# Ekonomi Manajerial
## dalam Perekonomian Global

Bab 4

## Estimasi Permintaan

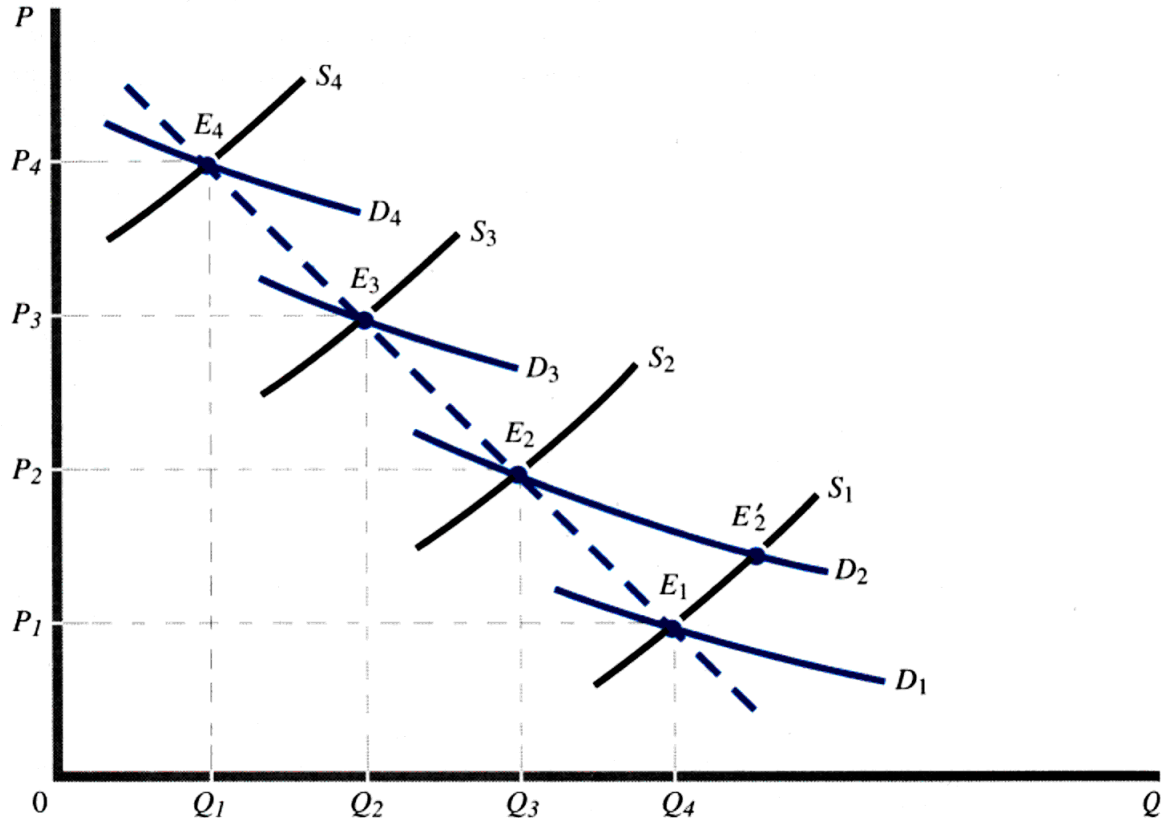
# Pokok Bahasan : Estimasi Permintaan

- Masalah Identifikasi
- Pendekatan Penelitian Pemasaran untuk Estimasi Permintaan
- Analisis Regresi
  - Regresi Sederhana
  - Regresi Berganda
- Masalah dalam Analisis Regresi
- Mengestimasi Permintaan Regresi

# Pokok Bahasan: Ramalan Permintaan

- **Peramalan Kualitatif** :
  - Survei & Jajak Pendapat
- **Peramalan Kuantitatif :**
  - **Analisis Deret Waktu**
  - **Teknik Penghalusan**
  - **Metode Barometrik**
  - **Model Ekonometrik**
  - **Model Input-Output**
- Ringkasan, Pertanyaan Diskusi, Soal-Soal dan Alamat Situs Internet

# Masalah Identifikasi




**Observasi Harga-Quantitas TIDAK SECARA LANGSUNG menghasilkan kurva Permintaan dari suatu komoditas**

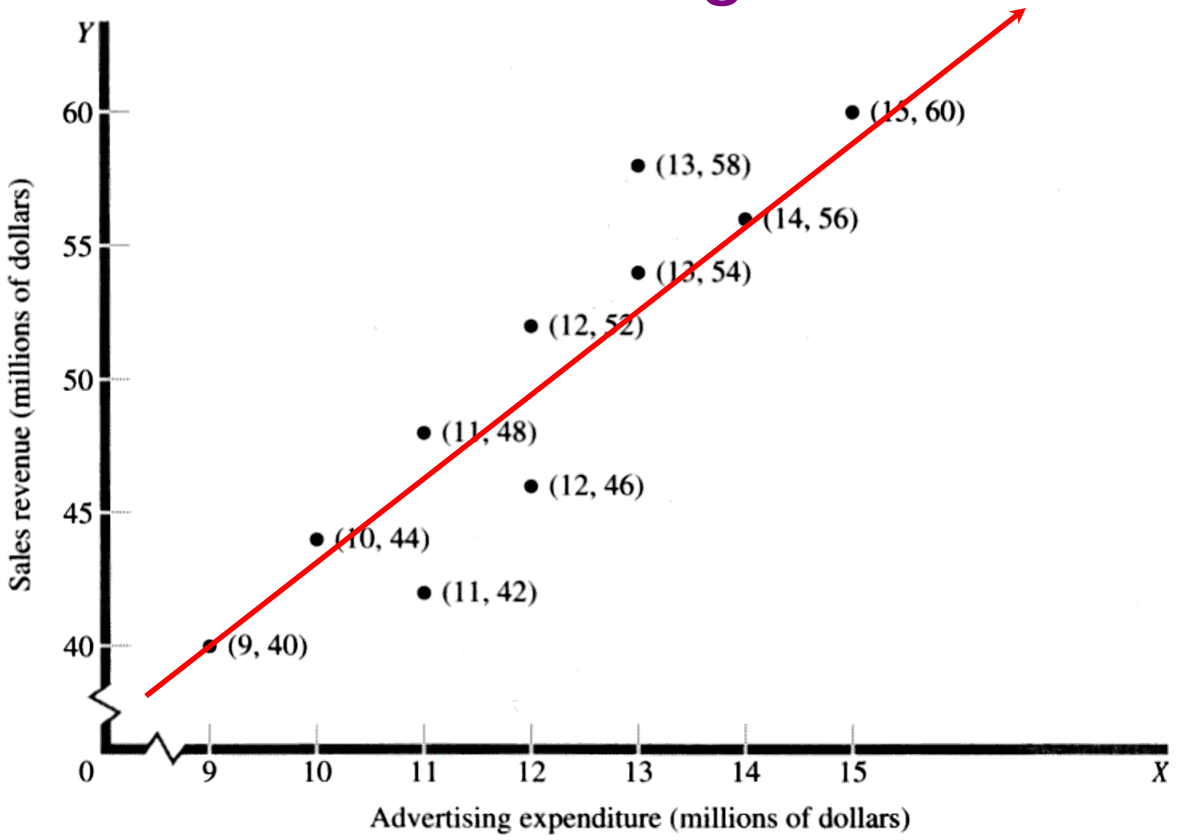
# Estimasi Permintaan: Pendekatan Riset Pemasaran

- **Survei Konsumen :** mensurvei konsumen bgm reaksi terhadap jumlah yg diminta jika ada perubahan harga, pendapatan, dll menggunakan kuisioner
- **Penelitian Observasi :** pengumpulan informasi ttg preferensi konsumen dengan mengamati bagaimana mereka membeli dan menggunakan produk
- **Klinik Konsumen :** eksperimen lab dimana partisipan diberi sejumlah uang tertentu dan diminta membelanjakannya dalam suatu toko simulasi dan mengamati bagaimana reaksi mereka jika terjadi perubahan harga, pendapatan, selera, dll
- **Eksperimen Pasar :** mirip klinik konsumen, tetapi dilaksanakan di pasar yang sesungguhnya

# Analisis Regresi

| Year | X | Y |
|---|---|---|
| 1 | 10 | 44 |
| 2 | 9 | 40 |
| 3 | 11 | 42 |
| 4 | 12 | 46 |
| 5 | 11 | 48 |
| 6 | 12 | 52 |
| 7 | 13 | 54 |
| 8 | 13 | 58 |
| 9 | 14 | 56 |
| 10 | 15 | 60 |

## Scatter Diagram




**Persamaan Regresi : Y = a + bX**

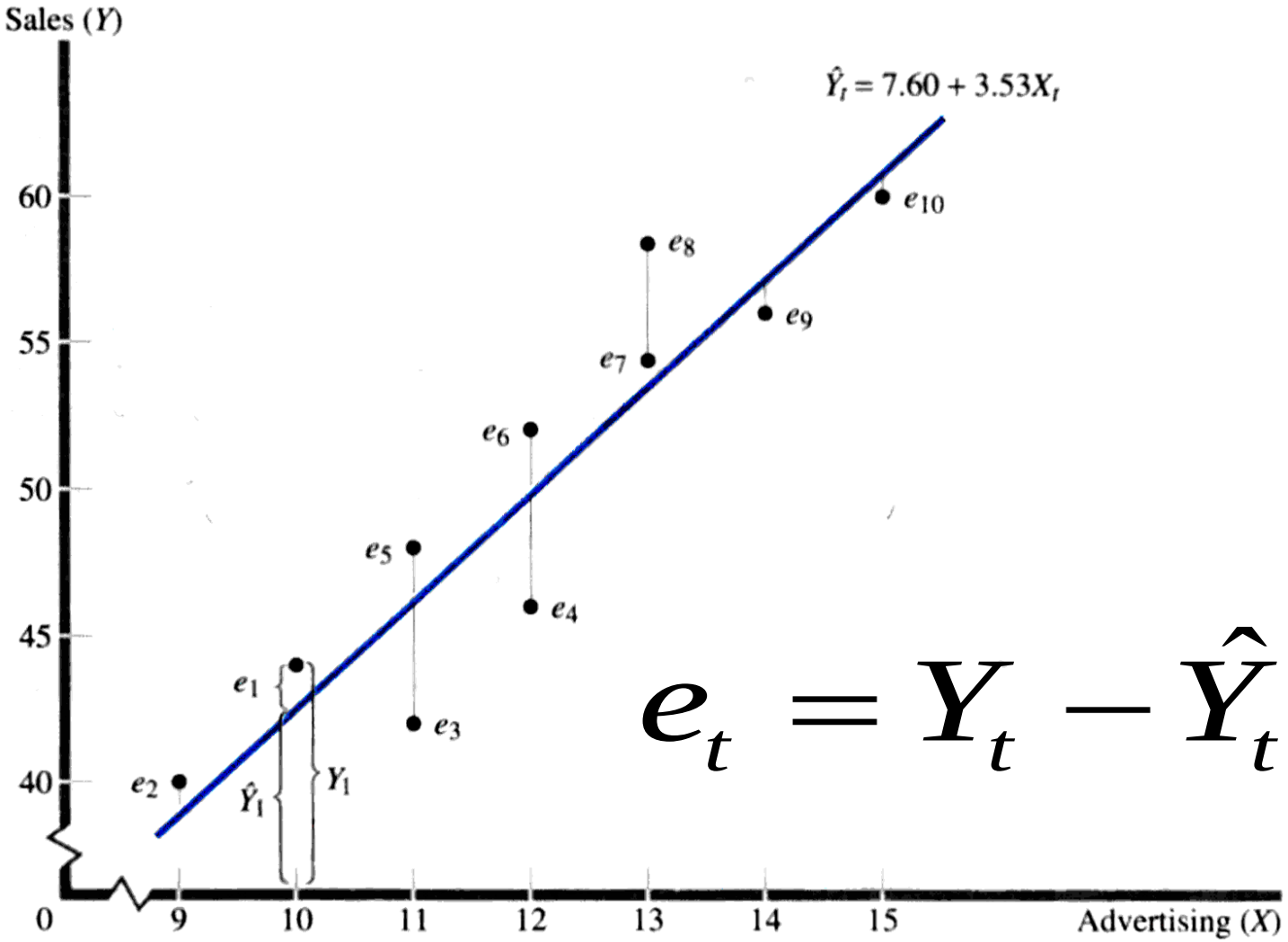
# Analisis Regresi

- **Garis Regresi** : *Line of Best Fit.*

- **Garis Regresi** : meminimunkan jumlah dari simpangan kuadrat pada sumbu vertikal ($e_t$) dari setiap titik pada garis regresi tersebut.

- **Metode OLS** (*Ordinary Least Squares*): metode jumlah kuadrat terkecil.

# Menggambarkan Garis Regresi




$$e_t = Y_t - \hat{Y}_t$$

# Analisis Regresi Sederhana

Metode : OLS

Model: $$Y_t = a + bX_t + e_t$$

$$\hat{Y}_t = \hat{a} + \hat{b}X_t$$

$$e_t = Y_t - \hat{Y}_t$$

# Metode OLS

**Tujuan**: menentukan kemiringan (*slope*) dan *intercept* yang meminimumkan jumlah simpangan kuadrat (*sum of the squared errors*).

$$\sum_{t=1}^{n} e_t^2 = \sum_{t=1}^{n} (Y_t - \hat{Y}_t)^2 = \sum_{t=1}^{n} (Y_t - \hat{a} - \hat{b}X_t)^2$$

# Metode OLS

Prosedur Estimasi :

$$\hat{b} = \frac{\sum_{t=1}^{n} (X_t - \bar{X})(Y_t - \bar{Y})}{\sum_{t=1}^{n} (X_t - \bar{X})^2}$$

$$\hat{a} = \bar{Y} - \hat{b}\bar{X}$$

# Metode OLS

## Contoh Estimasi

| *Time* | $X_t$ | $Y_t$ | $X_t - \bar{X}$ | $Y_t - \bar{Y}$ | $(X_t - \bar{X})(Y_t - \bar{Y})$ | $(X_t - \bar{X})^2$ |
|---|---|---|---|---|---|---|
| 1 | 10 | 44 | -2 | -6 | 12 | 4 |
| 2 | 9 | 40 | -3 | -10 | 30 | 9 |
| 3 | 11 | 42 | -1 | -8 | 8 | 1 |
| 4 | 12 | 46 | 0 | -4 | 0 | 0 |
| 5 | 11 | 48 | -1 | -2 | 2 | 1 |
| 6 | 12 | 52 | 0 | 2 | 0 | 0 |
| 7 | 13 | 54 | 1 | 4 | 4 | 1 |
| 8 | 13 | 58 | 1 | 8 | 8 | 1 |
| 9 | 14 | 56 | 2 | 6 | 12 | 4 |
| 10 | 15 | 60 | 3 | 10 | 30 | 9 |
| | 120 | 500 | | | 106 | 30 |

$n = 10$ $\quad \sum_{t=1}^{n} X_t = 120$ $\quad \sum_{t=1}^{n} Y_t = 500$ $\quad \sum_{t=1}^{n} (X_t - \bar{X})^2 = 30$ $\quad \hat{b} = \frac{106}{30} = 3.533$

$\bar{X} = \sum_{t=1}^{n} \frac{X_t}{n} = \frac{120}{10} = 12$ $\quad \bar{Y} = \sum_{t=1}^{n} \frac{Y_t}{n} = \frac{500}{10} = 50$ $\quad \sum_{t=1}^{n} (X_t - \bar{X})(Y_t - \bar{Y}) = 106$ $\quad \hat{a} = 50 - (3.533)(12) = 7.60$

# Metode OLS

## Contoh Estimasi

$$n = 10$$

$$\bar{X} = \sum_{t=1}^{n} \frac{X_t}{n} = \frac{120}{10} = 12$$

$$\sum_{t=1}^{n} X_t = 120 \qquad \sum_{t=1}^{n} Y_t = 500$$

$$\bar{Y} = \sum_{t=1}^{n} \frac{Y_t}{n} = \frac{500}{10} = 50$$

$$\sum_{t=1}^{n} (X_t - \bar{X})^2 = 30$$

$$\hat{b} = \frac{106}{30} = 3.533$$

$$\sum_{t=1}^{n} (X_t - \bar{X})(Y_t - \bar{Y}) = 106$$

$$\hat{a} = 50 - (3.533)(12) = 7.60$$

# Uji Signifikansi

Standard Error of the Slope Estimate

$$s_{\hat{b}} = \sqrt{\frac{\sum (Y_t - \hat{Y})^2}{(n-k)\sum (X_t - \bar{X})^2}} = \sqrt{\frac{\sum e_t^2}{(n-k)\sum (X_t - \bar{X})^2}}$$

# Uji Signifikansi

## Contoh Perhitungan

| *Time* | $X_t$ | $Y_t$ | $\hat{Y}_t$ | $e_t = Y_t - \hat{Y}_t$ | $e_t^2 = (Y_t - \hat{Y}_t)^2$ | $(X_t - \bar{X})^2$ |
|---|---|---|---|---|---|---|
| 1 | 10 | 44 | 42.90 | 1.10 | 1.2100 | 4 |
| 2 | 9 | 40 | 39.37 | 0.63 | 0.3969 | 9 |
| 3 | 11 | 42 | 46.43 | -4.43 | 19.6249 | 1 |
| 4 | 12 | 46 | 49.96 | -3.96 | 15.6816 | 0 |
| 5 | 11 | 48 | 46.43 | 1.57 | 2.4649 | 1 |
| 6 | 12 | 52 | 49.96 | 2.04 | 4.1616 | 0 |
| 7 | 13 | 54 | 53.49 | 0.51 | 0.2601 | 1 |
| 8 | 13 | 58 | 53.49 | 4.51 | 20.3401 | 1 |
| 9 | 14 | 56 | 57.02 | -1.02 | 1.0404 | 4 |
| 10 | 15 | 60 | 60.55 | -0.55 | 0.3025 | 9 |
| | | | | | 65.4830 | 30 |

$$\sum_{t=1}^{n} e_t^2 = \sum_{t=1}^{n} (Y_t - \hat{Y}_t)^2 = 65.4830 \qquad \sum_{t=1}^{n} (X_t - \bar{X})^2 = 30$$

$$s_{\hat{b}} = \sqrt{\frac{\sum (Y_t - \hat{Y})^2}{(n-k)\sum (X_t - \bar{X})^2}} = \sqrt{\frac{65.4830}{(10-2)(30)}} = 0.52$$

# Uji Signifikansi

Contoh Perhitungan

$$\sum_{t=1}^{n} e_t^2 = \sum_{t=1}^{n} (Y_t - \hat{Y}_t)^2 = 65.4830$$

$$\sum_{t=1}^{n} (X_t - \bar{X})^2 = 30$$

$$s_{\hat{b}} = \sqrt{\frac{\sum (Y_t - \hat{Y})^2}{(n-k)\sum (X_t - \bar{X})^2}} = \sqrt{\frac{65.4830}{(10-2)(30)}} = 0.52$$

# Uji Signifikansi

Perhitungan : *t-Statistic*

$$t = \frac{\hat{b}}{s_{\hat{b}}} = \frac{3.53}{0.52} = 6.79$$

Derajat Bebas = (n-k) = (10-2) = 8

*Critical Value at 5% level* =2.306

# Uji Signifikansi

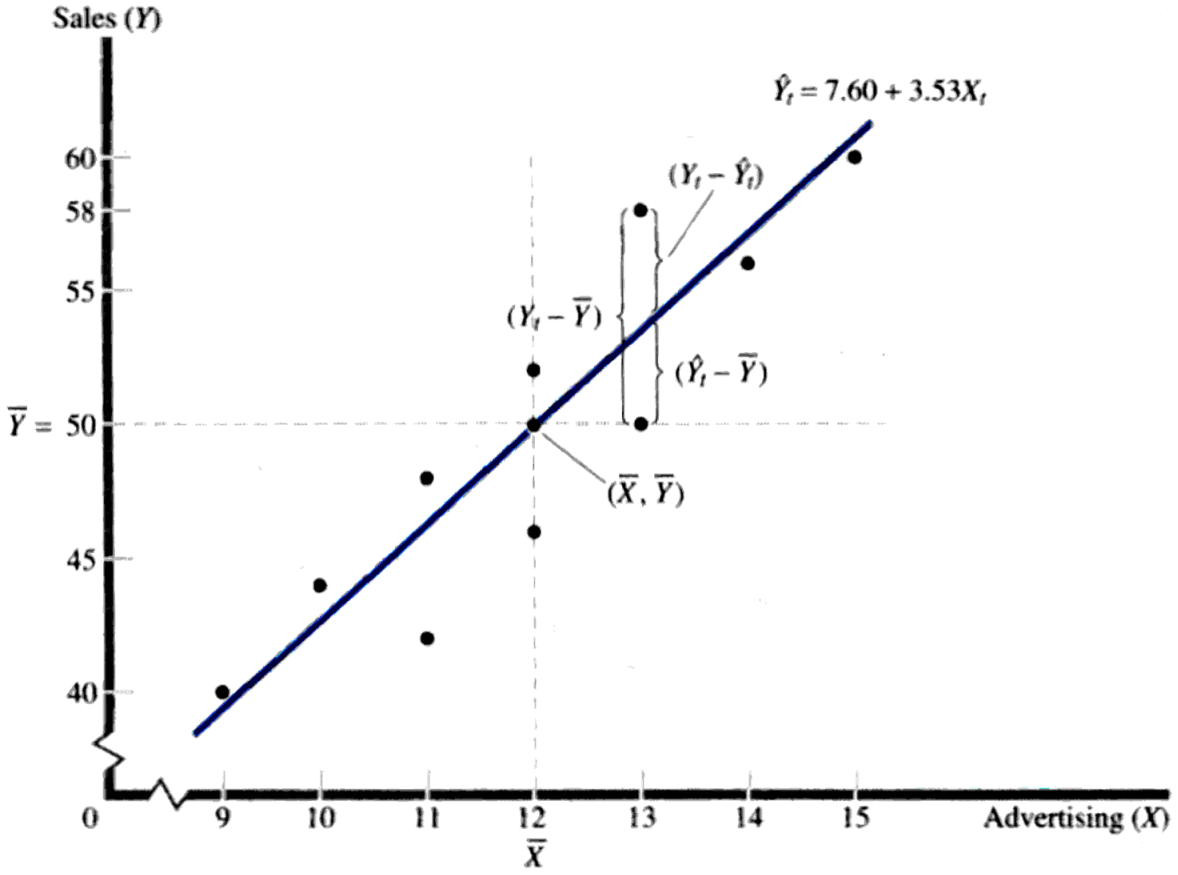
*Decomposition of Sum of Squares*

*Total Variation = Explained Variation + Unexplained Variation*

$$\sum (Y_t - \bar{Y})^2 = \sum (\hat{Y} - \bar{Y})^2 + \sum (Y_t - \hat{Y}_t)^2$$

# Uji Signifikansi

*Decomposition of Sum of Squares*



# Uji Signifikansi

Koefisien Determinasi

$$R^2 = \frac{Explained\,Variation}{Total\,Variation} = \frac{\sum (\hat{Y} - \bar{Y})^2}{\sum (Y_t - \bar{Y})^2}$$

$$R^2 = \frac{373.84}{440.00} = 0.85$$

# Uji Signifikansi

Koefisien Korelasi

$$r = \sqrt{R^2}\ with\ the\ sign\ of\ \hat{b}$$

$$-1 \le r \le 1$$

$$r = \sqrt{0.85} = 0.92$$

# Analisis Regresi Berganda

Model:

$$Y = a + b_1 X_1 + b_2 X_2 + \cdots + b_{k'} X_{k'}$$

# Analisis Regresi Berganda

*Adjusted Coefficient of Determination*

$$\overline{R}^2 = 1 - (1 - R^2)\frac{(n-1)}{(n-k)}$$

# Analisis Regresi Berganda

*Analysis of Variance and F Statistic*

$$F = \frac{Explained\,Variation/(k-1)}{Unexplained\,Variation/(n-k)}$$

$$F = \frac{R^2/(k-1)}{(1-R^2)/(n-k)}$$

# Masalah-Masalah dalam Analisis Regresi

- ***Multicollinearity***: Dua atau lebih variabel bebas mempunyai korelasi yang sangat kuat.
- ***Heteroskedasticity***: Variance of error term is not independent of the Y variable.
- ***Autocorrelation***: Consecutive error terms are correlated.

# Durbin-Watson Statistic

Uji Autocorrelation

$$d = \frac{\sum_{t=2}^{n} (e_t - e_{t-1})^2}{\sum_{t=1}^{n} e_t^2}$$

If d=2, autocorrelation is absent.

# Langkah-Langkah Estimasi Permintaan dengan Regresi

- Spesifikasi Model dengan Cara Mengidentifikasi Variabel-Variabel, misalnya :

  $Q_d = f(P_x, I, P_y, A, T)$
- Pengumpulan Data
- Spesifikasi Bentuk Persamaan Permintaan

  Linier : $Q_d = A - a_1 P_x + a_2 I + a_3 P_y + a_4 A + a_5 T$

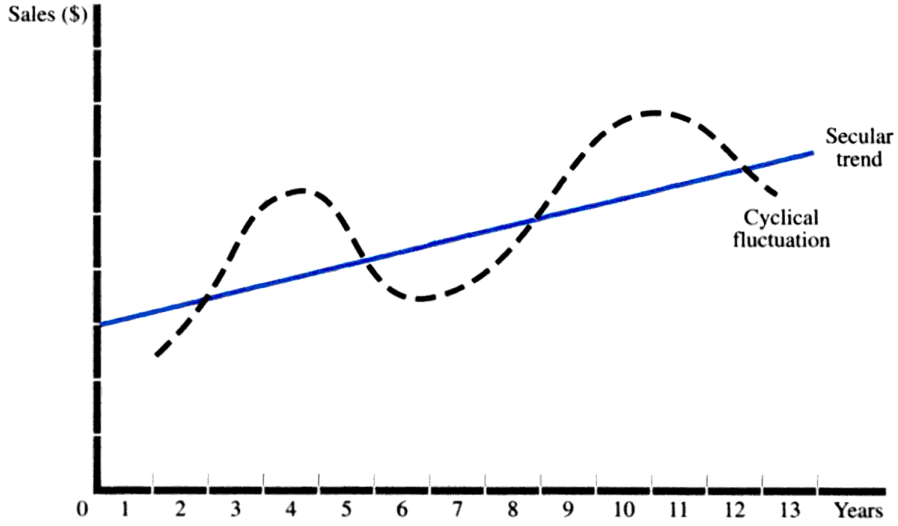
  Pangkat : $Q_d = A(P_x)^b(P_y)^c$
- Estimasi Nilai-Nilai Parameter
- Pengujian Hasil

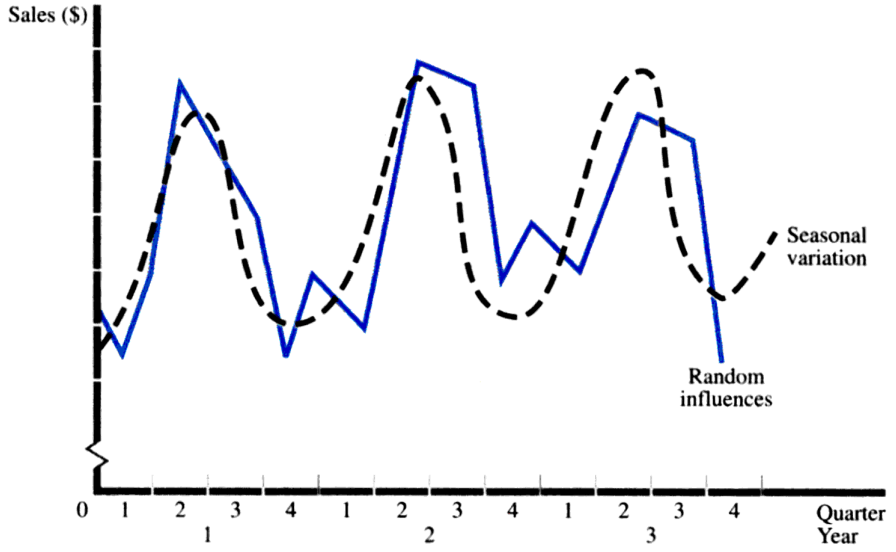
# Qualitative Forecasts

- **Survey Techniques**
  - Planned Plant and Equipment Spending
  - Expected Sales and Inventory Changes
  - Consumers' Expenditure Plans
- **Opinion Polls**
  - Business Executives
  - Sales Force
  - Consumer Intentions

# Time-Series Analysis

- **Secular Trend**
  - Long-Run Increase or Decrease in Data
- **Cyclical Fluctuations**
  - Long-Run Cycles of Expansion and Contraction
- **Seasonal Variation**
  - Regularly Occurring Fluctuations
- **Irregular or Random Influences**


Sales ($)
Secular trend
Cyclical fluctuation
0 1 2 3 4 5 6 7 8 9 10 11 12 13 Years


Sales ($)
Seasonal variation
Random influences
0 1 2 3 4 1 2 3 4 1 2 3 4 Quarter
1 2 3 Year

# Trend Projection

- **Linear Trend:**

  $S_t = S_0 + b\ t$

  b = Growth per time period

- **Constant Growth Rate:**

  $S_t = S_0 (1 + g)^t$

  g = Growth rate

- **Estimation of Growth Rate :**

  $\ln S_t = \ln S_0 + t \ln(1 + g)$

# Seasonal Variation

## Ratio to Trend Method

$$\text{Ratio} = \frac{\text{Actual}}{\text{Trend Forecast}}$$

$$\text{Seasonal Adjustment} = \text{Average of Ratios for Each Seasonal Period}$$

$$\text{Adjusted Forecast} = \text{Trend Forecast} \bullet \text{Seasonal Adjustment}$$

# Seasonal Variation

Ratio to Trend Method:
Example Calculation for Quarter 1

Trend Forecast for 1996.1 = 11.90 + (0.394)(17) = 18.60

Seasonally Adjusted Forecast for 1996.1 = (18.60)(0.8869) = 16.50

| Year | Trend Forecast | Actual | Ratio |
|---|---|---|---|
| 1992.1 | 12.29 | 11.00 | 0.8950 |
| 1993.1 | 13.87 | 12.00 | 0.8652 |
| 1994.1 | 15.45 | 14.00 | 0.9061 |
| 1995.1 | 17.02 | 15.00 | 0.8813 |
| Seasonal Adjustment = | | | 0.8869 |

# Moving Average Forecasts

Forecast is the average of data from *w* periods prior to the forecast data point.

$$F_t = \sum_{i=1}^{w} \frac{A_{t-i}}{w}$$

# Exponential Smoothing Forecasts

Forecast is the weighted average of of the forecast and the actual value from the prior period.

$$F_{t+1} = wA_t + (1-w)F_t$$

$$0 \le w \le 1$$

# Root Mean Square Error

Measures the Accuracy of a Forecasting Method

$$RMSE = \sqrt{\frac{\sum (A_t - F_t)^2}{n}}$$

# Barometric Methods

- National Bureau of Economic Research
- Department of Commerce
- Leading Indicators
- Lagging Indicators
- Coincident Indicators
- Composite Index
- Diffusion Index

# Econometric Models

Single Equation Model of the Demand For Cereal (Good X)

$$Q_X = a_0 + a_1P_X + a_2Y + a_3N + a_4P_S + a_5P_C + a_6A + e$$

$Q_X$ = Quantity of X

$P_X$ = Price of Good X

Y = Consumer Income

N = Size of Population

$P_S$ = Price of Muffins

$P_C$ = Price of Milk

A = Advertising

e = Random Error

# Econometric Models

Multiple Equation Model of GNP

$$C_t = a_1 + b_1 GNP_t + u_{1t}$$

$$I_t = a_2 + b_2 \pi_{t-1} + u_{2t}$$

$$GNP_t \equiv C_t + I_t + G_t$$

Reduced Form Equation

$$GNP_t = \frac{a_1 + a_2}{1 - b_1} + \frac{b_2 \pi_{t-1}}{1} - b_1 + \frac{G_t}{1 - b_1}$$

# Input-Output Forecasting

Three-Sector Input-Output Flow Table

| | Producing Industry | | | | |
|---|---|---|---|---|---|
| Supplying Industry | A | B | C | Final Demand | Total |
| A | 20 | 60 | 30 | 90 | 200 |
| B | 80 | 90 | 20 | 110 | 300 |
| C | 40 | 30 | 10 | 20 | 100 |
| Value Added | 60 | 120 | 40 | | 220 |
| Total | 200 | 300 | 100 | 220 | |

# Input-Output Forecasting

**Direct Requirements Matrix**

$$\text{Direct Requirements} = \frac{\text{Input Requirements}}{\text{Column Total}}$$

| | Producing Industry | | |
|---|---|---|---|
| Supplying Industry | A | B | C |
| A | 0.1 | 0.2 | 0.3 |
| B | 0.4 | 0.3 | 0.2 |
| C | 0.2 | 0.1 | 0.1 |

# Input-Output Forecasting

Total Requirements Matrix

| | Producing Industry | | |
|---|---|---|---|
| Supplying Industry | A | B | C |
| A | 1.47 | 0.51 | 0.60 |
| B | 0.96 | 1.81 | 0.72 |
| C | 0.43 | 0.31 | 1.33 |

# Input-Output Forecasting

| Total Requirements Matrix | | | | Final Demand Vector | | Total Demand Vector |
|---|---|---|---|---|---|---|
| 1.47 | 0.51 | 0.60 | • | 90 | = | 200 |
| 0.96 | 1.81 | 0.72 | | 110 | | 300 |
| 0.43 | 0.31 | 1.33 | | 20 | | 100 |

# Input-Output Forecasting

Revised Input-Output Flow Table

| | Producing Industry | | | | |
|---|---|---|---|---|---|
| Supplying Industry | A | B | C | Final Demand | Total |
| A | 22 | 62 | 31 | 100 | 215 |
| B | 88 | 93 | 21 | 110 | 310 |
| C | 43 | 31 | 10 | 20 | 104 |