Chapter Two Study Questions

Study Questions (Deductive)

1. For any given price, how would the following changes impact a team's revenue?

   a. Increase in the size of the market

   Solution: revenue increases

   b. Building a new stadium

   Solution: revenue increases

   c. Decline in the quality of the team's roster

   Solution: revenue declines

2. For a typical firm, what is the shape of the marginal cost curve? Why does it have this shape?

   Solution: Upward-sloping. This is because of the law of diminishing returns. As a firm expands, it must hire more labor to produce the additional output. Because capital is fixed, the productivity of labor declines and the marginal cost increases.

3. For a sports team, what might the shape of the marginal cost curve be? Why does it have this shape?

   Solution: It is zero until a team reaches capacity. Then it is vertical. This is because adding additional fans (i.e., increasing output for a team) essentially costs nothing until a team reaches capacity. Then the cost is essentially infinite.

4. What is the profit-maximizing rule?

   Solution: Marginal revenue equals marginal cost

Study Questions (Inductive)

5. Given Wins = $a_0 + a_1 \times$ Population + e_i what is the regression term that describes each element in this equation?

   a. Wins

   Solution: dependent variable

   b. a_0

Solution: y-intercept or constant term

c. a_1

Solution: slope coefficient

d. Population

Solution: independent variable

e. e_i

Solution: error term

6. What is a "constant term"? Why is this term included in a regression equation, and what information does it convey?

Solution: The constant term is the y-intercept. It is the value of the dependent variable when the independent variables are zero. It is included to enforce a zero mean for the error term. But it doesn't convey any practical information because zero values for the independent variables are often outside the realm of what is possible.

7. We have a rule-of-thumb that a t-statistic should be, in absolute value, greater than 2. Explain the reasoning behind this rule.

Solution: We are 95% certain that the true value of any estimated coefficient is within 2 standard errors of the coefficient. So if a coefficient is 8 and the standard error is 6, we are 95% certain that the true value of the coefficient is between -4 and 20. Such a range would mean that the true value could be negative, zero, or positive. In other words, we don't really know the direction of the relationship. But if the standard error were 2, then the true value would lie between 4 and 12. Now we would be 95% certain that the true value is not zero and not negative.

Now imagine that the standard error is 4. In that instance, the confidence interval would extend from 0 to 16. So zero is on the edge of our interval. In this instance the t-statistic—or the coefficient divided by the standard error—would be 2. So if the t-statistic is 2, zero lies on the edge of the confidence interval and can't be eliminated.

Hence we prefer a value that in absolute terms is greater than 2.

8. How do we calculate R-squared? What does this tell us?

Solution: R-squared is either

ESS / TSS or

1 – (RSS/TSS)

It tells us the percentage of the dependent variable explained by our model.

9. What is the relationship between market size and win in North American pro sports? Answer this question using both deductive and inductive analysis.

Solution: Deductive analysis says that market size and wins are strongly linked. Inductive analysis of the four major North American sports leagues failed to find a strong empirical link.

10. Use the following econometric model and results to answer these questions.

Dependent Variable: Team Winning Percentage from the WNBA (1997–2013)

a. Interpret each slope coefficient.

Solution: An additional point scored per game will increase winning percentage by 3.15%. An additional point surrendered per game will decrease winning percentage by 3.11%.

b. For which variables are we at least 95% certain that the coefficient is different than zero?

Solution: Points Scored and Points Surrendered

c. Explain the reasoning behind your answer.

Solution: To answer this question, you need to calculate the *t*-statistic. The *t*-statistic for points per game is 31.5. For points surrendered per game, it is −28.27. Both values are greater than 2 in absolute terms, so both coefficients—according to our rule-of-thumb—are statistically significant.

d. For which variables are we not at least 95% certain that the coefficient is different than zero? Explain the reasoning behind your answer.

Solution: None

e. Calculate the R^2 and interpret your answer.

Independent Variables	Coefficient	Standard Error	*t*-Statistic
Points per game	0.0315	0.0010	
Points surrendered per game	−0.0311	0.0011	
Constant	0.4712	0.0553	
Observations: 220			
Total sum of squares	5.56520		
Residual sum of squares	0.95645		

Solution: Explained sum of squares is 4.609. So R-squared is 4.609/5.5652, which is 0.828.

11. What is the relationship between payroll and wins in MLB, the NFL, NBA, and NHL? Is the deductive study consistent with the inductive study?

Solution: Payroll does not explain as much as 25% of the variation in winning percentage and fails to explain 75% of the variation in winning percentage. The deductive model suggests that payroll is very important to team wins. But the empirical analysis—or the inductive analysis—suggests a different story.

12. When we estimate the model in Question 10 for the NBA, we see a higher explanatory power than what we do for MLB, the NFL, and the NHL. Why is explanatory power higher for the NBA? Why are we unable to explain 100% of the variation in winning percentage with points scored and points surrendered per game?

Solution: The NBA has fewer blowouts than the other three leagues. In each game decided by more than 1 point, there are points scored and surrendered that do not actually impact the outcome of the game. These excess points reduce our explanatory power.

13. What factors should we consider in evaluating a regression? Should we make sure the regression conforms to prior beliefs?

Solution: These are listed in the text. And prior beliefs are not part of our list. We have to allow our empirical analysis to change what we think about the world.

14. What is the difference between statistical significance and economic significance?

Solution: Statistical significance tells us if the estimated coefficient is different from zero. Economic significance is what we think about when we wonder how large of an effect we have uncovered.

Thought Questions

1. Why do NFL, NBA, and NHL teams tend to sell out while MLB teams do not?

   Solution: The NFL, NBA, and NHL appear to reach a profit-maximizing level of attendance beyond the capacity of the stadium/arena where they play. This is not the story in baseball.

2. According to deductive reasoning, how successful should the New York Mets be on the field relative to the Detroit Tigers? From 1962 to 2016, the Mets won 48.1% of their

regular season games while the Tigers won 49.9% of their contests. Do these records match your deductive reasoning? Why or why not?

Solution: The Mets—playing in a much bigger market—should be much more successful. The inductive reasoning, though, tells us that there is more to team success than market size.

3. Consider the following regression for the WNBA:

   Wins = $b_0 + b_1 \times$ Points per Game + e_i

   Dependent Variable: Team Winning Percentage from the WNBA (1997–2013)

   a. What is the 95% and 99% confidence interval around (b_1)?

      Solution: The 95% confidence interval ranges from 0.006 to 0.013. The 99% confidence interval—or three standard errors in each direction—is 0.005 to 0.014.

   b. Is (b_1) statistically significant?

      Solution: By our rule-of-thumb (i.e., the *t*-statistic must be greater than 2), we would conclude it is statistically significant. The *t*-statistic is 6.195.

   c. According to the results below, what is the chance that (b_1) could equal 0.0315?

      Solution: Less than 1%. A value of 0.0315 is outside the 99% confidence interval.

   d. What lesson do we learn when we compare the results below to the results from Question 10 above?

      Solution: If you do not specify a model correctly, you can be very misled. The estimated coefficient in the model below is statistically significant. And the range possible is not even close to what we see when we specify the model correctly. This highlights why specifying a model correctly is so important and how we have to be careful interpreting a model.

Independent Variables	Coefficient	Standard Error	*t*-Statistic
Points per game	0.00954	0.00154	
Constant	−0.1892	0.1120	
Observations: 220			
Total sum of squares	5.5652		
Residual sum of squares	4.7360		

Math Questions

1. If $P = a_0 - a_1 \times Q$, what is the equation for total revenue?

   Solution: $TR = P \times Q$, so

   $TR = [a_0 - a_1 \times Q] \times Q$

   $TR = a_0 \times Q - a_1 \times Q^2$

2. If $P = \$150 - 0.005 \times Q$, what is the equation for total revenue?

   Solution: $TR = \$150 \times Q - 0.005 \times Q^2$

3. Complete the following table:

Ticket Prices, Attendance, and Revenue if the Demand Curve is $P = \$50 - 0.005 \times Q$		
\$10.00		
\$15.00		
\$20.00		
\$25.00		
\$30.00		
\$35.00		
\$40.00		
\$45.00		

4. If $P = \$50 - 0.005 \times Q$,

   a. what is the equation for marginal revenue?

   Solution: $MR = \$50 - 0.01 \times Q$

   b. how many tickets will the team sell when it maximizes revenue?

   Solution: To answer this, set $MR = 0$ and solve for Q:

   50,000

   c. what will the price be when the team maximizes revenue?

   Solution: \$25

   d. how much revenue will the team earn when it maximizes revenue?

   Solution: \$1,250,000

5. Given the demand curve in Math Question 4, if marginal cost for a sports team is zero,

   a. how many tickets will the team sell when it maximizes profit?

      Solution: 50,000

   b. what will the price be when the team maximizes profit?

      Solution: $25

   c. how much revenue will the team earn when it maximizes profit?

      Solution: $1,250,000

6. How would your answers to Math Questions 5(a), 5(b), and 5(c) change if the team's capacity was 10,000 seats less than your answer to Math Question 5(a)?

   Solution: This would mean that capacity for the team is at 40,000 seats. So capacity would be profit-maximizing for the team. So the team would sell out, and the price would be $30 (or what the demand curve indicates the price would be at $40,000). Revenue would be $30 × 40,000 or $1,200,000.