Unit 4: Correlation

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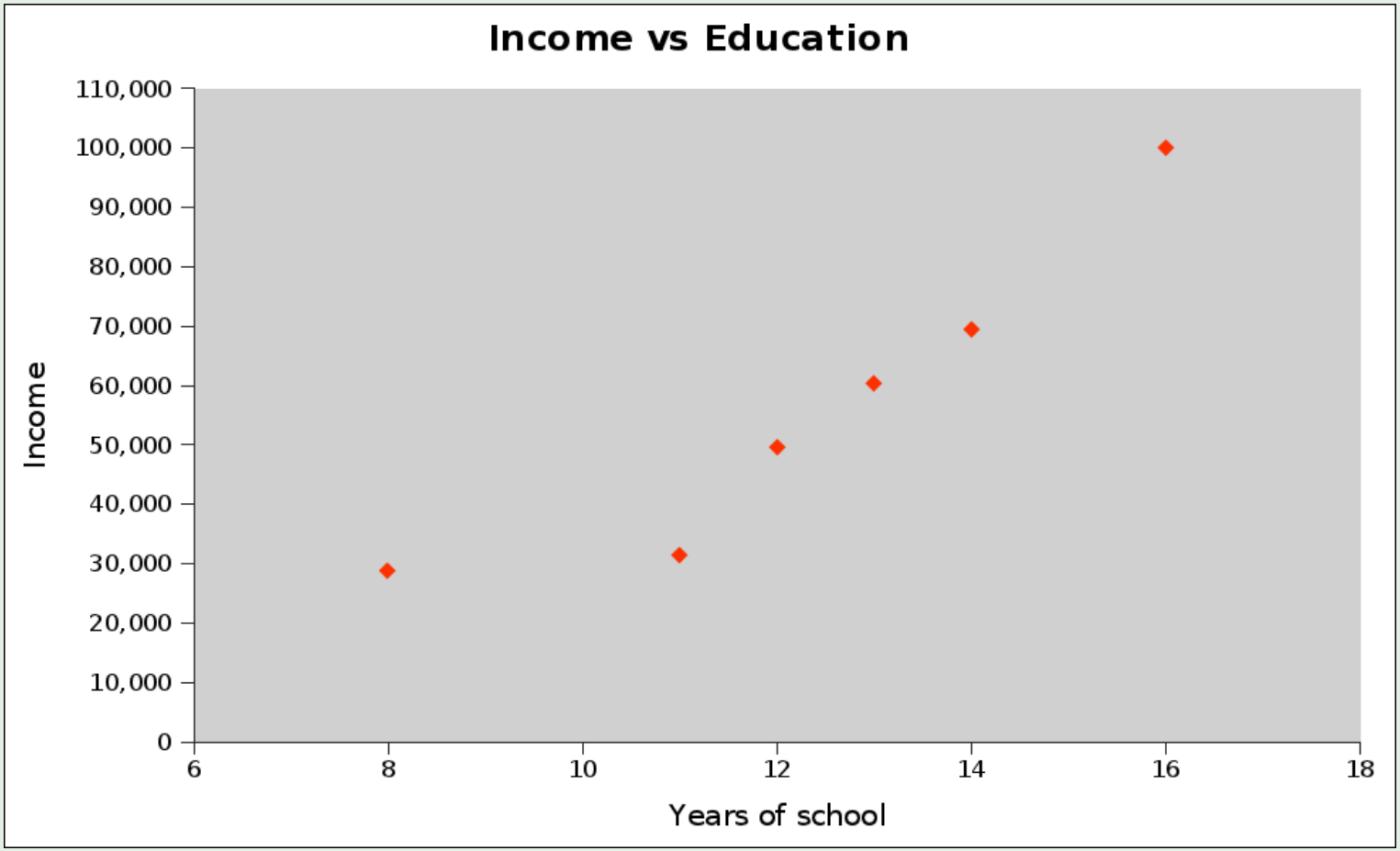
Fact

Correlation = the relationship between two variables

Scatter Diagram

Example

Education pays:



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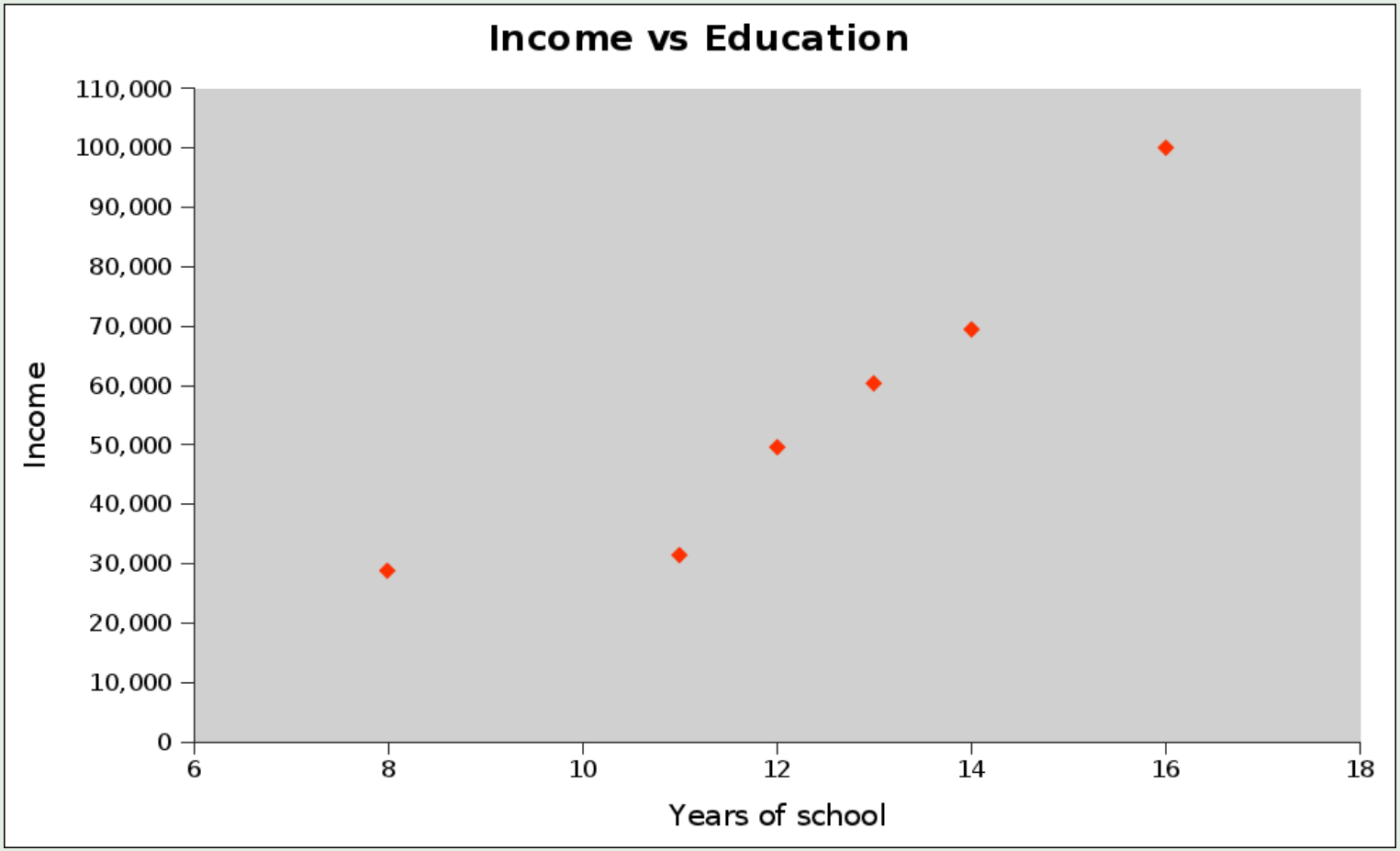
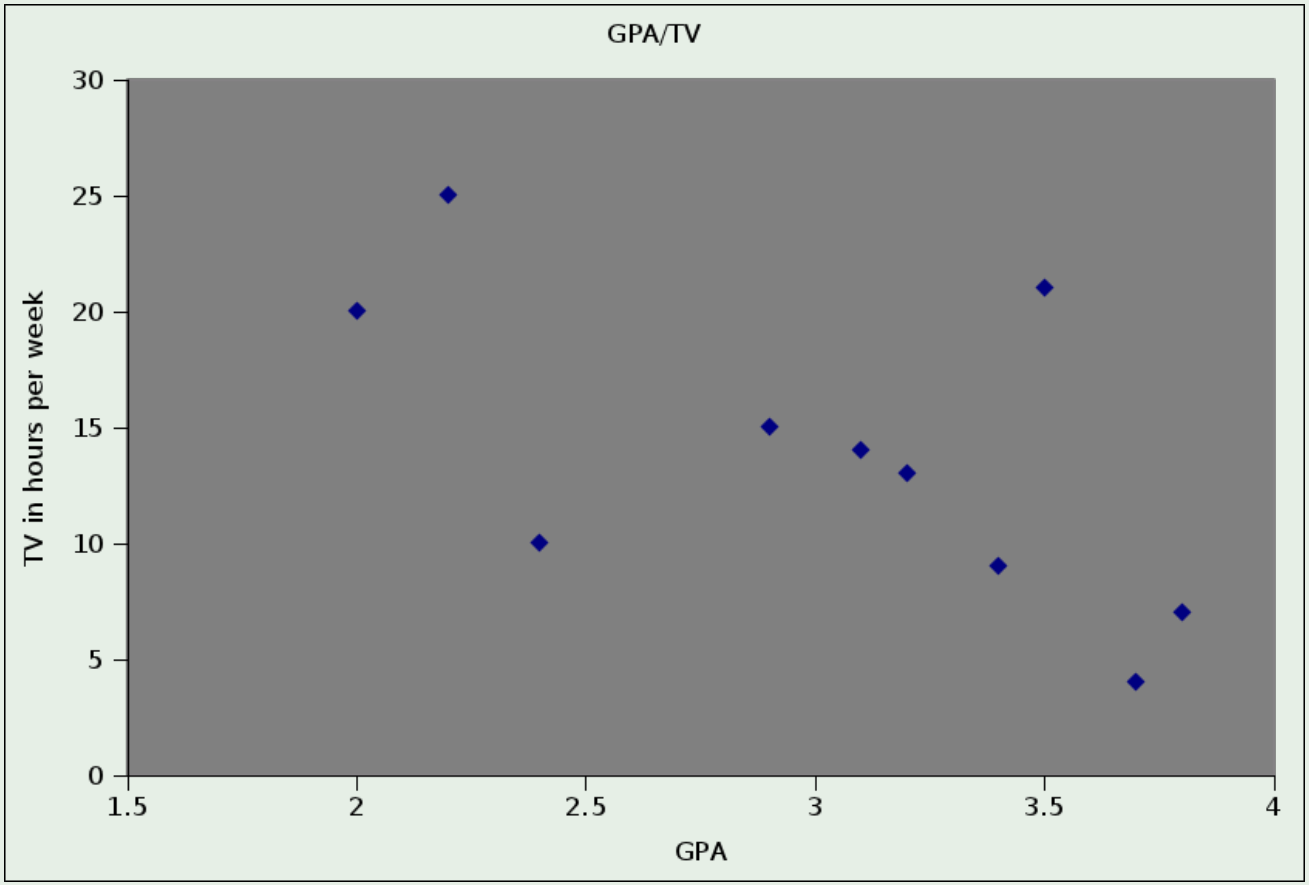


We see a positive correlation

Another scatter diagram

Example

GPA/TV hourse per week:



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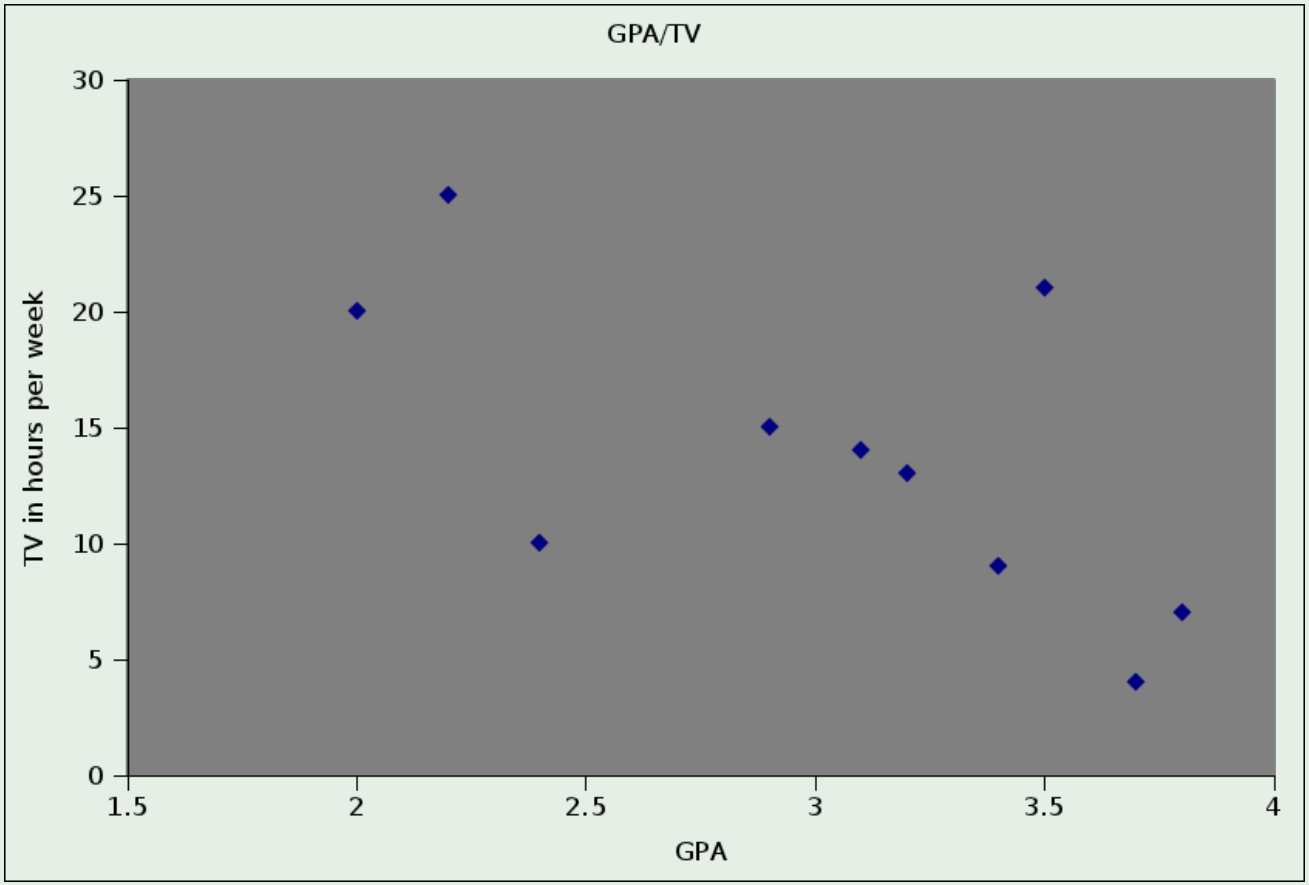

We see a negative correlation.

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- *The best way to choose a scale for a scatter diagram is to use standard units*
- *If x and y_i is your data point and the average of x is $\overline{x}$ and the average of y is $\overline{y}$ with SD_x and SD_y then convert to standard units as follows*

$$\mathrm{X} = \frac{x_i - \overline{x}}{SD_x} \text{ and } \mathrm{Y} = \frac{y_i - \overline{y}}{SD_y}.$$

How do we measure the correlation?

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- That is, the correlation coefficient equals the average of (X in standard units times Y in standard units).

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- *We standardize it so that* ± 1 *is perfectly linear, and* 0 *is void of any linear relation.*

Example

Find the correlation of

x	y
1	4
2	5
6	4
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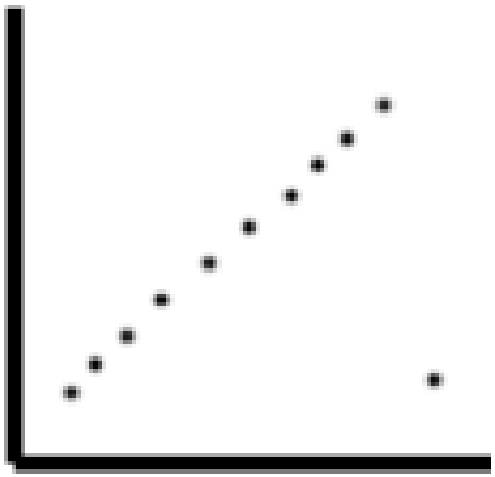
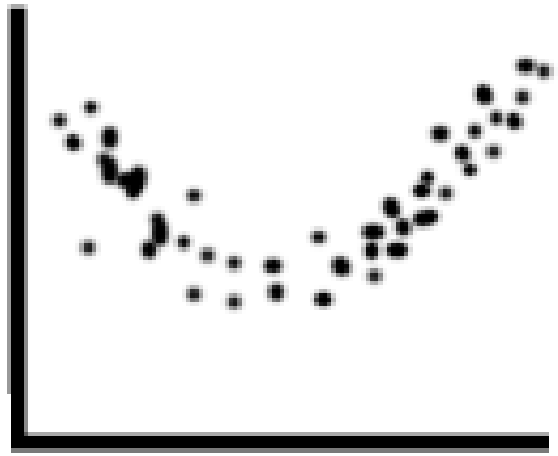


CLEAR ASSOCIATION
BUT R = 0



NONLINEAR ASSOC.
BUT R = 0

Important

Fact

r is valid when the scatterplot is football-shaped!

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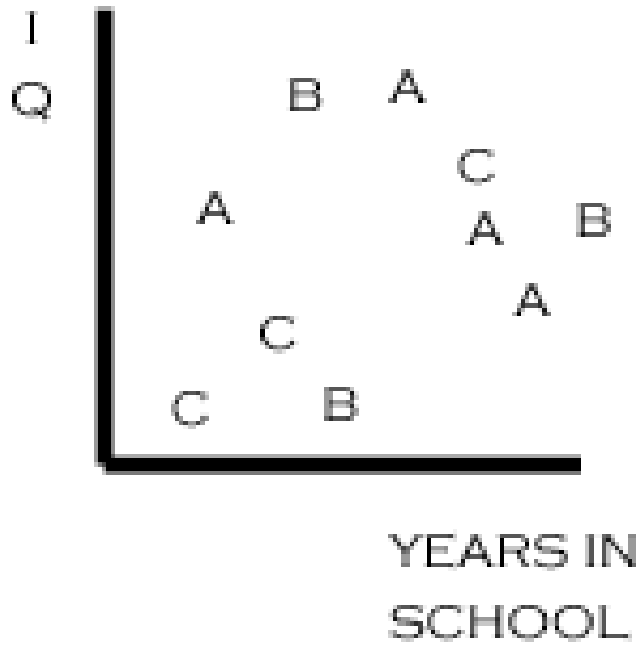
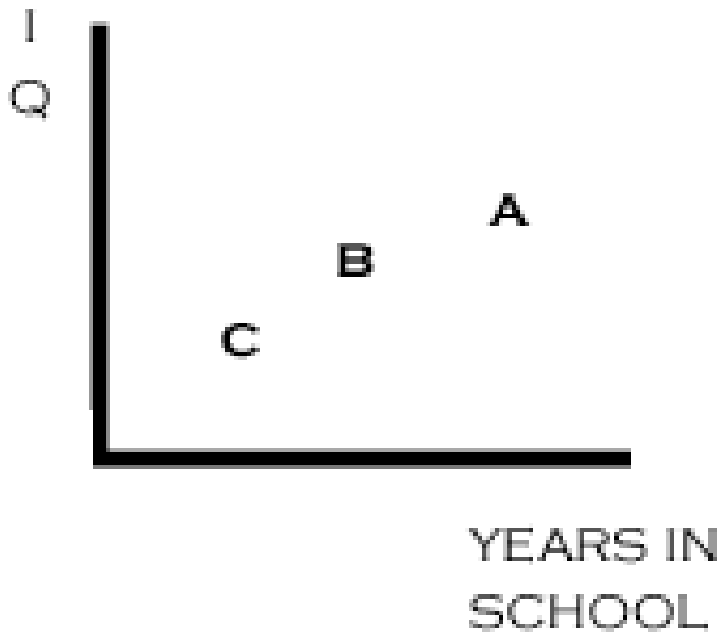
- *Used often in Poly Sci and Sociology.*
- *They tend to overstate the strength of an association.*
- *Reason: When we average we get rid of variations.*

Example

Consider IQ versus years in school, separated by age group: A = 30 year olds; B = 40 year olds; C = 50 year olds





Association is not Causation

Fact

Important:

"Correlation does not imply causation"

Example

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Are people rich because they go to school or they go to school because they are rich?

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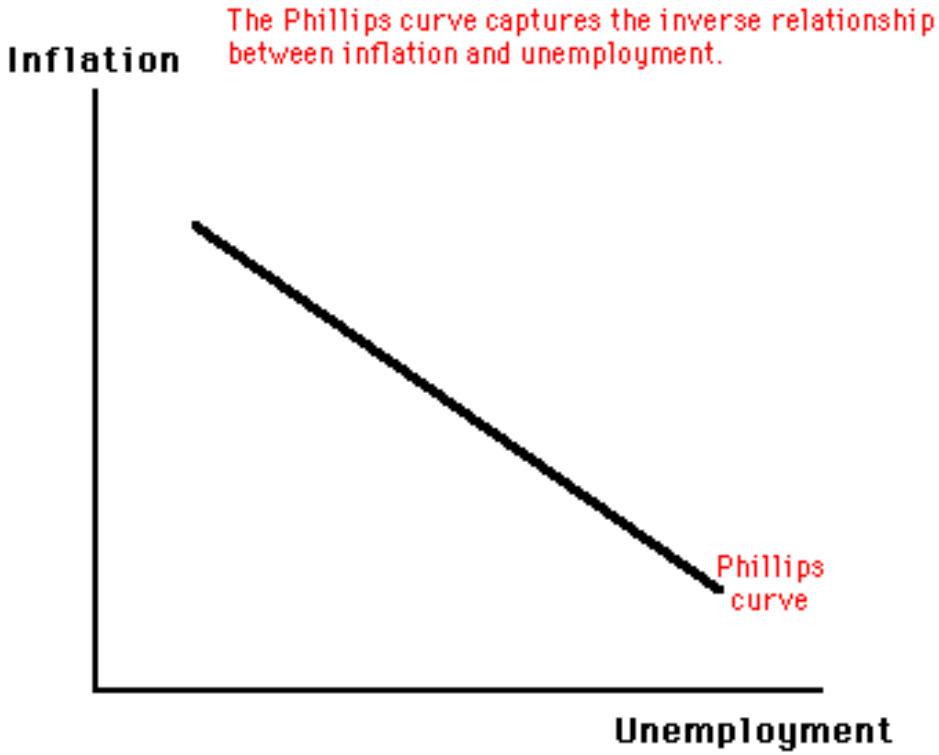

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- It was used in policy and we got high inflation and high unemployment.

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If the mayor puts 200 more police officers in the street will the temperature go down?