




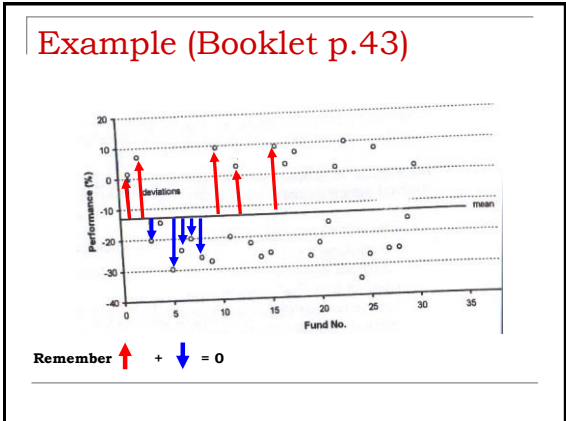
Index Numbers

Repeating:
 Mean, Median, Mode, Standard Deviation... (and all other horrible things which belong to this topic)

New:
 Mean, Median, Mode,

Questions you need to know answers on?

- What is Mean/Median/Mode?
- Why do we need so many different ways of calculating a simple average?
- What is Standard Deviation?
- How is Mean connected to Standard Deviation?
- What are the drawbacks of pure average calculation?
- If I want a precise estimation... would I like an analyst having a big SD or a small SD in his calculations?

Smart advise

- Calculation of **standard deviation** with raw data

X	\bar{X}	$X - \bar{X}$	$(X - \bar{X})^2$
...
- Calculation of **standard deviation** with classes

$x \leq y$	(f)	X	X^2	$f \cdot X$	$f \cdot X^2$
...

Formulas you better remember

- Standard deviation for raw data

$$s = \sqrt{\frac{\sum X^2}{n} - \bar{X}^2} \quad s = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$$
- Standard deviation for frequencies

$$s = \sqrt{\frac{\sum f \cdot X^2}{n} - \bar{X}^2}$$
- Small sample correction

$$SSC = s \cdot \sqrt{\frac{n}{n-1}}$$
- Coefficient of variation

$$CV = \frac{s}{\bar{X}} \cdot 100\%$$

Example (Booklet p.53)

Year	Acme's statistics		Steel widgets	
	Average prices (£)	Price Index (1990 = 100)	Price Index (1990 = 100)	Price Index (1992 = 100)
1992	43.90	100	109.7	100
1993	44.00	100.22	111.9	102.005
1994	44.30	100.91	114.2	104.102
1995	47.80	106.85	117.3	107.47
1996	48.20	109.79	121.8	111.05

Source: Annual Abstract of Statistics

$\frac{44.00}{43.90} \cdot 100$
 $\frac{111.9}{109.7} \cdot 100$
 $\frac{44.30}{43.90} \cdot 100$

Example (Booklet p.54)

Year	1985 = 100	1990 = 100
1987	110.7	91.94
1988	117.7	97.353
1989	119.9	99.58
1990	120.4	100
1991		98.7
1992		99.4
1993		102.4

$\frac{110.7}{120.4} \cdot 100$

$$\frac{102.4 - 91.94}{91.94} \cdot 100 = +11.37\%$$

Example (Booklet p.55)

Year	Weekly earnings (£)				RPI
	Actual	'Real'	Actual	'Real'	
1990	251.4	251.4	219.7	219.7	126.1
1991	261.8	247.3	236.4	223.23	133.5
1992	279.7	254.66	248.2	225.98	138.5
1993	287.9	258.16	254.2	227.52	140.7
1994	296.9	259.81	260.0	227.52	144.1

$261.8 \cdot \frac{126.1}{133.5} = 247.3$

Index of real weekly earnings (1990 = 100)		
Year	Manuf. Industry	Service Industry
1990	100	100
1991	98.26	101.61
1992	101.29	102.85
1993	102.63	103.69
1994	103.34	103.55

$\frac{247.3}{251.4} \cdot 100$

Example (Booklet p.58)

Food item	Unit	Year 1			Year 2		Year 3	
		q ₀	p ₀	p _n	q _n	p _n	q _n	p _n
Bread	loaf	7	£0.26	£0.34	£0.50			
Butter	kg	1.5	£1.04	£1.60	£2.40			
Cheese	kg	1.0	£1.40	£2.20	£3.20			

$$\text{Yr 2: } L_2 = \frac{7 \cdot 0.34 + 1.5 \cdot 1.60 + 1.0 \cdot 2.20}{7 \cdot 0.26 + 1.5 \cdot 1.04 + 1.0 \cdot 1.40} \times 100 = \frac{6.98}{4.76} \cdot 100 = 146.025$$

$$\text{Yr 3: } L_3 = \frac{7 \cdot 0.50 + 1.5 \cdot 2.40 + 1.0 \cdot 3.20}{7 \cdot 0.26 + 1.5 \cdot 1.04 + 1.0 \cdot 1.40} \times 100 = \frac{10.3}{4.76} \cdot 100 = 215.481$$

Example (Booklet p.59)

Food item	Unit	Year 1		Year 2		Year 3	
		p ₀	q _n	p _n	q _n	p _n	p _n
Bread	loaf	£0.26	6.5	£0.34	6.8	£0.50	
Butter	kg	£1.04	2.0	£1.60	2.0	£2.40	
Cheese	kg	£1.40	1.25	£2.20	1.4	£3.20	

$$\text{Yr 2: } P_2 = \frac{6.5 \cdot 0.34 + 2.0 \cdot 1.60 + 1.25 \cdot 2.20}{6.5 \cdot 0.26 + 2.0 \cdot 1.04 + 1.25 \cdot 1.40} \times 100 = \frac{8.16}{5.25} \cdot 100 = 155.428$$

$$\text{Yr 3: } P_3 = \frac{6.5 \cdot 0.50 + 2.0 \cdot 2.40 + 1.4 \cdot 3.20}{6.5 \cdot 0.26 + 2.0 \cdot 1.04 + 1.4 \cdot 1.40} \times 100 = \frac{12.65}{5.863} \cdot 100 = 215.819$$