Lecture 13: Measuring Business Cycles
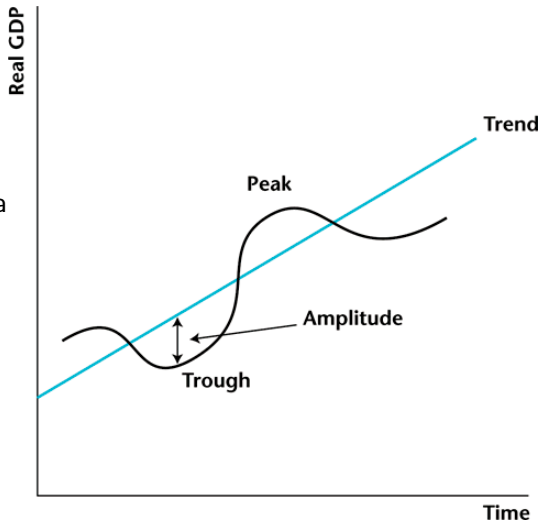
ECON30009/90080 Macroeconomics

Semester 2, 2025

Business Cycles

What are business cycles?

□ Business cycles refer to fluctuations in the level of economic activity around a long term trend.

□ These fluctuations are recurrent but not periodic

Expansions and Contractions

☐ Business cycles have two phases – **expansion and contraction** – and two turning points – **peak and trough**.

☐ A contraction – a period over which output moves from its peak to its trough. Expansions are defined as the period from trough to peak.

☐ Both are usually characterised using the <u>level</u> of economic activity.
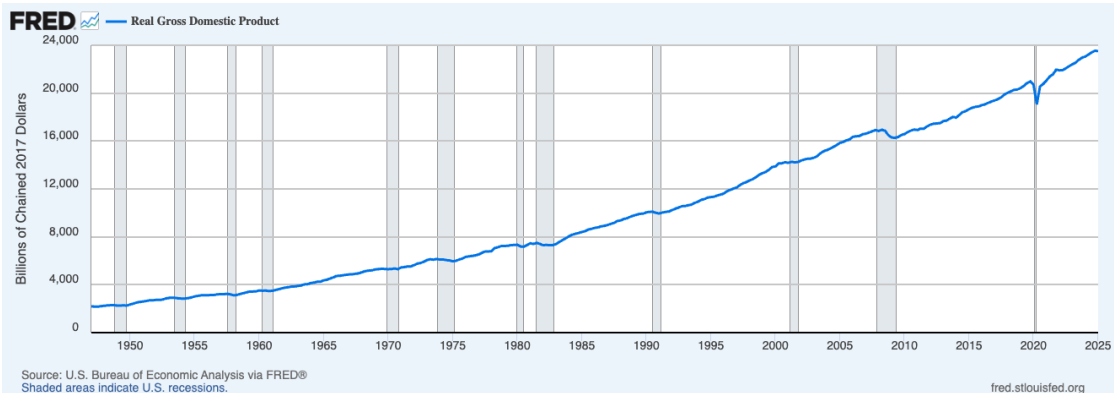
Expansions and Contractions

☐ The National Bureau of Economic Research (NBER) Business Cycle Dating Committee maintains a **chronology** of the U.S. business cycle with peak and trough dates

☐ You can find this information by using this link: Business cycle dates

☐ A recession (contraction) is defined as a **significant** and **broadbased** decline in economic activity and can last from a few months to several years (**persistent**)

☐ An **expansion** is where economic activity significantly increases, is broadbased (not in just one or two sectors), and usually lasts for several years.
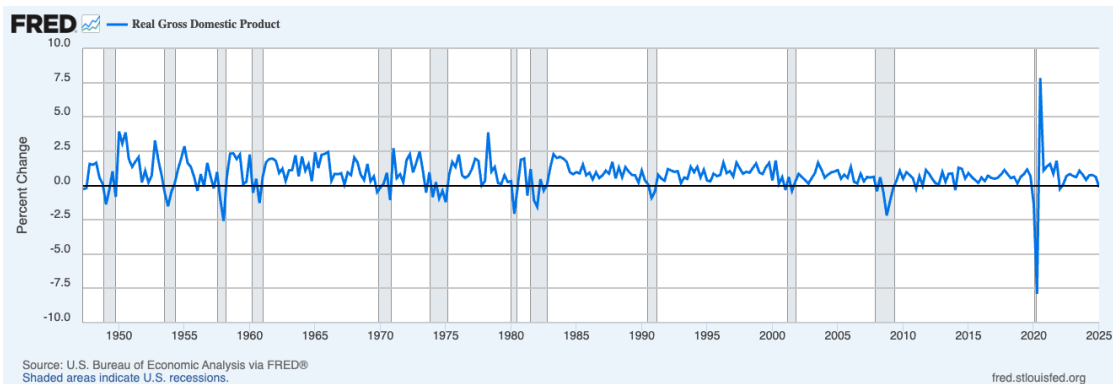
Expansions and Contractions

☐ The NBER Committee applies judgment in identifying recessions and expansions (not every peak and trough identified in GDP is necessarily a business cycle).

☐ The Committee analyses **a range of measures of economic activity**: real GDP, labour market variables, production indicators, etc.

US Real GDP over time

Source: U.S. Bureau of Economic Analysis via FRED®
Shaded areas indicate U.S. recessions.

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US Real GDP growth over time

Source: U.S. Bureau of Economic Analysis via FRED®
Shaded areas indicate U.S. recessions.

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Because GDP is non-stationary (has a trend), we look at how GDP growth varies over the business cycle

Business Cycle Dating

☐ In Australia, there have been 6 business cycles since 1960 and the last recession (prior to 2020-21) was in 1992.

☐ In the absence of a formal dating committee, 2 consecutive quarters of contracting GDP is sometimes used as an informal rule-of-thumb for identifying recessions.

Identifying Business Cycles

☐ Business cycles refer to fluctuations in the level of economic activity around a long term trend.

☐ To isolate the cyclical component, we need to de-trend our data and focus on deviations from trend

$$Y_t^{cycle} = \frac{Y_t - Y_t^{trend}}{Y_t^{trend}} \approx \ln Y_t - \ln Y_t^{trend}$$

☐ By removing the trend component, we seek to make the data stationary

  ○ By stationarity: we mean a stochastic (not deterministic) process whose joint probability distribution is not changing over time.

  ○ That is, by stationarity, we mean that if we choose any point in time, the object of interest has the same probability of transitioning to that state.

De-trending

☐ The following methods are used when we want to remove the trend in data:

  ○ First-differencing the data (treating real GDP as an I(1) process)

  ○ Removal of a linear or quadratic trend (treating real GDP as an I(0) process)

  ○ HP filter: proposed by Hodrick and Prescott (1980, 1997)

  ○ Band-Pass filter: proposed by Baxter and King (1999)

☐ Business cycle statistics can then be constructed from the filtered data to document properties about business cycles.

GDP or GDP per capita

☐ Business cycles: the short-run fluctuations in economic activity around a trend

☐ One of the key indicators we look at is Real GDP

☐ and not Real GDP per capita

GDP or GDP per capita

Growth rates in Real GDP vs. Real GDP per capita

Real GDP per capita —— Real GDP ----
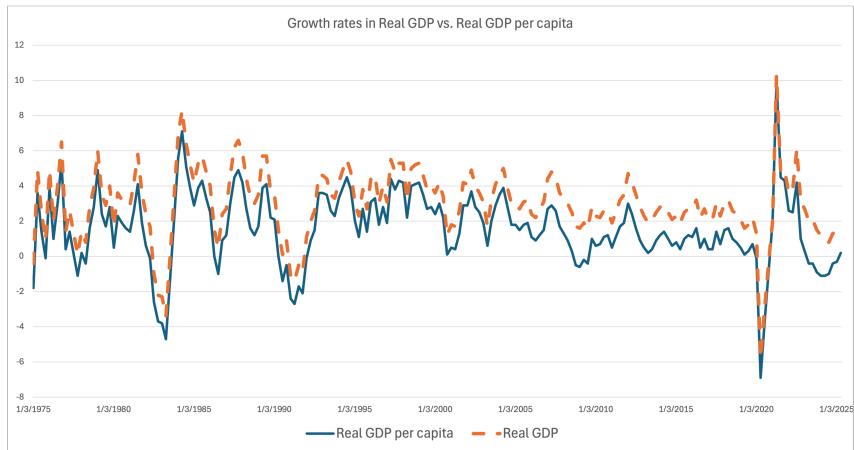
Normally, when the population is growing at a fairly constant rate, the two measures give qualitatively the same story.

GDP or GDP per capita

Growth rates since 2021
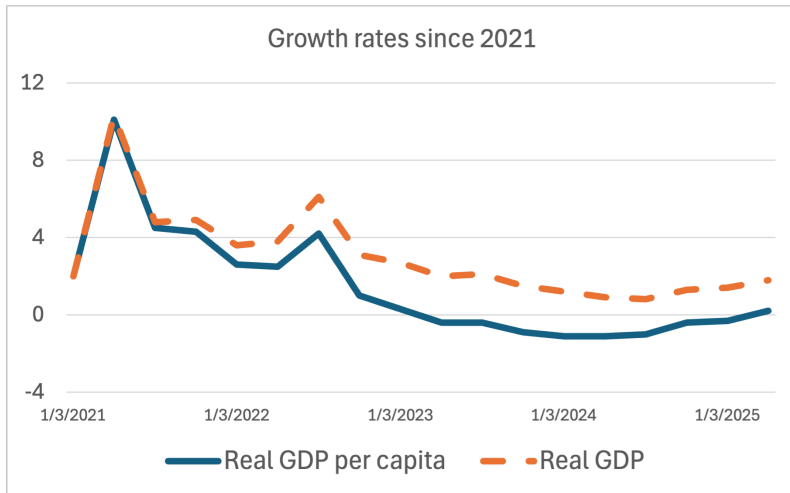
When population grows very rapidly relative to the past, the two measures can differ

WHAT FACTS DO WE WANT A BUSINESS CYCLE THEORY TO MATCH?

Business Cycle Statistics

☐ Calculate correlations with real output growth to examine **co-movement** – whether a data series is pro-cyclical or counter-cyclical.

☐ Calculate standard deviations to examine the **amplitude of fluctuations** relative to real output growth – is a series more or less volatile than real output growth?

☐ Calculate cross-correlations to examine **lead and lag relationships** with real output growth – whether a data series leads or lags real output growth.

Business Cycle Statistics

☐ Modern business cycle theory started with Real Business Cycle (RBC) theory in the early 1980s. (The 'Real' in RBC refers to the fact that the model involves real and not nominal variables)

☐ In response to the Lucas Critique (1976): RBC was built to address the issue that parameters estimated from statistical models were not policy-invariant.

☐ Instead RBC starts from a micro-founded approach (optimizing behavior of individuals) and was developed to reconcile a series of empirical regularities obtained from US business cycles.

☐ "Success" of RBC model rested on its ability to match statistics on co-movement and amplitude of fluctuations

Some Definitions

☐ A variable is called procyclical (to GDP) if, on average, it co-moves positively with GDP along the business cycle.

☐ A variable is called countercyclical (to GDP) if, on average, it co-moves negatively with GDP long the business cycle.

☐ A variable is acyclical (to GDP) if it moves independent of GDP along the business cycle
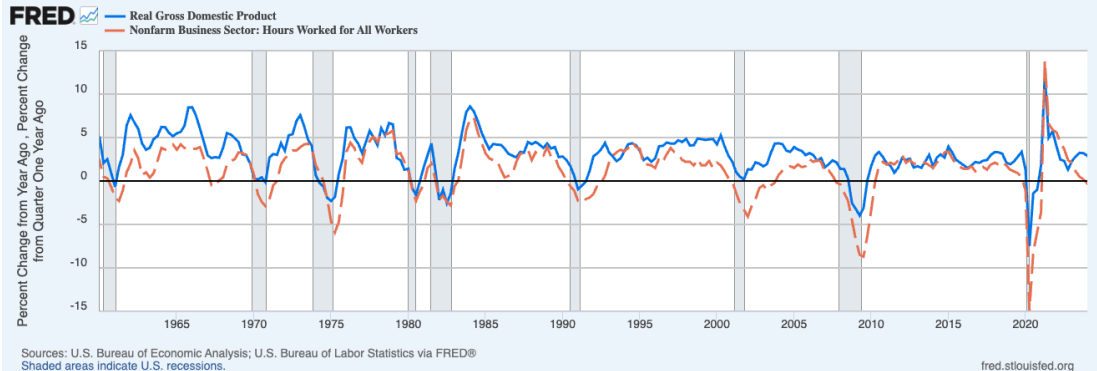
Consumption Spending and GDP
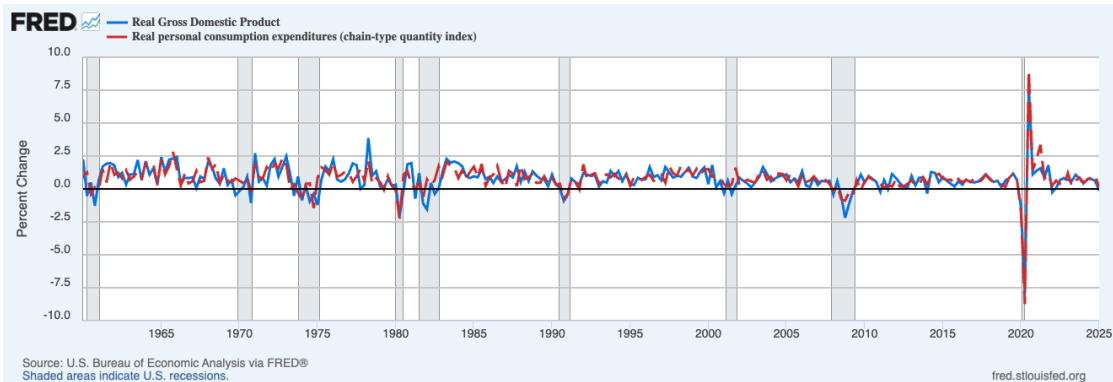
Source: BEA. Data series have been first-differenced. Blue solid line is real GDP growth, red dashed line is consumption spending growth
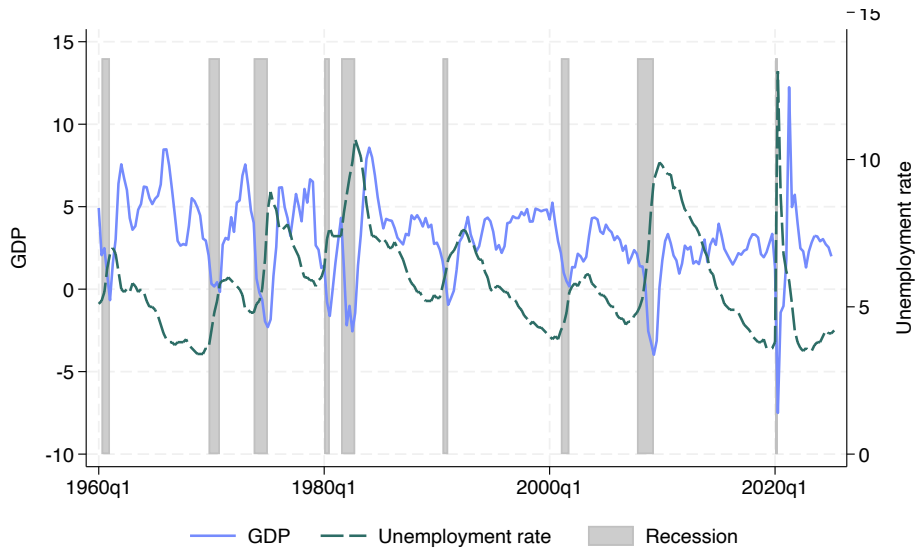
Investment and GDP
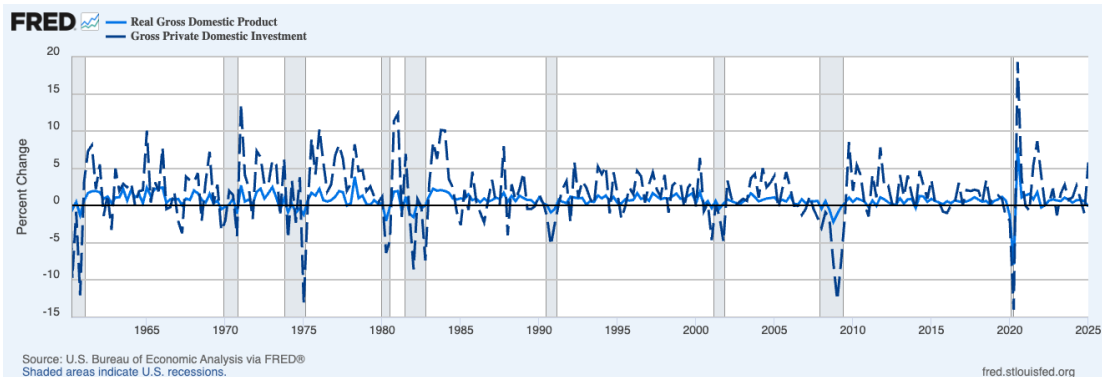
Source: BEA. Data series have been first-differenced. Dark blue dotted line depicts growth rate in real investment. Blue solid line depicts real GDP growth

Hours worked and GDP

Source: BEA. Data series have been first-differenced. Blue solid line depicts real GDP growth. Orange dashed line growth in hours worked

Unemployment Rate and GDP

Stylised real facts for the US

☐ **Total employment** and **total hours of work** are pro-cyclical, and the **unemployment rate** is counter-cyclical.

☐ Volatility in output and **total hours** are similar in percentage terms.

☐ Unemployment fluctuates almost as much as output, hours *per worker* actually more stable

☐ Most of the variation in total hours comes from variation in employment (**extensive margin**) rather than in hours worked per worker (**intensive margin**).

Stylised real facts for the US

☐ Investment and consumption are both procyclical.

☐ **Investment** is more volatile than output.

Thought experiment: If RBC model is supposed to be a theory of business cycles, should replicate these stylized facts on co-movement and volatility

The RBC model

☐ Driver of business cycles in the RBC model: (random) variations in productivity (TFP)

☐ Similar to OLG model of growth which emphasized TFP as the source of *long-run* sustained growth

☐ RBC emphasizes variations in TFP as source of business cycles

☐ The RBC model proposes that it can replicate these business cycle facts, but only if booms and recessions are driven by productivity

☐ Idea that the driver of long-run growth is also the factor behind short-run fluctuations in economic activity

A 2 period RBC model

☐ Consider an economy that lasts for only 2 periods

☐ For now, we will only assume there are households and firms.

☐ Output is produced according to

$$Y_t = F(z_t, K_t, L_t)$$

☐ z_t represents exogenous TFP and can vary across periods.

☐ We will assume that agents know z_t (no uncertainty)

☐ Capital evolves according to:

$$K_{t+1} = (1 - \delta)K_t + I_t$$

A 2 period RBC model: households

☐ Unlike your OLG model, we will assume there is only 1 generation of households

☐ There are N households and each household enters the economy in period 1 with an initial endowment of capital a_1.

☐ The household lives for 2 periods and works each period by inelastically supplying 1 unit of labour.

    ○ Why does it make sense that households supply labour every period if there is only 1 generation of households ?

☐ The household gets rental income from renting out capital to firms.

☐ Households also get dividend income from firms

A 2 period RBC model: households' budget constraints

☐ This implies that in period 1, the household budget constraint is given by:

$$c_1 + a_2 = w_1 + R_1 a_1 + \pi_1$$

☐ And in the second period, the budget constraint is given by:

$$c_2 = w_2 + R_2 a_2 + \pi_2$$

☐ We can derive the lifetime budget constraint as:

$$c_1 + \frac{c_2}{R_2} = R_1 a_1 + w_1 + \frac{w_2}{R_2} + \pi_1 + \frac{\pi_2}{R_2}$$

A 2 period RBC model: household problem

☐ Our household gets utility from consuming each period: $U(c_1, c_2)$

☐ and so the household's problem is given by:

$$\max_{c_1, c_2} U(c_1, c_2)$$

s.t.

$$c_1 + \frac{c_2}{R_2} = R_1 a_1 + w_1 + \frac{w_2}{R_2} + \pi_1 + \frac{\pi_2}{R_2}$$

A 2 period RBC model: firms

☐ There is perfect competition among firms

☐ Firms solve the same profit maximization problem every period.

☐ They choose how much capital and labour to use in production given rental rate R_t and wage rate w_t, so as to maximize profits:

$$\pi_t = \max_{K_t, L_t} F(z_t, K_t, L_t) - R_t K_t - w_t L_t$$

A 2 period RBC model: market clearing

☐ In each period, firms and households trade in

- a labour market

- an asset market

- a goods market

A 2 period RBC model: equilibrium

In equilibrium:

- ☐ Household optimally choose consumption for each period to maximize their lifetime utility

- ☐ Firms optimally choose capital and labour to maximize profits each period

- ☐ All markets clear.

The road ahead

☐ Unsurprisingly, the set-up of the model sounds very similar to what we've done before!

☐ As mentioned, central idea in RBC is what drives growth can also be the driver of short-run fluctuations

☐ As we go through an example of this model next class, we want to consider some implications of the RBC model (is it a good model? why or why not? what does the RBC model reveal?)

The road ahead

☐ To prepare for next class. Solve the model for log utility preferences

$$U(c_1, c_2) = \ln c_1 + \beta \ln c_2$$

and Cobb-douglas production function, and $\delta = 1$.

☐ Our goal is to show that TFP (*and only TFP*) in this model is the driver of business cycles