

Lecture 13: Business Cycles – Overview

Christian Wolf

14.05, Fall 2025

Business cycles

- So far: **long-run growth** – why do countries grow, why are some rich and some poor, what are the implications for trends in inequality?
- Now second half: **business cycles**
 - Why do economies undergo recurrent fluctuations? Why is unemployment sometimes high, sometimes low? What about inflation?
 - What can policy do about those fluctuations? Should it do anything?
- **Today:**
 1. Recap some basic facts about business cycles
 2. A roadmap for business-cycle theory: how to think about demand vs. supply in general equilibrium
- *Background reading:* Axios Macro newsletter (<https://www.axios.com/newsletters>)

Outline

1. What are business cycles?

Two case studies

Business-cycle regularities

2. Towards a theoretical framework

An overview of business cycles

- What are business cycles?
 - Def'n: recurrent short-run fluctuations in macroeconomic aggregates around a smoother long-run trend
 - Featuring:
 - Co-movement of real quantities: GDP, consumption, investment, employment, at both the aggregate and regional level
 - No clear picture for prices: sometimes inflation is high when unemployment is high, sometimes vice-versa
- Roadmap:
 1. Two case studies: Great Recession & Covid-19
 2. General business-cycle facts

Outline

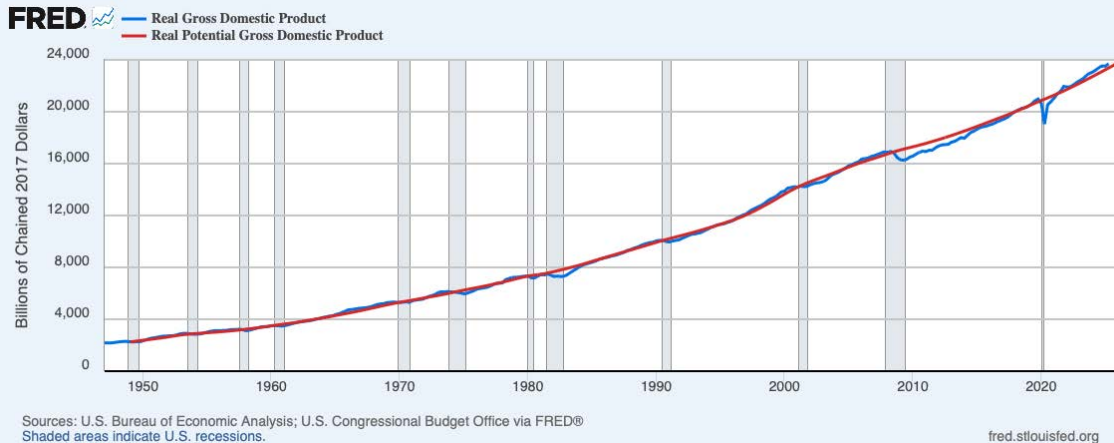
1. What are business cycles?

Two case studies

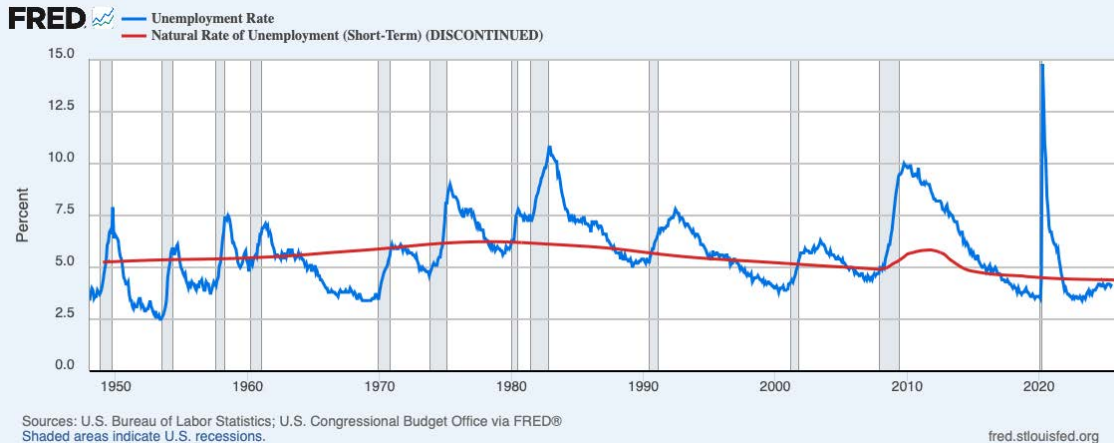
Business-cycle regularities

2. Towards a theoretical framework

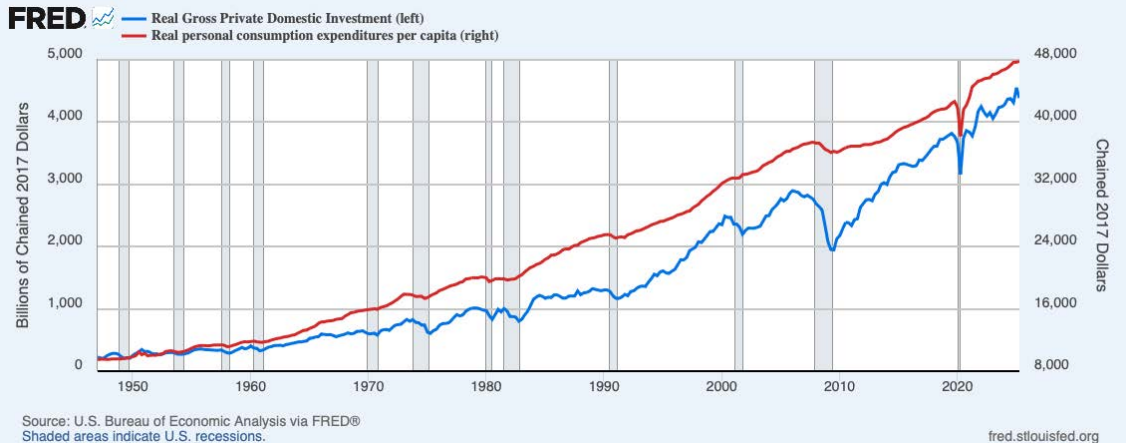
History of GDP



History of unemployment



History of consumption & investment



Great Recession vs. Covid-19 Recession

- These two recessions have very different origins
Financial/housing shock vs. infectious disease, “demand” vs. “supply.”
- Key differences: Covid recession has more dramatic drop in consumer expenditure, not as concentrated in investment. Also faster recovery.
- But these and other recessions are similar in many other ways:
 - Most (but not all) sectors contracting at the same time
 - Both consumption and investment falling
 - Big spikes in unemployment
 - Monetary policy tries to fight, but is constrained
- Let's try to be a bit more systematic with these observations ...

Outline

1. What are business cycles?

Two case studies

Business-cycle regularities

2. Towards a theoretical framework

Business cycle regularities

- We will restrict attention to post-WWII and the U.S.
But: similar conclusions can be drawn for many other countries & time periods.
- Objective: document empirical regularities (“*stylized facts*”)
 - Focus on some key U.S. macro time series
 - Document their “average” behavior over time to provide benchmarks for the theoretical models we construct
- Two steps to detect these empirical regularities:
 1. Select macroeconomic variables of interest
 2. Extract *cyclical components* using appropriate *filters*

Key macro variables

- GDP and key expenditure components: $Y = C + I + G$

Mostly think of closed economy. Some discussion of trade & tariffs at the end, if time permits.

- Consumption C : nondurables + services
 - Investment I : durables + fixed investment + changes in inventories
 - Government consumption G : purchases of goods and services
- Labor: total hours worked = employment $\times$ hours per worker
- Unemployment rate
- Inflation: CPI or GDP deflator
- Interest rates: federal funds rate

Def'n: interest rate at which depository institutions (banks and credit unions) lend reserve balances to other depository institutions overnight on an uncollateralized basis.

GDP expenditure components

	Share in output	Share in category
Consumption C	0.56	—
<i>Non-durables</i>	0.20	0.36
<i>Services</i>	0.36	0.64
Investment I	0.25	—
<i>Fixed investment</i>	0.15	0.60
<i>Changes in inventories</i>	0.01	0.04
<i>Durables</i>	0.09	0.36
Government consumption G	0.19	—

Trend vs. cycle

- Let $\{x_t\}$ be the time series of a macroeconomic variable of interest, such as the levels of GDP and investment, or unemployment and inflation.
- Think about decomposing x_t as

$$x_t \equiv x_t^{trend} + x_t^{cycle}$$

where x_t^{trend} is the *trend component* and x_t^{cycle} is the *cyclical component*.

- **Question:** How are these components defined?
- **Answer:** We use different types of *statistical filters*.

Trend vs. cycle: linear filter

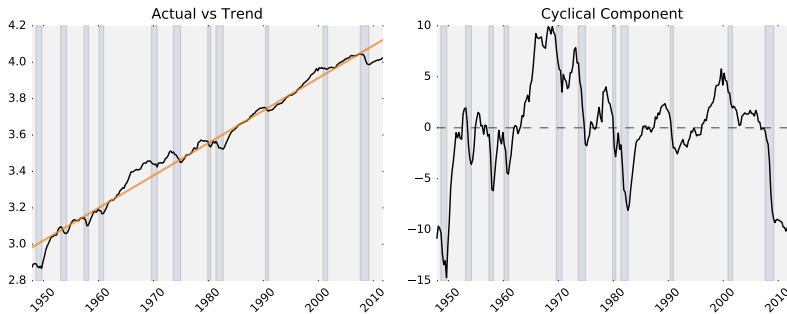
- Simplest answer: deviation from linear trend. Trend is obtained via

$$x_t = \alpha + \beta t + \text{residual}$$

Cyclical component is then calculated using estimated coefficients

$$x_t^{cycle} \equiv x_t - (\hat{\alpha} + \hat{\beta}t) = \text{residual}$$

- Expansions/recessions then correspond to output above/below trend.



Trend vs cycle: linear filter

- There are some important issues with linear filters:
 - Not flexible, simply assumes a deterministic trend
 - Slow-moving irregular phenomena at medium or low frequencies are attributed to the business cycle, rather than to slow structural changes
Examples: productivity slowdown, demographics, policy-regime changes
- **Needed:** filter that eliminates medium- to low-frequency variation.

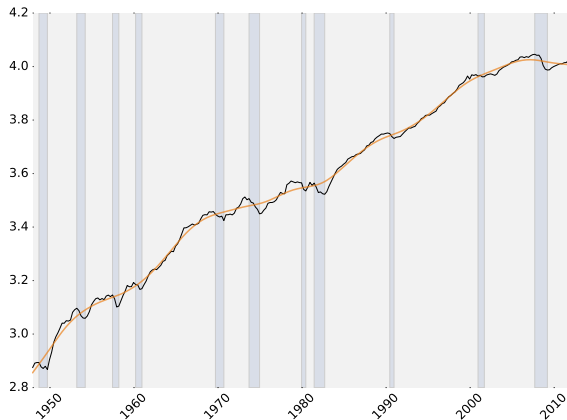
Trend vs. cycle: Hodrick-Prescott (HP) filter

- HP filter: trend is obtained by solving

$$\min_{\{x_t^{trend}\}_{t=1}^T} \left\{ \sum_{t=1}^T (x_t - x_t^{trend})^2 + \lambda \sum_{t=2}^{T-1} ((x_{t+1}^{trend} - x_t^{trend}) - (x_t^{trend} - x_{t-1}^{trend}))^2 \right\}$$

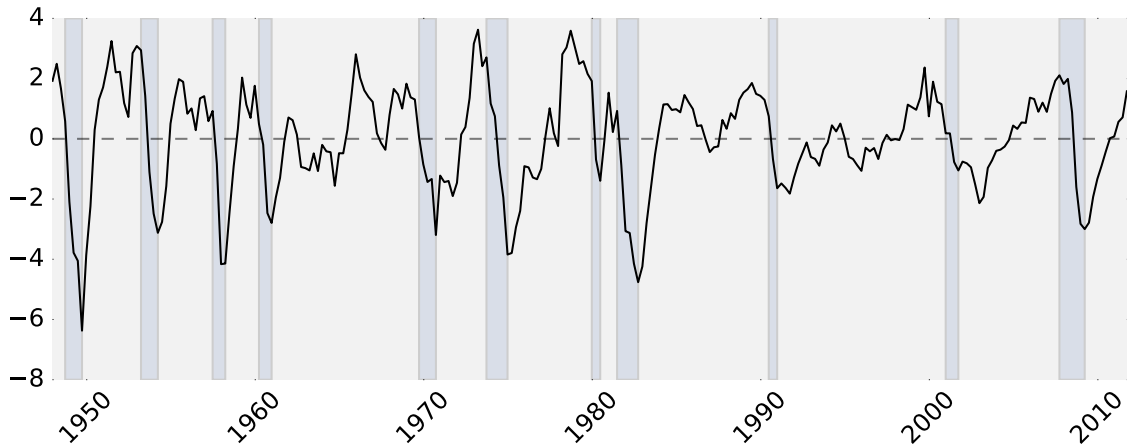
- Parameter λ measures the penalty for allowing fluctuations in the trend
 - No penalty ($\lambda = 0$) $\Rightarrow$ no filter, trend = original series. Infinite penalty ($\lambda = \infty$) $\Rightarrow$ linear
 - Rule-of-thumb $\lambda = 1600$ for quarterly data.
- Don't worry about the details, just remember the basic idea:
 - The “trend” captures medium to long-run fluctuations ...
 - ... while the residual “cycle” captures short-run fluctuations.

HP Filter results: GDP



Data in black. Trend in orange (smooth but not linear). Cycle is difference between actual and trend. Not without problems — notice how filter treats the Great Recession.

HP Filter results: GDP

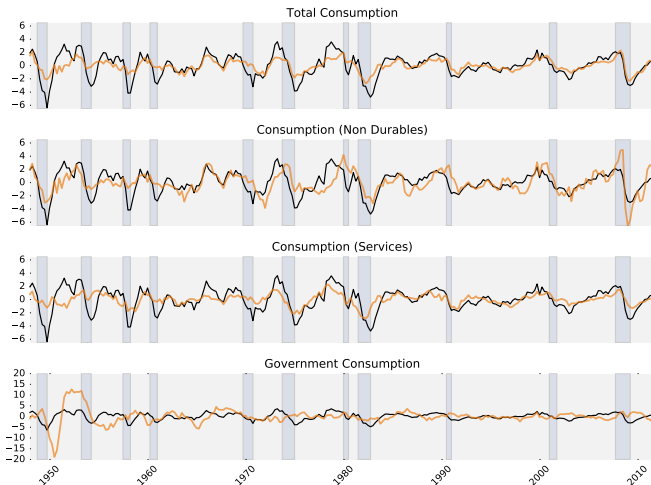


Cycle in real GDP, measured as percent deviation from trend. Shaded periods are "official" NBER recessions. Notice how cycle tracks these recession dates.

Business-cycle regularities

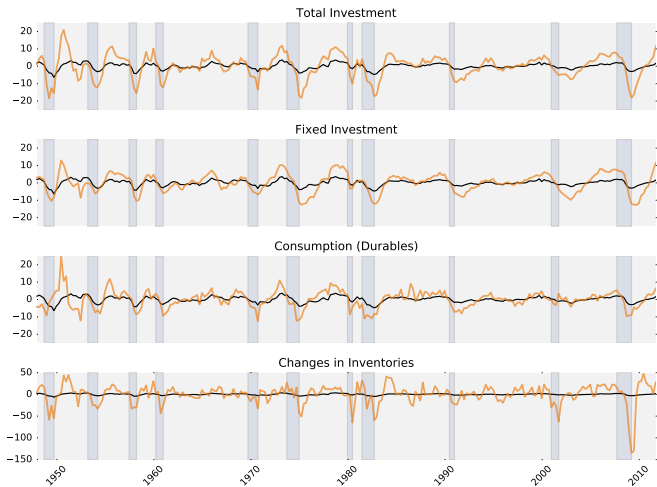
- We are now ready to document the empirical regularities of interest.
- The following figures each plot the cyclical components of various macro variables (in orange) against the cyclical component of GDP (in black).
- These figures, and a few statistics that summarize the patterns in these figures, will represent our main “*stylized facts*” for business cycles and help guide the development of theoretical frameworks.

Consumption



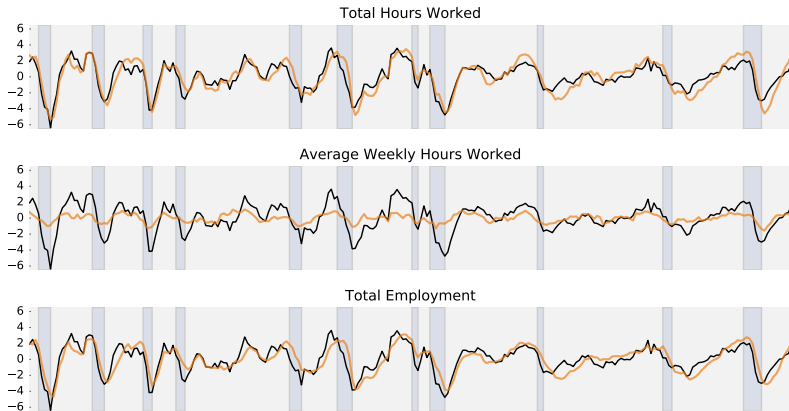
Consumption is procyclical, but less volatile than GDP. *Consumption smoothing* plays a key role in many macroeconomic models.

Investment



Investment is procyclical and more volatile than GDP.

Labor

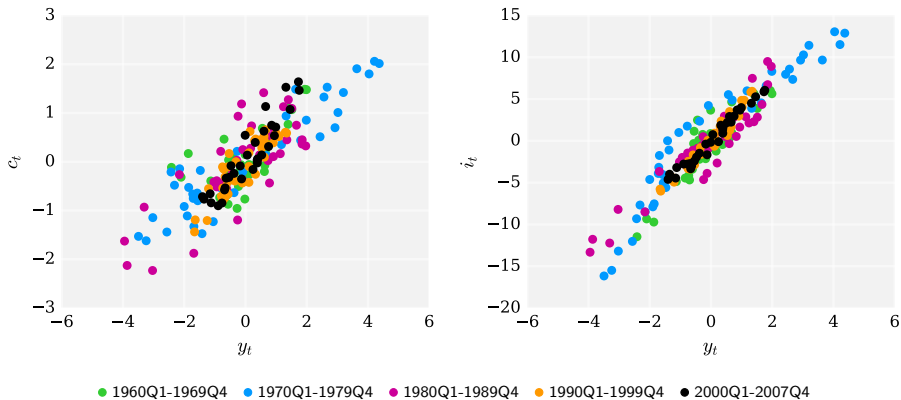


Labor input (total hours worked) is procyclical and as volatile as GDP. Extensive margin (# of workers) more important than intensive margin (average hours per worker).

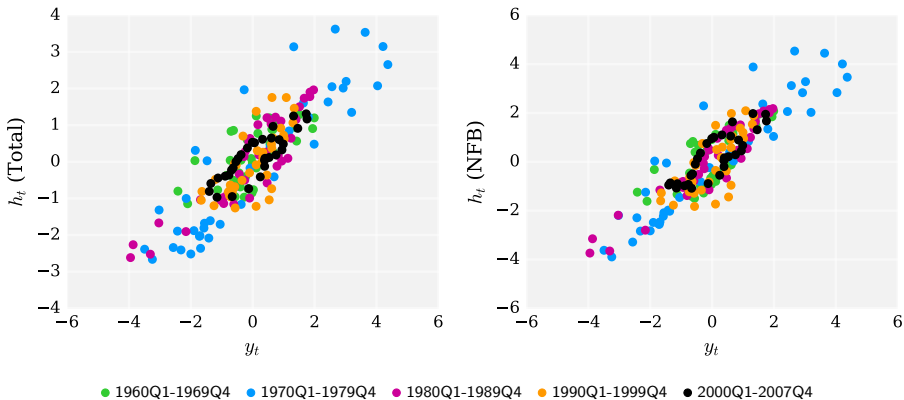
Business-cycle regularities: summary

- Consumption, investment, output, and employment all strongly comove over the business cycle.
 - Can also see this in *scatterplots* of the cyclical components of these variable, as shown in the next few slides.
- But there is a distinct *lack* of similarly strong comovement between real economy activity and inflation.
- Invites a certain interpretation of demand and supply shocks, as we will see.

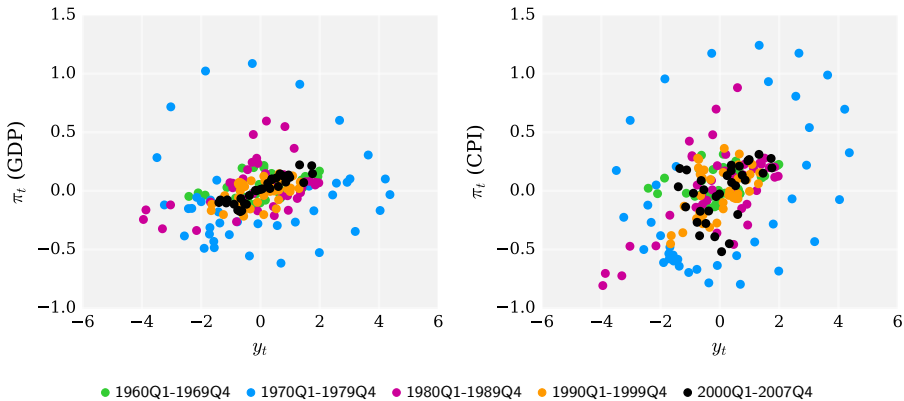
Strong co-movement of C , I , and Y



Strong co-movement of employment



But not for inflation



No clear pattern, correlation of π and Y close to zero.

Outline

1. What are business cycles?

Two case studies

Business-cycle regularities

2. Towards a theoretical framework

Towards a framework: demand and supply

- How can we make sense of this strong comovement in real quantities without a commensurate comovement in prices/inflation?
- Econ101 suggests: demand and supply
 - Demand shocks cause q and p to move in *the same* direction
(tracing out supply curve)
 - Supply shocks cause q and p to move in *the opposite* direction
(tracing out demand curve)

If business cycles are driven by *both* demand shocks and supply shocks, then overall the (*unconditional*) correlation between q and p could be ≈ 0

- This is where we're going: can we make sense of this basic micro-101 logic in models of the macro-economy as a whole?

As we will see: lots of subtleties in extrapolating from micro ("partial eq'm") to macro ("general eq'm").

Aggregate demand and business cycles

- Popular narratives in particular put a big emphasis on “**aggregate demand**”
- Examples: the Great Recession and the slow recovery from it were caused, in large part, by weak or deficient consumer and investment demand
- We will try to make sense of such stories in models with optimizing households & firms
 - Straightforward for individual markets = micro-101: demand $\downarrow$ means output and prices $\downarrow$
We will quickly recap this basic logic on the next slide.
 - As we will see: in general equilibrium, for the economy as a whole, it's easy for supply to matter, but actually not so easy for demand
 - Say's law: supply creates its own demand, with prices adjusting to bring demand in line.
 - Intuitively think of a vertical supply curve. Basic models of the business cycle are like that.

Demand and supply in micro

- Demand and supply in a single market

$$q = D(p, \dots), \quad q = S(p, \dots)$$

where "... " = prices of all other goods, income, tastes, technologies ...

- Partial equilibrium

$$q = D(p) = S(p)$$

- Negative demand shock $\equiv$ exogenous shift in D curve down given S curve. Implies endogenous fall in both q and p .
- Negative supply shock $\equiv$ exogenous shift in S curve down given D curve. Implies endogenous fall in q and rise in p .

From micro to macro

- Tempting: extrapolate from micro to macro. Just put in upper case.
- Demand and supply:

$$Q = D(P), \quad Q = S(P)$$

General equilibrium:

$$Q = D(P) = S(P)$$

- Does this extrapolation make any kind of sense?

From micro to macro: difficulties

- You can think of Q as aggregate of q across all goods/markets.
 1. **Problem 1:** then $P = 1$ always!
 - Micro: p is the price *relative* to basket of all other goods
 - Macro: the price of the basket relative to itself is always one. Do absolute prices matter?
 2. **Problem 2:** what is an “aggregate” drop in demand anyway?

No problem for supply here: can have supply of aggregate good going down, e.g., higher TFP.

 - Micro: demand shock shifts demand for a good *relative* to other goods
 - Macro: how do we map “aggregate” to “relative”? If one good, then demand = income.
- Lesson: extrapolating from micro to macro can be tricky/misleading
 - Macro is GE (general eq'm of multiple markets and decisions), not just aggregation!
 - In GE, “prices” mean “relative prices,” not the *nominal* price level (which may or may not matter, depending on nominal frictions)

Solution: “aggregate” = “relative to future”

- Standard resolution: “aggregate” = “relative to future”
 1. Prices are prices of goods today vs. tomorrow = interest rates
 2. Demand shock: shift in the demand for goods today *relative* to tomorrow
vs. supply shock: *absolute* decline in supply today and/or tomorrow.
 - Formalize as a shock to intertemporal preferences: discount factor β goes up
 - Interpretation: drop in spending because credit is tight, uncertainty has increased, ...
- So now we have a conceptual way to think about demand shocks in general equilibrium. Will they indeed cause business cycles? How about supply?
 - Rest of class: demand & supply shocks in general equilibrium models with optimizing households & firms
 - As we've seen, this is the modern methodological tradition in macroeconomics. Macro = micro blocks subject to shocks, interacting in GE.

Roadmap for business-cycle half

1. Neoclassical growth model + supply & demand shocks

Same model that we used for long-run growth. Is it also useful to understand cycles?

- Supply shocks will generate something that looks like the cycle, demand shocks won't
- Limitations: demand probably does matter, plus model is silent on inflation
“Classical dichotomy” – real & nominal variables separate, demand irrelevant.

2. Detour: enriching the household and firm problems

- Add borrowing constraints/financial frictions to household & firm problems
- Why? will allow us to give a deeper interpretation to “demand” shocks

3. Making demand shocks matter: New Keynesian model

- Prevent prices from adjusting (“nominal rigidities”). Demand and monetary policy matter.
- What should the Fed do? How about fiscal policy?

MIT OpenCourseWare
<https://ocw.mit.edu/>

14.05 Intermediate Macroeconomics
Fall 2025

For information about citing these materials or our Terms of Use, visit: <https://ocw.mit.edu/terms>.