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**BA 355: ICE 4 (15 points)**

In Cases 2.1 and 2.2, we used simulated (fake) credit score and loan default data to determine how those two factors might be related. Real data is preferable to fake data, and the following source might give us some insight into how interest rates for automobile loans depend on credit scores.

<https://www.businessinsider.com/personal-finance/average-auto-loan-interest-rate>

1) Read the article, paying particular attention to the information in the tables.

2) Using the data from the *first* table in the article, create a list of paired data points with credit score in the first column and average loan APR for a new car in the second column. Since the credit score data comes from a range of values, average the two (like we did in Case 2) to get a single number – for example, for “non-prime” scores from 601 to 660, use 630 as the value. This should yield five data points.

3) Draw a scatter diagram of the points (shocking!) and fit a straight line through them. Fix the x-axis to start at 300 on the graph. Determine the equation of the line and r2. Format the trendline label to be to Percentage with 3 decimal places of accuracy. What are the equation of the line and r2?

4) One way to interpret r2 is: The x-variable explains/determines r2% of the y-variable. Interpret r2 this way. According to real data, what is your conclusion about the relationship between credit scores and interest rates on new automobile loans?

**90.1% of the variation in loan APR for a new car is explained by the average credit score category, (Deep Subprime… – Super Prime).**

5) Starting at 350 on the left and increasing by 100 credit score points each step, interpret the y-intercept (at 350) and the slope (per 100 units) of the line. In other words, what does the line tell us about the worst interest rates (at credit score 350) and how the rates change (per every 100 units)?

**-.0003(350) +.2751 = 17.01%, -.0003(100) = -.03, for every 100 points increase in credit score, loan APR goes down by 3%.**

6) Assume your credit score is 700; what kind of rate are you likely looking at? What if you had a perfect credit score of 850?

**-.0003\*700 +.2751 = 6.51%, -.0003\*850 +.2751 = 2.01%.**

7) By how many points must your credit score increase to decrease your interest rate by a percentage point (1%)?

**About 33.06 points, -0003x = .01 = -33.33 - .2751 = 33.06**

8) Google “auto loan calculator” and use the one that pops up online assuming a $25,000 loan for 5 years. Using the equation from part 3) and the auto loan calculator, develop a relationship between monthly payment and credit score. How much would you need to increase your credit score to decrease your monthly payment by, say, $25? Explain your steps on this part.

372.82 – 25 = 347.82 = R from 4.5 to 1.687 = 2.813

Difference from starting loan amount and $25 less than the amount is 347.82, and R drops from 4.5 by 1.687 to get 2.813. Solving for 2.813 means plugging in x values into equation 3 and we get the boundaries of 66.12 and 99.18, with an approximation of 80.63.

Solving with the data by plugging in the loan amount and graphing its corresponding cedit score from the original data against the monthly payments gives us y=-.3838x + 743.88, and 65.14\*-0.3838 = -25, giving us 65.14.

Between **66.12 and 99.18**, close to 99.18. 99.18-18.5466 = **80.6334 or 65.14**

**Extra Credit:**

1. The averages from the article must have come from a massive data set. Find that data set or one like it.

https://www.kaggle.com/datasets/burak3ergun/loan-data-set

1. Credit scores clearly affect interest rates. But so does the term – shorter loans have lower rates, longer loans have higher rates. Use the data from the article or some other data set to build a two-factor model where the interest rate is a function of both the credit score and the term of the loan.

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| SUMMARY OUTPUT | |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| *Regression Statistics* | |  |  |  |  |  |  |  |
| Multiple R | 0.99994367 |  |  |  |  |  |  |  |
| R Square | 0.99988734 |  |  |  |  |  |  |  |
| Adjusted R Square | 0.99985516 |  |  |  |  |  |  |  |
| Standard Error | 1.88280086 |  |  |  |  |  |  |  |
| Observations | 10 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| ANOVA |  |  |  |  |  |  |  |  |
|  | *df* | *SS* | *MS* | *F* | *Significance F* |  |  |  |
| Regression | 2 | 220245.585 | 110122.793 | 31064.7913 | 1.5175E-14 |  |  |  |
| Residual | 7 | 24.8145735 | 3.54493908 |  |  |  |  |  |
| Total | 9 | 220270.4 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
| Intercept | 1103.8463 | 2.64688045 | 417.036706 | 1.2037E-16 | 1097.58743 | 1110.10518 | 1097.58743 | 1110.10518 |
| X Variable 1 | 1185.08353 | 12.9242253 | 91.6947436 | 4.8333E-12 | 1154.52259 | 1215.64446 | 1154.52259 | 1215.64446 |
| X Variable 2 | -11.5 | 0.04961616 | -231.77933 | 7.3464E-15 | -11.617324 | -11.382676 | -11.617324 | -11.382676 |
|  |  |  |  |  |  |  |  |  |
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Where x1 = r

And x2 = term

And y = payment