# Linear Regression for Business Statistics

## Overview of Regression

1. Modeling — *Developing a regression model*
2. Estimation — *Using software to estimate the model*
3. Inference — *Interpreting the estimated regression model*
4. Prediction — *Making predictions about the variable of interest*

# Linear Regression for Business Statistics

## Overview of Regression

1. ✓ Modeling — *Developing a regression model*
2. Estimation — *Using software to estimate the model*
3. Inference — *Interpreting the estimated regression model*
4. Prediction — *Making predictions about the variable of interest*

# Linear Regression for Business Statistics

## Overview of Regression

1. **Modeling** *Developing a regression model*
2. **Estimation** *Using software to estimate the model*
3. **Inference** *Interpreting the estimated regression model*
4. **Prediction** *Making predictions about the variable of interest*

# Linear Regression for Business Statistics

## Overview of Regression

1. Modeling — *Developing a regression model*
2. Estimation — *Using software to estimate the model*
3. Inference — *Interpreting the estimated regression model*
4. Prediction — *Making predictions about the variable of interest*

$$Sales = \beta_0 + \beta_1 Price + \beta_2 AdExp + \beta_3 PromExp$$

$$Sales = -25096.83 - 5055.27 Price + 648.61 AdExp + 1802.61 PromExp$$

# Linear Regression for Business Statistics

## Overview of Regression

1. Modeling — *Developing a regression model*
2. Estimation — *Using software to estimate the model*
3. **Inference** — ***Interpreting the estimated regression model***
4. Prediction — *Making predictions about the variable of interest*

$$Sales = \beta_0 + \beta_1 Price + \beta_2 AdExp + \beta_3 PromExp$$

$$Sales = -25096.83 - 5055.27 Price + 648.61 AdExp + 1802.61 PromExp$$

# Linear Regression for Business Statistics

3. Inference *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

# Linear Regression for Business Statistics

3. Inference *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

# Linear Regression for Business Statistics

3. Inference *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

# Linear Regression for Business Statistics

3. Inference *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

# Linear Regression for Business Statistics

3. Inference *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

# Linear Regression for Business Statistics

3. Inference *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

# Linear Regression for Business Statistics

3. Inference *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

- **k independent variables**
- **k+1 beta parameters**

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_1$…,

When the $X_1$ variable increases by one unit then the $Y$ variable increases by $\beta_1$ units, all other variables in the model being kept at the same level.

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_1$…,

When the $X_1$ variable **increases by one unit** then the $Y$ variable increases by $\beta_1$ units, all other variables in the model being kept at the same level.

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_1$…,

When the $X_1$ variable **increases by one unit** then the $Y$ variable **increases by $\beta_1$ units**, all other variables in the model being kept at the same level.

# Linear Regression for Business Statistics

3. Inference *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_1$…,

When the $X_1$ variable **increases by one unit** then the $Y$ variable **increases by $\beta_1$ units**, all other variables in the model being **kept at the same level**.

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_1$…,

When the $X_1$ variable **increases by one unit** then the $Y$ variable **increases by $\beta_1$ units**, all other variables in the model being **kept at the same level**.

That is, if we do not change other variables and only change $X_1$ by increasing it by one unit, then the $Y$ variable will increase by $\beta_1$ units.

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_1$…,

1

When the $X_1$ variable **increases by one unit** then the $Y$ variable **increases by $\beta_1$ units**, all other variables in the model being **kept at the same level**.

That is, if we do not change other variables and only change $X_1$ by increasing it by one unit, then the $Y$ variable will increase by $\beta_1$ units.

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_1$…,

1

When the $X_1$ variable **increases by one unit** then the $Y$ variable **increases by $\beta_1$ units**, all other variables in the model being **kept at the same level**.

2

That is, if we do not change other variables and only change $X_1$ by increasing it by one unit, then the $Y$ variable will increase by $\beta_1$ units.

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_1$…,

When the $X_1$ variable **increases by one unit** then the $Y$ variable **increases by $\beta_1$ units**, all other variables in the model being **kept at the same level**.

That is, if we do not change other variables and only change $X_1$ by increasing it by one unit, then the $Y$ variable will increase by $\beta_1$ units.

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_1$…,

1

When the $X_1$ variable **increases by one unit** then the $Y$ variable **increases by $\beta_1$ units**, all other variables in the model being **kept at the same level**.

2 3

That is, if we do not change other variables and only change $X_1$ by increasing it by one unit, then the $Y$ variable will increase by $\beta_1$ units.

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_0$ …,

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_0$…,

- $\beta_0$ is the value of *Y* variable when all *X* variables are zero.

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_0$…,

- $\beta_0$ is the value of *Y* variable when all *X* variables are zero.
- In other words it is the value of our variable of interest when all explanatory variables are zero.

# Linear Regression for Business Statistics

3. **Inference** *Interpreting the estimated regression model*

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$

Interpreting $\beta_0$…,

- $\beta_0$ is the value of *Y* variable when all *X* variables are zero.
- In other words it is the value of our variable of interest when all explanatory variables are zero.
- This technical interpretation may or may not have a managerially relevant interpretation.