Erasmus School of Economics

MOOC Econometrics

Lecture 1.1 on Simple Regression: Motivation

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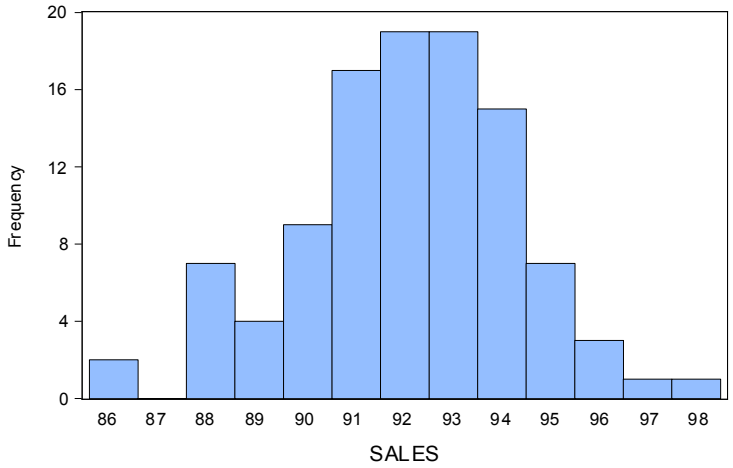
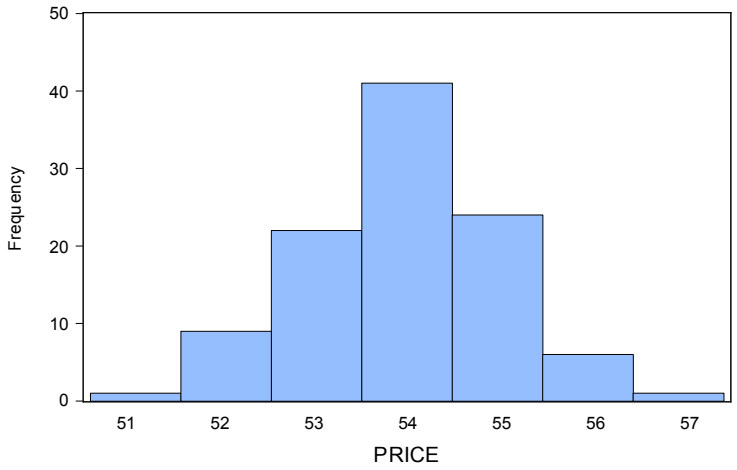
Histogram of 104 sales data



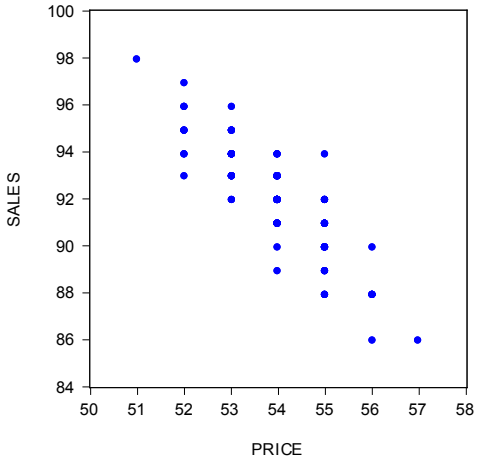
Frequency is number of weeks

Histogram of 104 price data



Frequency is number of weeks

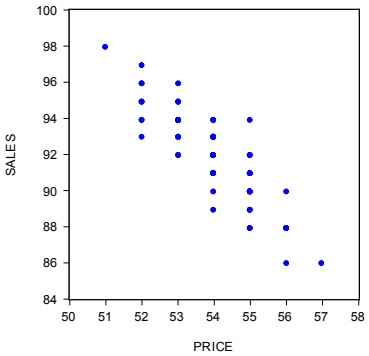
Scatter diagram of sales against price

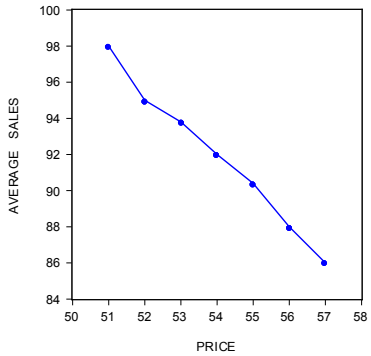


104 pairs of weekly observations on sales and price
(some sales-price combinations occur multiple times)

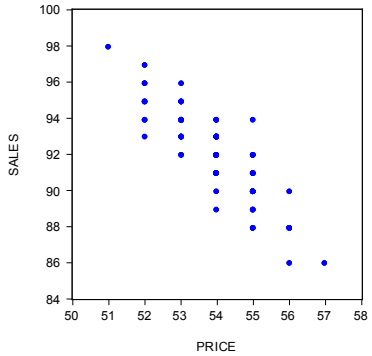
Average sales for given price

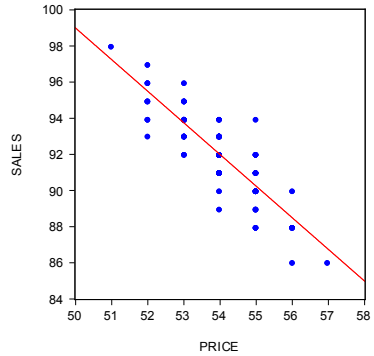
Price	51	52	53	54	55	56	57
Number of weeks	1	9	22	41	24	6	1
Average sales	98.0	95.0	93.8	92.0	90.4	88.0	86.0





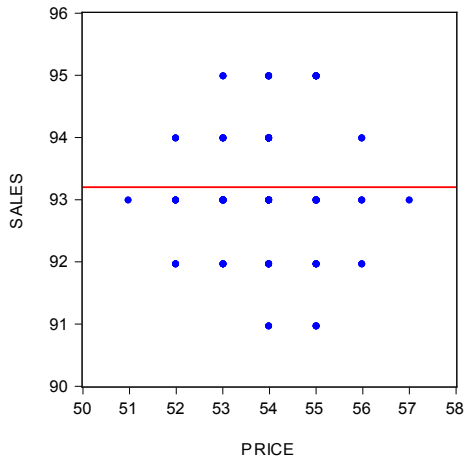
Fitting a straight line in a scatter diagram



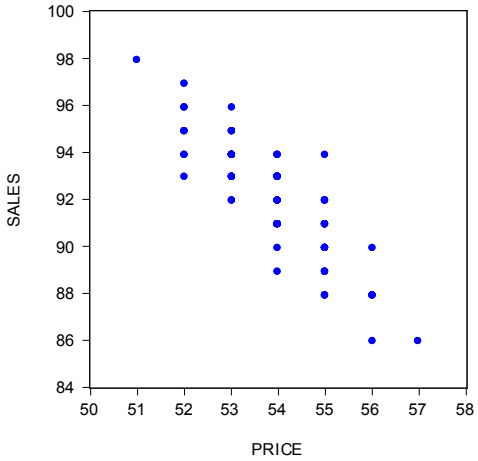


- Predicted Sales $= a + b \times$ Price
- Residual $e =$ Actual Sales $-$ Predicted Sales

Scatter diagram for data without price effect (b = 0)



Scatter diagram of sales against price



How to maximize turnover

Test

Define turnover as product of price and sales, where Sales $= a + b \times$ Price with $a > 0$ and $b < 0$. If a and b are known, the store manager can determine for which price turnover is maximal.
Derive the formula for the optimal price in terms of a and b.

- Answer: Let $P =$ Price and $T =$ Turnover $=$ Price $\times$ Sales, then

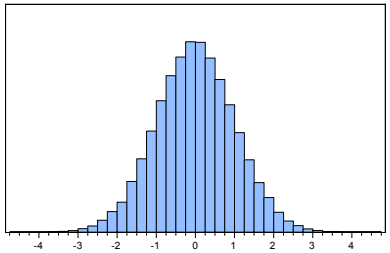
  $T = P(a + bP) = aP + bP^2$

  $\frac{dT}{dP} = a + 2bP = 0$

- Optimal price: $P = -\frac{a}{2b}$

Normal Distribution

- Sales $\sim NID(\mu, \sigma^2)$
- Standard normal distribution: $\mu = 0$ and $\sigma^2 = 1$



Density function (discretized; area is 1)

- Estimator of population mean μ: sample mean $\bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i$.

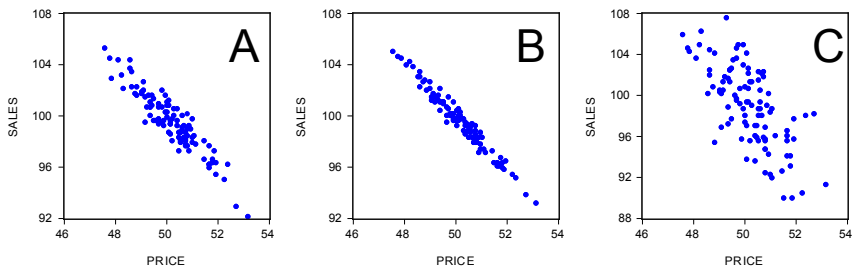
Overview of coming lectures

- Lecture 1.2: Simple regression model
- Lecture 1.3: The technique of regression
- Lecture 1.4: Assumptions and statistical properties
- Lecture 1.5: Two applications
- Modules 2-6: Various extensions
- Simple regression provides fundamental basis

Prediction

Test

Which situation is easiest to predict sales for given price?



- B is easiest: least variation around line.

TRAINING EXERCISE 1.1

- Train yourself by making the training exercise (see the website).
- After making this exercise, check your answers by studying the webcast solution (also available on the website).