Economics 2 Fall 2024 **Emmanuel Saez** 

## LECTURE 18 Monetary Policy



### I. OVERVIEW

### Determination of Short-Run Output: The "Keynesian Cross"



### Two More Things that Can Shift PAE

- Monetary Policy: Actions taken by the central bank to affect nominal and real interest rates.
- Disruptions in Financial Markets: Specifically, a financial crisis.

### II. INTEREST RATES, MONEY, AND THE FEDERAL RESERVE

### **Different Interest Rates**

- In practice, many different (nominal) interest rates.
- Interest rates depend especially on:
  - The riskiness of the bond or loan:
    - Riskier bonds pay higher interest because they may default.
      Loans to businesses (corporate bonds) typically riskier than loans to government (govt bonds).
  - Its maturity (time horizon).
    - Example: 10-year US bond: you loan \$100 to US government, you get interest i=5% each year. US govt repays you \$100 after 10 years (bond matures)
- However, different nominal interest rates generally move together. We talk about "The interest rate"

### **Interest Rates on Bonds of Different Riskiness**



Riskiness of bonds is evaluated by financial firms using letters: (Moody's, S&Ps, Fitch): AAA is safest, AA, A, BBB, ..., C, D are riskiest (junk bonds)

### Quiz on interest and risk

Suppose you have \$10K to save for one year. Which bond would be most attractive to you?

- A. A safe Federal Government Treasury bond that pays an interest rate of 5% (risk of default is zero).
- B. An BBB corporate bond with interest rate of 10% but where I can lose it all with 5% chance (if company goes bankrupt).
- C. A CCC junk corporate bond with interest rate of 15% but where I can lose it all with 10% chance (if company goes bankrupt)
- D. I am indifferent between A, B, C.

### **Interest Rates on Bonds of Different Maturities**



Source: Board of Governors of the Federal Reserve System (US)

myf.red/g/1bfeO

In principle: interest on long-term maturity bond of 2 or 5 years reflects expected average interest on short-term bonds over the next 2 or 5 years

### **Bonds with Different Maturities**

1) You save \$1 in a 1-year Treasury bond with annual interest i<sub>1</sub>. After 1 year, you get \$1+i<sub>1</sub>

Suppose you re-save in a 1-year Treasury bond next year that will pay interest  $i_{1n}$  where n denotes "next year".

You get  $(1+i_1)(1+i_{1n}) \approx 1+i_1+i_{1n}$ 

2) You save \$1 in 2-year Treasury bond with annual interest  $i_2$ . After 2 years, you get  $\approx$  \$1+2 $i_2$ 

You are indifferent between the 2 options if  $i_2 = (i_1 + i_{1n})/2$ 

 $i_1$  and  $i_2$  today tell us what the market expects for  $i_{1n}$ 

### Quiz

3-year Treasury bonds currently pay annual interest 4% but 1-year Treasury bonds pay 4.5%. This means that:

- A. The market expects interest on 1-year treasury bonds to increase in the next two years
- B. The market expects interest on 1-year treasury bonds to decrease in the next two years
- C. The market expects interest on 1-year treasury bonds to stay the same in the next two years
- D. None of the above necessarily

### Money

- Money is an asset that has 3 characteristics:
  - Medium of exchange (=can be used to make purchases)
  - Unit of account (=all prices are quoted in the money unit)
  - Store of value (=wealth can be held in the form of money)
- Historically: money was precious metals (gold and silver coins and ingots).
- Today: money is currency=cash (coins, paper bills)+ balances in checking accounts. Money typically does not pay interest but can be used for purchases
  - M0=cash (\$2 trillion), M1=M0+checking accounts (\$5T),
    M2=M1+savings accounts (\$15T)

### Quiz

How many of the money characteristics (medium of exchange, unit of account, store of value) does the crypto currency bitcoin have?

- A. 0
- B. 1
- C. 2
- D. 3

### **Commercial Banks and Money**

- Commercial Bank is a business that:
  - Takes and safeguards deposits (e.g. checking accounts)
  - Uses 90% of these funds to provide loans (e.g. mortgages, consumer credit loans, business loans). 10% is reserve.
- Banks borrow short (depositors can cash out anytime) and lend long (loans are for years)
  - Risk of bank run if depositors all cash out [<u>Diamond-Dybvig</u>].
    Federal government provides insurance (FDIC) to all deposits since 1933 to eliminate bank run risks
  - Bank activity "creates" money as both depositor and borrower have access to the same funds.

### The Federal Reserve and Monetary Policy

- The Fed (=US Central Bank) is the only institution that is allowed to put money (dollars) into circulation.
- It does this by printing money (literally and now mostly electronically) and trading it for financial assets (most often short-term U.S. government debt = US Treasury bills or bonds).
- These actions are called "open-market operations."
- Note: when the Fed does this, it isn't adding to government spending or making transfer payments to banks or individuals (it isn't engaging in fiscal policy).

### Fed (US Central Bank) has 3 functions

- Price stability: Ensure that price inflation stays low and stable around 2% per year
- Maximum employment: Ensure that the economy is at the normal output Y\* with efficiently low (but nonzero) unemployment (say around 4%)
- Financial stability: Fed is also lender of last resort for banks. Can loan any amount to any financial institution.

The first two sometimes referred to as dual-mandate

### Money production and government

- Money is a useful tool for unit of account and exchanges
- Historically: gold/silver had to be mined => costly to produce money
- Today: money is produced at essentially zero cost by central bank
- Great innovation which also gives government the powerful tool of monetary policy to stabilize the business cycle

### Downside risk of money mismanagement

- Excess money creation can sometimes debase the currency (sustained inflation, hyperinflation).
- Generally happens when government directly sells government debt to the central bank in exchange of new money to fund government expenses
- This is called monetization of government debt which mixes fiscal and monetary policy
- Making the central bank independent from the rest of government mitigates this risk (US Fed, EU central bank are largely independent)

### Modern Monetary Policy Analysis: Fed Controls the Short-Run Nominal Interest Rate

Fed uses two tools to move nominal interest rates ("conventional" monetary policy):

- Fed chooses interest rate i paid on banks' "reserves" (as reserves held by banks are deposited at Fed). Higher i makes reserves more attractive to banks (reduces bank loans and hence money)
- 2) Fed buys/sells Treasury bills (=short-term govt bonds) through open-market operations:
  - Fed creates money by buying Treasury bills in exchange of newly created money (and conversely)
  - Buying Treasury bills lowers the interest govt needs to pay on them (and conversely)

### Nominal Interest Rate chosen by the US Fed



#### Federal funds effective rate is the nominal interest rate set by fed.

### Nominal Interest Rate chosen by the US Fed



# Federal funds effective rate is the nominal interest rate set by fed. Interest rate on 3-month Treasury Bill follows very closely.

### Quiz

Why do the Fed funds rate and the interest rate on short-term Treasury bonds follow each other closely?

- A. The market expects interest on 1-year treasury bonds to increase in the next two years
- B. The market expects interest on 1-year treasury bonds to decrease in the next two years
- C. The market expects interest on 1-year treasury bonds to stay the same in the next two years
- D. None of the above necessarily

### **Money Demand Curve Economy Wide**



Money demand declines with interest i because money does NOT pay interest. Interest is the opportunity cost of holding money

### **Money Demand Curve and Fed Money Supply**



Money demand declines with interest i because money does NOT pay interest. Interest is the opportunity cost of holding money

### Fed Money Supply = Control on Nominal Interest Rate



Money demand declines with interest i because money does NOT pay interest. Interest is the opportunity cost of holding money

### The Fed's Ability to Influence the Real Interest Rate—the Short Run

- As we have seen, the Fed can change "the" nominal interest rate, i.
- Recall: real interest rate r = i π, and there is nominal rigidity: prices are rigid so that inflation moves relatively slowly
- So: When the Fed changes i, it changes r.

# Nominal and Real Interest Rates (1-year nominal interest rate, and 1-year nominal rate minus 1-year inflation rate)



Fed sets the nominal interest rate (blue line) which affects the real interest rate (red line) as inflation does not respond quickly due to nominal rigidities

### Takeaways

- The Fed has a variety of tools that allow it to affect "the" nominal interest rate.
- Effectively: decreasing the nominal interest rate means increasing money supply (and conversely)
- In the short run, when the Fed changes the nominal interest rate, the real interest rate moves in the same direction.

### III. MONETARY POLICY AND SHORT-RUN MACROECONOMIC FLUCTUATIONS

### The Real Interest Rate and Planned Aggregate Expenditure (PAE)

Recall:  $PAE = C + I^p + G + NX$ .

- I<sup>p</sup> decreases with interest rate r.
- Saving increases with r and therefore consumption
  C decreases with interest rate r.
- We will see later that NX is lower when r is higher.

 $PAE(r) = C(r) + I^{p}(r) + G + NX(r).$ 

**Conclusion:** An increase in r reduces PAE at a given Y through these 3 channels.

Normal interest r\* defined such that PAE(r\*)=Y\*

### Quiz

Why does investment I by firms decrease with r?

- A. Because with higher r, there is less money available for businesses to use
- B. Because the Fed sets the interest rate r
- C. Because with higher r, the present value of an investment is lower
- D. All of the above
- E. None of the above necessarily

### Normal interest rate r\* defined such that PAE(r\*)=Y\*



In the long-run, economy produces normal output Y\*, which defines the normal interest rate r\* such that PAE(r\*)=Y\*

### An Increase in the Real Interest Rate by Fed lowers PAE



If r>r\* then PAE(r) crosses Y diagonal at Y<sub>1</sub> below Y\*

### A Decrease in the Real Interest Rate lifts PAE up



If r<r\* then PAE(r) crosses Y diagonal at Y<sub>2</sub> below Y\*

The Fed's Ability to Influence the Real Interest Rate—the Short Run versus the Long Run

- The Fed can affect the real interest rate in the short run (Keynesian macroeconomics)
- However, in the long run, r must be at the level that equilibrates S\* and I\*—that is, it must equal r\* [this is the normal interest rate where PAE=Y crosses at Y\*]
- The Fed cannot keep r away from r\* indefinitely (as we will discuss later)

### Quiz

In the model, why is there a single interest rate r\* such that PAE(r\*)=Y\*?

- A. Because in the long-run, the economy goes back to Y\*
- B. Because the PAE decreases with r
- C. Because the Fed can only affect r in the short-run
- D. All of the above
- E. None of the above necessarily
# **Monetary Policy**

- Actions taken by the central bank to affect nominal and hence real interest rates.
- Contractionary monetary policy: Federal Reserve actions to increase nominal and hence real interest rates => Decreases output Y in short-run
- Expansionary monetary policy: Federal Reserve actions to decrease nominal and hence real interest rates => Increases output Y in short-run

Why Might the Central Bank Undertake Expansionary or Contractionary Monetary Policy?

- To offset some other force that is shifting the PAE line (countercyclical monetary policy).
  - We'll discuss an example at the end of lecture (monetary policy in the Great Recession).
- To pursue some other objective.
  - We'll discuss the Fed's main other objective next lecture: inflation.
- A mistake.
  - Example: Monetary policy in the Great Depression.

#### Nominal Interest Rate chosen by the US Fed



During recessions (grey bars): Fed reduces interest rate to stimulate the economy and cranks up interest rate during booms to prevent overheating

#### Nominal Interest Rate chosen by the US Fed



Source: Board of Governors of the Federal Reserve System (US)

myf.red/g/1ArY9

During recessions (grey bars): Fed reduces interest rate to stimulate the economy and cranks up interest rate during booms to prevent overheating

# Suppose PAE falls: Absent policy response, this generates a recession



# Combining the Effects of a Fall in PAE and an interest rate cut by the Fed



#### Industrial Production, 1927–1934



Source: Federal Reserve Bank of St. Louis, FRED.



Sources: FRED; Friedman and Schwartz, A Monetary History of the United States Money stock and bank reserves fell because many banks went bankrupt

#### Real Interest Rate, 1923–1933



Source: Federal Reserve Bank of St. Louis, FRED.

During Great Depression: Fed failed to reduce the real interest rate and this worsened and prolonged the economic downturn. Interest rate fell during New Deal of Roosevelt but WWII spending provided the strongest stimulus.

#### Monetary Contraction in the Great Depression



PAE<sub>2</sub> shows the effects of the fall in autonomous consumption.

#### Monetary Contraction in the Great Depression



PAE<sub>3</sub> shows the effect of monetary contraction and the rise in r.

#### Industrial Production, 1927–1934



Source: Federal Reserve Bank of St. Louis, FRED. Industrial production collapsed by 50% from 1929 to 1932 worse economic recession ever in the US (unemployment rate climbed to 25%)

# Limit of Monetary Policy: Zero Lower Bound for nominal interest

- Fed stimulates the economy by lowering the nominal interest rate
- Fed cannot lower the nominal interest rate below zero because economic agents can always get a zero nominal interest rate by just holding money
- This is called the Zero Lower Bound limit on monetary policy. US hit zero lower bound in 2009-2016 and 2020-21.
  Japan has been there for decades.
- Some countries such as Switzerland have experimented with negative interest rate (can be done as most money is now electronic).

#### Nominal Interest Rate chosen by the US Fed



Source: Board of Governors of the Federal Reserve System (US)

myf.red/g/1ArY9

During recessions (grey bars): Fed reduces interest rate to stimulate the economy and cranks up interest rate during booms to prevent overheating

# Central Banks in some countries have gone slightly below the Zero Lower Bound



Source: Refinitiv

A (slightly) negative interest rate is possible if banks can charge negative interest rate on bank accounts (and cash is not convenient alternative for users)

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# Poll

What would you do if banks charged a negative nominal interest rate of -5% and bank accounts? You put \$1000 in your account, after one year, you have only \$950.

- A. I would spend more to keep my account balance as small as possible.
- B. I would cash out my account and keep the cash in my wallet or at home.
- C. I would move my money to gold, bitcoin, or the stock-market
- D. I wouldn't do anything because I need my bank account and cash is not convenient

#### IV. FINANCIAL CRISES

# **Financial Intermediation**

- The process of getting saving into productive investment.
- Financial intermediaries are the markets and institutions that do this.
- Financial intermediaries include banks, investment banks, money market mutual funds, pension funds, etc.
- Simple example: your savings deposited at the bank (=saving) are used to provide a loan to a business that buys new capital (=investment)

# What Is a Financial Crisis?

- A time when:
  - A number of financial institutions are in danger of failing.
  - People lose confidence in many financial institutions.
- As a result, there is widespread disruption of financial intermediation
- Affects negatively "real economy" as businesses struggle to get access to finance (loans, etc.)

### A Stylized Bank Balance Sheet

Uses of funds (= Assets)

Loans

Sources of funds (= Liabilities)

Deposits

Reserves

Equity ("Capital") provided by bank owners

#### How an Individual Financial Institution Can Fail

- Defaults and changes in asset values can reduce the value of an institution's loans
- If the value of the loans falls to the point where they are worth less than the institution's obligations to its depositors and lenders, the institution is insolvent.
- A belief that the institution is in danger of becoming insolvent can cause depositors to withdraw their funds. Institution is then said to be illiquid
- Illiquid bank risks becoming insolvent if forced to liquidate its assets at low prices (fire sale prices)
- Fed can solve illiquid bank problems by being lender of last resort

How an Individual Financial Institution Can Fail—The Case of Silicon Valley Bank

- Many of its assets were long-term U.S. Treasury bonds (with fixed interest set when issued)
- What happens to the value of those bonds when interest rates rise?
- They fall (this is the concept of "present value" at work).
- Silicon Valley Bank became insolvent and was taken over by govt in March 2023, eventually sold to First Citizen Bank

Contagion from SVB—The Case of First Republic Bank

#### "First Republic shares' price dives on contagion fear" - Reuters, 3/13/2023



Source: MarketWatch.

# **Contagion of Crises across Financial Institutions**

- Confidence: Troubles at one institution create doubts about the health of other institutions, even if there are no connections between them.
- Linkage: Troubles at one institution directly harm other institutions because of loans, insurance contracts, and other direct links among them.
- Fire Sale: Troubles at one institution cause it to sell off assets, driving down the prices of assets held by other institutions.
- Macroeconomic: Troubles at one institution reduce PAE and hence Y, and so harm other institutions.

### Effects of a Financial Crisis on PAE

- It raises credit spreads (that is, the amounts that interest rates on risky bonds and loans exceed interest rates on safe assets).
- It may raise lending standards or otherwise reduce the availability of loans.
- It may harm consumer and firm confidence.
- All of these developments are likely to reduce PAE at a given level of Y.

#### Decline in the Number of Banks in the Great Depression

Number of Banks (1000s)



Source: <u>www.econreview.com</u>. Bernanke won Nobel prize in 2022 for documenting that bank bankruptcies disrupted business and worsened the Great Depression.

# The Effects of a Financial Crisis on Output



## The Effects of a Financial Crisis on Output



# Possible Policies to Prevent Financial Crises

- Deposit insurance (done in 1933 after Great Depression). All accounts below \$250K are insured.
- Higher "capital" requirements for financial institutions (done in 2010 Dodd-Frank Act after Great Recession)
- Regulation of risk-taking by financial institutions and linkages among financial institutions (Dodd-Frank addresses some of that, watered down since)
- Using monetary and fiscal policy to keep the economy stable

# V. UNCONVENTIONAL MONETARY POLICY: THE GREAT RECESSION AND COVID

#### Nominal Interest Rate chosen by the US Fed



Source: Board of Governors of the Federal Reserve System (US)

myf.red/g/1ArY9

During recessions (grey bars): Fed reduces interest rate to stimulate the economy and cranks up interest rate during booms to prevent overheating

#### Monetary Policy in 2007–2008



#### Monetary Policy in 2007–2008



Two Tools That Affect a Subset of Nominal Interest Rates ("Unconventional" Monetary Policy)

- The main motivation for unconventional monetary policy is that nominal interest rates cannot go (much) below zero.
  - The reason is that there is an asset—currency that offers a zero nominal rate of return for sure.
- Forward guidance: Statements or actions that influence expectations about *future* nominal interest rates.
- Quantitative easing: Buying assets other than shortterm government debt or providing liquidity to financial institutions using newly created money

## Forward Guidance in 2008 and 2009

- December 16, 2008: "The Federal Reserve ... anticipates that weak economic conditions are likely to warrant exceptionally low levels of the federal funds rate for some time."
- March 18, 2009: "[T]the Federal Reserve ... anticipates that economic conditions are likely to warrant exceptionally low levels of the federal funds rate for an extended period."

Announcing that interest rate will stay low is going to lower interest on longer maturity bonds, helping businesses and households borrow more cheaply

#### Nominal Interest Rate chosen by the US Fed



# Fed controls short-run interest rate. Longer-run interest rate (on 5-year Treasury bonds in green) responds to expectations about future short-run rate
## Fed balance sheet: Quantitative Easing since 2008

Jan 3, 2007 → Nov 8, 2023

 Federal Agency Debt and Mortgage-Backed Securities Purchases
Lending To Financial Institutions
Long Term Treasury Purchases
Providing Liquidity To Key Credit Markets
Traditional Security Holdings 10,000,000



\$4 trillion extra money created during COVID which absorbed majority of the extra Fed spending of 20 GDP points

Source: Federal Reserve Bank of Cleveland calculations based on data from Federal Reserve Board and Haver Analytics.

Source: <u>Cleveland Fed</u> By buying other assets, the Fed can help struggling bank, stabilize financial markets and influence longer term interest rates.

## Unconventional Monetary Policy, March 2020

- Quantitative easing: "the [Federal Reserve] will increase its holdings of Treasury securities by at least \$500 billion and its holdings of agency mortgage-backed securities by at least \$200 billion."
- Forward guidance: "The [Federal Reserve] expects to maintain [low interest rates] until it is confident that the economy has weathered recent events and is on track to achieve its maximum employment and price stability goals."

#### **Interest Rates on Bonds of Different Maturities**



Source: Board of Governors of the Federal Reserve System (US)

myf.red/g/1bfeO

Interest on long-term maturity bond of 2 or 5 years reflects expected average interest on short-term bonds (set by Fed) over the next 2 or 5 years

## Monetary vs. Fiscal Policy

- Government can use both monetary and fiscal policy to smooth business cycle
- Monetary policy is simpler to deploy than active fiscal policy
  - Fed chair (or central banker) decides on interest rate policy regularly
  - Active fiscal policy requires enacting new legislation (act of congress and president signature in the US)
- Monetary policy not as powerful to stimulate due to Zero Lower Bound in recent decades. Fiscal policy prominent in Great Recession and COVID.

# References

- <u>CORE-The Economy</u>, Chapter 15.
- Principles of Economics, Chapters 26.