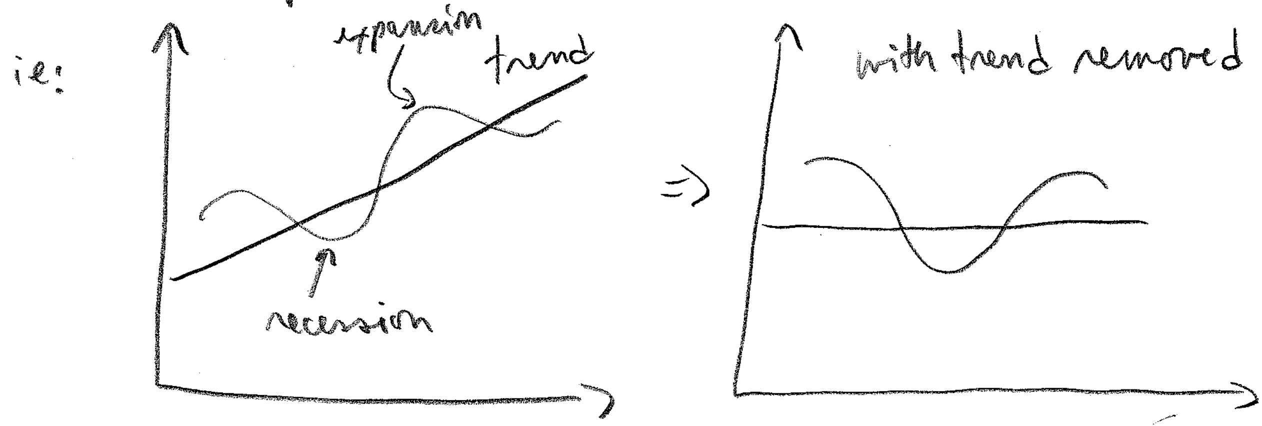
→ The model we look at so far aims at explaining the source of business cycle fluctuations

ie:



→ ultimately, whether a model can be used to explain what is actually happening in the "real world" is an empirical matter

↳ we have to compare the model's predictions to what we observe in the data

→ economists usually evaluate models in several dimensions of the data. We will limit our investigation to <u>correlations</u>

↳ measure of statistical association between two variables

→ we will look at correlations <u>over time</u>

↳ macro focuses on the time dimension. Our one period model is not suited to look at macro issues but we can still try to learn something from it.

Correlations

→ measured by the correlation coefficient

$$\rho = \frac{\overbrace{cov(x,y)}^{\text{covariance between } x \text{ and } y}}{\sqrt{\underbrace{Var(x)}_{\text{variability of } x} \cdot \underbrace{Var(y)}_{\text{variability of } y}}}$$

↳ ρ is between -1 and 1.

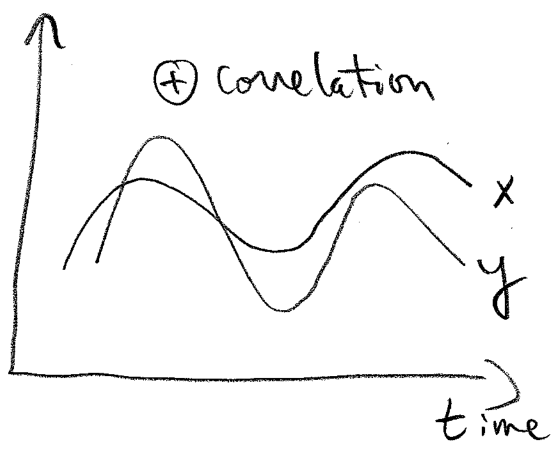
- -1 → perfect negative correlation → x and y always move in opposite direction
- 1 → perfect positive correlation → x and y always move in the same direction

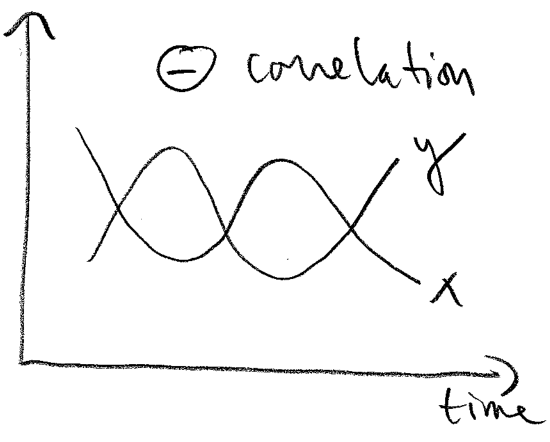
→ when $\rho = 0$, x and y are uncorrelated

↳ do not move together (no systematic relationship between x and y)

ex:

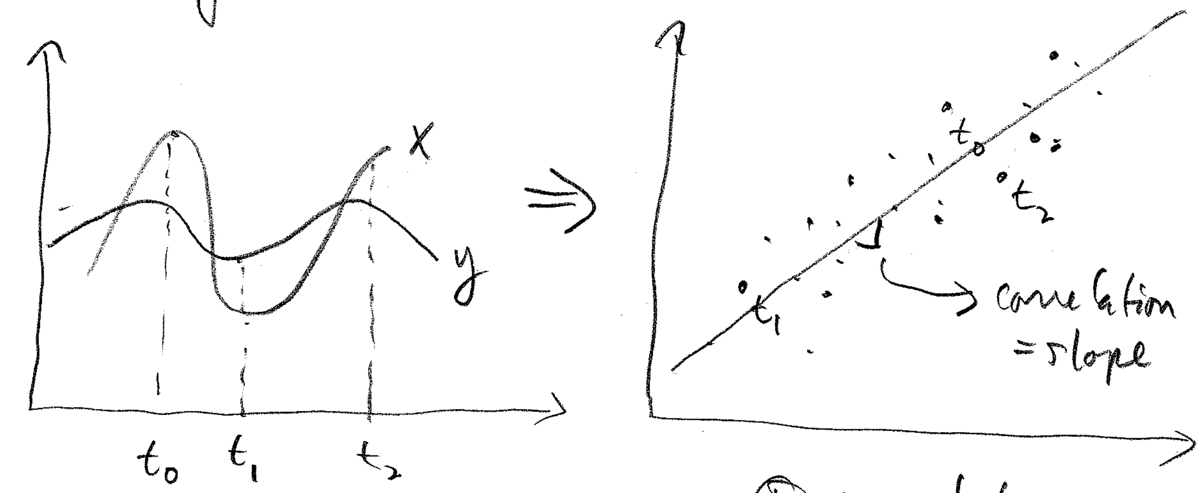
association between x and y over time





another way to look at correlations is to graph one variable against the other

ex:



⊕ correlation

note:
- a variable which has a positive correlation with real GDP is <u>pro cyclical</u>
  - ↳ moves with the business cycle
- a variable which has a negative correlation with real GDP is <u>counter cyclical</u>
  - ↳ moves opposite to the cycle
- a variable not correlated with GDP is <u>a cyclical</u>

↳ this is along this dimension that we will look at the predictions of our one-period model compared to "reality" a word of caution:

→ a correlation is <u>not</u> an indication of <u>causality</u>. If x and y are correlated, it does not mean that movements in x cause those in y (or vice versa)

↳ correlations only measure "statistical" association. Only <u>theory</u> can indicate causality.

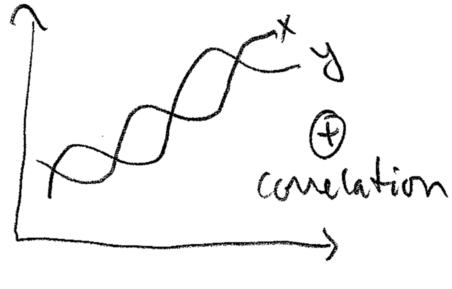
ex: pay $\uparrow z \rightarrow \uparrow x$

$\quad\quad\quad\;\; \rightarrow \downarrow y$

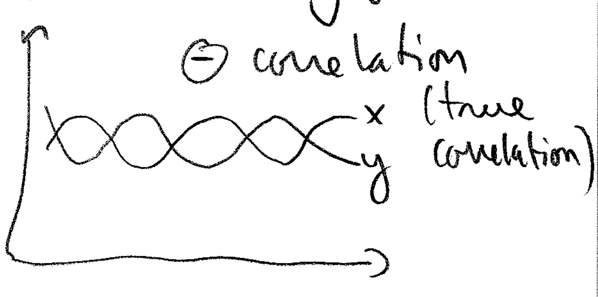
but x and y are not related

↳ if the correlation between x and y is calculated, it will be positive. However, changes in x does not cause changes in y (or vice versa). It is z that causes movements in both variables.

→ correlations work only for stationary variables



but



Let's look at the correlations predicted by our one period model:

what can be the source of business cycle fluctuations in this model?

↳ must come from variations in exogenous variables

ie: ΔG or Δz

only movements in those variables can <u>cause</u> variations in C, N, Y and w

Recall: predictions of the model

$$\uparrow G \longrightarrow \begin{cases} \downarrow C & (\uparrow T \rightarrow \downarrow \text{disposable income}) \\ \uparrow N & (\downarrow l : l \text{ and } C \text{ are normal goods}) \\ \uparrow Y & (\text{because } N \uparrow) \\ \downarrow w & (\uparrow N \rightarrow \downarrow MPN : w = MPN) \end{cases}$$

$$\uparrow z \longrightarrow \begin{cases} \uparrow C & (\text{because income } \uparrow) \\ \uparrow\downarrow N\,? & \text{substitution or income effect?} \\ \uparrow Y & [\uparrow z \rightarrow \uparrow Y \rightarrow \uparrow C) \\ \uparrow w & [\uparrow z \rightarrow \uparrow MPN] \end{cases}$$

look at graphs: ΔG cannot "cause" the business cycle because C is procyclical and $\uparrow G \begin{smallmatrix} \nearrow \uparrow Y \\ \searrow \downarrow C \end{smallmatrix}$

→ Δz seems a better candidate (see graph)

- income effect seem to dominate change in hours but employment (the number of people employed) is procyclical

↳ seems more important to explain (un)employment than movement in hours worked

note: the theory in which Δz produces ΔY is called "Real Business Cycle" theory (RBC)

↳ source of cycles are "real", (here, productivity changes) from the supply side of the economy, rather than from demand fluctuations (ie: ΔG)

↳ how do we "measure" z? (not observable)

$$Y = zK^{\alpha}N^{1-\alpha} \Rightarrow z = \frac{Y}{K^{\alpha}N^{1-\alpha}}$$

Y → observable

$\alpha = 1/3$

K, N → observable

This is called "Solow Residual"