Objectives

- Build a theoretical model of the macroeconomy
- Study the features of recessions driven by supply shocks
- Study the features of recessions driven by demand shocks
Introduction

- Modern macroeconomics is micro–based
- It views the economy as collections of
  - households
  - firms
- It consists of a set of assumptions on their objectives and information, which in turn imply economic decisions
- Household’s and firms’ decisions are reconciled in markets.
Nominal Rates, Inflation, Real Rates

- Think of a zero-coupon bond that pays 100 at maturity and is currently priced at 96.15
- Its nominal yield to maturity $i_t$ is determined by:
  \[ 96.15 = \frac{100}{1+i_t} \]
- What’s its expected real yield?
  - Let inflation expectation be $\pi^e = \frac{P_{t+1}^e}{P_t} - 1$, where $P_t$ is the current CPI and $P_{t+1}^e$ is expected CPI at maturity
  - Then the expected real yield $r_t$ solves
    \[ \frac{96.15}{P_t} = \frac{100/P_t^e}{1 + r_t} \]
    \[ 1 + r_t = \frac{1+i_t}{1+\pi^e} \]
    - It follows that $1 + r_t = \frac{1+i_t}{1+\pi^e}$
    - The standard approximation is $r_t = i_t - \pi^e$
Nominal Interest Rates and Inflation

Hungary – Realized Inflation and Nominal Yields

Yield on 6-month T-Bill

Rate of inflation

Source: National Bank of Hungary
Hungary – Realized Real Yields

Source: National Bank of Hungary
Markets

- The decisions taken by firms and households are reconciled in the marketplace

- Market for labor
  - Demand: From firms
  - Supply: From households
  - Price: Real wage rate

- Market for goods
  - Demand: From households (consumption goods) and firms (investment goods)
  - Supply: From firms
  - Price: Real interest rate
General Equilibrium
General Equilibrium: All markets clear
Financial Assets
Introducing money and other financial assets

- Households save in two types of assets
  - Money, yielding a zero nominal return
  - All other assets, yielding a positive nominal return \( i \)

- For the time being, money will consist of
  - Currency in the hands of the public
  - Checkable deposits
Money Supply

- For the time being, think of the supply of money as being perfectly controlled by the central bank
- It is not exactly true, but it is close enough
Money Demand

- We assume that $M^d = P \times f(Y, i)$
- The demand for money from the general public $M^d$
  - Decreases with the yield of other securities $i$, where $i = r + \pi^e$ and $\pi^e$ is expected inflation
  - Increases with the amount of transactions, which in turn is a function of total income $Y$
  - Increases one-for-one with the price level $P$
Equilibrium in financial assets markets

- Households must split their wealth across the only two assets, i.e. money and everything else.
- Therefore aggregate household wealth must equal $M^d + NM^d$, where $NM^d$ is the demand for non-monetary financial assets.
- On the other hand, since money and non–monetary assets are the only financial assets in the economy, their supply $M + NM$ must also be equal to aggregate household wealth.
- It follows that $M^d + NM^d = M + NM$ or $(M^d - M) + (NM^d - NM) = 0$.
- When the market for money clears, the market for the other asset must clear as well.
- Takeaway: We only need to take keep track of the market for money.
• We now have three markets to keep track of: goods, labor, money
• Recall from above that goods and labor markets pin down both the real rate $r$ and the income level $Y$
• It follows that – for stable inflation expectations $\pi^e$ – the market for money simply pins down the current price level

\[ M = P \times f(Y, r + \pi^e) \]
Application #1 – Supply Shocks and Business Cycles
A negative temporary supply shock
According to our theory, a negative temporary supply shock induces:

- A drop in income, employment, and wages
- An increase in interest rates
- A burst of inflation
Empirical on evidence supply shocks–driven recessions: Oil shocks in the 1970s

● 1973-74: OPEC imposed an oil embargo that greatly increased oil prices
  ○ On average, real wages declined by 5%
  ○ Consumption declined by 1.8%
  ○ Investment declined by 11.1%
  ○ Real rates rose
  ○ Inflation rose

● 1979-80: The Iranian revolution severely disrupted oil supplies and led to higher oil prices
  ○ On average, real wages declined by 8%
  ○ Consumption declined by 2.3%
  ○ Investment declined by 9.0%
  ○ Real rates did not rise
  ○ Inflation rose
Inflation was up during the 1973 and 1979 recessions.

Source: Bureau of Labor Statistics
Application #2 – Demand Shocks and Business Cycles
A negative temporary demand shock
Sticky Prices

- If companies adjust prices immediately upon a change in demand conditions, demand shocks have the only effect of leading to a decline in the price level.

- If companies adjust prices with delay, demand shocks can actually cause economic recessions. The reason is that in such scenario:
  - a negative demand shock will lead to an imbalance in the goods market
  - as a consequence, firms will scale down operations, reducing hours and hiring, laying off workers
Evidence on Sticky Prices

- Bils & Klenow (2004) analyzed 350 categories of goods and services covering about 70% of consumer spending
  - Half prices have a duration of less than 4.3 months
  - Excluding temporary price cuts (sales), half of prices last less than 5.5 months

- Nakamura & Steinsson (2008)
  - The median duration of nonsale price changes is between 7 and 9 months
  - The frequency of price increases covaries strongly with the inflation rate, while the frequency of decreases does not
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Demand Shocks and Labor Markets
According to our theory, a negative temporary demand shock induces:

- A drop in consumption, investment, income and employment
- A decline in interest rates
- A decline in inflation
- With real wage rigidity, an increase in unemployment
Empirical evidence on the Great Recession

- Consumption, investment, and GDP declined
- Unemployment increased
- Employment and labor force participation declined
- Real wages changed very little
- Real rates declined
- Inflation declined
Inflation during the Great Recession

Inflation
Annual Growth Rate of Core CPI

Source: Bureau of Labor Statistics
Real yields during the Great Recession

10-Year Treasury Inflation-Indexed Security
Annualized Yield

Source: Board of Governors of the Federal Reserve System
Growth in real wages during the Great Recession

Quarterly Growth in Real Hourly Earnings —– Private Sector

Annualized Rates

Source: Bureau of Labor Statistics
Unemployment during the Great Recession

![Graph showing Employment/Population Ratio with data points from 1980 to 2017. The graph indicates a decline in the ratio during the recession, with a notable drop in 2009 and a slow recovery thereafter.]

Source: Bureau of Labor Statistics
Employment Rate during the Great Recession

Unemployment Rate

Source: Bureau of Labor Statistics
1. Modern macro conceptualizes the economy as a collection of firms and households that take decisions that maximize shareholder value (firms) and utility (households).

2. In general equilibrium, their decisions are reconciled by movement in interest rates, wages, and the price level.
Takeaways

3. What are the effects of a negative supply shock?
   ◦ A decline in income, consumption, investment, employment
   ◦ An increase in real rates and inflation
   ◦ With real wage rigidity: An increase in unemployment


5. What are the effects of a negative demand shock?
   ◦ If price adjustment is slow, a decline in income, consumption, investment, employment
   ◦ A decline in real rates and inflation
   ◦ With real wage rigidity: An increase in unemployment