

Final Presentation

Group C1

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INTRODUCTION

- The pandemic saw a major increase of 70 million in credit card accounts, naturally causing credit card debt to surpass \$1 trillion.
- 5.08% of credit card balances fell into serious delinquency in the second quarter of 2023







BUSINESS PROBLEM

Does a credit card holder's home ownership status impact their delinquent behavior?

- Predictor variable (X): home ownership
 - Does the individual rent, own, or pay a mortgage?
- Outcome variable (Y): # of times someone has had a delinquent balance in the last 2 years
 - Measures the frequency of delinquency behavior
- We assume that an individual's past delinquency rate will stay consistent in the future.

WHY THIS PROBLEM?

Helpful for banks to understand what affects delinquency	
Identify which consumers are the most likely to default	
Refine strategies to target different types of consumers	
Chose home ownership because it was an interesting variable we wanted to test	



DATASET

Overview of Dataset

- Sourced from Lending Club
- Provides information about borrowers, like income, spending habits, delinquency trends, etc
- Includes all 4 quarters of 2016
- Over 100,000 data points per quarter

POSSIBLE OUTCOMES



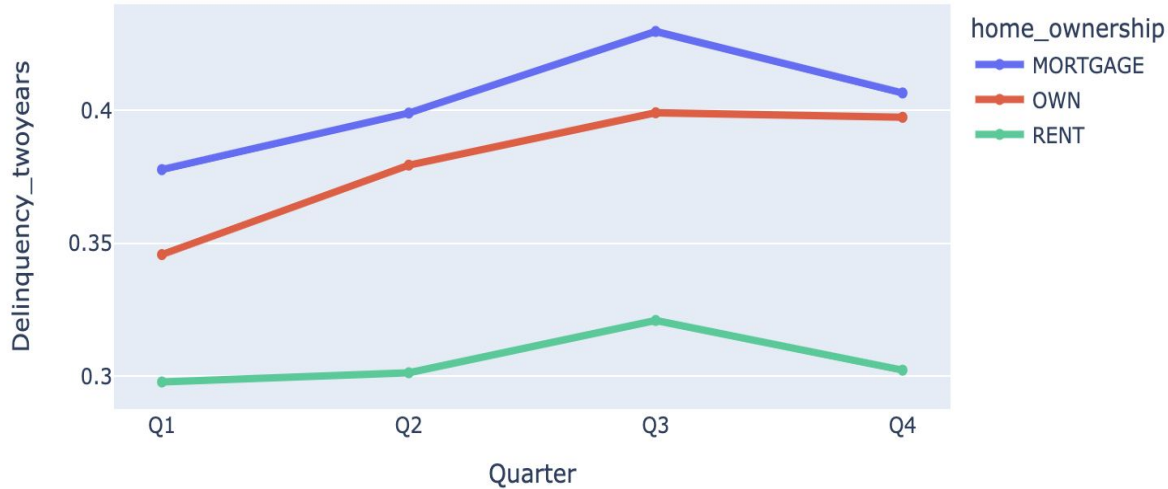
- Individuals who own a home have **a lower delinquency rate** than those who rent or pay a mortgage.
 - Individuals who own homes tend to have more money and thus default less.
- Individuals who own a home have **a higher delinquency rate** than those who rent or pay a mortgage.
 - Individuals who own a home may default more because they spent their money paying off a mortgage or may have a family they need to spend more money to support.



02

Results

DESCRIPTIVE STATISTICS



For every quarter, people with mortgages had the highest average delinquency rate and people who rented homes had the lowest average delinquency rate.

delinq_2yrs		
quarter	home_ownership	
Q1	MORTGAGE	0.377662
	OWN	0.345707
	RENT	0.297794
Q2	MORTGAGE	0.398944
	OWN	0.379366
	RENT	0.301254
Q3	ANY	0.000000
	MORTGAGE	0.429644
	OWN	0.399059
	RENT	0.320941
Q4	ANY	0.221154
	MORTGAGE	0.406509
	OWN	0.397356
	RENT	0.302230



0.40

Average # of delinquent balances in
the past 2 years for "Mortgage"

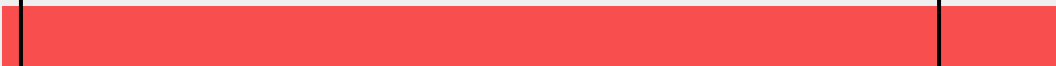
0.38

Average # of delinquent balances in
the past 2 years for "Own"

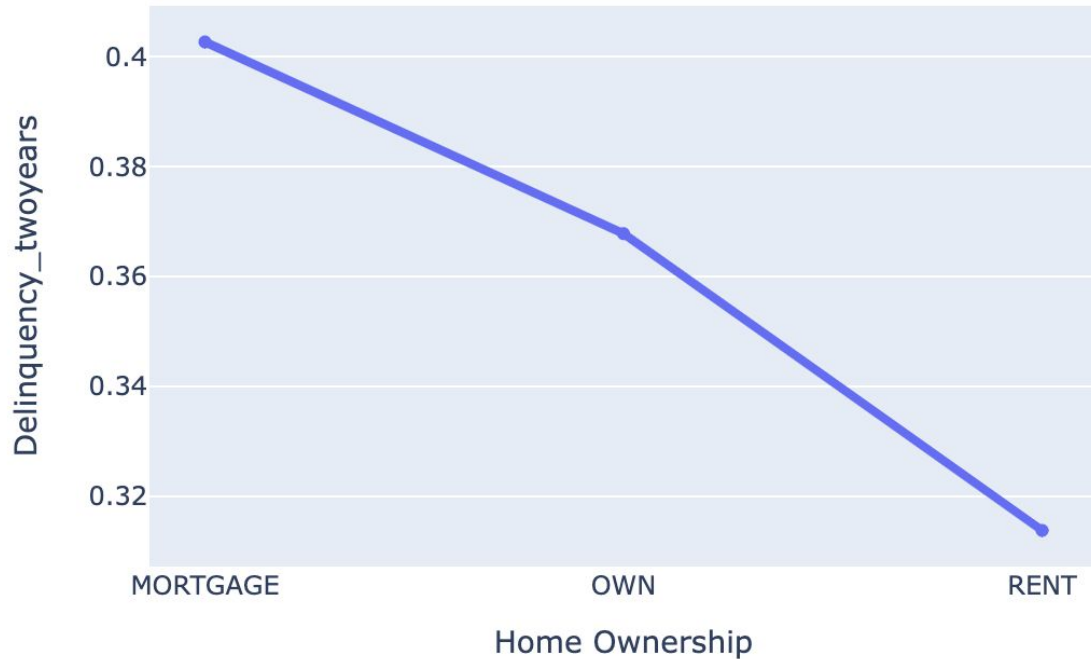


0.31

Average # of delinquent balances in
the past 2 years for "Rent"



SIMULATION



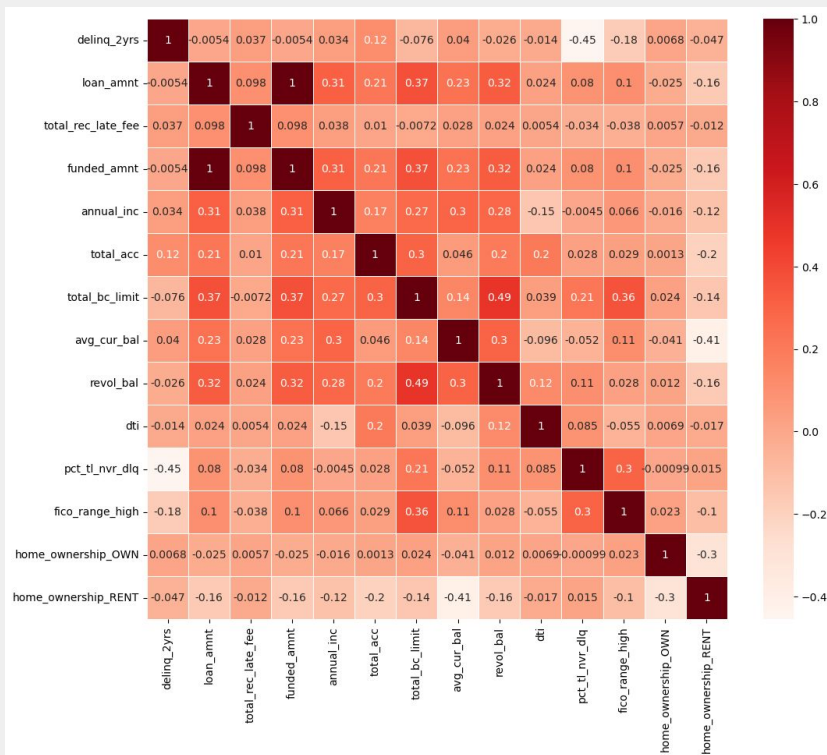
- Ran a simulation with a sample size of 100000.
- Mortgage had the highest delinquency rate and rent had the lowest delinquency rate.
- These results affirmed our previous findings.

03

CONFOUNDING VARIABLES

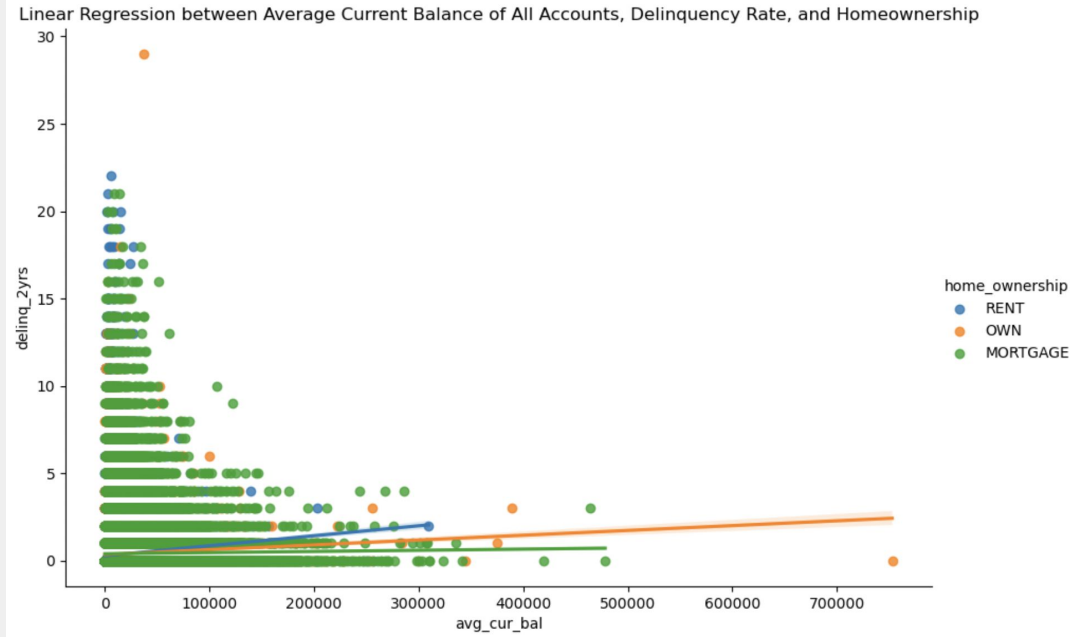


CORRELATION MATRIX



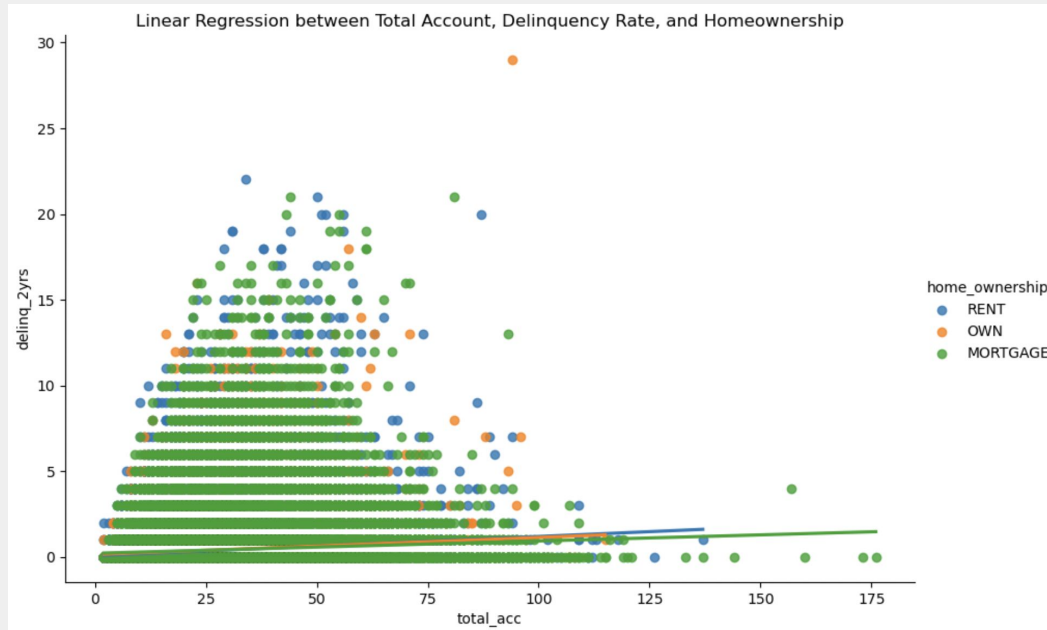
- Created two dummy variables to illustrate the three types of home ownership:
 - home_ownership_OWN and home_ownership_RENT (binary)
- Used the correlation matrix to identify three confounding variables:
 - Average current balance
 - Total accounts
 - Loan amount

AVERAGE CURRENT BALANCE



- The confounding variable has a clear relationship with delinquency.
 - Lower current balances tend to correspond with higher delinquency.
- In addition, the confounding variable has a slight relationship with home ownership (different slopes)
 - People who rent have the highest increase in delinquency with a one unit increase in current balance
 - Mortgage is the lowest

TOTAL NUMBER OF ACCOUNTS



- The confounding variable has a clear relationship with delinquency.
 - People with around 40 accounts tend to have the highest delinquency
- In addition, the confounding variable has a slight relationship with home ownership (different slopes)
 - People who rent have the highest increase in delinquency with a one unit increase in total accounts
 - Mortgage is the lowest

LOAN AMOUNT



- The confounding variable has a slight correlation with delinquency.
 - Higher loan amounts tend to correspond with a slightly lower delinquency rate than lower loan amounts.
- The confounding variable does not have a clear relationship with home ownership.



04

Conclusion

Regression

No interaction term inputted.

The MSPE of this model is 0.8929627034352903.

OLS Regression Results

Dep. Variable:	delinq_2yrs	R-squared:	0.002
Model:	OLS	Adj. R-squared:	0.002
Method:	Least Squares	F-statistic:	102.7
Date:	Tue, 28 Nov 2023	Prob (F-statistic):	2.87e-45
Time:	18:54:18	Log-Likelihood:	-1.2338e+05
No. Observations:	90000	AIC:	2.468e+05
Df Residuals:	89997	BIC:	2.468e+05
Df Model:	2		
Covariance Type: nonrobust			

	coef	std err	t	P> t	[0.025	0.975]
const	0.4066	0.005	89.123	0.000	0.398	0.415
home_ownership_RENT	-0.0966	0.007	-14.160	0.000	-0.110	-0.083
home_ownership_OWN	-0.0218	0.010	-2.150	0.032	-0.042	-0.002
Omnibus: 93030.010 Durbin-Watson: 1.994						
Prob(Omnibus): 0.000 Jarque-Bera (JB): 7956254.687						
Skew:	5.106	Prob(JB):	0.00			
Kurtosis:	47.915	Cond. No.	3.74			

Conducted a regression to test if each type of home ownership has a significant impact on delinquency rate.

Dummy Variables:

- home_ownership_OWN (binary)
- home_ownership_RENT (binary)
- Constant represents “mortgage” group

At an alpha level of 0.05, we can conclude that all three types of home ownership are significant factors that affect delinquency rate.

Regression Model

The MSPE of this model is 0.8763192807209423.

OLS Regression Results

Dep. Variable:	delinq_2yrs	R-squared:	0.018
Model:	OLS	Adj. R-squared:	0.018
Method:	Least Squares	F-statistic:	270.7
Date:	Tue, 28 Nov 2023	Prob (F-statistic):	0.00
Time:	18:54:21	Log-Likelihood:	-1.2268e+05
No. Observations:	90000	AIC:	2.454e+05
Df Residuals:	89993	BIC:	2.454e+05
Df Model:	6		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	0.1774	0.011	16.509	0.000	0.156	0.198
home_ownership_RENT	-0.0386	0.009	-4.124	0.000	-0.057	-0.020
home_ownership_OWN	0.0104	0.010	1.008	0.314	-0.010	0.031
avg_cur_bal	2.314e-06	2.34e-07	9.885	0.000	1.85e-06	2.77e-06
total_acc	0.0098	0.000	35.757	0.000	0.009	0.010
loan_amnt	-5.042e-06	3.7e-07	-13.638	0.000	-5.77e-06	-4.32e-06
interaction_home_ownership_RENT_avg_cur_bal	2.404e-06	7.75e-07	3.102	0.002	8.85e-07	3.92e-06

Omnibus: 91991.796 **Durbin-Watson:** 1.991
Prob(Omnibus): 0.000 **Jarque-Bera (JB):** 7632789.267
Skew: 5.018 **Prob(JB):** 0.00
Kurtosis: 46.985 **Cond. No.** 1.08e+05

Hypothesis Testing

- $H_0: \beta_6 = 0$
- $H_a: \beta_6 \neq 0$

Conclusion

- Avg_cur_bal, total_acc, and loan_amnt are all significant confounding variables



BUSINESS IMPLICATION

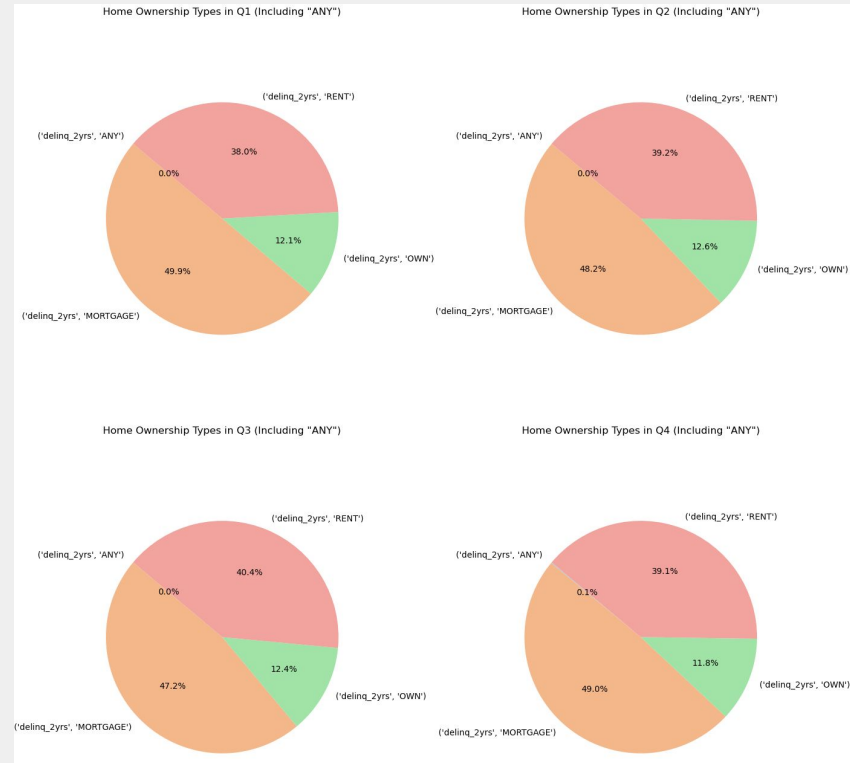
Conclusion: Home ownership has a significant impact on delinquency rate.

- People with mortgages are the most likely to default and people who rent are the least likely to default.
- Banks should take this into consideration when lending money.
- However, we must also consider other confounding factors that impact delinquency rate.
- Ex: Consider the combined effects of loan amount and home ownership on delinquency rate when shaping lending strategy.



LIMITATIONS

- Many confounding variables that also affect delinquency rate and home ownership
- We assumed that an individual's delinquency rate in the past 2 years is representative of their delinquency rate in the future.
- Uneven distribution of data points across each type of home ownership
 - We had the most data for "mortgage" and the least data for "own" (see chart).
- Missing age variable: can't prove our hypothesis that people with mortgages are younger than people who own homes, thus leading them to have less income and default more.



**THANK YOU
FOR LISTENING!**

