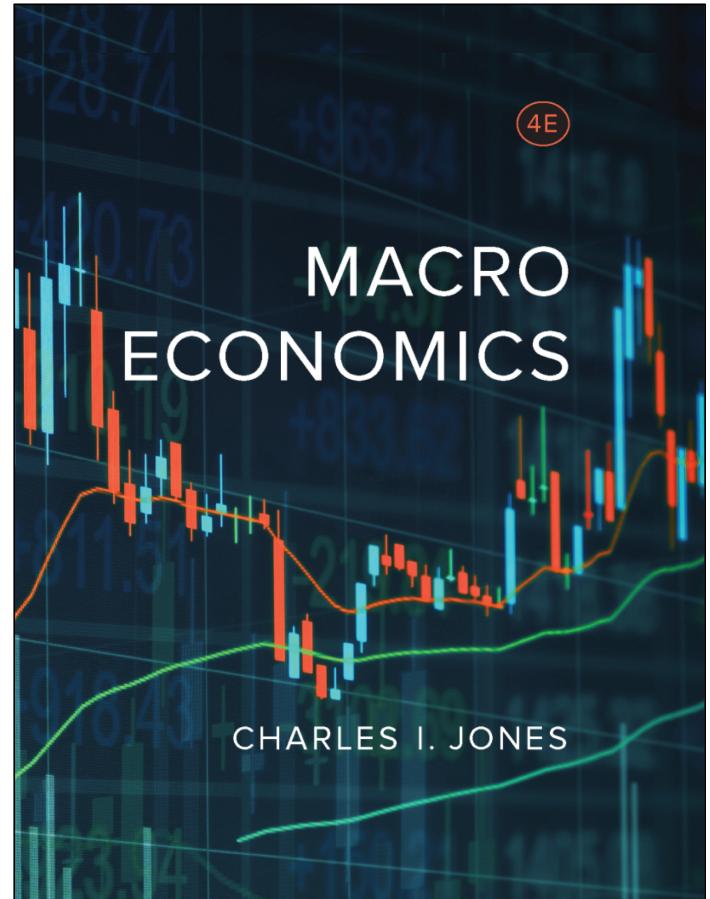


Chapter 12

Monetary Policy and the Phillips Curve



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12.1 Introduction

- In this chapter, we learn:

- How the central bank effectively **sets the real interest rate** in the short run (the **MP curve** in our short-run model)
- That the **Phillips curve** describes how **firms set their prices** over time, pinning down the inflation rate.
- How the **IS curve**, the **MP curve**, and the **Phillips curve** make up our short-run model.
- How to analyze the evolution of the macroeconomy in response to changes in policy or economic shocks.

choose nominal

Firms equation

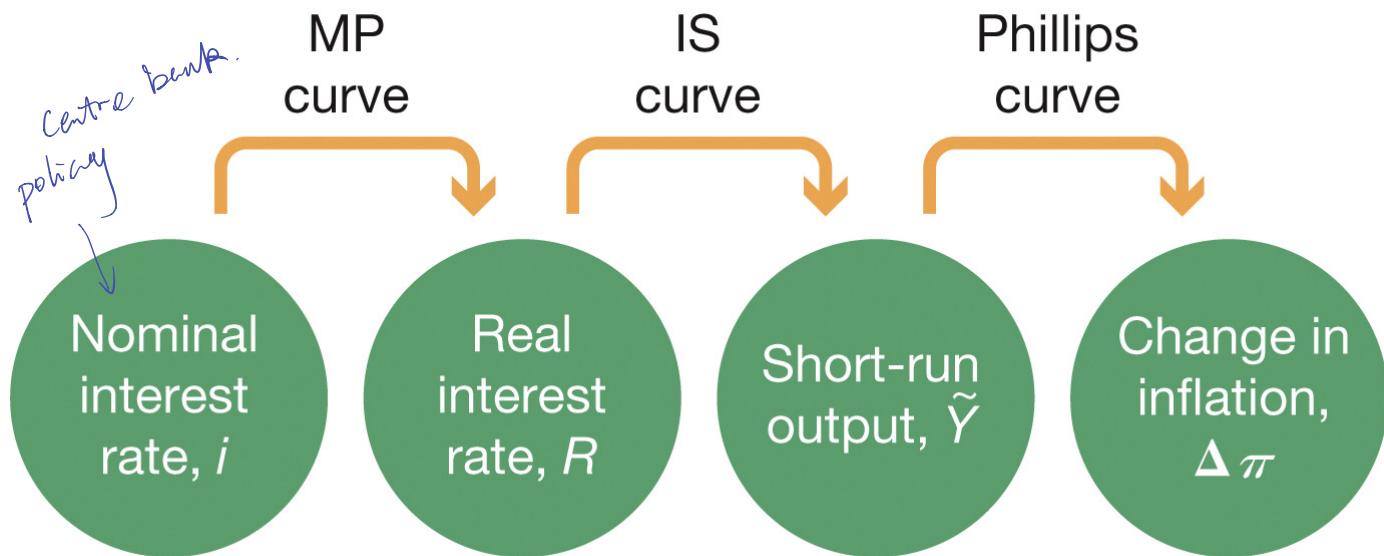
Introduction

- The federal funds rate = overnight lending rate between banks
- The short-run model summary:

Through the...	
MP Curve	nominal interest rate determine the real interest rate
IS Curve	the real interest rate influences short-run GDP
Phillips Curve	Describes the relationship between short-run GDP and inflation

The Structure of the Short-Run Model

The Structure of the Short-Run Model



12.2 The MP Curve

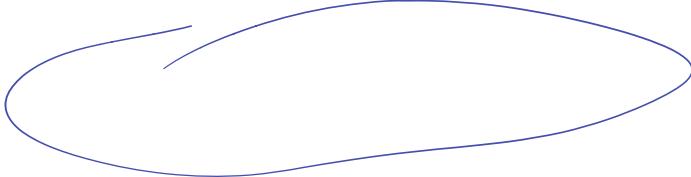
- Banks borrowing from each other must match the central bank lending rate (Federal Funds rate)
 - Banks cannot charge a higher rate
 - Everyone would borrow from the central bank
 - Banks cannot charge a lower rate
 - Everyone would borrow from commercial bank at the lower rate.
 - Then lend it back to the central bank at higher rate (arbitrage).
 - The bank would run out of resources quickly \Leftarrow constraint ('[↑]loanable deposits).

The Federal Funds Rate (Nominal Interest Rate)



Why Are Banks Borrowing / Lending From / To Each Other?

- satisfy daily reserve requirements.
 - set by the Board of Governors of Federal Reserve System
- (most recently 2019/11/17) [hyperlink](#)



recently

Small banks: x

most banks: 10%

larger 3%

From Nominal to Real Interest Rates

- Fisher equation:

$$i_t = R_t + \pi_t$$

nominal real inflation

↑ ↑ ↑

TR can set want to know not clear

↑ move much slower → but isn't actually sticky

$R_t = \bar{i}_t - \pi_t$

short run : set $i_t \rightarrow$ set R_t

From Real to Nominal Interest Rates

- Sticky inflation assumption.
- In the short run, inflation

- display inertia / stickiness
 - adjust slowly overtime
 - does not respond directly to monetary

- Central banks can set the real interest rate in the short run.

estimate.
don't know.
↓
$$\pi_t = \frac{P_{t+1} - P_t}{P_t}$$

Case Study: *Ex Ante* and *Ex Post* Real Interest Rates

- Sophisticated version of the Fisher equation:

$$i_t = R_t + \pi_t^e$$

\uparrow
expected rate of inflation.

- The rate relevant for investment decisions:

can be $\Rightarrow R_t^{\text{ex ante}} = i_t - \pi_t^e$

- The actual real interest rate

~~no guarantee~~ $R_t^{\text{ex post}} = i_t - \pi_t$.

The IS-MP Diagram – 1

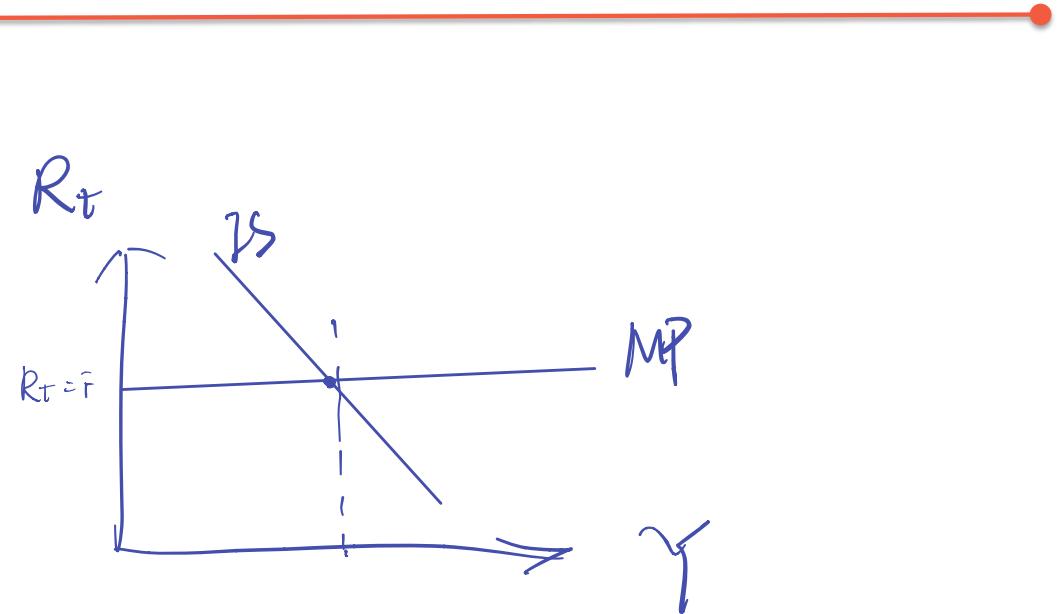
- The **MP curve**

- Illustrates the central bank's ability to set the real interest rate at a particular value (**horizontal line**)

- The **IS curve**

- Recall: Illustrates the **negative** relationship between interest rates and short-run output

The MP Curve in the IS-MP Diagram



The IS-MP Diagram—2

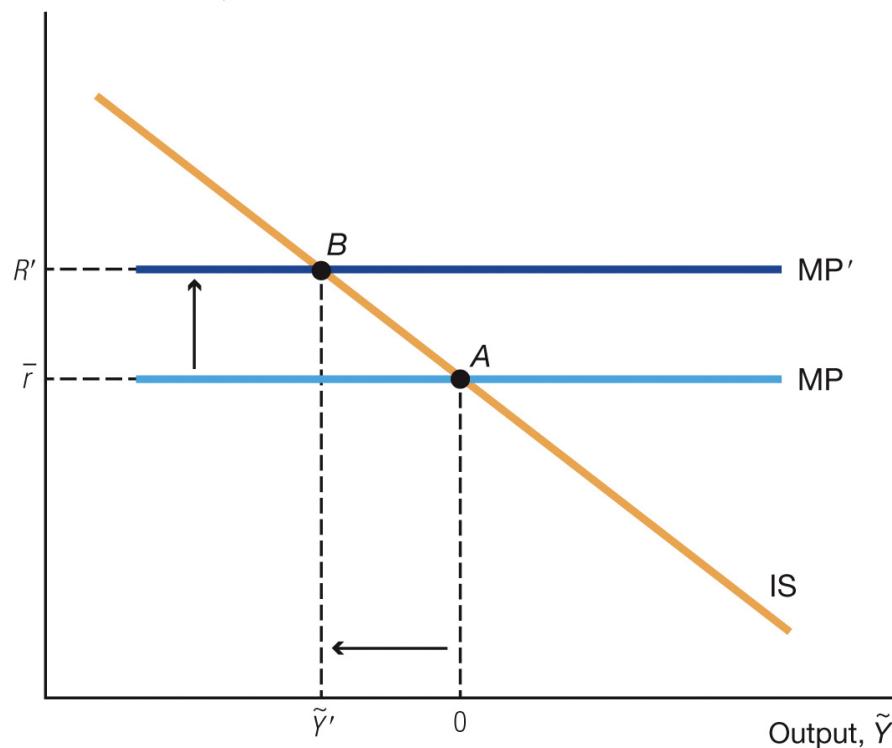
- The economy is at potential when
 - real interest rate = MPK
 - \times aggregate demand shocks
 - short run output = 0
- If the central bank raises the interest rate above the MPK

Inflation is sticky $\rightarrow \uparrow R_f$ \downarrow move along ^{IS} MP to different level $\rightarrow \downarrow$ Investment ($\downarrow Y$)

Raising the Interest Rate in the IS-MP Diagram

Raising the Interest Rate in the IS-MP Diagram

Real interest rate, R



The End of a Housing Bubble

Housing prices ↑

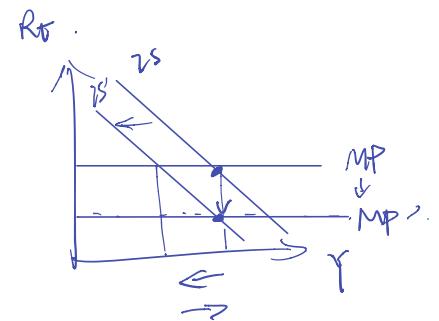


Then a shock occurs

Housing prices ↓



AD premium ↓



IS shift left



In response
the central
bank

↓ nominal
interest rate

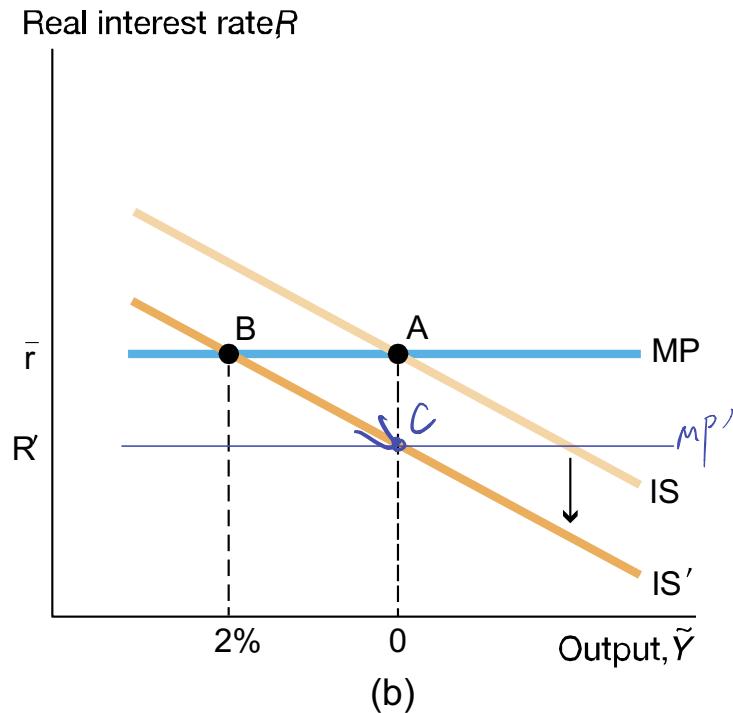
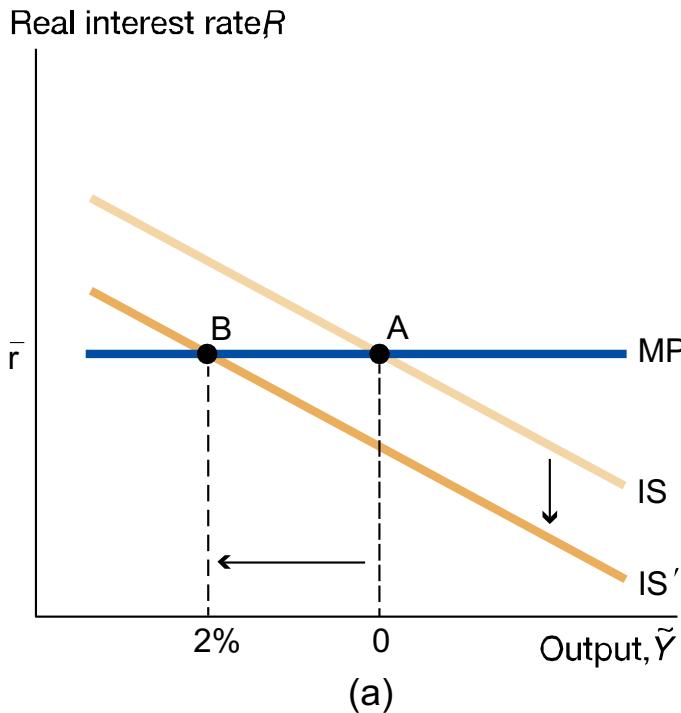


inflation is
sticky.

↓ Real
interest rate.

Stabilizing the Economy after a Housing Bubble

$A \rightarrow B \rightarrow C$.



Case Study: The Term Structure of Interest Rates

long term \Rightarrow not correlated

- Interest rates on investments of different lengths of time should yield the same return

$$i_{t+5} = E[(1 + i_t) \times \cdots \times (1 + i_{t+5})]^{1/5} - 1$$

- When the Fed changes the overnight rate

- Financial markets expect the change will persist
- Signals information about likely changes in the future
(in fact, Fed statements often discuss prospective rate decisions)
- Interest rate at longer maturities also change, but the correlation weakens as maturities rise.

12.3 The Phillips Curve

- Recall: the inflation rate is the percent change in the overall price level

$$\pi_t \equiv \frac{(P_{t+1} - P_t)}{P_t}$$

- Firms set their prices on the basis of

- their expectation of ^{the} money-wide inflation rate.
- the state of demand for their product.

Want to keep pace with inflation depend on
consumer's elasticity.

The Phillips Curve—1

■ Expected inflation

$$\pi_t = \underbrace{\pi_t^e}_{\text{expected inflation}} + \underbrace{\bar{v} \tilde{Y}_t}_{\text{demand conditions}}$$

how strong demand take condition amount into

where $\bar{v} \tilde{Y}_t$ represents **demand conditions**

■ Adaptive expectations:

- Formally written as $\hat{\pi}_t = \pi_{t-1}$
- Firms expect next year's inflation rate to be the same as this year's inflation rate
- Firms adjust their forecasts of inflation slowly.
- Embodies the sticky inflation assumption.

The Phillips Curve—2

■ The Phillips curve

- Describes how inflation evolves over time as a function of short-run output

$$\pi_t = \pi_{t-1} + \bar{\nu} \tilde{Y}_t$$

*present change
in prices.*

■ γ below potential

- price raise more slowly (anticipate ↓ demand)

■ γ above potential

- price raise more rapidly than usual.

The Phillips Curve—3

- Using the equations:

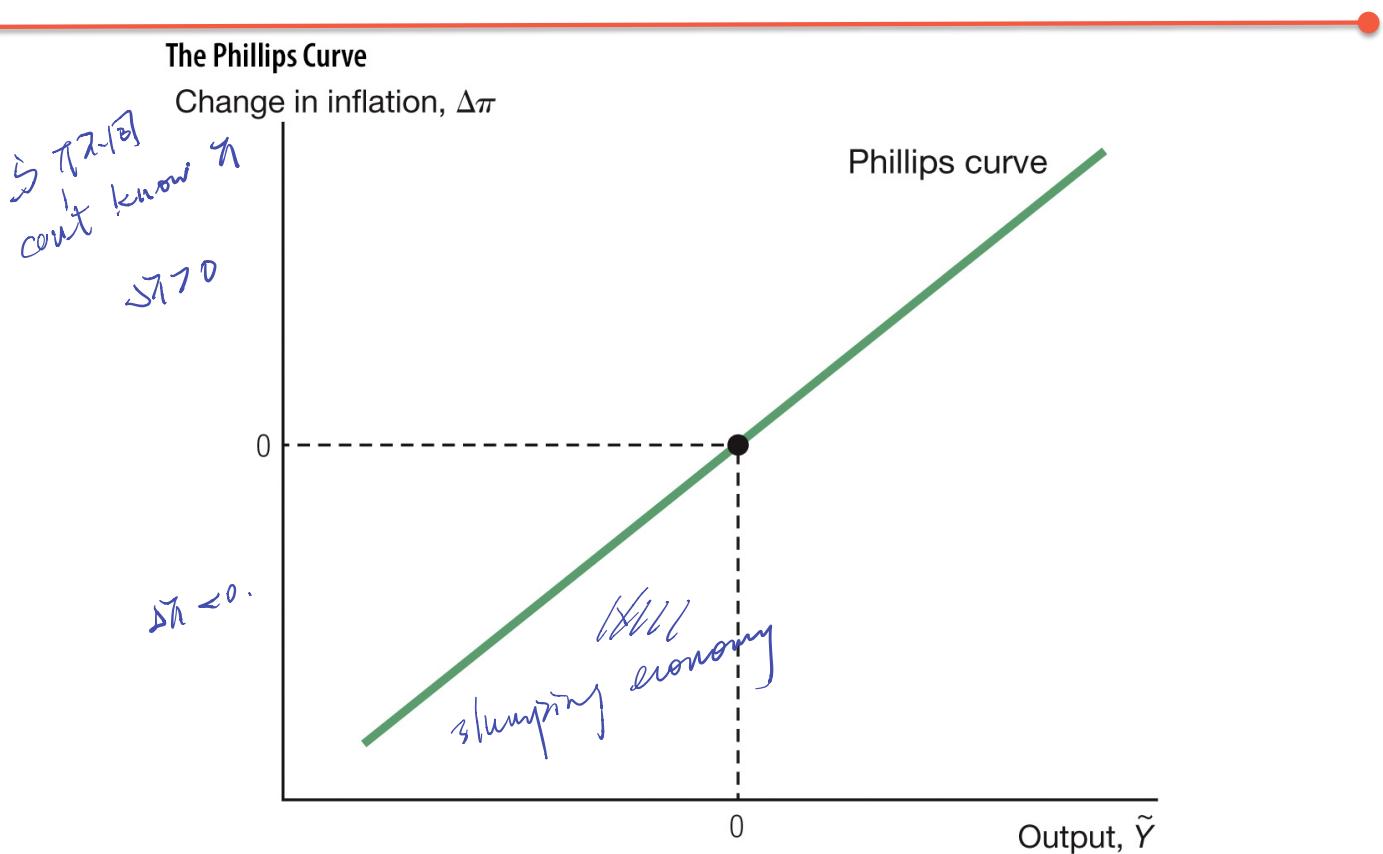
$$\pi_t = \pi_{t-1} + \bar{\nu} \tilde{Y}_t$$

$$\Delta\pi_t = \pi_t - \pi_{t-1}$$

- Therefore, the Phillips curve can be expressed as:

$$\Delta\pi_t = \bar{\nu} \tilde{Y}_t$$


The Phillips Curve—4



Price Shocks and the Phillips Curve

- We can add shocks (\bar{o}) to the Phillips curve

$$\pi_t = \pi_{t-1} + \bar{\nu} \tilde{Y}_t + \bar{o}_{\pi \text{ shock.}}$$

- Rewrite:

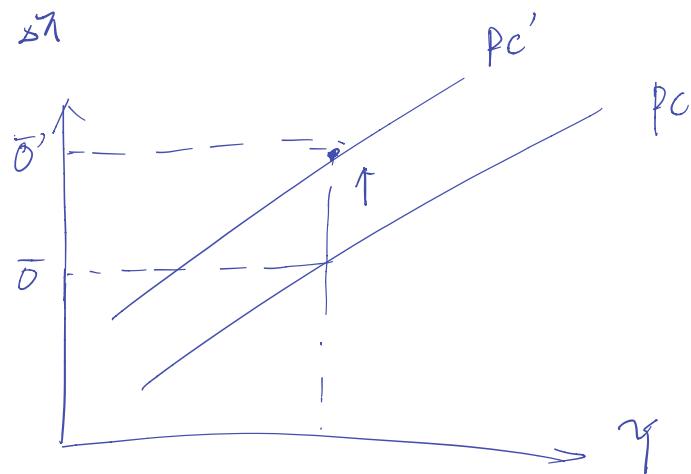
$$\Delta \pi_t = \bar{\nu} \tilde{Y}_t + \bar{o}$$

- Inflation depends on:

- Expectations of inflation
 - Demand conditions
 - Price shocks

Oil Price Shock

- Temporary upward shift in the Phillips curve



12.4 Using the Short-Run Model

■ Definition of disinflation

- ☐ decreasing rate of inflation

$$\Delta \pi < 0$$



deflation

$$\pi < 0$$



■ The Great Inflation of the 1970s

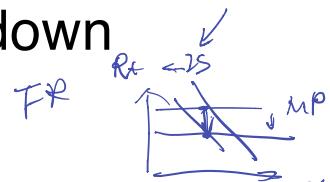
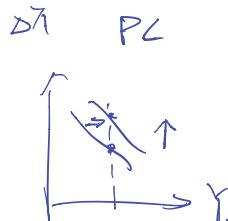
- ☐ Misinterpreting the productivity slowdown contributed to rising inflation

- ☐ How?

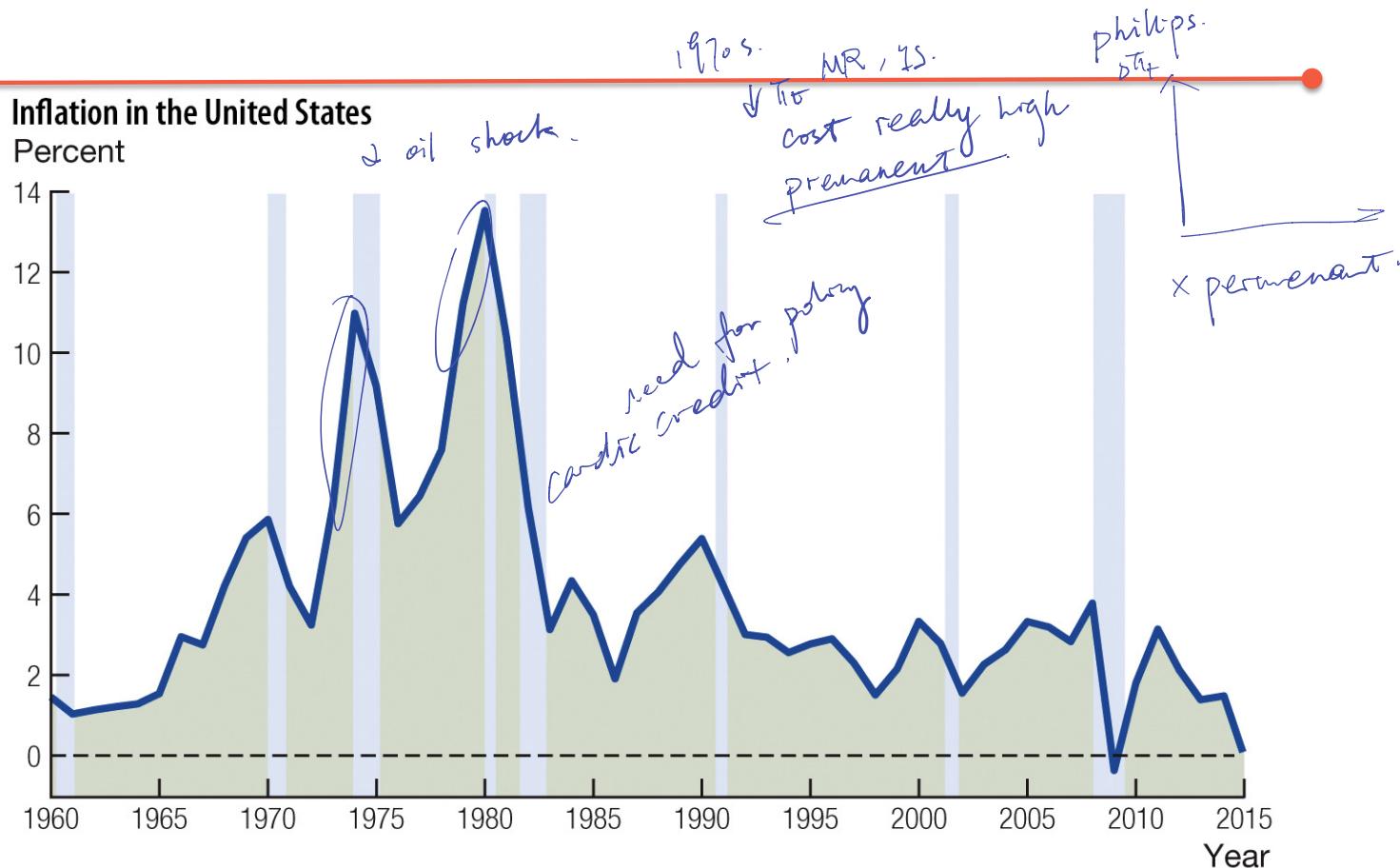
At that time,

FED: economy was headed for a recession

x period with lower productivity growth (different path of T).
(e.g. temp ℓ in T below potential)



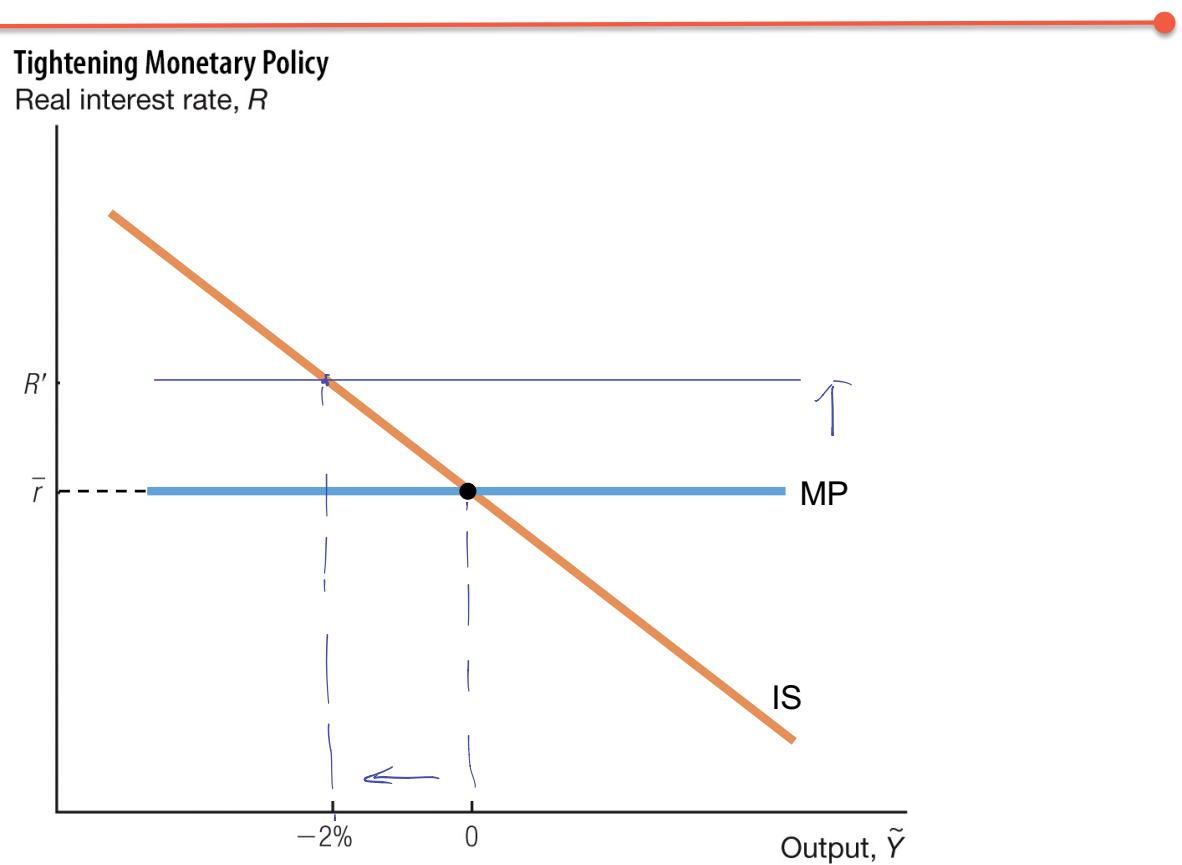
Inflation in the United States



The Volcker Disinflation – 1

- In the long run, reducing the level of inflation requires tight monetary policy
 - A sharp reduction in the rate of money growth
- Since inflation is sticky,
 - The classical dichotomy is unlikely to hold in the short run
 - A decrease in the money growth rate may not slow inflation
- The real interest rate increase induces a recession
 - The recession causes negative changes in inflation
 - As demand falls, firms raise their prices slower to sell more

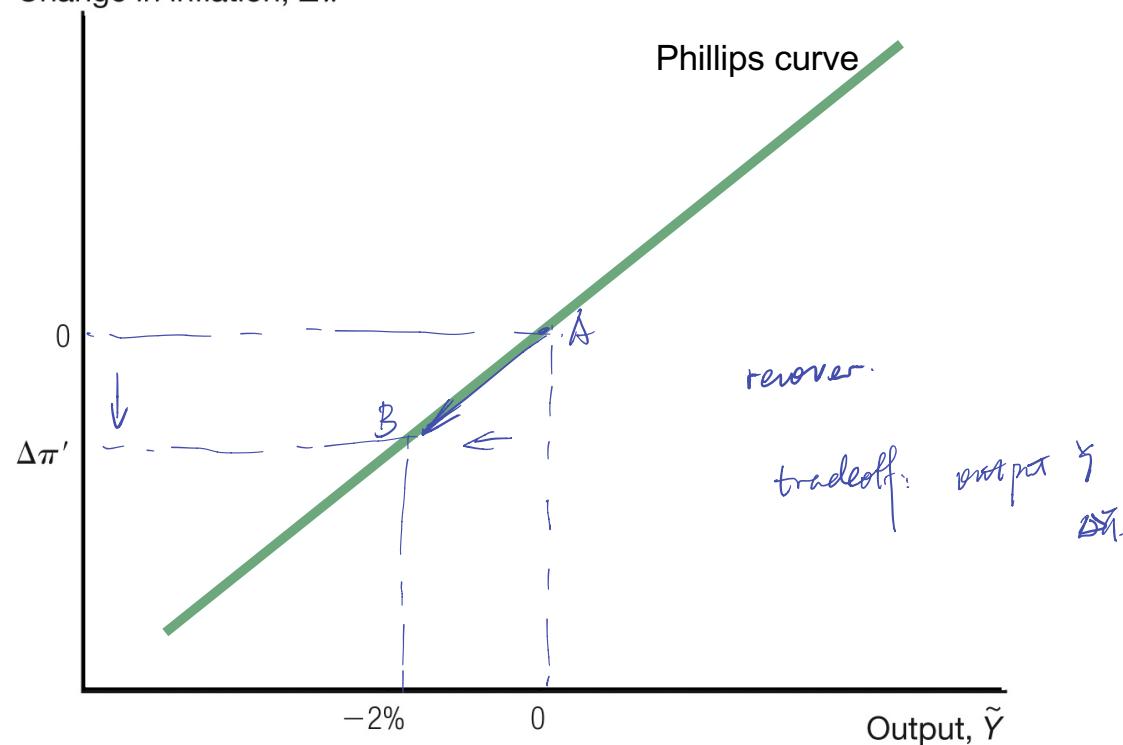
Tightening Monetary Policy



A Recession and Falling Inflation

A Recession and Falling Inflation

Change in inflation, $\Delta\pi$

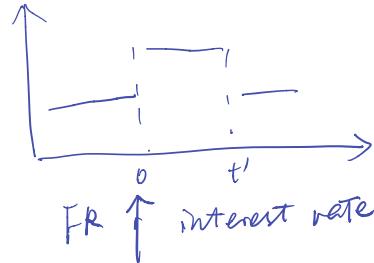


The Volcker Disinflation—2

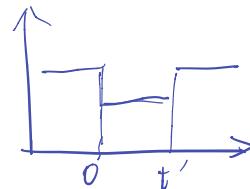
- Lowering the inflation rate
 - At the cost of a slumping economy (for a while)
 - high unemployment , lost output
- Once inflation has declined sufficiently
 - real interest rate can be raised back to MPK
 - allowing output to rise back to potential .
($\times \uparrow$ inflation)

The Disinflation over Time

disflation over time
real interest rate r_t

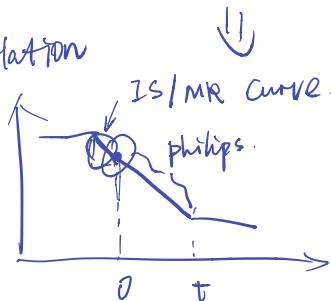


Output \tilde{Y}



↑ FR interest rate \rightarrow recession.

π_t inflation \downarrow



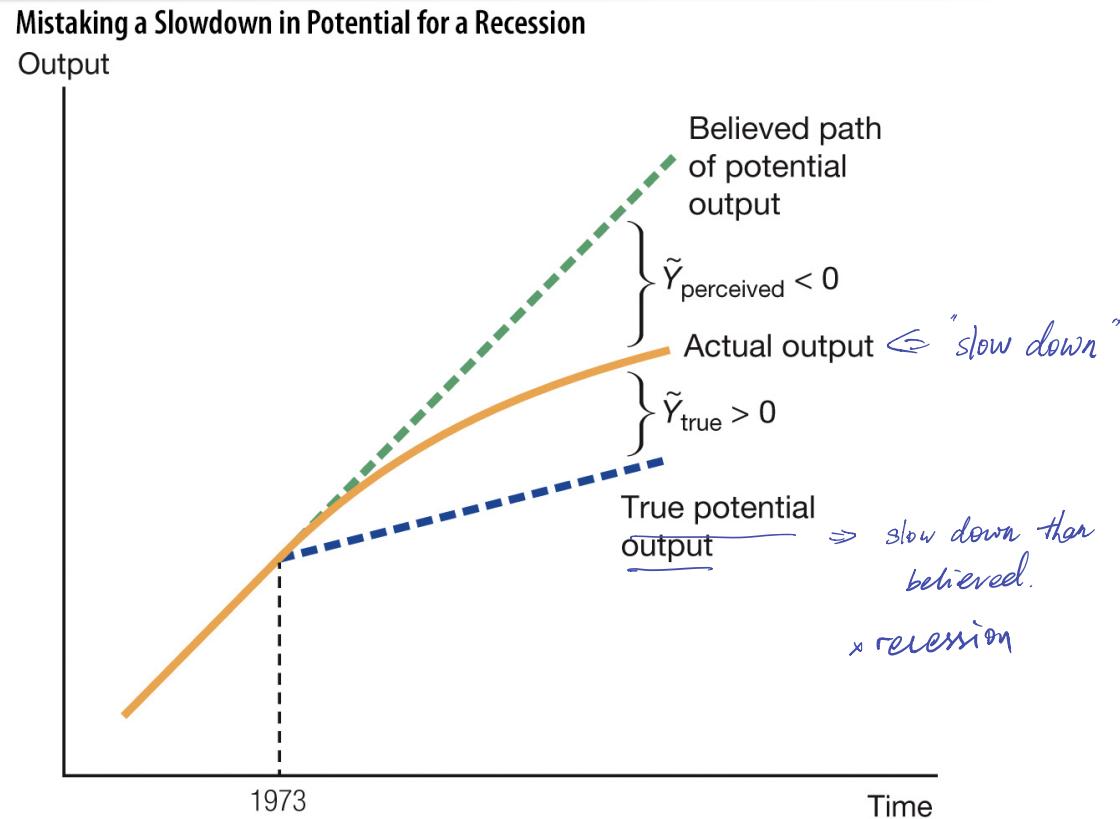
The Great Inflation of the 1970s—1

- Inflation rose in the 1970s for three reasons:
 - 1) OPEC coordinated oil price increases: Oil shock
 - 2) U.S. monetary policy was too loose
 - Fed
Policy makers thought that inflation required permanent ↑ in unemployment
 - In reality, disinflation require only temp recession
- Two “versions” of Phillips curve:
 - old I. Inflation vs short-run output
 - now II. Change in inflation vs. — — —

The Great Inflation of the 1970s—2

- Inflation rose in the 1970s for three reasons:
 - 3) The Federal Reserve did not have perfect information
 - thought the productivity slowdown as recession
 - the Fed ↓ interest \Rightarrow ↑ output above potential and generated ↑ inflation
 - However, the slowdown was a change in potential output.

Mistaking a Slowdown in Potential for a Recession



Mistaking a Slowdown in Potential for a Recession

- Federal Reserve may make analogous mistake when productivity growth *accelerates* (i.e. boom vs. slope of the potential output path steepens)
- Example:
 - Productivity growth during IT “revolution” and Fed response under Chairman Greenspan (maintain low interest rates despite low unemployment)
 - Some economists believe that Fed policy during that time fueled the housing boom and hence laid foundation for subsequent financial crisis

(↓ interest rate?)

The Short-Run Model in a Nutshell

MP curve

$$\uparrow i_t \Rightarrow \uparrow R_t$$

IS curve

$$\uparrow R_t \Rightarrow \downarrow \tilde{Y}_t$$

Phillips curve

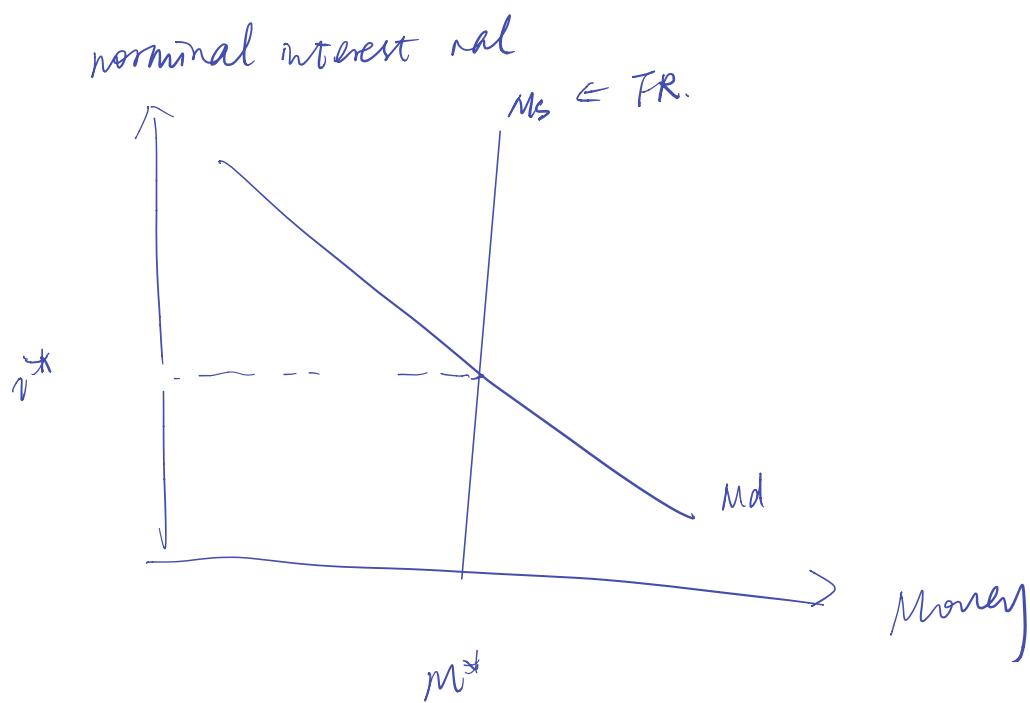
$$\downarrow \tilde{Y}_t \Rightarrow \downarrow \Delta \pi_t$$

12.6 Microfoundations: How Central Banks Control Nominal Interest Rates

The central bank controls the level of the nominal interest rate by supplying the money that is demanded at that rate

- The nominal interest rate \Leftarrow opportunity cost of holding money
- Quantity demanded of money is negatively related to the nominal interest rate

How the Central Bank Sets the Nominal Interest Rate



Money Supply and Demand

- The demand for money

- decreasing function of the nominal
 - downward sloping

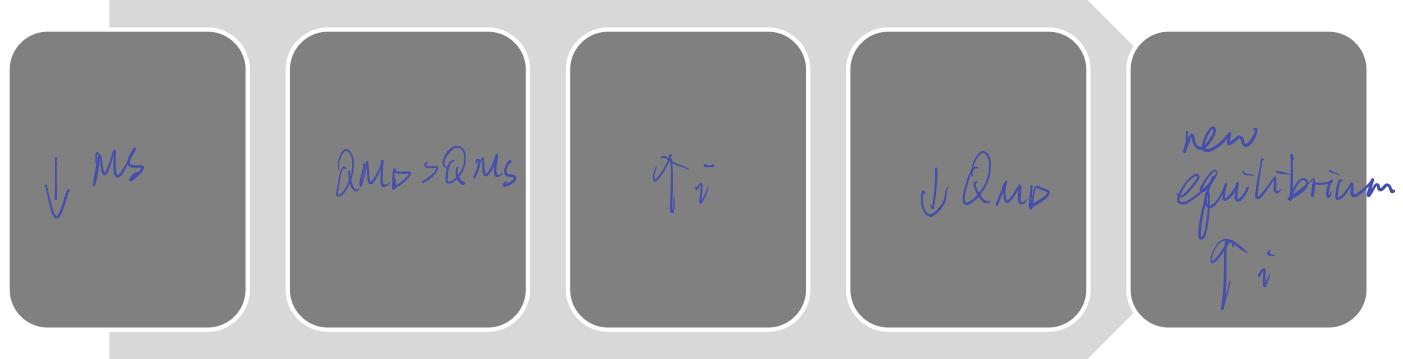
- The supply of money

- the level of money the central bank provides
 - vertical line.

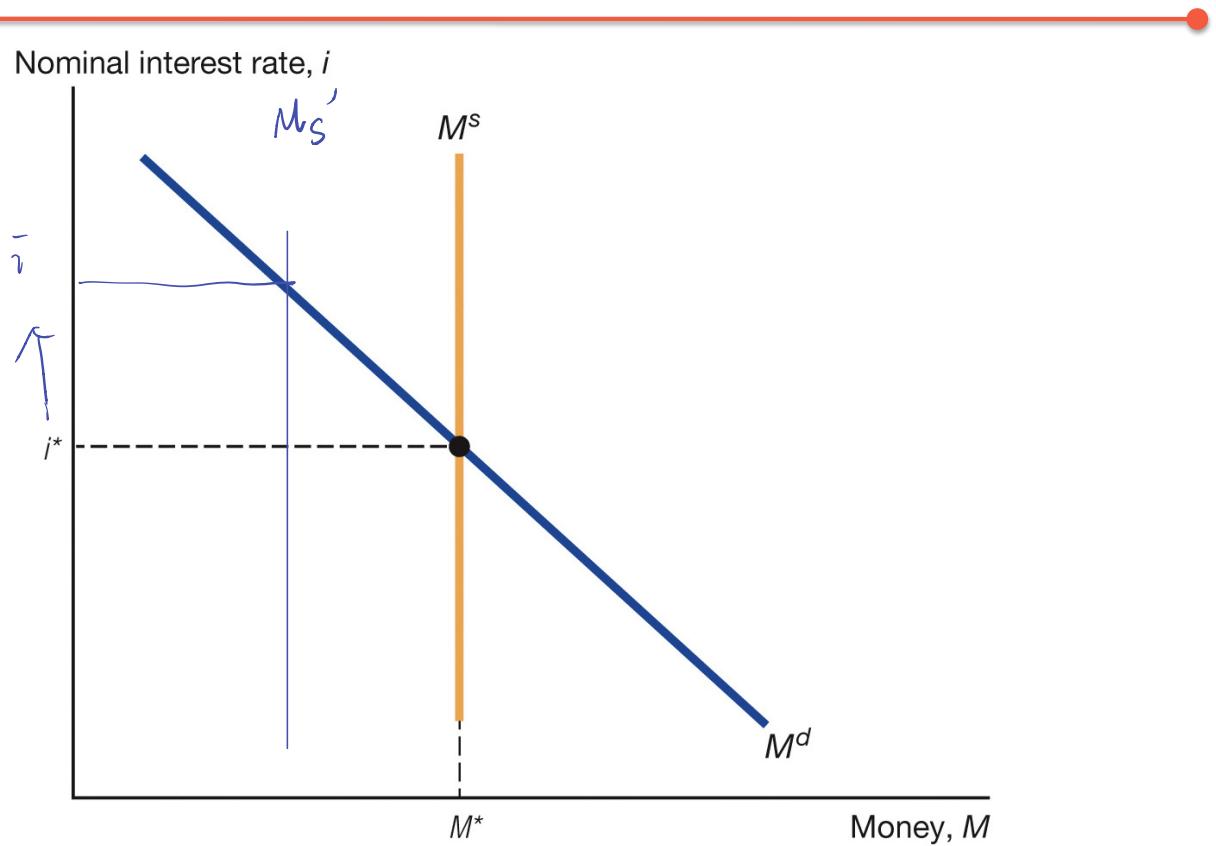
Changing the Interest Rate

- To raise the interest rate

market: high with respond.



Raising the Nominal Interest Rate



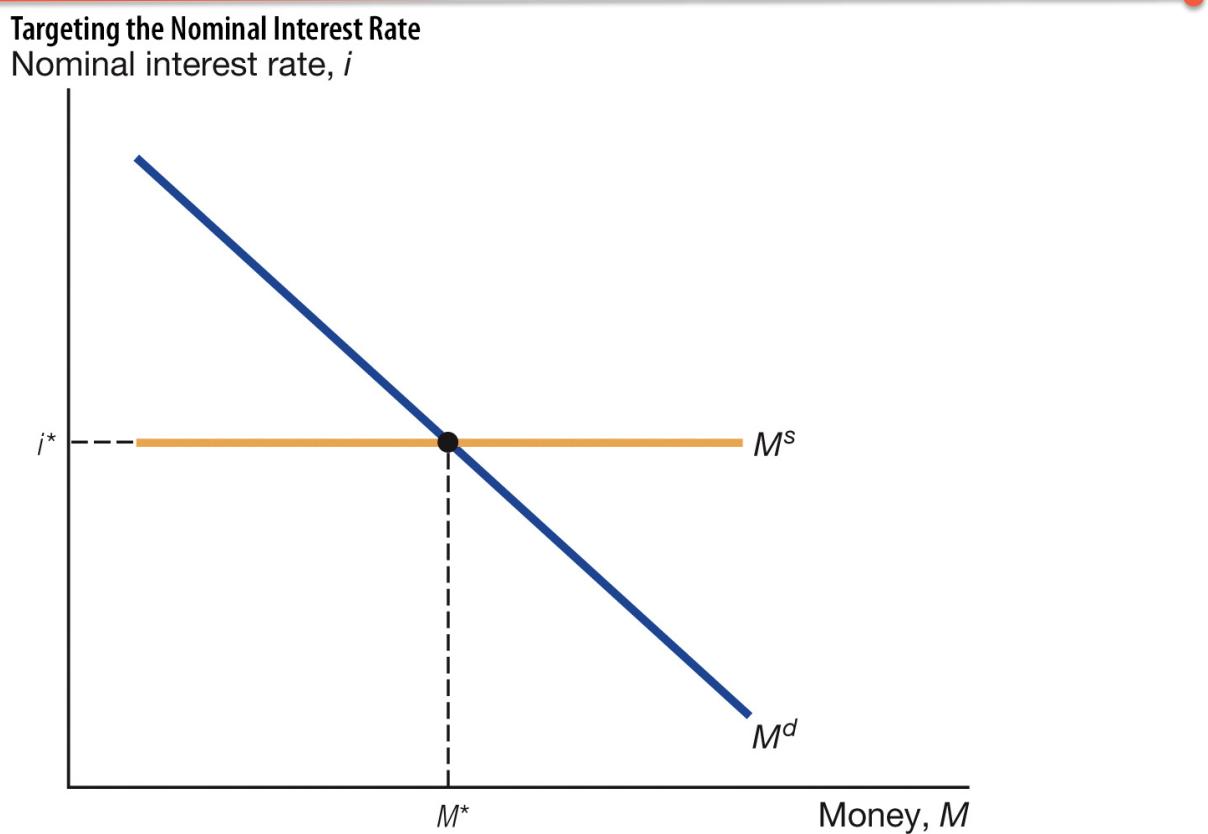
Why i instead of M ? – 1

- The interest rate is crucial even when central banks focus on the money supply
- The money demand curve is subject to many shocks, which shift the curve
 - Changes in price level
 - Changes in output (*boom/recessions abroad*).
- If the money supply is constant
 - The nominal interest rate fluctuates
 - Resulting in changes in output (*via real interest rate*)

Why i instead of M ? – 2

- The money supply schedule is effectively horizontal at a targeted interest rate
- An expansionary (loosening) monetary policy
 - ↑ money supply
 - ↓ nominal interest rate.
- A contractionary (tightening) monetary policy
 - ↓ money supply
 - ↑ the if

Targeting the Nominal Interest Rate



12.7 Inside the Federal Reserve

— Three Conventional “Tools”

1. Federal funds rate

- deposits held in accounts with the central bank
- pay no interest
- can be lent / borrowed overnight @ FFR. equity.

2. Reserve requirements

- Bank required to hold a certain fraction of their deposits

3. Discount rate

- interest rate charged by the FR on loans made to commercial banks.
→ go to bank keep balance

Open-Market Operations

- Open-market operations: The central bank trades interest-bearing government bonds in exchange for currency or non-interest-bearing reserves
- To increase the money supply, the Fed buys government bonds in exchange for currency or reserves.
- How exactly does this work?

↑ MS ← ↑ buy bonds.

Open-Market Operations – 2

12.8 Conclusion

- Policymakers exploit the stickiness of inflation.
- **Changes in the nominal interest rate change the real interest rate.**
- Through the Phillips curve, booms and recessions alter the evolution of inflation.
- Because inflation evolves gradually, the only way to reduce it is to slow the economy.