Trend line

$$y = a + bd$$

where y = the variable for which trend is required, d = the deviation in time from the midpoint of the time series, $a = \bar{y}$, and $b = \sum yd / \sum yd^2$

Subdivision of the trend line

$$\text{Sub - period value } y^1 = \frac{a}{n} + \frac{b}{n^2} d^1$$

Where n = the number of sub-periods per cycle, and d^1 = the deviation from the midpoint of the series measured in sub-periods.

Index Numbers

Laspeyre price index

$$\text{Index} = \frac{\sum(p_n \cdot q_o)}{\sum(p_o \cdot q_o)} \times 100$$

Paasche price index

$$\text{Index} = \frac{\sum(p_n \cdot q_n)}{\sum(p_o \cdot q_n)} \times 100$$

Useful Formulae

Weighted average

$$\text{Weighted average} = \frac{\sum xw}{\sum w}$$

Geometric mean

$$\text{GM} = \sqrt[n]{(x_1 \times x_2 \times x_3 \times \ldots\ldots x_n)}$$

Alternative

$$\text{Log GM} = \frac{\sum \log x}{n}$$

STATISTICAL FORMULAE

ESSENTIAL FORMULAE

Frequency Distributions

Arithmetic Mean $(\bar{x})$

$$\bar{x} = \frac{\sum fx}{\sum f} \text{ OR } \bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

Range

Range = Highest value – Lowest value

Quartile deviation

$$\text{Quartile deviation} = \frac{\text{Upper quartile} - \text{Lower quartile}}{2}$$

Mean deviation

$$\text{Mean deviation} = \frac{\sum f\left|x - \bar{x}\right|}{\sum f} (\text{sign of } (x - x) \text{ to be ignored})$$

Standard deviation

$$S.D. = \sqrt{\frac{\sum f_i (x_i - \mu)^2}{\sum f_i}}$$

Variance

$$\text{Variance} = (S.D.)^2 \text{ OR Variance} = \frac{\sum f_i (x_i - \mu)^2}{\sum f_i}$$

Coefficient of variation

$$\text{Coefficient of variation} = \frac{\text{S.Deviation}}{\text{Mean}} \times 100$$

Pearson coefficient of skewness (Sk)

$$Sk = \frac{3(\text{Mean} - \text{Median})}{S.D.}$$

Median by calculation

$$\text{Median by calculation} = L + \frac{(N/2 - \text{cf to Median Class})(\text{Class Interval})}{\text{Frequency of Median Class}}$$

where L = Lower Class Boundary of Median Class and N = Total Frequency

Regression/Correlation

Regression lines

Regression line of *y* on *x*

Line equation: $y = a + bx$

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - \left(\sum x\right)^2} \qquad a = \frac{\sum y - b\sum x}{n}$$

Correlation (r)

$$r = \frac{n\sum xy - \sum x\sum y}{\sqrt{\left(n\sum x^2 - \left(\sum x\right)^2\right)\left(n\sum y^2 - \left(\sum y\right)^2\right)}}$$

Rank correlation

$$\text{Spearman's coefficient of rank correlation} = 1 - \frac{6\sum d^2}{n\left(n^2 - 1\right)}$$

where n = the number of pairs, and d = the difference between ranking of the same item in each series.

Standard Errors

Standard error of the mean $\left(\sigma_x\right)$

$$S.E. = \frac{s}{\sqrt{n}} \qquad \mu = \bar{x} \pm z\frac{\sigma}{\sqrt{n}}$$

Standard error of a proportion $\left(\sigma_p\right)$

$$S.E. = \sqrt{\frac{pq}{(n)}} \qquad p = p \pm z\sqrt{\frac{p(1-p)}{n}}$$

where p = sample proportion, and $q = 1 - p$.

Standard error of the difference between means $\left(\sigma_{(x1 - x2)}\right)$

$$\sigma_{(x1 - x2)} = \sqrt{\sigma^2_{x1} + \sigma^2_{x2}}$$

Standard error of the difference between proportions $\left(\sigma_{(p1=p2)}\right)$

$$\sigma_{(p1-p2)} = \sqrt{\left(\sigma^2_{p1} + \sigma^2_{p2}\right)}$$

Harmonic mean

$$HM = \frac{n}{\sum 1/x}$$

Bayes' Theorem

$$P(E/S) = \frac{P(E) \text{ X } P(S/E)}{\sum_{i=1}^{n}\left(P(E_i) \text{ X } P(S/E_i)\right)}$$

where S is the subsequent event and there are *n* prior events, *E*.

Standard normal deviation

$$z = \frac{x - \mu}{\sigma}$$

Price relative

$$\text{Price relative} = \frac{P_n}{P_o} \text{ X } 100$$

Base changing

$$\text{New index number} = \frac{\text{Old index number}}{\text{Old index number of new base period}} \text{ x } 100$$

Asset revaluation

$$\text{New valuation} = \text{Original value} \text{ x } \frac{\text{New price index}}{\text{Original price index}}$$