Intermediate Macroeconomics

Stabilization Policy and the AS/AD Framework

ECON 3311 – Fall 2024

UT Dallas

before: IS+MP +PC

IS/MP PC

[assumes sticky inflation]

Now: AD: Aggregate Demand

AS: Aggregate Supply

IS/MP ⟶ AD
PC ⟶ AS
} Still represent economy in the Short run

Introduction

In this lecture we will go over:

- How the **IS and MP curves can be combined** to derive the **aggregate demand (AD)** curve
- How the **Phillips curve** can be depicted as the **aggregate supply (AS)** curve
- How the **AS/AD** curves can represent the economy in the **short-run** with a single graph
- How the AS/AD model can be used to analyze modern monetary policy theories

Introduction

Is there a certain way that policy makers should respond to various shocks? That is, is there a **monetary policy rule** (formula) that should be followed?

The short-run model consists of:

IS Curve: $\tilde{Y}_t = \bar{a} - \bar{b}(R_t - \bar{r})$ → Shows (AD)

MP Curve: Federal reserve sets i_t which also determines R_t

Phillips Curve: $\Delta\pi_t = \bar{v}\tilde{Y}_t + \bar{o}$ → Shows (AS) ("Cost-push")

From previous lectures:

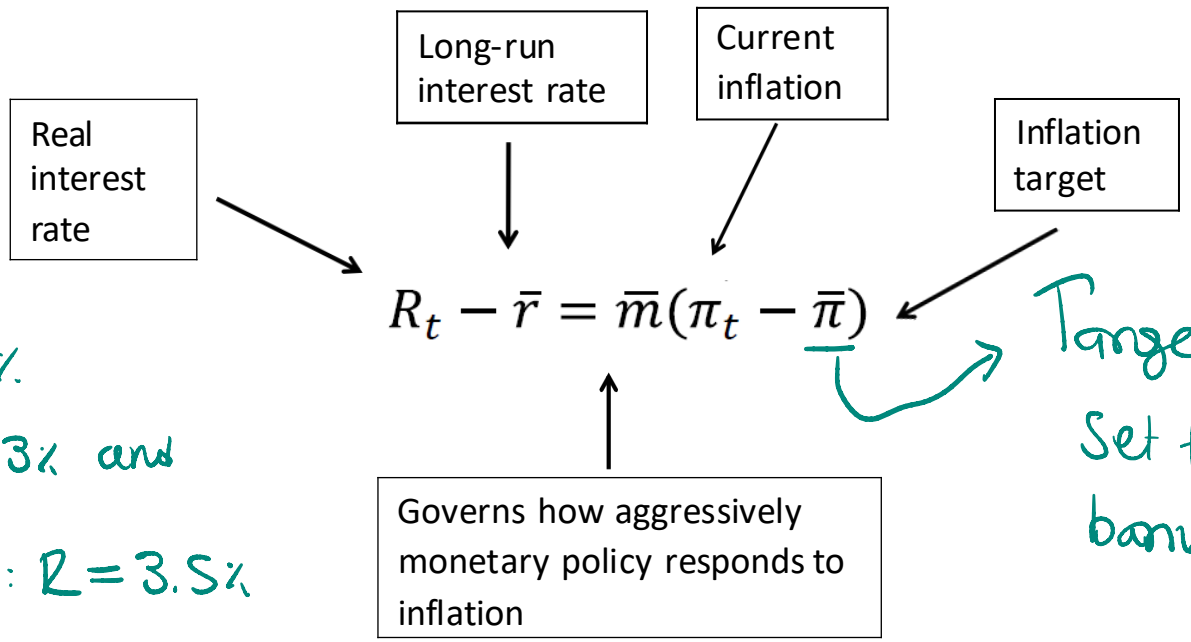
- High short-run output increases inflation ⟶ $\tilde{y}, \pi$ Comove
- The central bank faces a tradeoff between output and inflation
  - ↳ Given comovement: Changing R improves one variable but worsens the other ⇒ Can we think of a rule for setting R?

Ideal "rule" → Should react positively to inflation

Simple Monetary Policy Rule

A monetary policy rule is a guideline for what monetary policy should be given a certain situation in the economy:

A possible monetary policy rule is:



Example:
$\pi = 2\%$; $R = 2\%$
↑ π by 1% to $\pi = 3\%$ and
$\bar{m} = 1.5$ → Set: $R = 3.5\%$
$\bar{m} = 1$ → Set: $R = 3\%$

Target: long-run goal set for π by central bank

Usually, rules depend on other features: Output gap, shocks, past policies. But for now we consider this simplified rule.

AD: Join IS & MP rule into a single expression

AD Curve

From the policy rule and the IS curve we can derive the **aggregate demand** curve:

$$\tilde{Y}_t = \bar{a} - \bar{b}(R_t - \bar{r})$$

$$R_t - \bar{r} = \bar{m}(\pi_t - \bar{\pi})$$

Substitute the policy rule into the IS:

$$\tilde{Y}_t = \bar{a} - \bar{b}\bar{m}(\pi_t - \bar{\pi})$$

$\bar{a} = \bar{a}_c + \bar{a}_i + \bar{a}_g + \bar{a}_{ex} - \bar{a}_{im} - 1$

Resulting AD curve

AD Curve - Graph

Plot: π vs $\tilde{y}$

also downward sloping Like the IS

BUT this one embeds the whole info of the IS/MP diagram

(a R is no longer in the y-axis)

The AD curve represents how the central bank chooses short-run output based on the current inflation

Done by choosing the interest rate:

If **inflation is above its target**:

Central bank raises rates and output falls below potential

If **inflation is below its target**:

Central bank lowers rates and output rises above potential

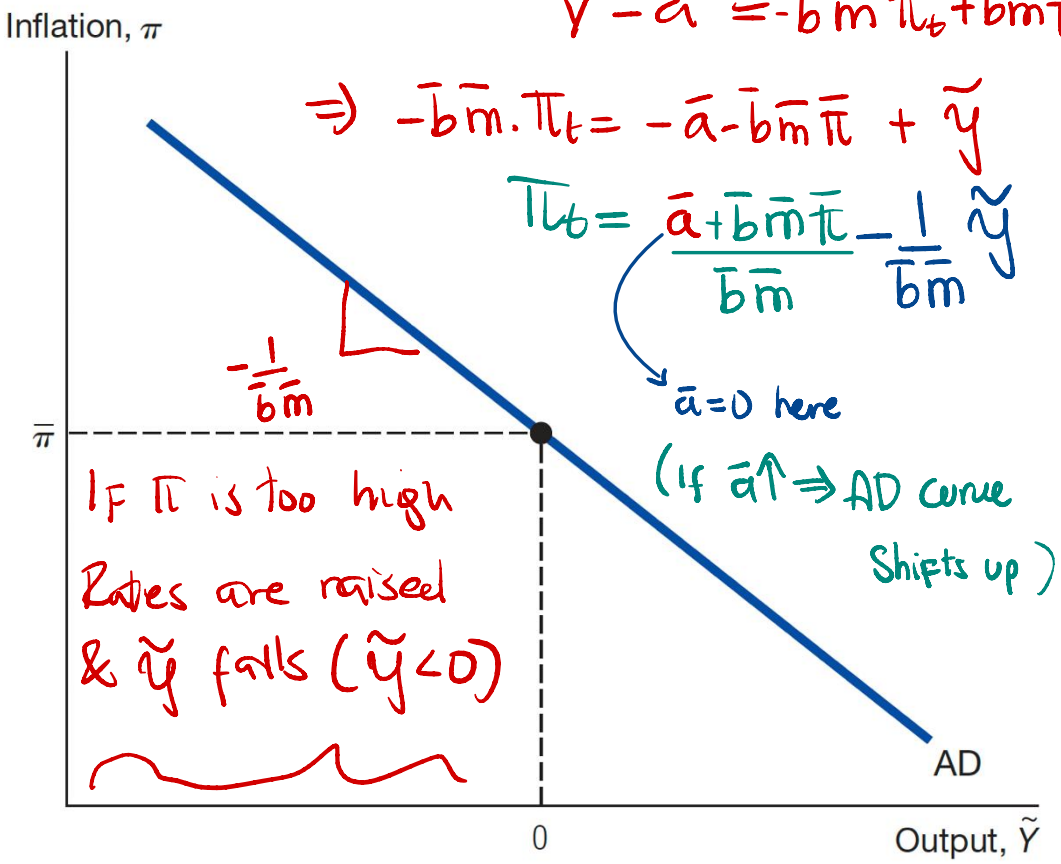
The Aggregate Demand Curve:

$$\tilde{Y} = \bar{a} - \bar{b}\bar{m}(\pi_t - \bar{\pi})$$

$\tilde{y} - \bar{a} = -\bar{b}\bar{m}\pi_t + \bar{b}\bar{m}\bar{\pi}$

$\Rightarrow -\bar{b}\bar{m}.\pi_t = -\bar{a} - \bar{b}\bar{m}\bar{\pi} + \tilde{y}$

$\pi_t = \frac{\bar{a} + \bar{b}\bar{m}\bar{\pi}}{\bar{b}\bar{m}} - \frac{1}{\bar{b}\bar{m}}\tilde{y}$



Here the curve corresponds to the 'no demand shock' case: $\bar{a} = 0$

AD Curve

AD curve: Built from demand side (IS curve)

Describes how the central bank "sets" short-run output for each rate of inflation

Change in inflation:

A movement along the AD curve

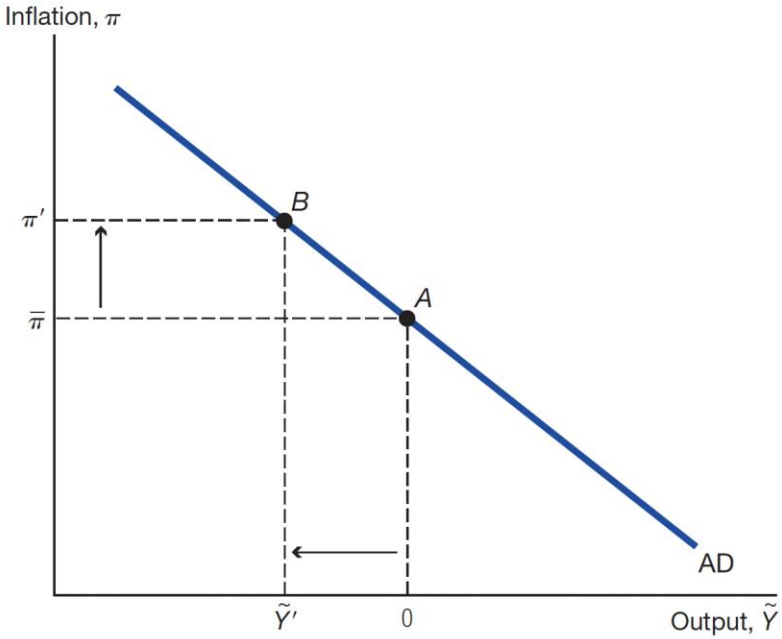
Changes in $\bar{m}$:

Alters the slope of the AD curve

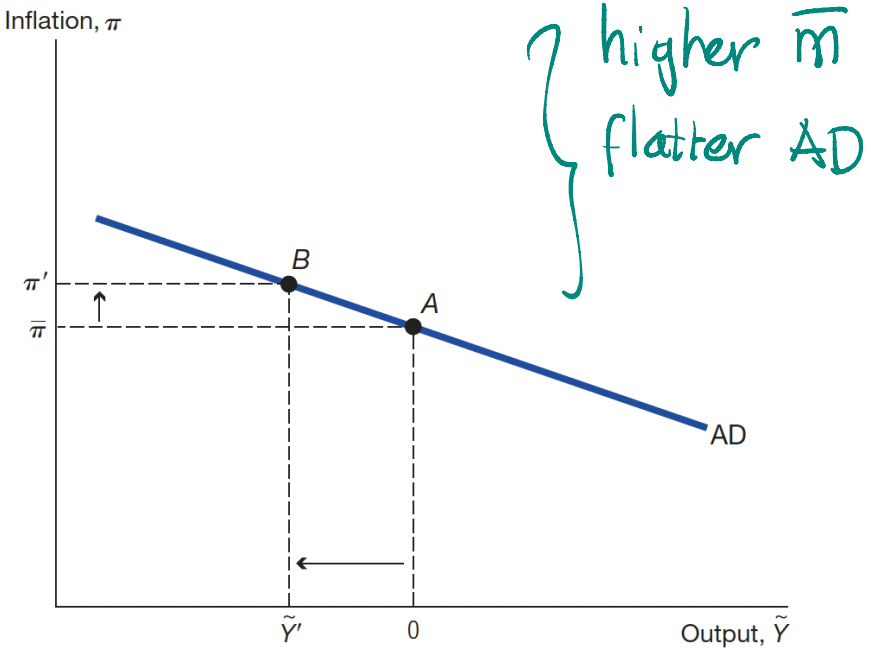
Stronger tradeoff for policymakers

(higher "Output cost" of lowering π)

The AD Curve after an Inflation Shock



An Aggressive Monetary Policy Rule

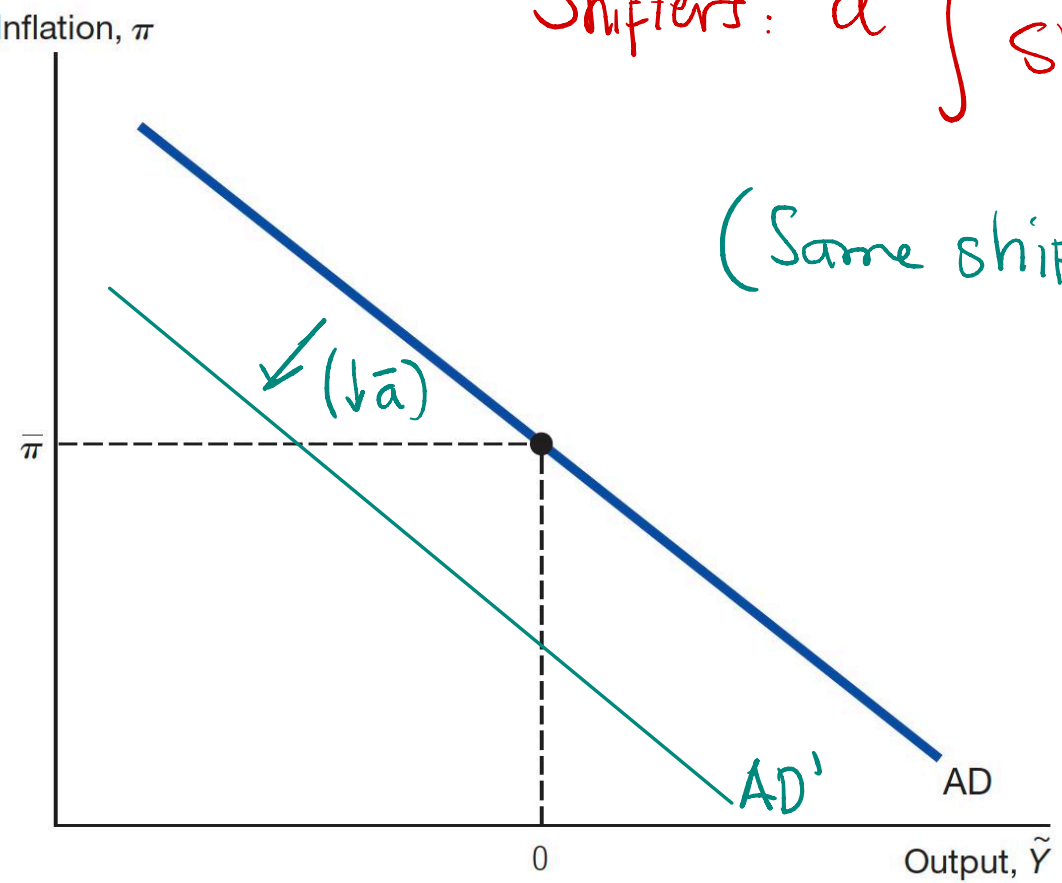


Shifts of the AD Curve

The AD curve shifts when there are changes in $\bar{a}$ or when there are changes in the target rate of inflation $\bar{\pi}$

Shifters: $\bar{a}$ { aggregate demand shocks

(Same shifters as the IS curve)



AS: Supply side ⟶ Comes from Phillips curve

AS Curve

Shifters: Supply Shocks "o" ("Cost-Push")

(example: Price of oil)

AS curve: depicts the way firms set prices in the economy

- It can simply be thought of as a Phillips curve with a different name

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

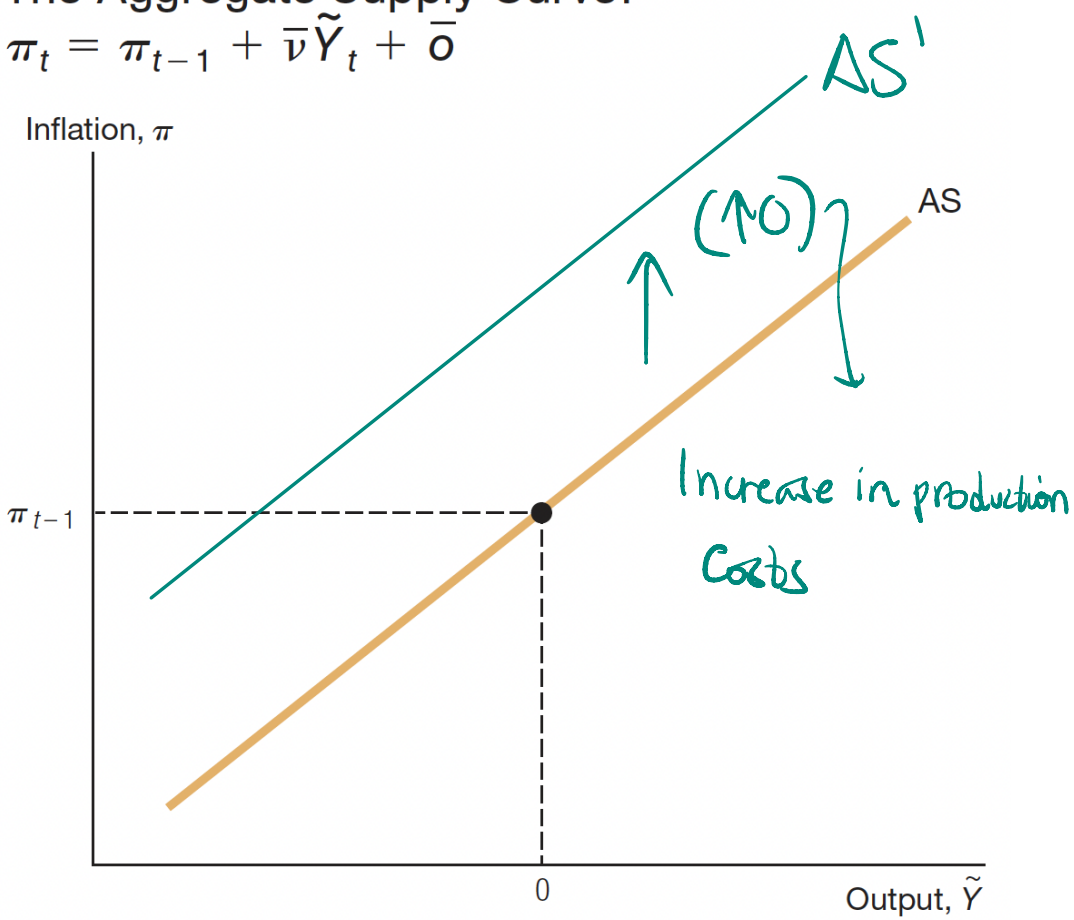
Recall that π_{t-1} represents the expected rate of inflation

AS curve shifts if:

- The (expected) inflation rate changing
- Changes in the inflation shock parameter ($\bar{o}$)

The Aggregate Supply Curve:

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



When there are no inflation shocks and output is at potential, the current rate of inflation is expected to continue

→ given assumption: $\pi_t^e = \pi_{t-1}$

Combining the AS-AD curves

AS-AD curves: Two equations with two unknowns $(\pi_t, \tilde{Y}_t)$:

AD curve: $$\tilde{Y}_t = \bar{a} - \bar{b}\bar{m}(\pi_t - \bar{\pi})$$

AS curve: $$\pi_t = \pi_{t-1} + \bar{v}\tilde{Y}_t + \bar{\theta}$$

Steady State: Suppose that there are no shocks to the economy: $\bar{a} = 0$ and $\bar{o} = 0$

If the inflation rate is constant then $\pi_t = \pi_{t-1} = \pi^*$, which implies that: $\tilde{Y}^* = 0$

Substitute this into the AD equation, then $\pi^* = \bar{\pi}$

$$0 = \tilde{y} = \frac{Y - \bar{Y}}{\bar{Y}} \Rightarrow Y = \bar{Y}$$

In the "steady state" the inflation equals the target and the actual output the the potential

Long-run values: $\pi^* = \bar{\pi}$ & $\tilde{y}^* = 0$ ($\Rightarrow$ In long run $Y^* = \bar{Y}$)

Output — Potential Output

Graph of AS-AD

AS-AD Diagram
(No shocks yet)

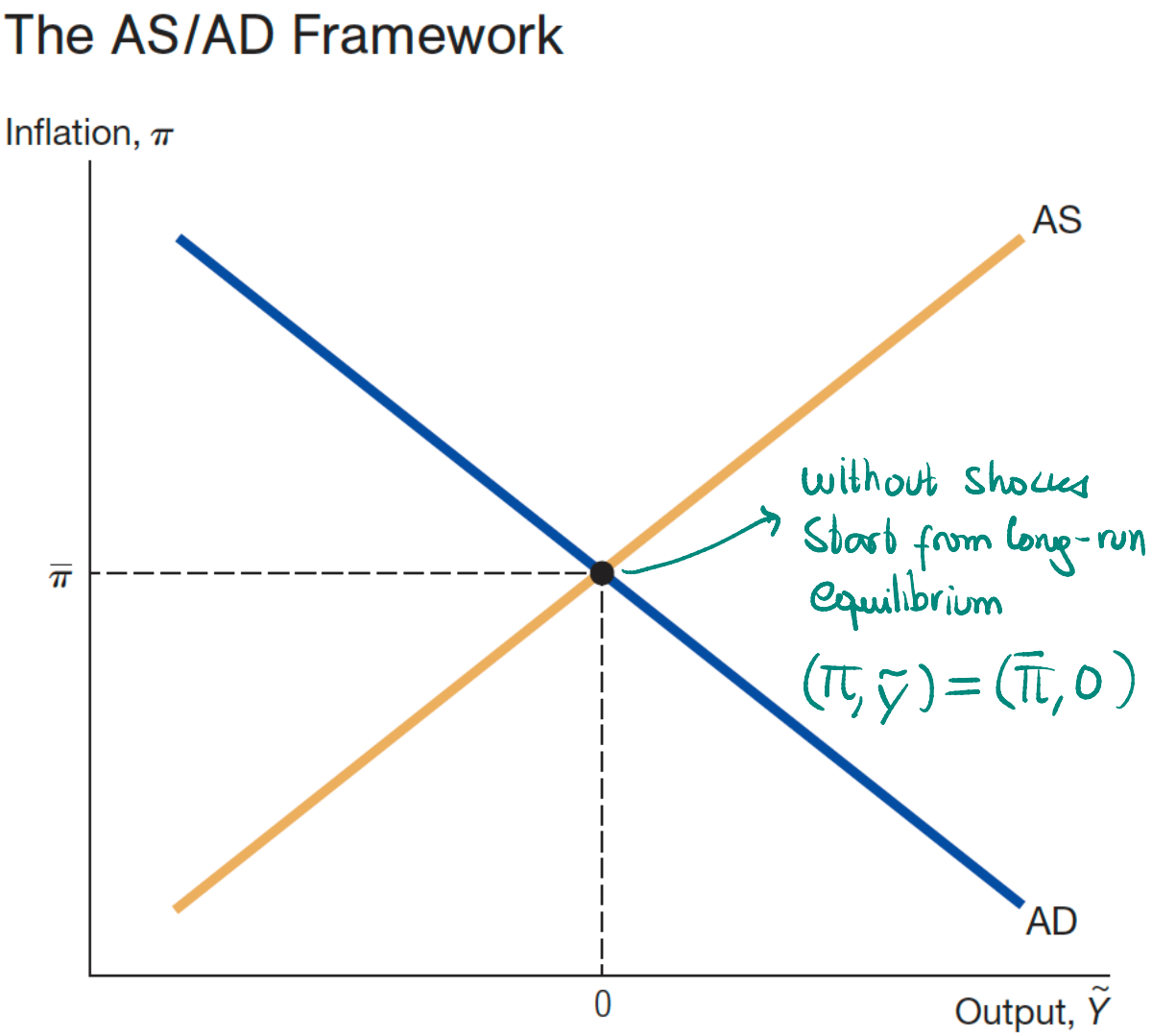
AS curve: slopes up

- Due to the Phillips curve

AD curve: slopes down

- Due to the response of policymakers to inflation

As before here we plot the curves assuming we depart from the steady state (no shocks)



Notice the slopes also align with the typical microeconomic relationship between Supply/Demand and prices

Inflationary shocks → Cost-Push shocks

Using the AS-AD model - Inflation

Shocks: $\uparrow \bar{O}$

Suppose there is a long period of oil price increases

- The AS curve to shifts up, leading to stagflation
- Stagflation: Recession and inflation together

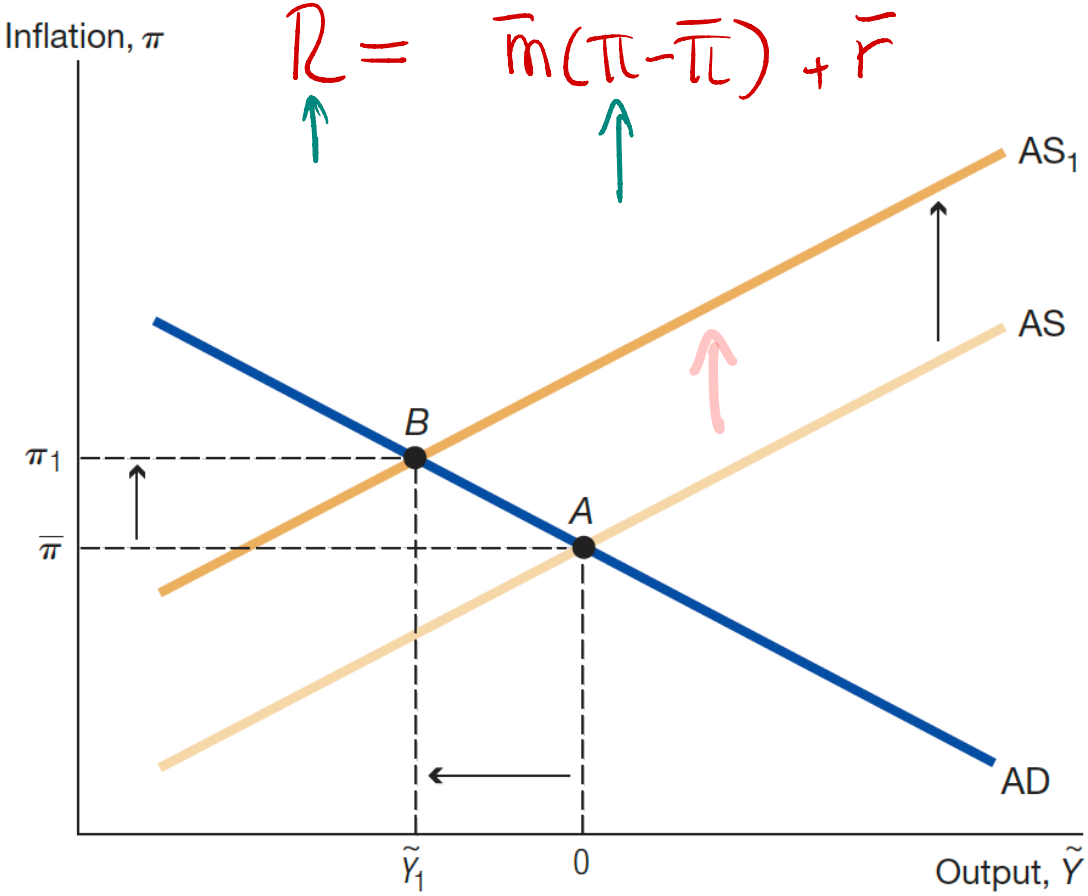
The **monetary policy rule** is going to slow economic activity as economy moves from A to B

→ Policy reaction to a higher π

($\uparrow R \rightarrow \tilde{Y}\downarrow$)

The Initial Response to an Inflation Shock

$R = \bar{m}(\pi - \bar{\pi}) + \bar{r}$



To note: Here the shock can be seen as an increase in $\bar{o}$

New Equilibrium: B

$\uparrow \pi, \downarrow \tilde{y}$

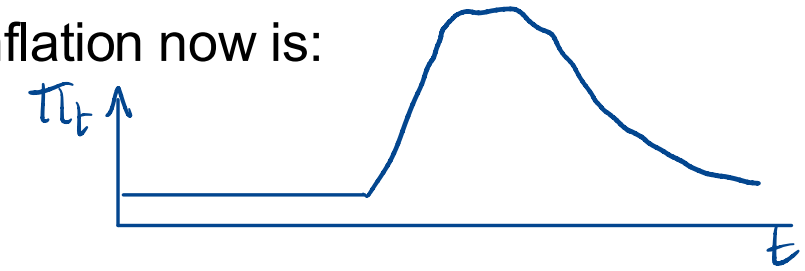
Using the AS-AD model – Inflation

In the second period (after the initial increase in prices), $\bar{o}$ returns to its original position $(\bar{o} = 0)$, **but the AS curve does not shift back** … why?

Recall that the initial AS curve is $\pi_t = \pi_{t-1} + \tilde{v}\tilde{Y}_t + \bar{o}$ and $\pi_{t-1} = \bar{\pi}$

Since we started at Steady State, **but**, must account for the shock:

Inflation now is:



$\pi_1 > \bar{\pi}$

	π	Shock ($\bar{o}$)
t-1	$\bar{\pi}$	0
(Shock) t	$\bar{\pi} + \bar{o}$	$\bar{o} > 0$
t+1	$\pi_t + \tilde{v}\tilde{Y}_t$	0

The AS curve in period 2 is therefore: $\pi_2 = \pi_1 + \tilde{v}\tilde{Y}_2$

In period 2, the economy moves towards a lower inflation (point B to point C in the plot of the two slides ahead)

Inflation remains over target for some time
This goes on until $\tilde{y} < 0$ lowers inflationary pressure so that eventually $\pi = \bar{\pi}$

Using the AS-AD model – Inflation (2)

↓ $\tilde{Y}$ allows ↓ π (towards $\bar{\pi}$)

Essentially, because the economy is in a recession, inflation falls

According to the **monetary policy rule**: The inflationary shock pushed up the interest rates which lowers output (recession)

As the shock fades out, inflation lowers, the interest rate normalizes and the economy (GDP) starts increasing.

In this example in period 2 is still below potential ($\tilde{Y}_2$ is negative)

- This actually depend on how strong is the policy change
- But here the change is designed to show how inflation moves slow

But in later periods the economy gets even closer to its long-run values

Mechanism relies on Monetary rule

higher π → ↑R → ↓Y → lower π

slow / lengthy Process

Once π is controlled ($\pi = \bar{\pi}$)

R lower (returns to previous levels)

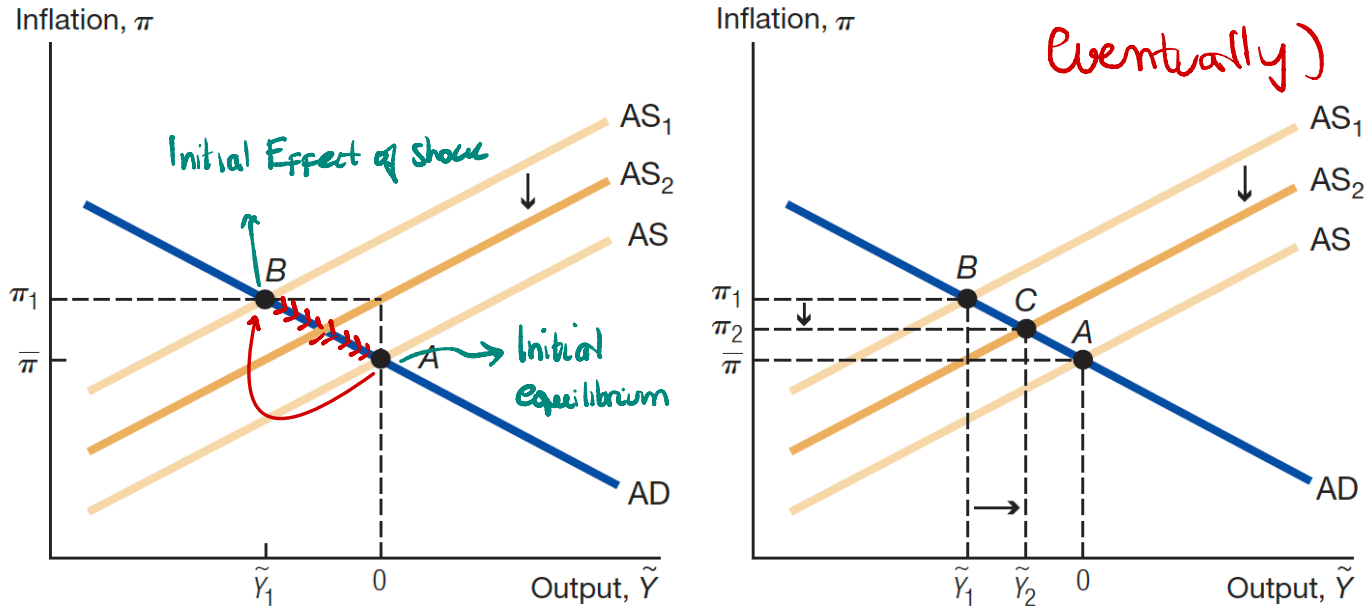
and output starts recovering

Using the AS-AD model - Inflation

- Inflation will slowly decrease, causing a movement along the AD curve (sticky inflation)
- The monetary policy rule will cause an increase in output

Transition from B to A (takes time but happens eventually)

Two Periods after an Inflation Shock



(a) The new AS curve, AS_2, is such that inflation would equal π_1 if short-run output were zero.

(b) Since inflation remains high, the Fed keeps output below potential, moving the economy to point *C*.

Takeaways:

(1) The (cost-push) shock shifts the AS curve

(2) The economy returns to its steady state but slowly (sticky inflation)

Using the AS-AD model - Inflation

Same principle (as in Solow model)
"The further from Steady-State ($\bar{\pi}$) the faster the transition" (growth +, −)

Transition dynamics:

- Movement back to the steady state is fastest when the economy is furthest from its steady state and gets slower as steady-state is approached

In summary, a price shock: $\uparrow \bar{O}$ (Cost Push Shock)

Not visible in AS/AD type of diagrams!
(requires instead a plot of variables over time)

- Raises inflation directly (direct effect)
- Leads central bank to induce a recession (Policy reaction and effect)
- Shock lasts for one period, **but inflation remains higher for an extended period** of time, due to sticky inflation (Effect on π is persistent...)
- The shock raises inflation expectations and it takes time for expectations to return to normal (... but not permanent: π slowly returns to $\bar{\pi}$)
- Causes the economy to suffer from stagflation

What if Policymakers lower $\bar{\pi}$ to $\bar{\pi}'$?

Using the AS-AD model – Disinflation

AD shifts down

$$AD: \tilde{Y}_t = \bar{a} - \bar{b}\bar{m}(\pi_t - \bar{\pi}')$$

Upon change: π_t is too high ($\bar{\pi} > \bar{\pi}'$)

Suppose the economy begins in a steady state with a high rate of inflation, $\bar{\pi}$, and policymakers lower the inflation target to $\bar{\pi}'$

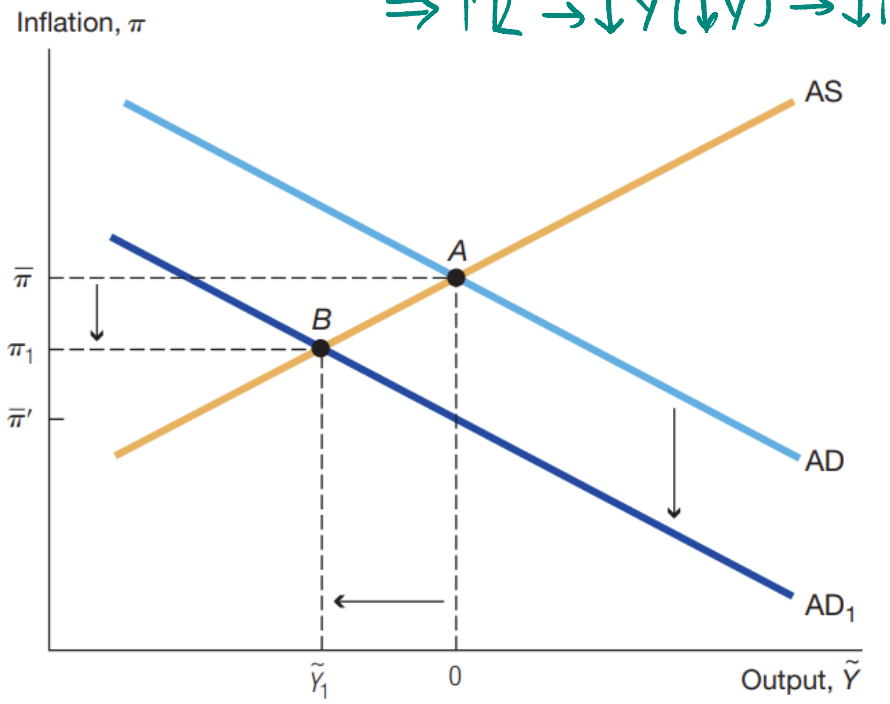
That is, there is a policy rule change

The inflation target appears in the AD curve: The **AD curve shifts down**

- The new rule calls for an increase in interest rates because inflation is too high
- New inflation: Somewhere between the old target and the new target
- By how much will the AD curve shift?

The Initial Response to Disinflation

$\Rightarrow \uparrow r \rightarrow \downarrow Y (\downarrow \tilde{Y}) \rightarrow \downarrow \pi$



Using the AS-AD model – Disinflation

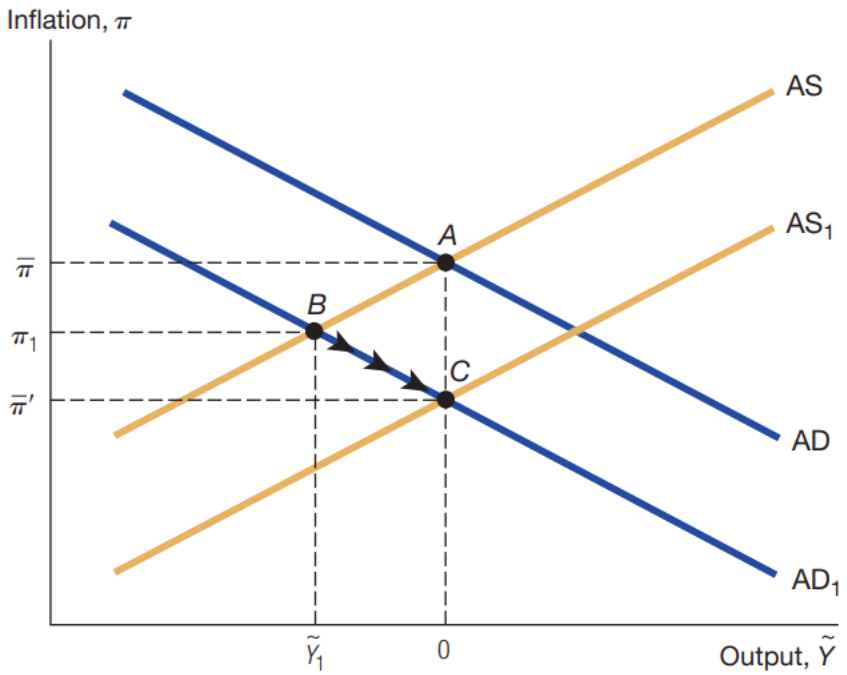
Afterwards the **economy transitions to its steady state**:

- Shifts in the AS curve as the rate of inflation decreases
- See AS equation: Expected Inflation lowers $\pi_1 < \bar{\pi} \rightarrow$ Shifts down
- Inflation is **still above the target, so output is still kept below potential**
- **Process continues** until the economy reaches the new inflation rate target
- Change in monetary policy rule will cause a change in the steady state inflation

Note that if inflation is not sticky, then the AS and AD curves would adjust immediately.

After → Transition to new steady state because $\tilde{Y} < 0$ (See π_t formula)

The Dynamics of Disinflation



AD Shock ($\uparrow \bar{a}$): AD shifts up (higher π, Y)

Using the AS-AD model – Positive AD shock

But AS shifts to the Left $\Rightarrow$ (higher π)
(and same $\tilde{Y}$)

Suppose there is an increase in $\bar{a}$

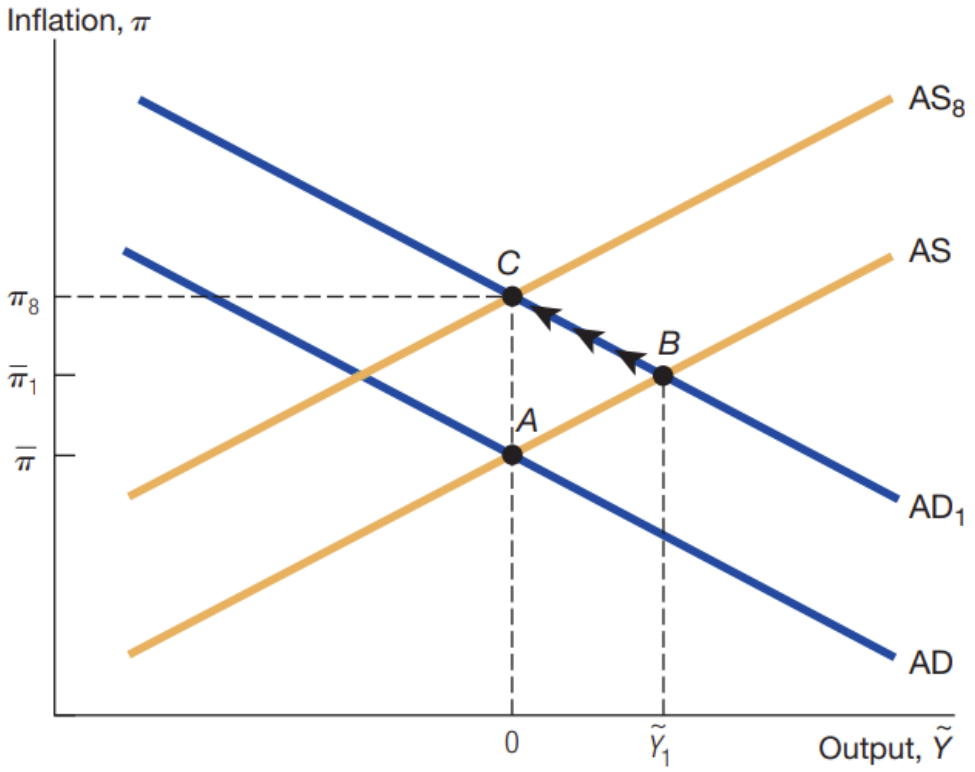
Increased demand for goods and services leading to higher prices

- A to B

The AS curve will adjust up and move the economy back to its long-run steady state

- The economy gradually moves from B to C

Dynamics as the AS Curve Shifts



Intuition: Demand by itself has no role in pushing production capacity up, it will mostly push up prices (via greater willingness to spend)

Using the AS-AD model – Positive AD shock

... as AD shock fades away, AD shifts back (Now $\tilde{Y}$ is too low)
and $\tilde{Y} < 0$ impacts π_t and brings it back to $\bar{\pi}$

Back to steady-state:

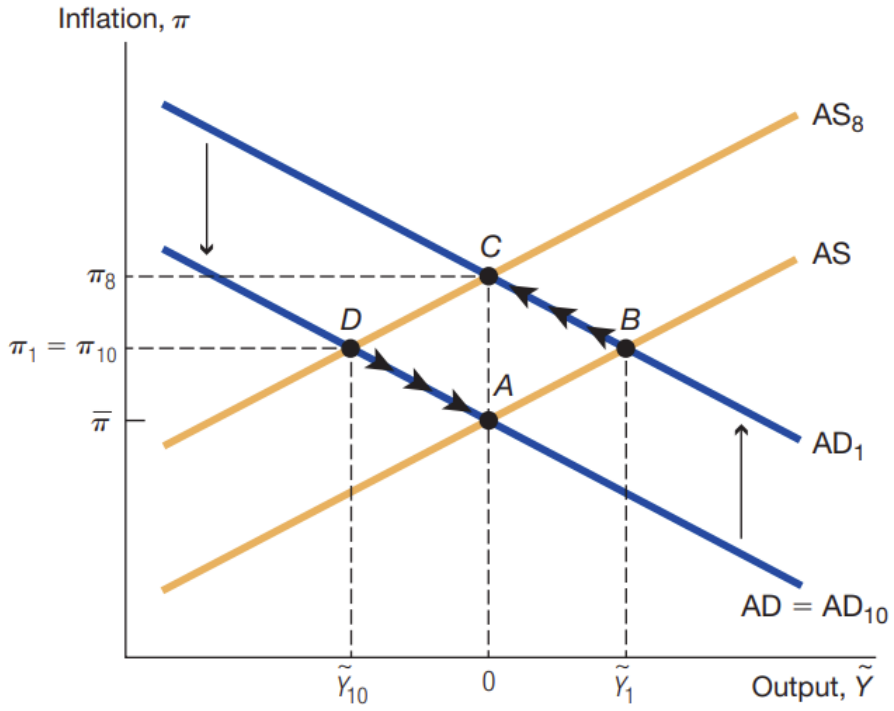
Over time: Shock to the AD curve subsides and the AD curve shifts back

- C to D

Now **output is below potential** and the economy will slowly move back to point A

- This final change is driven by **lower inflation expectations** (see AS eq.)

A Positive AD Shock: Summary

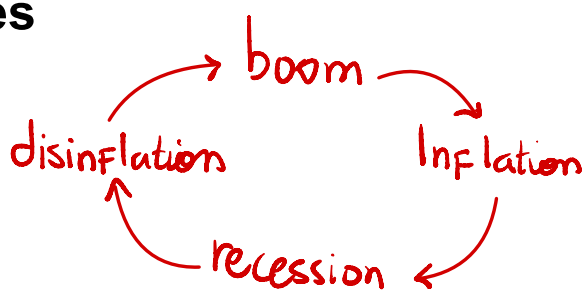


Intuition: A demand shock has no long-term consequences as it is not a real phenomenon but a nominal one instead.

Using the AS-AD model – Positive AD shock

Key for adjustment: Cyclical behavior of output

- AD shock example shows that **booms are matched by recessions**, because whatever caused the change in $\bar{a}$ needs to subside at some point
  - The economy benefits from a **boom but inflation rises**
  - The way to **reduce inflation is by a recession**
    - Given prompt **monetary policy** actions



- Back to the initial point
- But due to the costs of inflation: Economy would have been better off just staying at the original steady state

This is the reason that one of central aims of central banks is to stabilize the **economy at short-run output**

Predicting the Federal Funds Rate

We can use the Fisher equation to write the monetary policy rule in terms of the nominal interest rate to see how well it aligns with real-world data:

- Policy rule: $R_t - \bar{r} = \bar{m}(\pi_t - \bar{\pi})$
- Fisher equation: $i_t = R_t + \pi_t$

To get an expression (Consistent w/ model) for i_t: Use policy rule & the Fisher eq.

Considering these two equations we can back out how the nominal rate behaves:

$$i_t = \bar{r} + \pi_t + \bar{m}(\pi_t - \bar{\pi})$$

We can plug known values of $\bar{r}$, $\bar{m}$, $\bar{\pi}$ and see how the nominal rate flows with inflation

What the model "Predicts" i_t will be over time

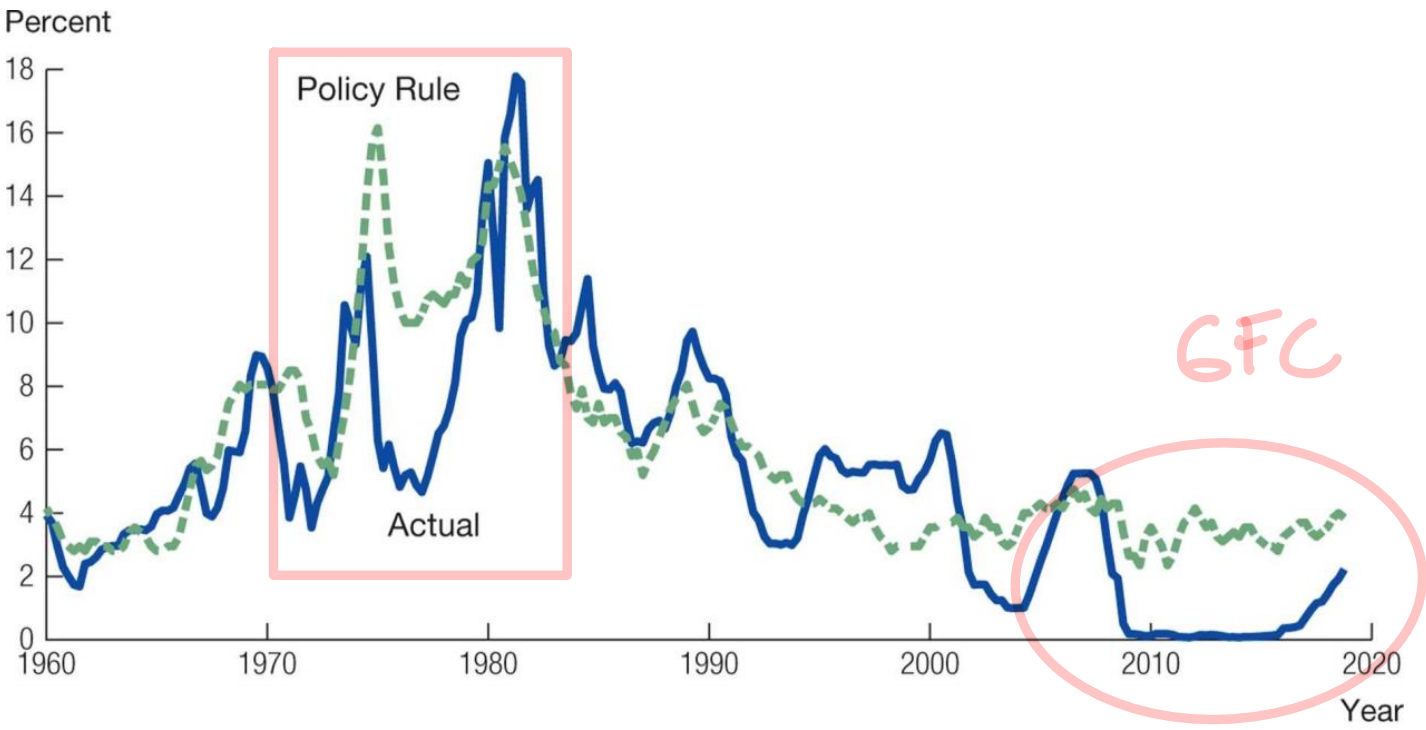
Actual and predicted Federal Funds rate

If we assume that:

$$\bar{\pi} = 2$$
$$\bar{r} = 2$$
$$\bar{m} = {}^{1}/_{2}$$

We see that a few periods that stand out:

1970s, 1990s, 2000s, and 2008



Source: The FRED database.

Good fit most of the time:

Except during "atypical" times when Fed had to make extra efforts to stimulate Y

On average the fit is good

But there are period with important departures where the Fed has had to adopt a softer stance to stimulate output: An example is the GFC of 2007-8

Inflation-Output Loops

The short-run model depicts a **counterclock wise inflation-output loop**

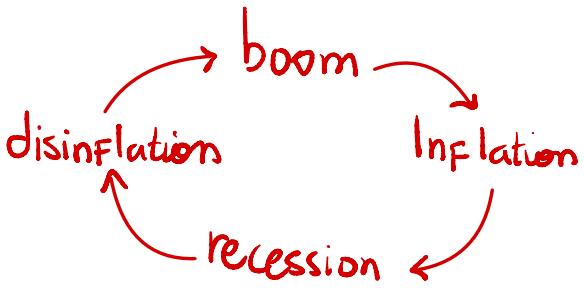
For the U.S. economy this prediction seems to hold.

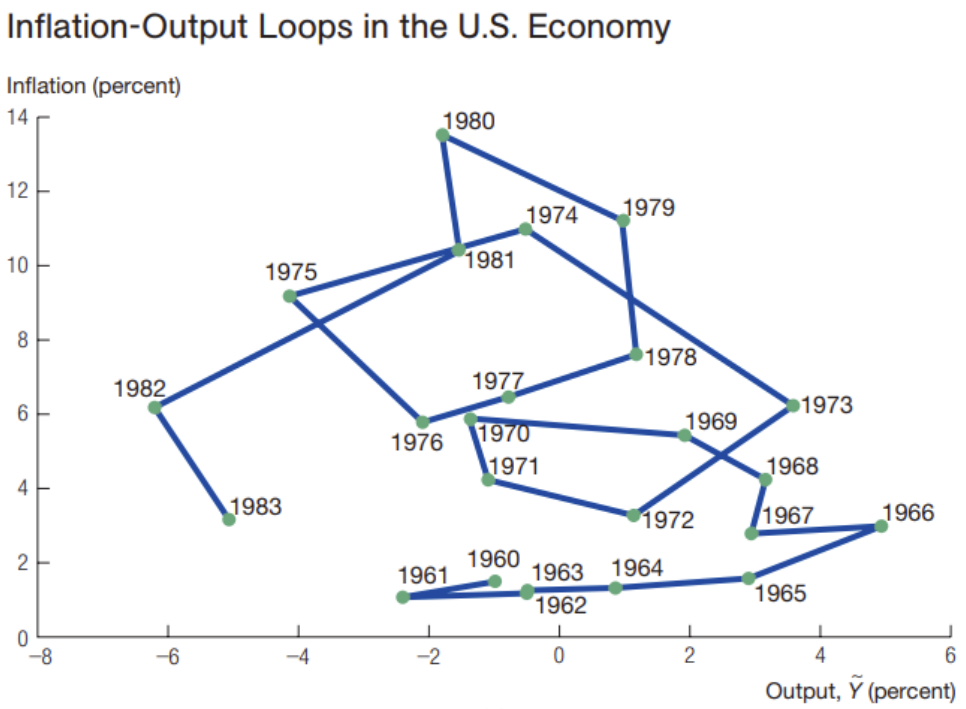
Intuition:

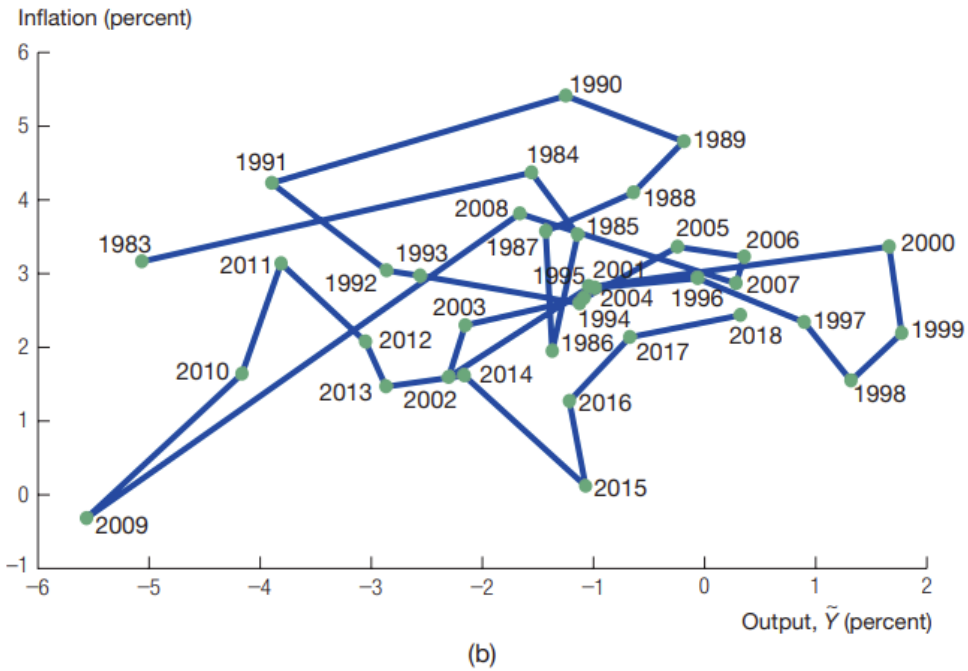
A boom is followed by inflation — right, and up in the plot

Afterwards a recession follows, which cools down demand pushing inflation down —left and down in the plot

Data Supports Loop from before:







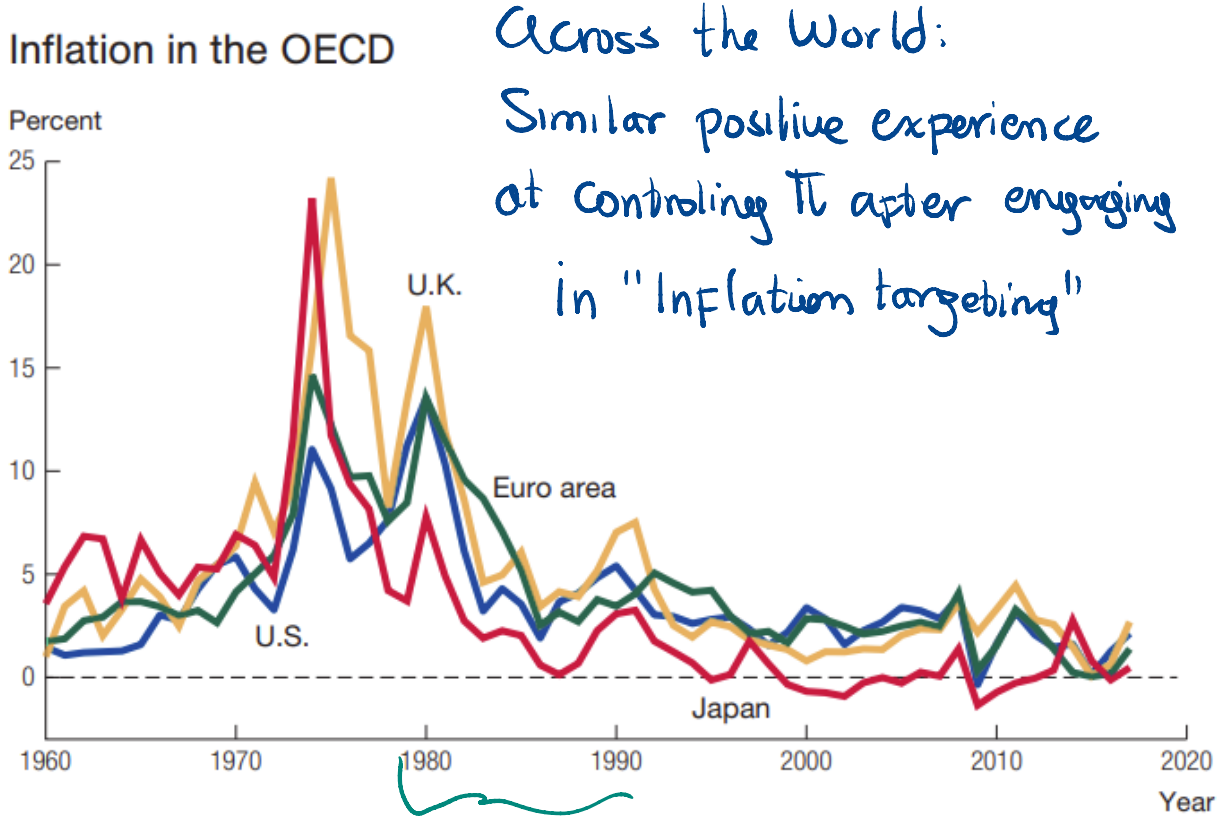
Modern Monetary Policy

Inflation was high in the 1970s in many advanced countries.

Central banks succeeded in lowering inflation substantially after the 1980s.

This is attributed to consistent and active policy reactions to inflationary pressures

For many countries, these actions are part of an **inflation targeting regime**



Across the World:
Similar positive experience at controlling π after engaging in "Inflation targeting"

Key: Mix of {(1) Inflation targeting
(2) Commitment to Stick to (1) + Credibility

Period where many countries adopted an inflation targeting regime

Implementing **explicit inflation targets** together with the commitment to hit them have been critical for **anchoring the inflation expectations** of the economies' 'agents'

Short Run Model: IS/MP → AD AD shocks → Affect Y temporarily and leads to π

PC → AS AS shocks → affect Costs of Production & π

Conclusion

We can consider the **AS/AD model** to understand the workings of monetary policy and the implications for inflation and output fluctuations

Key factors attributed to the decrease of inflation in the past few decades is having a **central bank with a commitment** to low rates of inflation

- **Temporary shocks can be quickly contained** if inflation expectations are anchored at 2% (the target for many countries)
- It is also **easier to stabilize** the economy without making people think high inflation is on the horizon

One of the byproducts of the 1980–1982 recession was that the **Fed focused much more on keeping inflation low**

This is credited with the long period of relative expansion that followed

Despite this, inflation can surge if the right shocks hit.

Example: Post COVID period

Appendix

On Expectations and the role of credibility

Rules versus Discretion

Should monetary policy follow a **certain rule** or should central bankers use mostly their own discretion?

We analyzed the case of a rule —which is considered the best way forward: **Set a rule and really commit to it**

The reason for this is that Central Banks may have **expost** incentives to inflate the economy that is, commit to a low inflation first, wait for firms to set prices (to a low level) and then lower the interest rates to push output.

This is known as a “time consistency problem.” The ex-ante incentives to push inflation down strongly are inconsistent with the ex-post incentive to boost the economy.

Rules versus Discretion

Inflationary bias:

Deceiving, if successful would lead to low inflation and high output.

Sounds good, but **can backfire!**

Next time they try to do it, the public will just set higher prices to begin with.

Stagflation: This explains why the behavior of inflation was puzzling in the 1970's, inflation was going up, but output was not increasing.

Reason: Previous versions of the Phillips curve ignored **inflation expectations** which were increasing and were shifting inflation up regardless of output.

Paradox of Policy and Rational Expectations

The expectations are a critical ingredient in this model

Goal of macro policy: full employment, output at potential, and slow/stable inflation

- Policymakers who convincingly signal that they are willing to generate large recessions to fight inflation, **makes having to use that policy less likely**

- In our model, this would show up as a high value for $\bar{m}$

•Recall the equation representing the monetary policy rule:

$$R_t - \bar{r} = \bar{m}(\pi_t - \bar{\pi})$$

Going back to the importance of commitment: If firms trust the Central Bank would do whatever if takes to control inflation, they are less likely to react to inflationary shocks.

Central Bank's **credibility is paramount**, which is why the Fed, ECB, BOE, etc. spent considerable time and resources in communicating their policies to the public

Incorporating Expectations into AS/AD model

Expectations are already in the model, but we simplified them by setting $\pi_t^e = \pi_{t-1}$

We assumed people expected inflation to remain stable

But if we believe this is flawed, we can always include rewrite the AS curve: $\pi_t = \pi_t^e + \bar{v}\tilde{Y}_t + \bar{o}$

Now suppose that the Fed announces a lower inflation target

The AS curve would shift down immediately if expectations adjust