$$\overline{X} = \frac{\sum x}{N}$$

$$SDx = \sqrt{\frac{\sum \left(x_i - \overline{X} \right)^2}{N}}$$

$$SDy = \sqrt{\frac{\sum \left(y_i - \overline{Y} \right)^2}{N}}$$

$$S^2 y = SDy^2$$

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

T-test

between group-variation
within group variation

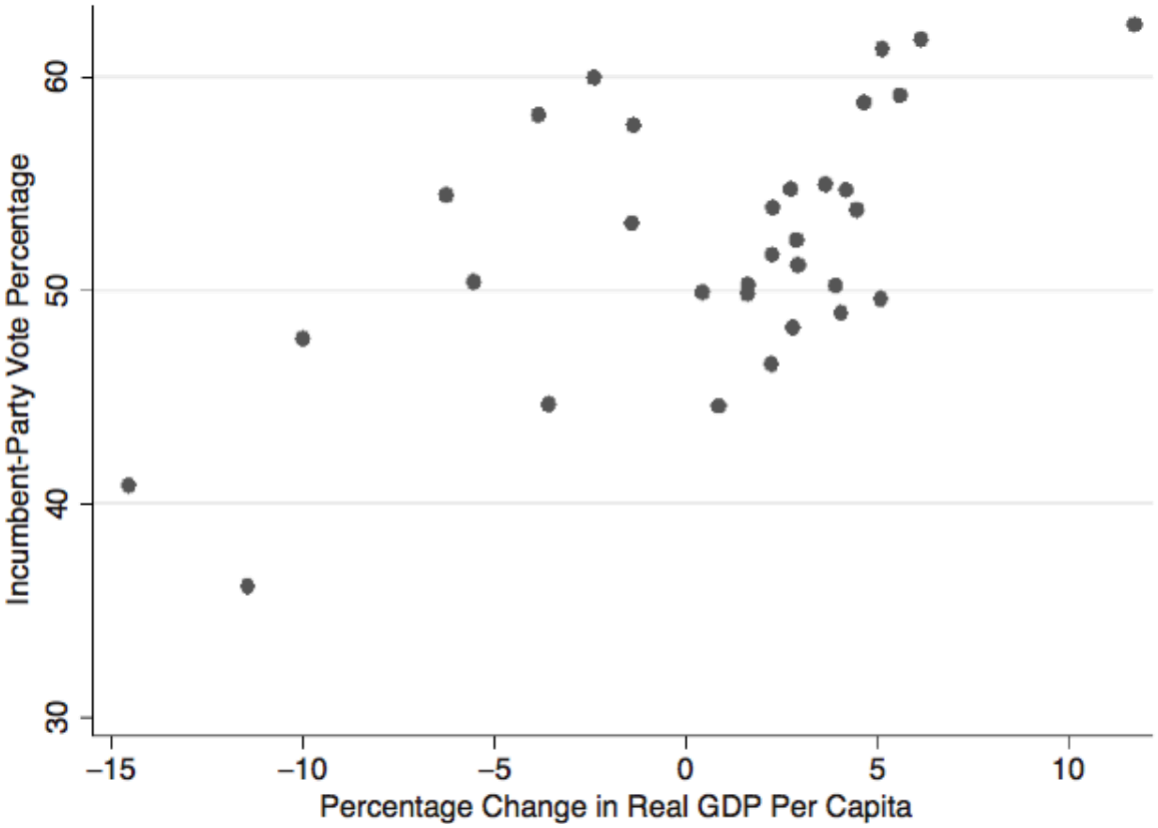
Correlation

co-variation between x & y
variation within x & y

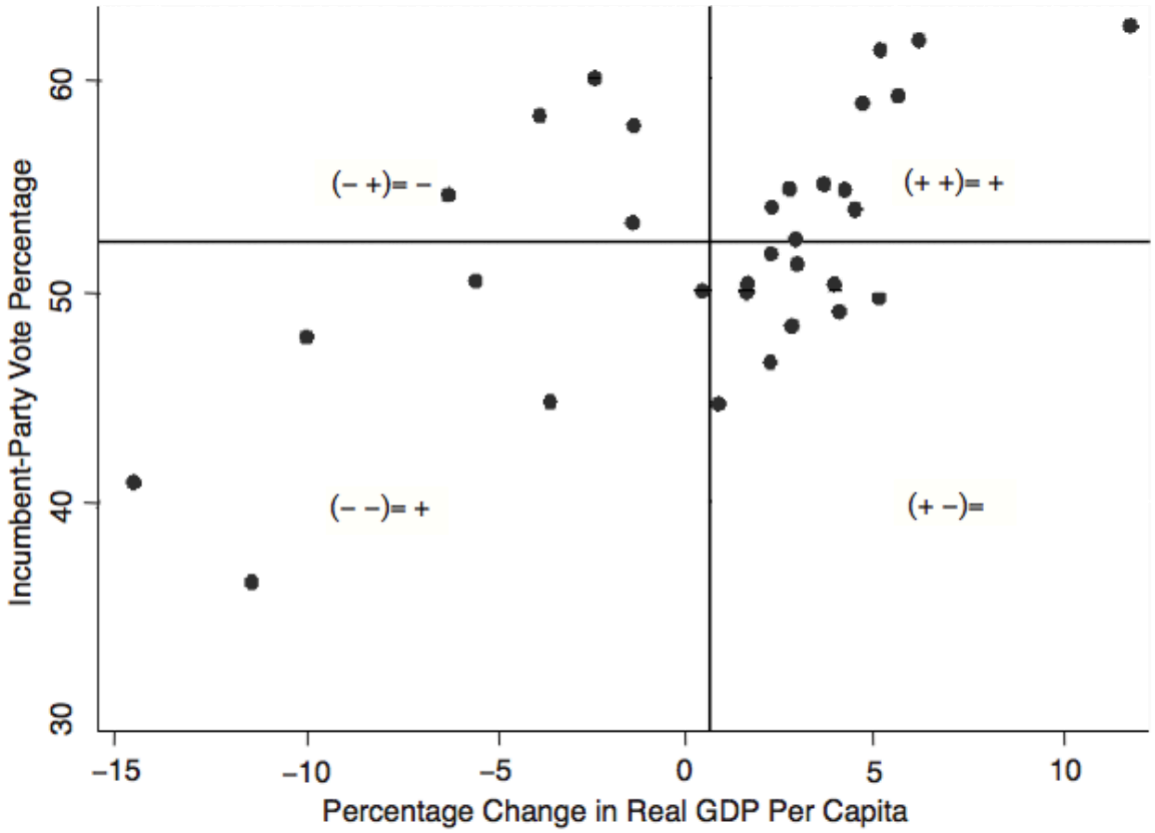
Correlation equation numerator calculates covariance.

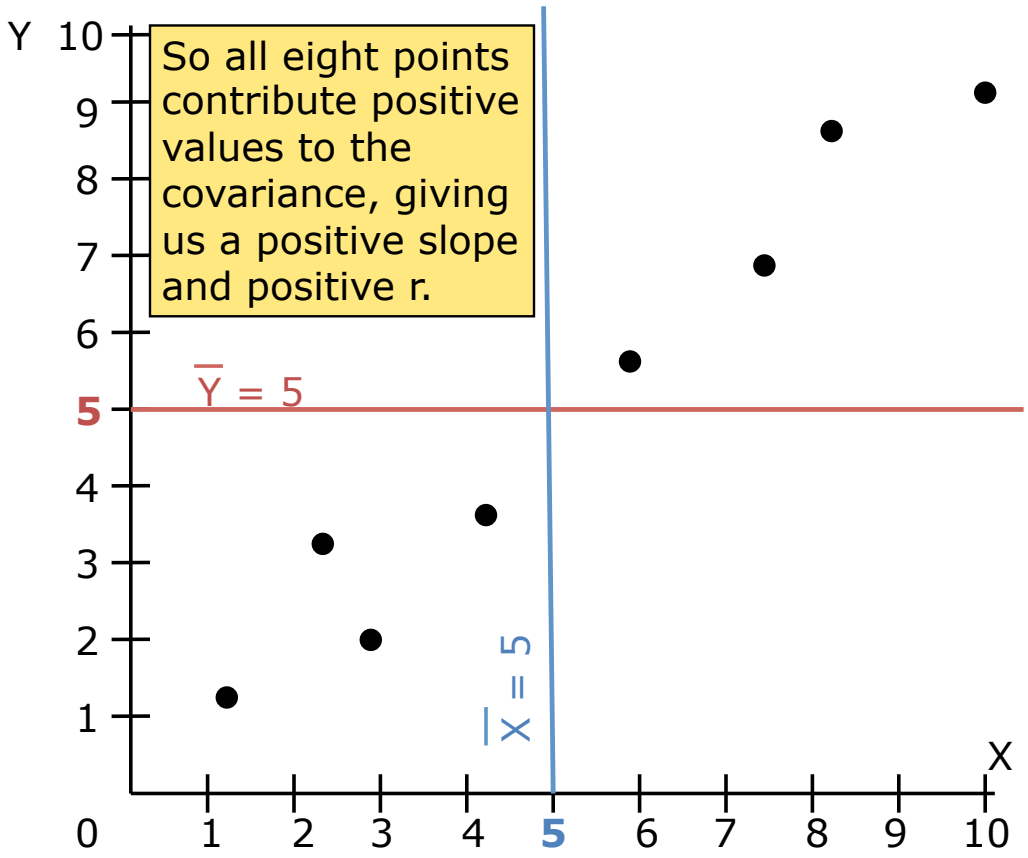
It is a core concept in Correlation & Regression

K&W Fig 8.3


Incumbent-Party Vote Percentage
30
40
50
60
−15
−10
−5
0
5
10
Percentage Change in Real GDP Per Capita

K&W Fig 8.4


(– +)= –
(+ +)= +
(– –)= +
(+ –)=
Incumbent-Party Vote Percentage
30
40
50
60
–15
–10
–5
0
5
10
Percentage Change in Real GDP Per Capita


So all eight points contribute positive values to the covariance, giving us a positive slope and positive r.
Y
10
9
8
7
6
5
4
3
2
1
0
$\bar{Y} = 5$
$\bar{X} = 5$
X
1
2
3
4
5
6
7
8
9
10

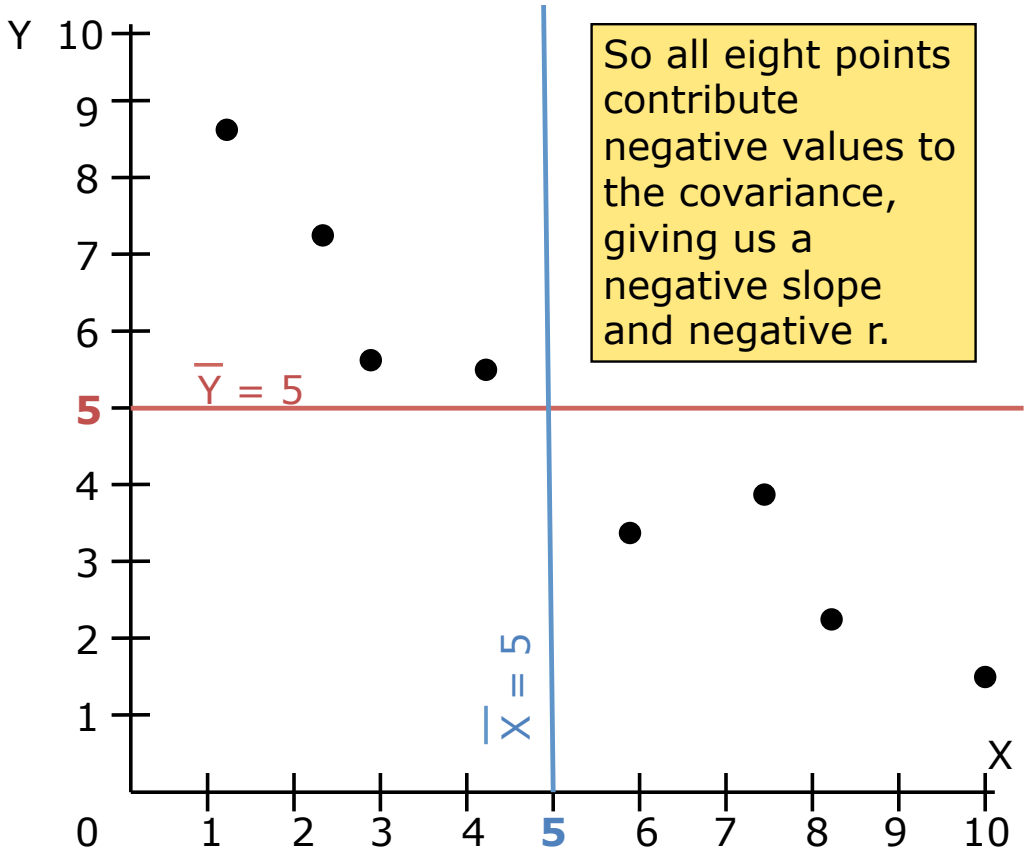
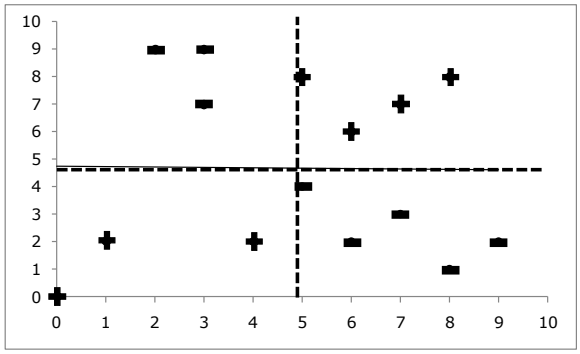
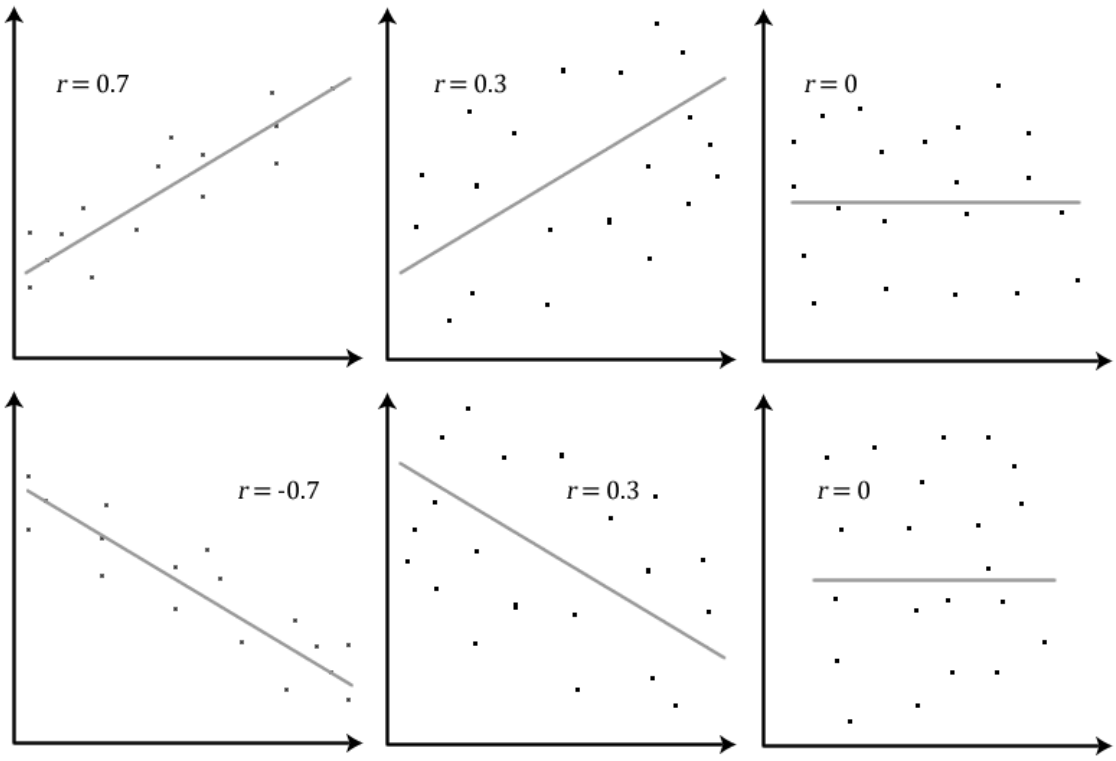

Y
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
9
10
X
$\overline{Y} = 5$
$\overline{X} = 5$
So all eight points contribute negative values to the covariance, giving us a negative slope and negative r.

Exhibit 7.11: Illustrating a Covariance of Zero

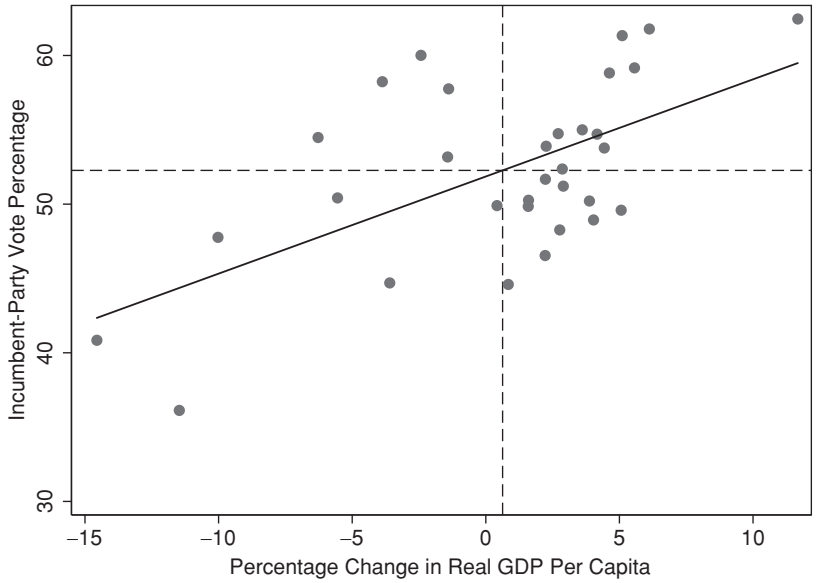



r = 0.7
r = 0.3
r = 0
r = -0.7
r = 0.3
r = 0

$$r = \sqrt{\text{explained variance}}$$

r^2 = explained variance

K&W Fig 9.3


Incumbent-Party Vote Percentage
30
40
50
60
−15
−10
−5
0
5
10
Percentage Change in Real GDP Per Capita

(Pearson) Correlation

The correlation coefficient developed by statisticians Bravais and Pearson, often denoted as r, is a standardized measure for the relationship between two metric variables.

Example 1:

```
COR var1 var17 var25.
```

Example 2:

```
COR var1 var17 var25 WITH var33 var37.
```

Corr y x_1 x_2 x_3.

or

Corr y with x_1 x_2 x_3.

Corr DV with IV1 IV2 IV3

Corr DV IV1 IV2 IV3.

Corr RawMj3 by Democrat5 liberal5

Correlations: MJ Attitude, Partisanship & Ideology

	RawMJ3	Democrat5	liberal5
RawMJ3	1	.209	.361
Democrat5	.209	1	.372
liberal5	.361	.372	1

Aggregate Data Sets

worlddata.sav
statedata.sav
UN2019data.sav
    details at: hdr.undp.org/en/data

Available DataArt.ca under the data tab