Eating Out vs. Eating at Home

While eating out has many fun perks, there are also the associated costs to consider. Is it true that eating out is always more expensive than cooking the same meal at home? If so, has this always been the case? Today we will look at the ratio of restaurant to grocery store prices for the same meals over time.

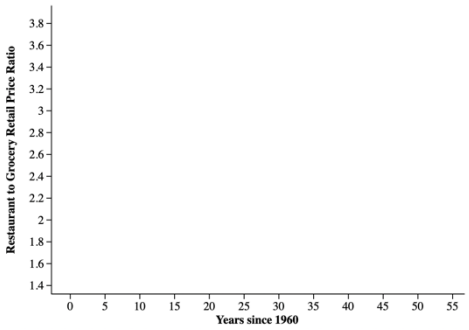
1. Look at the data showing the restaurant to grocery retail price ratio in the years since 1960. What do you notice? What do you wonder?

2. Go to Stapplet.com and click on the "Two Quantitative Variables" option under Data Analysis.
   a. Which variable is the Explanatory Variable?

   b. Which variable is the Response Variable?

   c. Copy and paste the data from Column B and Column C in the appropriate spots. (You can paste a whole column of data at once, entries will be automatically separated by spaces.)

3. Look at the scatterplot. Describe how the restaurant to grocery retail price ratio is changing over time. Then sketch the scatterplot below.

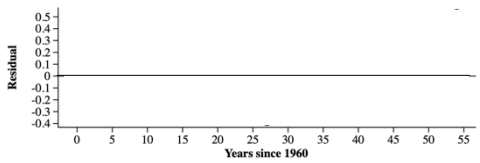


4. Suppose we wanted to find an equation that would help us model the price ratio based on the number of years since 1960. A least squares regression line fits a line to the data. Click "Calculate least-squares regression line."
   a. Write the equation of the line below.

   b. What does this model assume about how the price ratio is changing each year?

   c. Do you think this is a good model? Why or why not?

5. A residual plot shows the difference between the actual value and the value predicted by the regression model. Sketch a picture of the residual plot for the least-squares regression line.



6. In which years does the regression model give an *underestimate* of the true ratio?

7. In which years does the regression model give an *overestimate* of the true ratio?

8. What would you expect the residual plot to look like if the regression model was a good fit for the data?

9. Perhaps a linear model is not the right fit. Under "Calculate other regression model", you can see what a quadratic or exponential model would look like.
    a. Describe what a quadratic model indicates about how the restaurant to grocery ratio is changing over time.

    b. Write the equation of the quadratic regression model below.

    c. Describe what an exponential model indicates about how the restaurant to grocery ratio is changing over time.

    d. Write the equation of the exponential regression model below.

    e. Looking at both residual plots, which function do you think is the better fit? Explain.

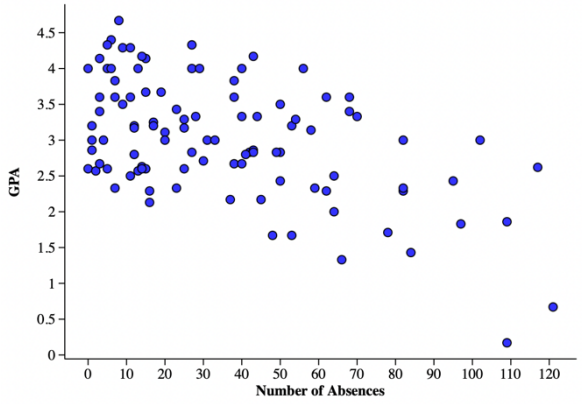
10. Using your chosen model, predict the restaurant to grocery retail price ratio for 2023.

Lesson 4.8 – Using Regression Models

QuickNotes

Check Your Understanding

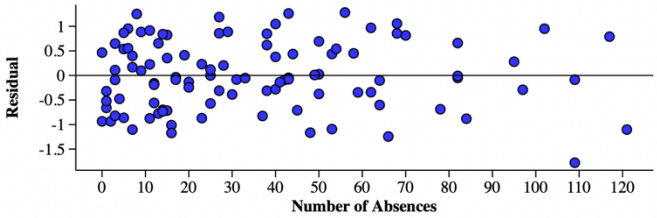
Data for a random sample of high school students is shown in the scatterplot.



1. Describe the relationship between the number of absences and the student's GPA.

2. Does the data seem to suggest a linear, quadratic, or exponential model? How do you know?

3. A least squares regression model for this data is given by $\hat{y} = 3.53496 - 0.0146x$, where x is a student's number of absences and y is the student's GPA.
   a. Use the residual plot to determine if a linear regression model is appropriate.



   b. Interpret the slope of the regression model.

   c. Use the regression model to predict the GPA of a student who has 23 absences.