

2021-22 MTFC Qualifying Scenario

Mortgage Lending

Student Version



A Program of The Actuarial Foundation

Modeling the Future Challenge



Introduction

For many people in the United States, home ownership is often a benchmark of stability and financial independence. However, many are unable to afford to purchase their own home without financing assistance from a lending institution. Thus, many hopeful homeowners will rely on a mortgage in order to purchase their home. While there are many types of mortgages, a mortgage in the simplest sense is a loan awarded to a borrower where the house itself is held as collateral. The interest rate on a conventional mortgage is influenced by many factors including (but not limited to) inflation, the loan-to-value ratio, and credit score. A borrower's credit score is a predictive index of the applicant's likelihood of repaying the loan that is determined by their payment history, total amount owed over all credit lines, length of credit history, diversity of credit accounts, and number of new credit lines opened or hard inquiries performed by lenders within a recent time frame.

Mortgage lending has been the subject of additional scrutiny over the past decade when the unprecedented growth of the subprime mortgage lending market began in 1999 by U.S.-government sponsored mortgage lenders Fannie Mae and Freddie Mac led to risky mortgage lending to "subprime borrowers" who had low credit scores and higher risks of defaulting on loans. These subprime borrowers were allowed to take out adjustable-rate mortgages where the monthly payments started small but grew to much larger than they were able to afford after several years. When these borrowers and by 2008, subprime borrowers were defaulting on their mortgages at high rates which caused turmoil in the financial markets and ensuing collapse of the stock market and housing crash of 2008 and ensuing Great Recession.

With this background in mind, the XYZ Mortgage Company is reviewing their data from mortgages lent in 2010. XYZ has decided to hire you as a consulting actuary to help them analyze their data and make recommendations about how to define which loans they should make and at what interest levels.



Data Description

The spreadsheet attached to this scenario provides 7 fields:

- date of origin of the loan
- term (15 years or 30 years)
- purchase price of the home
- loan amount
- interest rate
- credit score of the borrower
- whether or not the mortgage was delinquent as of 1/1/2019 (1 is delinquent, 0 is not)

Some questions require written answers, some mathematical calculations, and some require both. The questions follow the five steps of the Actuarial Process and additional perspective can be found by referencing each section of the Actuarial Process Guide.

Part 3:
... continued.

16. Assuming that XYZ loses an average of \$164,563 for every delinquent loan, what is the expected value of loan lending by XYZ (assuming the interest rate is 4.44% and average interest paid is \$152,946)?

17. Find the probability that of the next twenty-five 15-year loans, none of them will become delinquent.

Part 4: Critical Thinking & Risk Analysis

The following questions relate to Part 4 of the Actuarial Process. It may be valuable to review this section of the Actuarial Process Guide before answering the questions below.

18. Suppose delinquency rates for all loans from XYZ Mortgage from 2011-2014 were 3.2%, 3.31%, 3.44%, and 3.46%, respectively. Use a linear regression model with the 2010 delinquency rate and these four new data points to predict the delinquency rate for loans issued in 2018. What is the correlation coefficient? Is a linear regression model on this data a good way to project the future delinquency rates? Why or why not? Include a labeled graph in your response.

19. Suppose the delinquency rate for 2015 was low – 3.04%. By how much would this reduce the prediction for the delinquency rate for loans in 2018?

Part 4:
... continued ...

20. Different types of loans have different requirements and ways of determining eligibility. Compare the mean and standard deviation of the loan to purchase price ratio and the percent delinquent for current loans with borrowers in the following FICO credit score categories: Bad (300-619), Fair (620-689), Good (690-719), and Excellent (720-850). Explain what this tells us about the risks associated with lending based on credit score? Interpret the standard deviations you see in terms of what it means for risks in each category.

	Bad (300-619)	Fair (620-689)	Good (690-719)	Excellent (720-850)
Mean <i>loan/pp ratio</i>				
Stdev <i>loan/pp ratio</i>				
# Delinquent				
% Delinquent <i>as of 1/1/2019</i>				

Part 4:
... continued.

21. The length of mortgage awarded is also a factor to consider for XYZ in lending. Complete the table and note any relevant observations on the possibility of risk between the 15-year and 30-year mortgages.

	% Delinquent	Average Loan to Purchase price Ratio	Standard Deviation of Loan to Purchase Price Ratio
15-year Mortgage			
30-year Mortgage			

22. Is there a bigger risk (in terms of delinquency) to loans originating in the winter (before March 20)? Explain and justify your response and offer some suggestions as to why this may be the case.

Part 5: Recommendations

The following questions relate to Part 5 of the Actuarial Process. It may be valuable to review this section of the Actuarial Process Guide before answering the questions below.

- 23. Is the correlation between credit score and delinquency a credible method of predicting whether a loan should be awarded based solely on credit score? Justify your response.**
- 24. Give and justify an evidence-based recommendation (based on delinquency rate) on lending more than 80% of the purchase price.**
- 25. Give an evidence-based recommendation on lending to customers with a credit score under 620. What steps could be taken by lenders to cover the risk they assume when lending to borrowers with credit scores under 620? Explain and justify your response.**
- 26. Should XYZ increase the marketing of their 15-year loans or their 30-year loans? Why? Give an evidence-based rationale for your recommendation.**