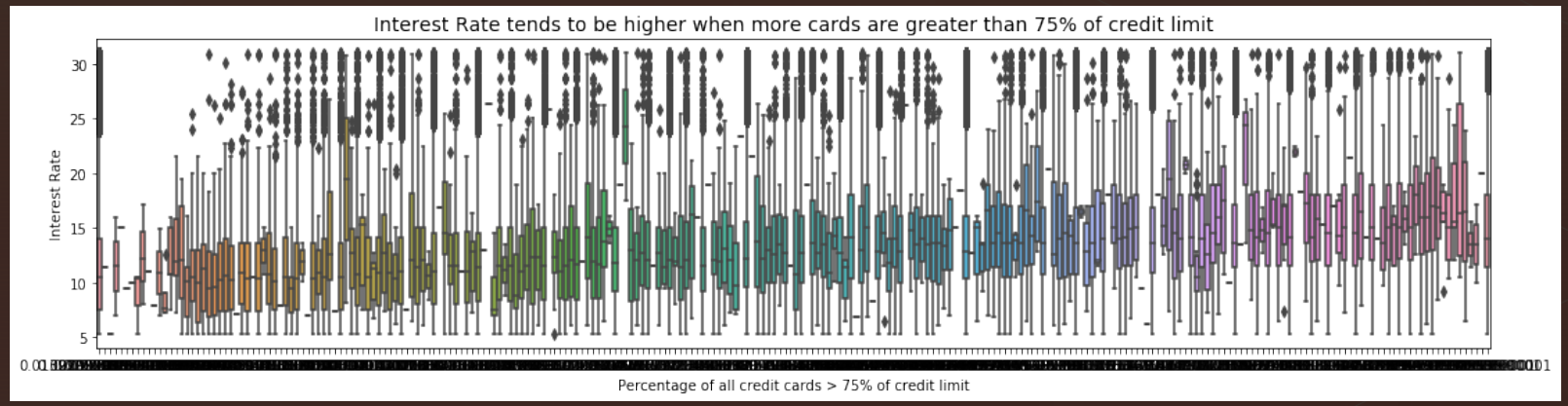


1) **FICO**
   - FICO score
2) **term_36 months**
   - 36 Months Term loan
3) **bc_open_to_buy**
   - Total credit available on all revolving credit cards
4) **total_bc_limit**
   - Total limit on all credit cards
5) **purpose_credit_card**
   - Purpose of loan is to pay off credit cards
6) **mo_sin_old_rev_tl_op**
   - Number of months since oldest revolving account opened

These are the top variables correlated to higher interest rate if applicants are not mindful of their activities. Our Sales Rep can advise on lowering activities on inquiries, opening accounts, and reduce utilization of credit cards if the balance is not going to be paid off immediately







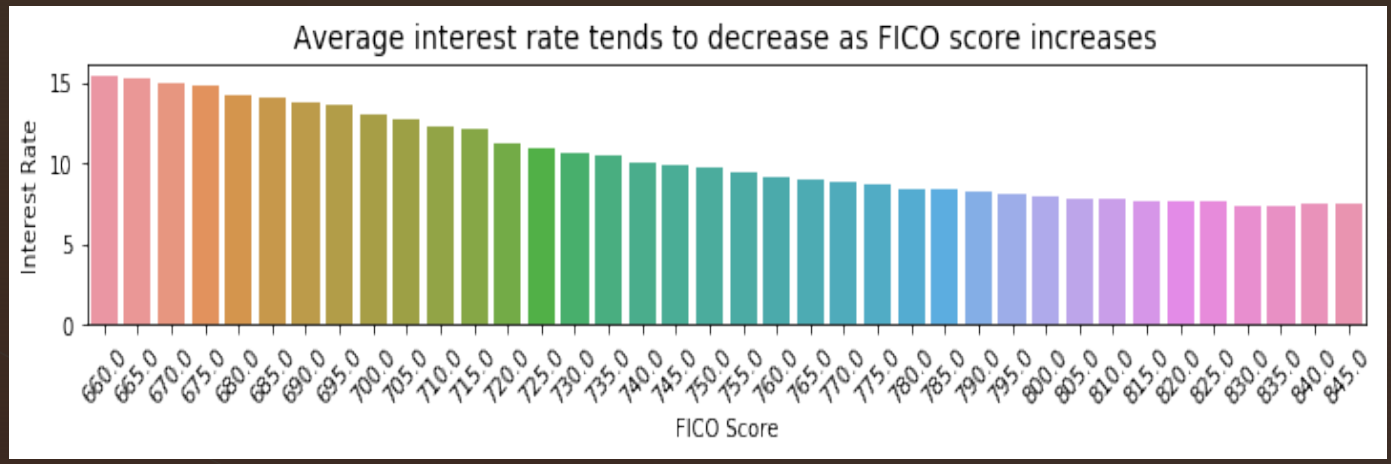
Insights

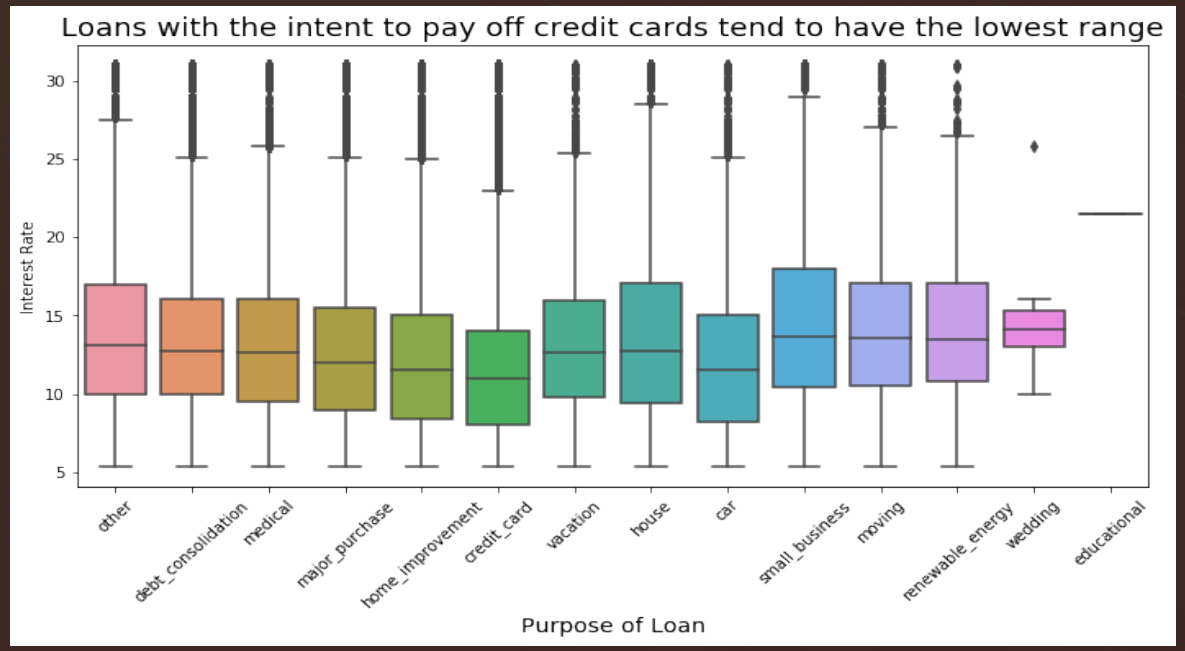
1. Applicants should make less inquiries within 6 months of applying for a loan
2. Should not open too many accounts, especially credit card accounts, within 12 months of applying for a loan
3. For applicants with several credit cards that have utilization over 75%, they should make additional payments to quickly lower their balance to keep it below 75%

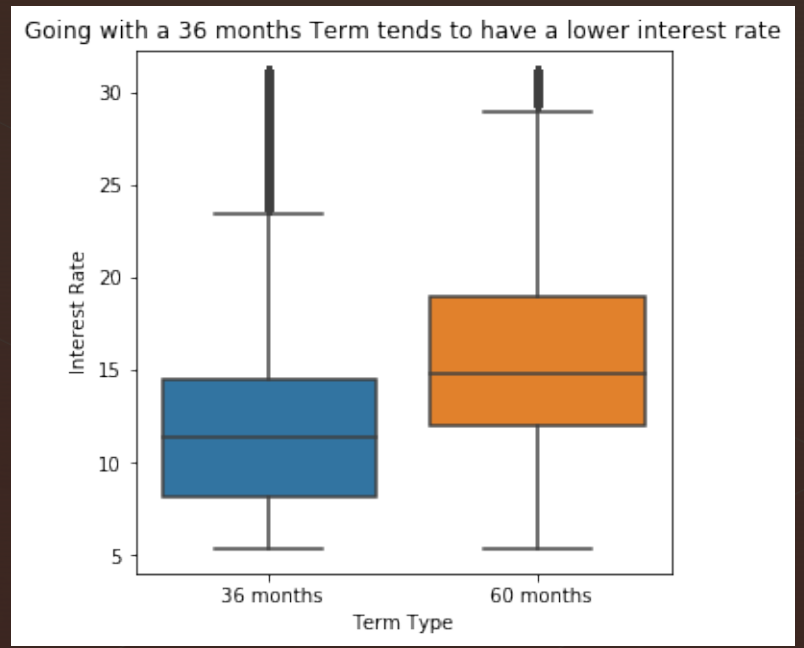
Our sales rep should advise our applicants to go with a 36 months loan opposed to 60 months with the intent to pay off credit cards. This may show a lower rate right away.

Insights

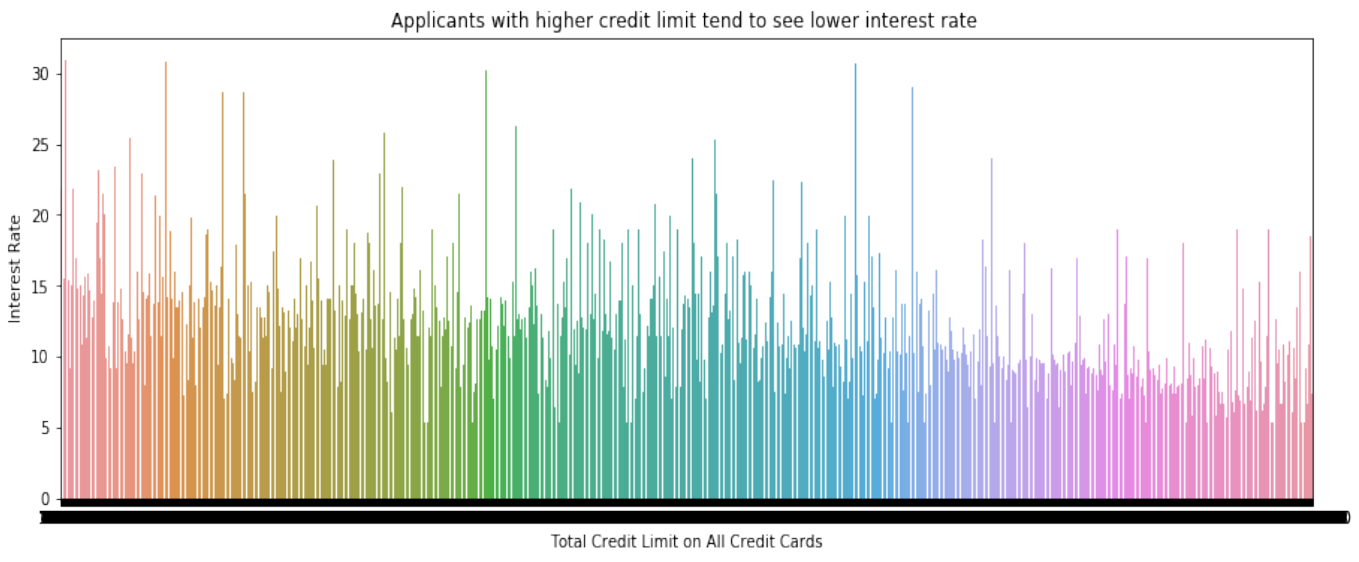
1. On average higher FICO scores will lead to lower interest rate
2. Having purpose of the loan to pay off credit card debt tends to have a lower interest rate range
3. Choosing a 36 Months term over a 60 Months term loan shows a significantly lower range





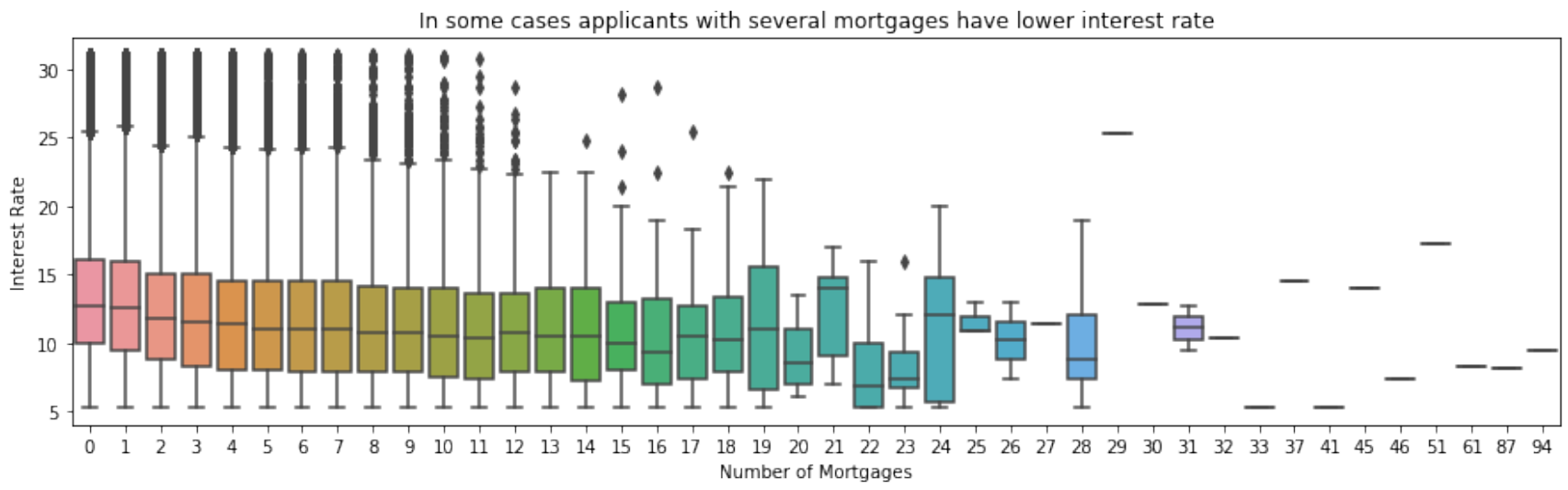


Total credit limit on all credit cards and number of mortgages also showed correlation to lower interest rate, but it would not make sense to ask out applicants to increase their credit limit by applying for more cards or apply for more mortgages. If the applicant happens to have a few mortgages it is good to inform our applicant that because they have a few mortgages it helped.



Insights

1. Applicants with higher total credit limit may not apply to a lot of our applicants. Having high limits may correlate to having really good FICO score.
2. Whether you have 1 mortgage or 0 the range is about the same. This variable may be more useful to those with several mortgages.



The regression model produced an R-Squared of 0.44. This is not the ideal model, but some of the variables used in this regression model can be used to help explain to our customers why their rates may be high. To improve the model, more data may be required that may not have been available or a more complex model than a regression model is required.

	coef	std err	t	P>|t|	[0.025	0.975]
const	5.0926	0.007	781.679	0.000	5.080	5.105
percent_bc_gt_75	0.0016	8.49e-06	184.561	0.000	0.002	0.002
num_tl_op_past_12m	0.0266	0.000	180.224	0.000	0.026	0.027
inq_last_6mths	0.0503	0.000	151.285	0.000	0.050	0.051
il_util	0.0010	1.16e-05	82.493	0.000	0.001	0.001
dti	0.0020	1.48e-05	135.323	0.000	0.002	0.002
mort_acc	-0.0229	0.000	-154.152	0.000	-0.023	-0.023
mo_sin_old_rev_tl_op	-0.0002	2.68e-06	-93.053	0.000	-0.000	-0.000
purpose_credit_card	-0.1288	0.001	-216.732	0.000	-0.130	-0.128
total_bc_limit	-8.899e-07	2.12e-08	-41.979	0.000	-9.31e-07	-8.48e-07
bc_open_to_buy	-1.455e-06	3.16e-08	-46.051	0.000	-1.52e-06	-1.39e-06
term_ 36 months	-0.3086	0.001	-557.144	0.000	-0.310	-0.308
FICO	-0.0035	8.98e-06	-393.544	0.000	-0.004	-0.004

R-squared:	0.447
Adj. R-squared:	0.447
F-statistic:	9.265e+04

Conclusion:

1. Although the regression model is not great, we hope that this can still provide insight for the sales team. We hope that by improving customer experience, by helping our customers understand what they can improve on, it will encourage them to re-apply for a better rate.
2. By finding more variables and improving the model we will be able to assist our customers even more.
3. This tool may help save time/money trying to acquire new customers because the customers may work on areas they need to improve on and re-apply later in the future. Another test will need to be done to measure how effective this will be.