

## Multiple regression

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### MULTIPLE CHOICE

1. The mathematical equation relating the expected value of the dependent variable to the value of the independent variables, which has the form of  $E(y) = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_px_p$  is
- a simple linear regression model
  - a multiple nonlinear regression model
  - an estimated multiple regression equation
  - a multiple regression equation

ANS: D

PTS: 1

TOP: Multiple Regression

2. The mathematical equation that explains how the dependent variable  $y$  is related to several independent variables  $x_1, x_2, \dots, x_p$  and the error term  $\varepsilon$  is
- a simple nonlinear regression model
  - a multiple regression model
  - an estimated multiple regression equation
  - a multiple regression equation

ANS: B

PTS: 1

TOP: Multiple Regression

3. A multiple regression model has
- only one independent variable
  - more than one dependent variable
  - more than one independent variable
  - at least 2 dependent variables

ANS: C

PTS: 1

TOP: Multiple Regression

4. A regression model in which more than one independent variable is used to predict the dependent variable is called
- a simple linear regression model
  - a multiple regression model
  - an independent model
  - None of these alternatives is correct.

ANS: B

PTS: 1

TOP: Multiple Regression

5. A multiple regression model has the form

$$\hat{Y} = 5 + 6X + 7W$$

As  $X$  increases by 1 unit (holding  $W$  constant),  $Y$  is expected to

- increase by 11 units
- decrease by 11 units
- increase by 6 units
- decrease by 6 units

ANS: C

PTS: 1

TOP: Multiple Regression

#### Exhibit 15-4

- a.  $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$
- b.  $E(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$
- c.  $\hat{Y} = b_0 + b_1 X_1 + b_2 X_2$
- d.  $E(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2$

6. Which equation gives the estimated regression line?
- a. Equation A
  - b. Equation B
  - c. Equation C
  - d. Equation D

ANS: C                      PTS: 1                      TOP: Multiple Regression

7. A measure of goodness of fit for the estimated regression equation is the
- a. multiple coefficient of determination
  - b. mean square due to error
  - c. mean square due to regression
  - d. sample size

ANS: A                      PTS: 1                      TOP: Multiple Regression

8. The adjusted multiple coefficient of determination is adjusted for
- a. the number of dependent variables
  - b. the number of independent variables
  - c. the number of equations
  - d. detrimental situations

ANS: B                      PTS: 1                      TOP: Multiple Regression

9. In a multiple regression analysis involving 15 independent variables and 200 observations,  $SST = 800$  and  $SSE = 240$ . The coefficient of determination is
- a. 0.300
  - b. 0.192
  - c. 0.500
  - d. 0.700

ANS: D                      PTS: 1                      TOP: Multiple Regression

10. The correct relationship between SST, SSR, and SSE is given by
- a.  $SSR = SST + SSE$
  - b.  $SSR = SST - SSE$
  - c.  $SSE = SSR - SST$
  - d. None of these alternatives is correct.

ANS: B                      PTS: 1                      TOP: Multiple Regression

11. In a multiple regression analysis involving 10 independent variables and 81 observations,  $SST = 120$  and  $SSE = 42$ . The coefficient of determination is
- a. 0.81
  - b. 0.11
  - c. 0.35
  - d. 0.65

ANS: D

PTS: 1

TOP: Multiple Regression

12. In a multiple regression analysis involving 5 independent variables and 30 observations,  $SSR = 360$  and  $SSE = 40$ . The coefficient of determination is
- a. 0.80
  - b. 0.90
  - c. 0.25
  - d. 0.15

ANS: B

PTS: 1

TOP: Multiple Regression

13. In a multiple regression model, the error term  $\varepsilon$  is assumed to be a random variable with a mean of
- a. zero
  - b. -1
  - c. 1
  - d. any value

ANS: A

PTS: 1

TOP: Multiple Regression

14. In a multiple regression model, the values of the error term  $\varepsilon$ , are assumed to be
- a. zero
  - b. dependent on each other
  - c. independent of each other
  - d. always negative

ANS: C

PTS: 1

TOP: Multiple Regression

15. In order to test for the significance of a regression model involving 3 independent variables and 47 observations, the numerator and denominator degrees of freedom (respectively) for the critical value of F are
- a. 47 and 3
  - b. 3 and 47
  - c. 2 and 43
  - d. 3 and 43

ANS: D

PTS: 1

TOP: Multiple Regression

16. A term used to describe the case when the independent variables in a multiple regression model are correlated is
- a. regression
  - b. correlation
  - c. multicollinearity
  - d. None of the above answers is correct.

ANS: C

PTS: 1

TOP: Multiple Regression

17. A regression model involved 5 independent variables and 136 observations. The critical value of  $t$  for testing the significance of each of the independent variable's coefficients will have
- a. 121 degrees of freedom
  - b. 135 degrees of freedom
  - c. 130 degrees of freedom
  - d. 4 degrees of freedom

ANS: C

PTS: 1

TOP: Multiple Regression

18. The ratio of MSE/MSR yields
- a. SST
  - b. the F statistic
  - c. SSR
  - d. None of these alternatives is correct.

ANS: D

PTS: 1

TOP: Multiple Regression

19. In order to test for the significance of a regression model involving 14 independent variables and 255 observations, the numerator and denominator degrees of freedom (respectively) for the critical value of  $F$  are
- a. 14 and 255
  - b. 255 and 14
  - c. 13 and 240
  - d. 14 and 240

ANS: D

PTS: 1

TOP: Multiple Regression

20. In order to test for the significance of a regression model involving 8 independent variables and 121 observations, the numerator and denominator degrees of freedom (respectively) for the critical value of  $F$  are
- a. 8 and 121
  - b. 7 and 120
  - c. 8 and 112
  - d. 7 and 112

ANS: C

PTS: 1

TOP: Multiple Regression

21. In order to test for the significance of a regression model involving 4 independent variables and 36 observations, the numerator and denominator degrees of freedom (respectively) for the critical value of  $F$  are
- a. 4 and 36
  - b. 3 and 35
  - c. 4 and 31
  - d. 4 and 32

ANS: C

PTS: 1

TOP: Multiple Regression

**Exhibit 15-1**

In a regression model involving 44 observations, the following estimated regression equation was obtained.

$$\hat{Y} = 29 + 18X_1 + 43X_2 + 87X_3$$

For this model  $SSR = 600$  and  $SSE = 400$ .

22. Refer to Exhibit 15-1. MSR for this model is

- a. 200
- b. 10
- c. 1,000
- d. 43

ANS: A

PTS: 1

TOP: Multiple Regression

**Exhibit 15-2**

A regression model between sales ( $Y$  in \$1,000), unit price ( $X_1$  in dollars) and television advertisement ( $X_2$  in dollars) resulted in the following function:

$$\hat{Y} = 7 - 3X_1 + 5X_2$$

For this model  $SSR = 3500$ ,  $SSE = 1500$ , and the sample size is 18.

23. Refer to Exhibit 15-2. The coefficient of the unit price indicates that if the unit price is

- a. increased by \$1 (holding advertising constant), sales are expected to increase by \$3
- b. decreased by \$1 (holding advertising constant), sales are expected to decrease by \$3
- c. increased by \$1 (holding advertising constant), sales are expected to increase by \$4,000
- d. increased by \$1 (holding advertising constant), sales are expected to decrease by \$3,000

ANS: D

PTS: 1

TOP: Multiple Regression

24. Refer to Exhibit 15-2. To test for the significance of the model, the test statistic  $F$  is

- a. 2.33
- b. 0.70
- c. 17.5
- d. 1.75

ANS: C

PTS: 1

TOP: Multiple Regression

25. Refer to Exhibit 15-2. The multiple coefficient of correlation for this problem is

- a. 0.70
- b. 0.8367
- c. 0.49
- d. 0.2289

ANS: B

Exhibit 15-2

PTS: 1

TOP: Multiple Regression

**Exhibit 15-3**

In a regression model involving 30 observations, the following estimated regression equation was obtained:

$$\hat{Y} = 17 + 4X_1 - 3X_2 + 8X_3 + 8X_4$$

For this model SSR = 700 and SSE = 100.

26. Refer to Exhibit 15-3. The computed F statistic for testing the significance of the above model is
- 43.75
  - 0.875
  - 50.19
  - 7.00

ANS: A                      PTS: 1                      TOP: Multiple Regression

27. Refer to Exhibit 15-3. The conclusion is that the
- model is not significant
  - model is significant
  - slope of  $X_1$  is significant
  - slope of  $X_2$  is significant

ANS: B                      PTS: 1                      TOP: Multiple Regression

**Exhibit 15-5**

Below you are given a partial Minitab output based on a sample of 25 observations.

	Coefficient	Standard Error
Constant	145.321	48.682
$X_1$	25.625	9.150
$X_2$	-5.720	3.575
$X_3$	0.823	0.183

28. Refer to Exhibit 15-5. The interpretation of the coefficient on  $X_1$  is that
- a one unit change in  $X_1$  will lead to a 25.625 unit change in Y
  - a one unit change in  $X_1$  will lead to a 25.625 unit increase in Y when all other variables are held constant
  - a one unit change in  $X_1$  will lead to a 25.625 unit increase in  $X_2$  when all other variables are held constant
  - It is impossible to interpret the coefficient.

ANS: B                      PTS: 1                      TOP: Multiple Regression

29. Refer to Exhibit 15-5. The t value obtained from the table to test an individual parameter at the 5% level is
- 2.06
  - 2.069
  - 2.074
  - 2.080

ANS: D                      PTS: 1                      TOP: Multiple Regression

**Exhibit 15-6**

Below you are given a partial computer output based on a sample of 16 observations.

	<b>Coefficient</b>	<b>Standard Error</b>
Constant	12.924	4.425
$X_1$	-3.682	2.630
$X_2$	45.216	12.560

**Analysis of Variance**

<b>Source of Variation</b>	<b>Degrees of Freedom</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F</b>
Regression		4,853	2,426.5	
Error			485.3	

30. Refer to Exhibit 15-6. The estimated regression equation is

- $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$
- $E(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2$
- $\hat{Y} = 12.924 - 3.682X_1 + 45.216X_2$
- $\hat{Y} = 4.425 + 2.63X_1 + 12.56X_2$

ANS: C

PTS: 1

TOP: Multiple Regression

31. Refer to Exhibit 15-6. We want to test whether the parameter  $\beta_1$  is significant. The test statistic equals

- 1.4
- 1.4
- 3.6
- 5

ANS: A

PTS: 1

TOP: Multiple Regression

32. Refer to Exhibit 15-6. Carry out the test of significance for the parameter  $\beta_1$  at the 1% level. The null hypothesis should be

- rejected
- not rejected
- revised
- None of these alternatives is correct.

ANS: B

PTS: 1

TOP: Multiple Regression

33. Refer to Exhibit 15-6. The sum of squares due to error (SSE) equals

- 37.33
- 485.3
- 4,853
- 6,308.9

ANS: D

PTS: 1

TOP: Multiple Regression

34. Refer to Exhibit 15-6. The F value obtained from the table used to test if there is a relationship among the variables at the 5% level equals
- 3.41
  - 3.63
  - 3.81
  - 19.41

ANS: C

PTS: 1

TOP: Multiple Regression

**Exhibit 15-7**

A regression model involving 4 independent variables and a sample of 15 periods resulted in the following sum of squares.

$$SSR = 165$$

$$SSE = 60$$

35. Refer to Exhibit 15-7. The coefficient of determination is
- 0.3636
  - 0.7333
  - 0.275
  - 0.5

ANS: B

PTS: 1

TOP: Multiple Regression

36. Refer to Exhibit 15-7. The test statistic from the information provided is
- 2.110
  - 3.480
  - 4.710
  - 6.875

ANS: D

PTS: 1

TOP: Multiple Regression

**Exhibit 15-8**

The following estimated regression model was developed relating yearly income (Y in \$1,000s) of 30 individuals with their age ( $X_1$ ) and their gender ( $X_2$ ) (0 if male and 1 if female).

$$\hat{Y} = 30 + 0.7X_1 + 3X_2$$

Also provided are  $SST = 1,200$  and  $SSE = 384$ .

37. Refer to Exhibit 15-8. From the above function, it can be said that the expected yearly income of
- males is \$3 more than females
  - females is \$3 more than males
  - males is \$3,000 more than females
  - females is \$3,000 more than males

ANS: D

PTS: 1

TOP: Multiple Regression



38. Refer to Exhibit 15-8. The yearly income of a 24-year-old male individual is
- a. \$13.80
  - b. \$13,800
  - c. \$46,800
  - d. \$49,800

ANS: C

PTS: 1

TOP: Multiple Regression

39. Refer to Exhibit 15-8. If we want to test for the significance of the model, the critical value of F at 95% confidence is
- a. 3.33
  - b. 3.35
  - c. 3.34
  - d. 2.96

ANS: B

PTS: 1

TOP: Multiple Regression

40. Refer to Exhibit 15-8. The model
- a. is significant
  - b. is not significant
  - c. would be significant if the sample size was larger than 30
  - d. None of these alternatives is correct.

ANS: A

PTS: 1

TOP: Multiple Regression