Intermediate Macroeconomics

An Introduction to the Short Run

ECON 3311 – Spring 2025

UT Dallas

Introduction

GDP gap ≡ GDP − Potential GDP

↳ Indicative of performance of economy

↳ fluctuations ≈ Business Cycles

In this lecture, we will examine:

- How the **gap between actual GDP and potential GDP** measures the economy's performance in the short run
  ↳ Trend/long-run level of GDP
- How costly **fluctuations** in economic activity can be – the short run may not be a short amount of time
- How the rate of inflation tends to decline when the economy is in a recession
  ↳ Comorement with Inflation
- A simple version of the **short-run model** that will help us understand these patterns

*Important to remember that the terms 'GDP', 'output', and 'national income', are the same thing

Long-run, Short-run, and Shocks

Average over a long period of time

Potential Output: highest sustainable level of Production

The long-run model depicts how the economy behaves on average

long-run GDP

- It determines potential output and long-run inflation
- **Potential output** is the amount of production if all inputs were utilized at their long-run sustainable levels

At any given time, however, the output is unlikely to exactly equal the long-run average

- There will be **fluctuations below and above** the long-run average

actual GDP "fluctuates" around Potential

- The extent these fluctuations is what matters in the short-run

The **short-run model** depicts **current output** and **current inflation**

- Short-run deviations from the long-run may last several years

long-run model ⇒ potential output, long-run inflation
short-run model ⇒ current output, current inflation

Similar terms: Potential GDP, Trend GDP, long-run trend GDP } Unobserved variable

Trends and fluctuations

The actual output of an economy is equal to the long-run trend plus whatever short-run fluctuations there are:

Called "cycle" too

$$\underbrace{\text{actual output}}_{Y_t} = \underbrace{\text{long-run trend}}_{\bar{Y}_t} + \underbrace{\text{short-run fluctuations.}}_{\text{depends on } \tilde{Y}_t}$$

More concretely: $\tilde{Y}_t \equiv \frac{Y_t - \bar{Y}_t}{\bar{Y}_t}$

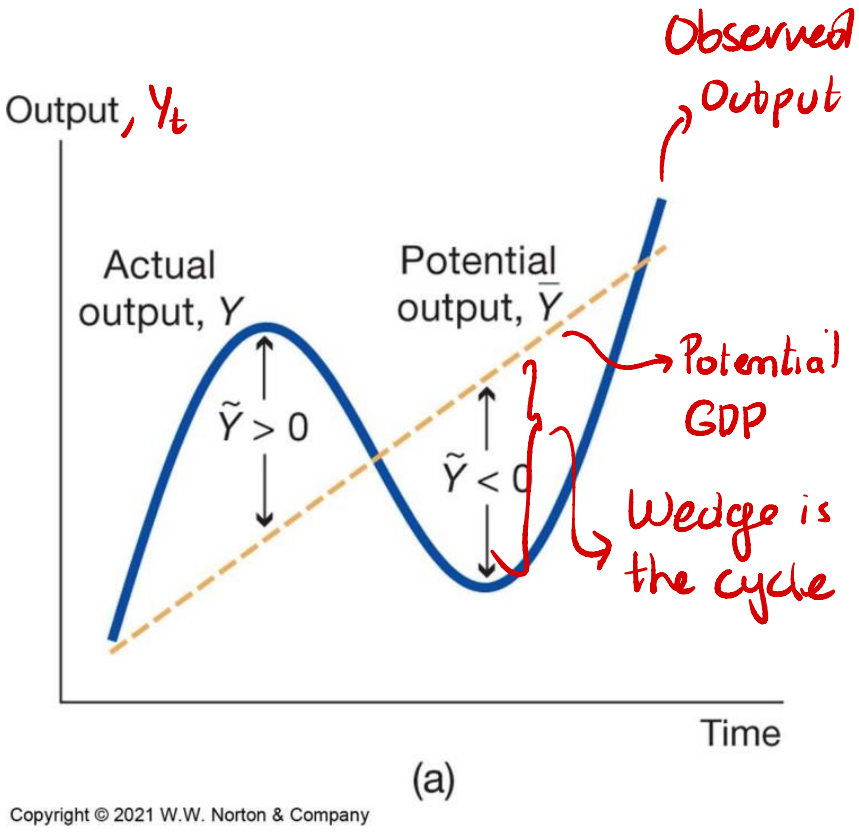
- Long-run trend: potential output ($\bar{Y}_t$)
- Short-run fluctuations ($\tilde{Y}_t$): percentage deviations of Y_t from $\bar{Y}_t$
- The percentage change of the deviation from the long-run trend is called **'detrended' output**

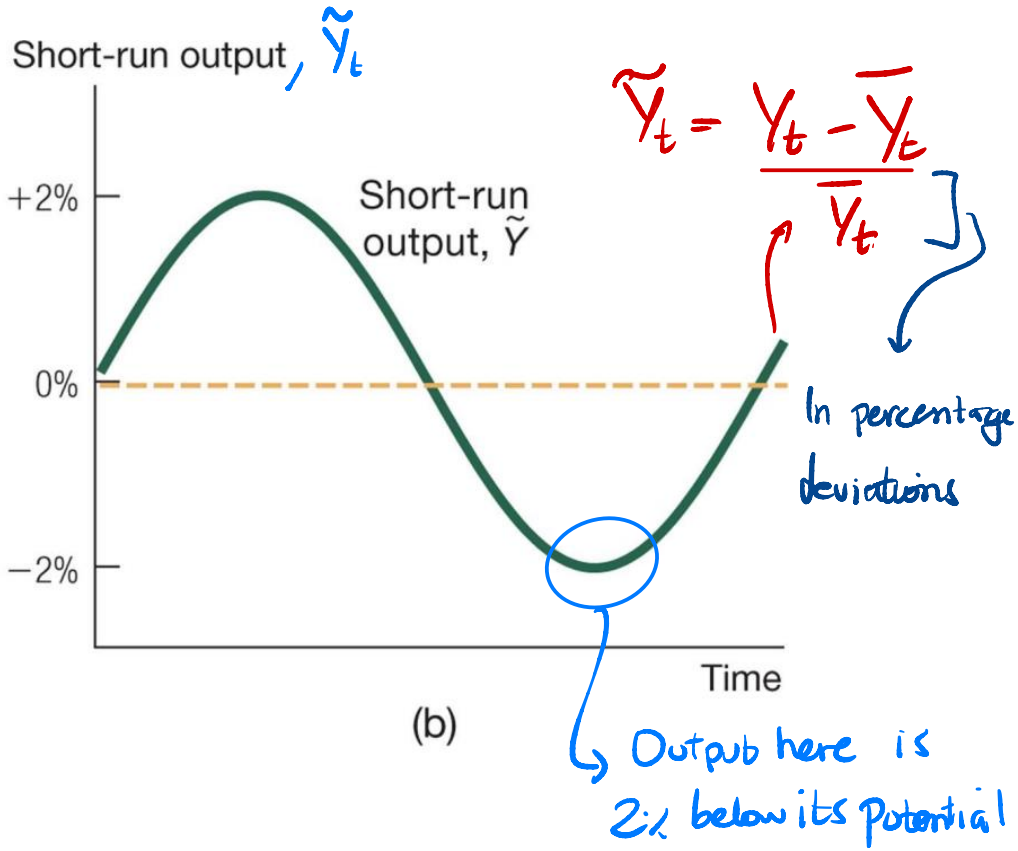
In some books: $\tilde{Y}_t = Y_t - \bar{Y}_t \equiv$ "Short run Output" or cycle

Here: $\tilde{Y}$ is not short run output in levels $(Y - \bar{Y})$, instead, $\tilde{Y}$ is the short-run percentage deviation of GDP from its potential $\tilde{Y} = \frac{Y - \bar{Y}}{\bar{Y}}$

Trends and fluctuations

These graphs describe the difference between long-run and short run output:





Short-run versus long-run

US Data

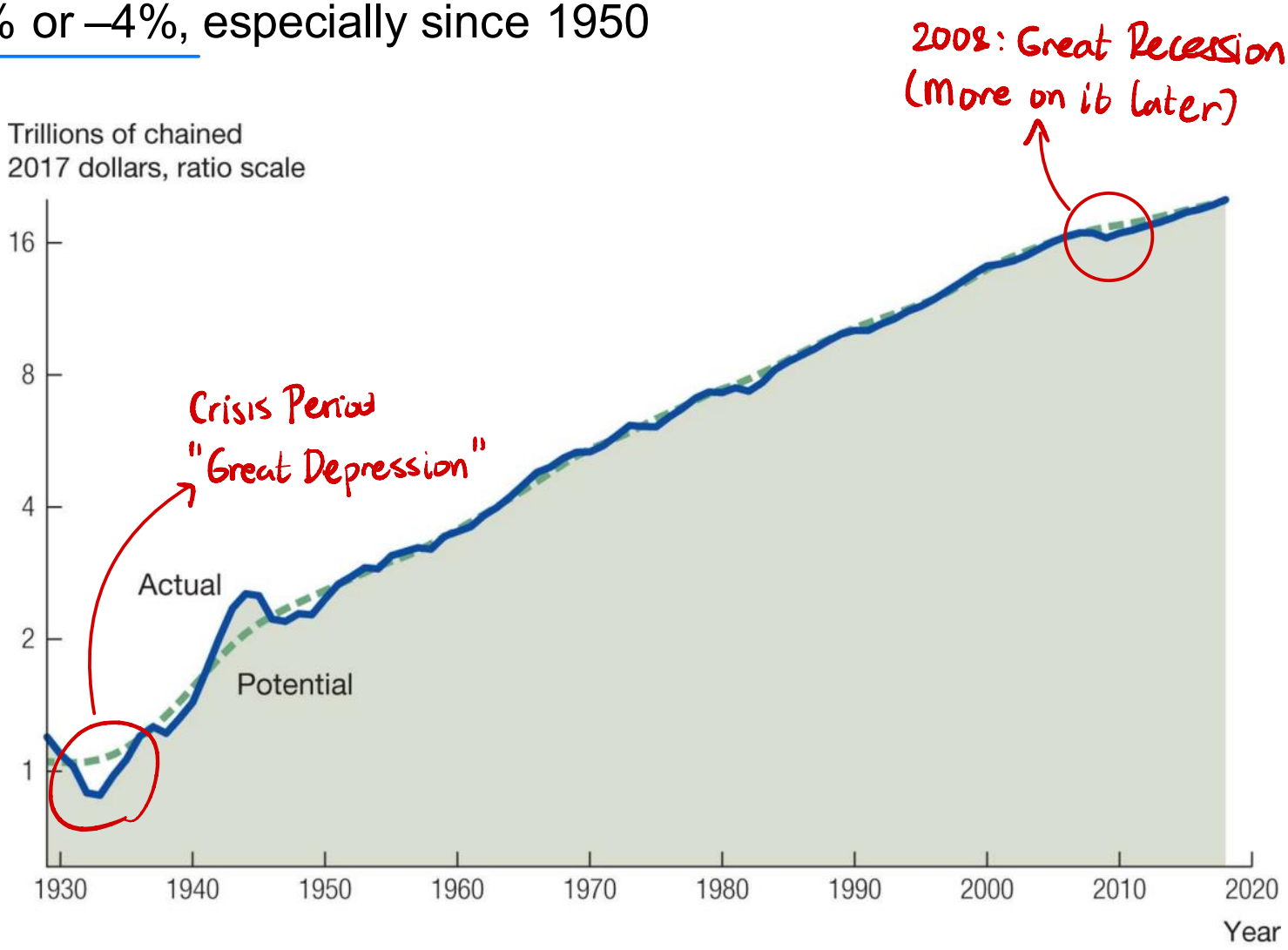
Fluctuations in GDP are difficult to see over a long period of time

Most are between +4% or –4%, especially since 1950

One exception:

Great Depression

- Negative gap during the 1930s
- Actual output was far below potential



Source: U.S. Department of Commerce. Potential output is constructed by the Congressional Budget Office for years after 1949.

Short-run versus long-run

It's easier to see the fluctuations if we look at the percentage difference of short-run output versus potential output.

The shaded areas represent recessions (crises periods)

↳ Periods where economy is decreasing/worsening

(Negative growth phase)

Recessions

Source: Federal Reserve Economic Data (FRED), courtesy of the Federal Reserve Bank of St. Louis. Potential output is constructed by the Congressional Budget Office. Periods of recession are shaded, using the dates assigned by the National Bureau of Economic Research.

Still actual definition of a recession is a bit more complex: → In the US the NBER determines the recessionary periods

Recession → an economy that shrinks also usually has an output that's falling below its potential

A **recession** begins when **actual output falls below potential** output

As a consequence: **Short-run output becomes negative**

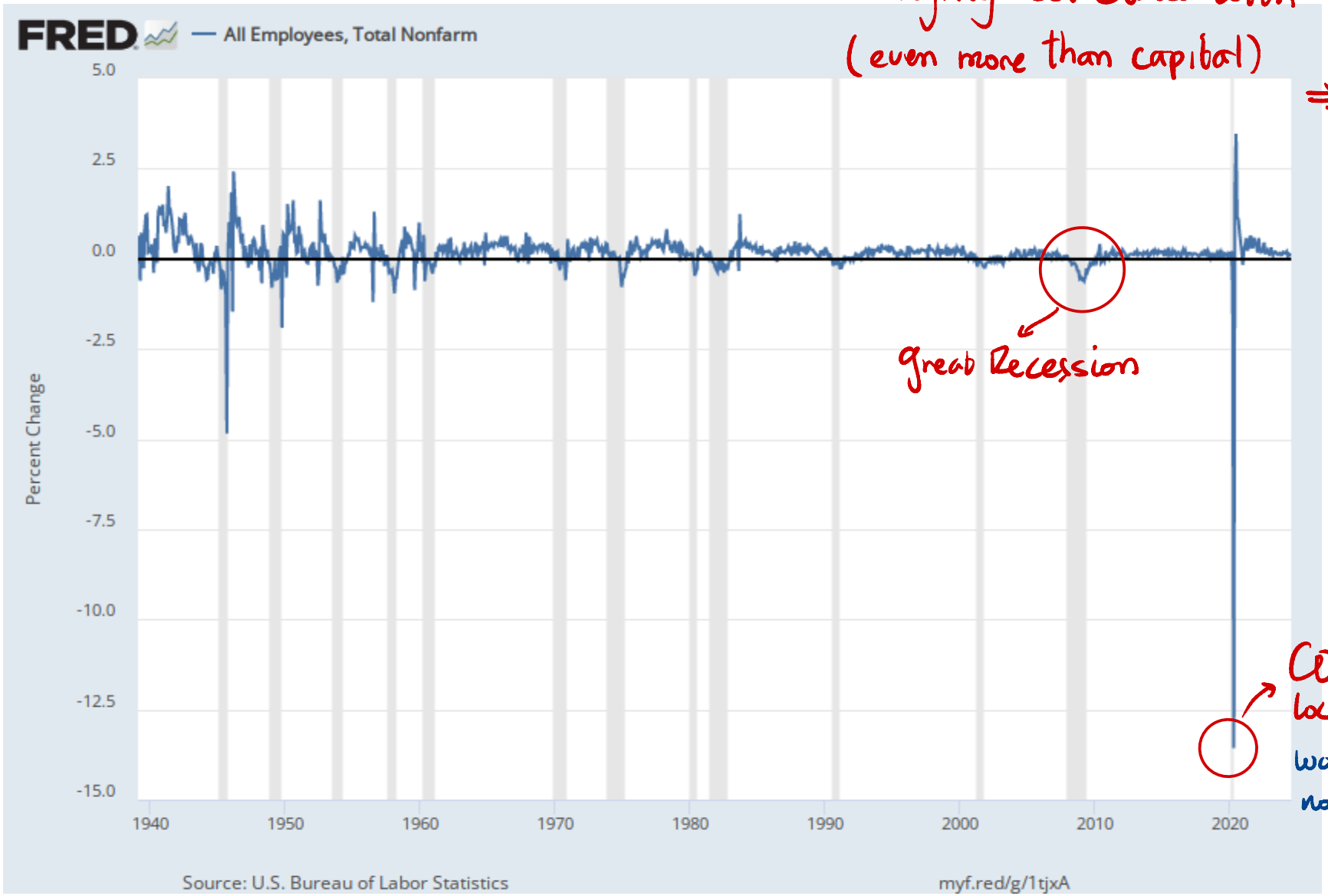
- A recession ends when short-run output rises and becomes less negative

All recessions are different, but on average:

- Output falls below potential output for approximately 2 years
- Overall GDP decreases by about 6%
  - (about $4,000 per person in today's dollars)
- Millions of jobs are lost

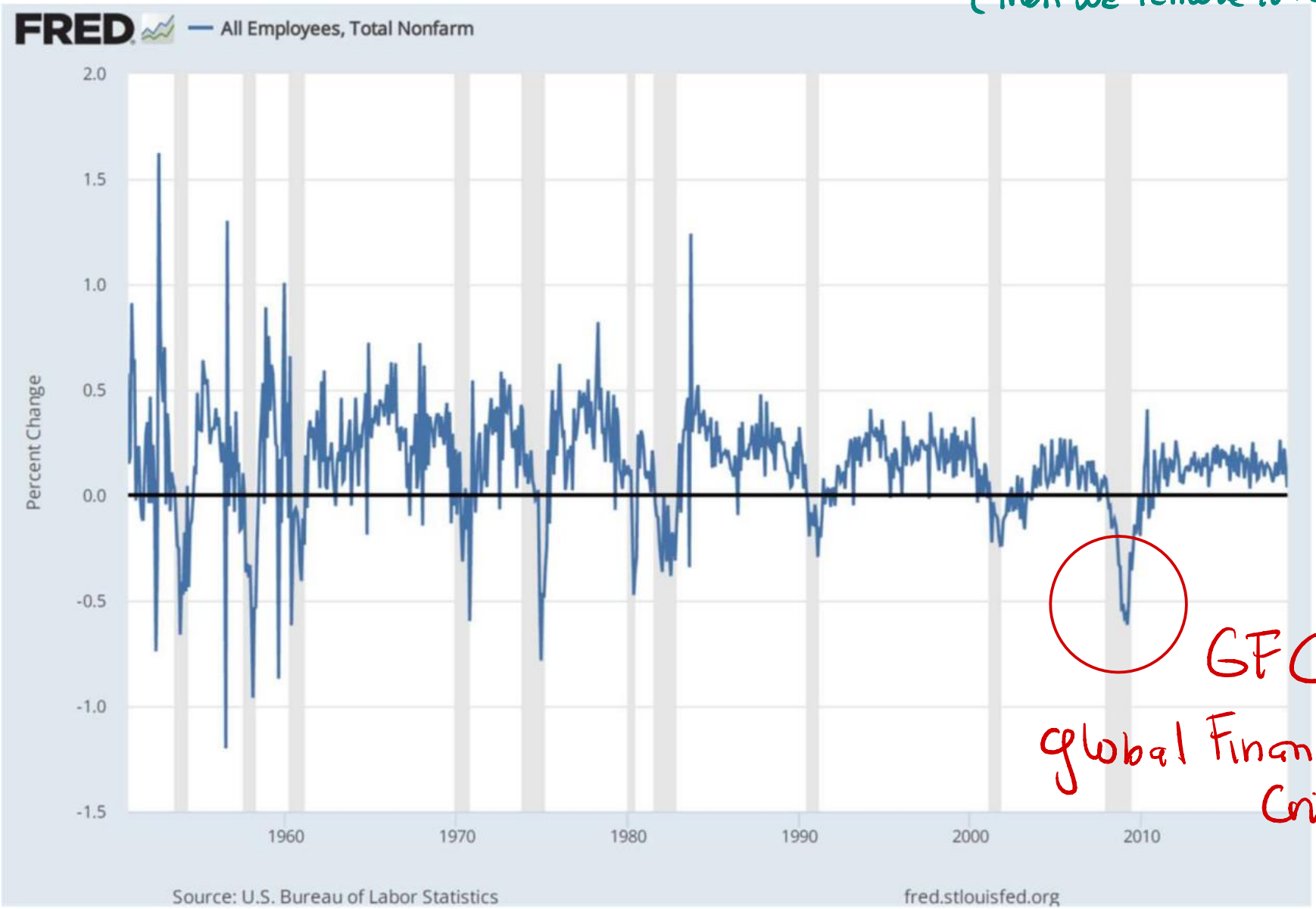
Recession and employment levels

↳ highly correlated with GDP
(even more than capital)
⇒ key indicator



Removing the COVID-19 episode:

unprecedented magnitude
⇒ undermines other fluctuations
(then we remove it here)



Potential output → Not Observed ⇒ must be gauged or estimated (approximated)

In order to determine how much output is deviating from potential output, we need to determine what potential output is.

Potential output: The highest level of output that can be sustained over the long run (implies using inputs in the best yet sustainable way)

Problem: Potential output is not "observed" (must be calculated/approximated)

How come and what does that mean?

The GDP trend leading to a long-run potential value of it is rather a concept, is the output we expect to see once short-term shocks or surprises fade away.

There are many statistical and economic (model based) methods yielding different proposals for what the potential output is!

And what is key is that different candidate "potential outputs" can lead to diverging diagnostics of the state of the economy.

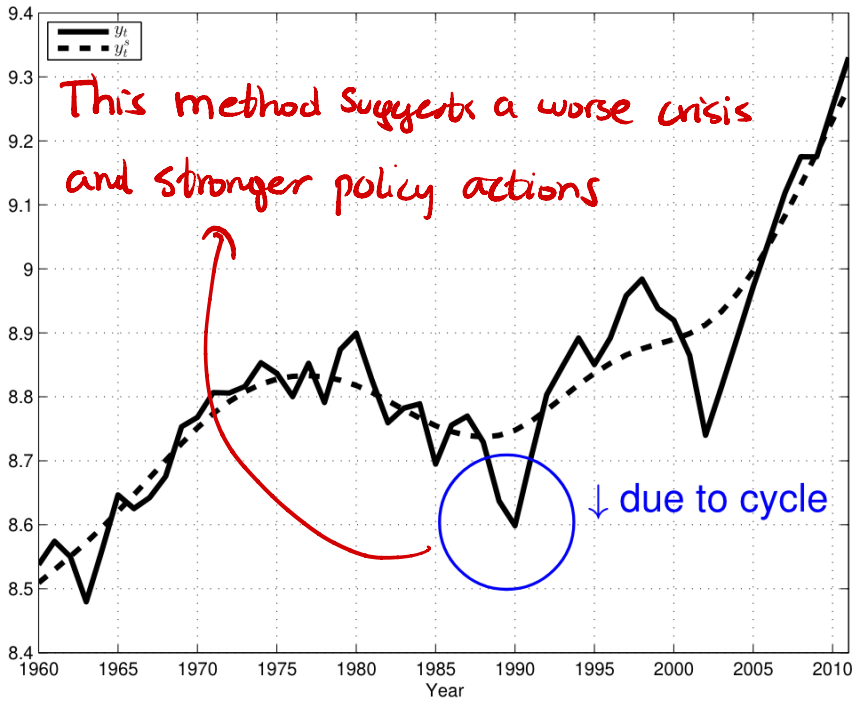
Problem: Bad Potential GDP estimations can lead to Bad Policy Prescriptions

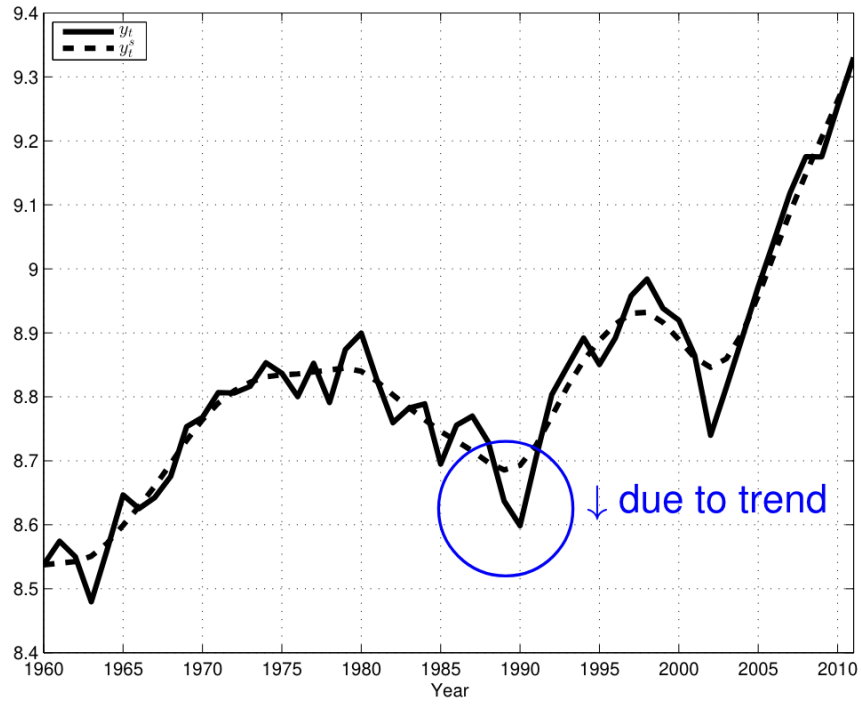
Potential output (cont')

Example: Argentina

If calculated as 'too high'/'to low', then decision-makers may mistakenly try and stimulate/'restrain' the economy

Example: Log of Argentine GDP and Two competing Output Gap measurements





The method in the left would indicate crises are more severe and perhaps justify more government interventions.

2 different methods for estimating $\bar{Y}$

2 different conclusions

Potential output (cont')

$\bar{Y}$ methods may not even agree on whether $\tilde{Y}_t > 0$, $\tilde{Y}_t < 0$ at any given t

Even worse, sometimes different methods indicate actual GDP being above and below the potential output

If there is a significant increase in output, does this mean that the economy is doing well or that potential output has increased?

Output:

$$Y_t = \bar{Y}_t + \text{Short Run Output}$$

Hard to assess:

⇒ Economists look at related indicators to evaluate which method is more reasonable

Some measures looked at to gauge this are:

- How quickly the unemployed are finding jobs
- Surveys of particular industries → Sentiment surveys
- Demand by firms for new factories and equipment

Other: Sales
Inventories
etc

Inflation and recessions

π and Recessions (related to $\downarrow \tilde{Y}$)

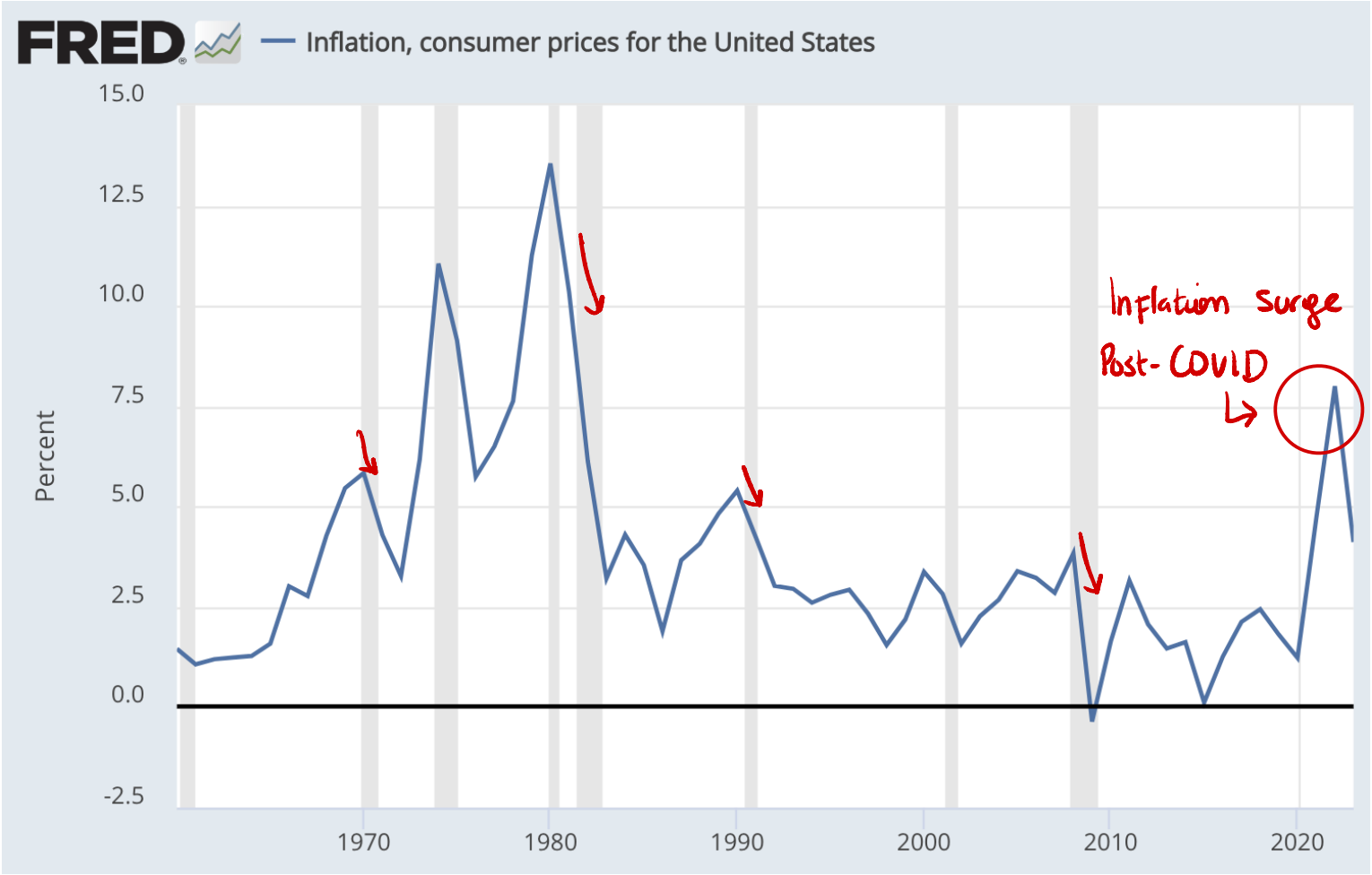
Comove: Inflation ↓ in recessions

(Mechanism: A recession hits ⇒ ↓ Demand → ↓ Prices)

This plot: Inflation (annual)

Inflation decreases during recessions

There was a post COVID inflation surge AFTER the last recession.



We saw this in a prior lecture, but here we look at inflation again and link it to the short-run output dynamics (suggested in the data here but also from the lenses of a model)

Short-run model

Link economic variables to the Output gap

deviation/wedge of GDP from its Potential

We use the short-run model to help **explain deviations of actual GDP from the long-term trend** (potential output):

Temporary: Affect the Short run GDP but not the Long-run GDP

The short-run model is based on three premises:

1) The economy is **constantly being hit by shocks**, which include

- Changes in oil prices, new technologies, natural disasters, etc.

2) Monetary and fiscal policies affect output: Policy: Monetary, Fiscal, etc.

- The central bank (Federal Reserve in the case of the US) can implement **monetary policy**
- Changes in **government spending and taxes** also affect the economy

3) There is a trade-off between output and inflation:

The relationship between inflation and GDP is given by the Phillips curve

Graph of the Short-run model

Mechanism: Phillips Curve

Boom → ↑π

Recession → ↓π

The Phillips curve depicts the relationship between inflation and output

it shows that an economic boom will increase inflation and a recession will decrease inflation

The slope is about 1/3, so the economy being 3% above potential output is associated with inflation increasing by 1%

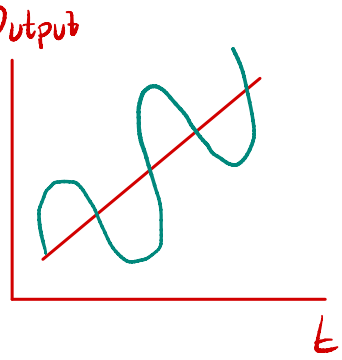
Example: Boom: $\tilde{Y}$ increases

(at aggregate level)

↑ Firms raise wages → Firms must raise prices → Inflation rate increases → Demand for products decreases (↓ Sales)

→ Firms need to cut costs and lay off workers → Inflation rate falls back down to previous levels (π↓)

↳ People consume & Invest less ↑



$$\Delta\pi_t = \pi_t - \pi_{t-1} = f(\tilde{Y}, \dots) \quad (+)$$

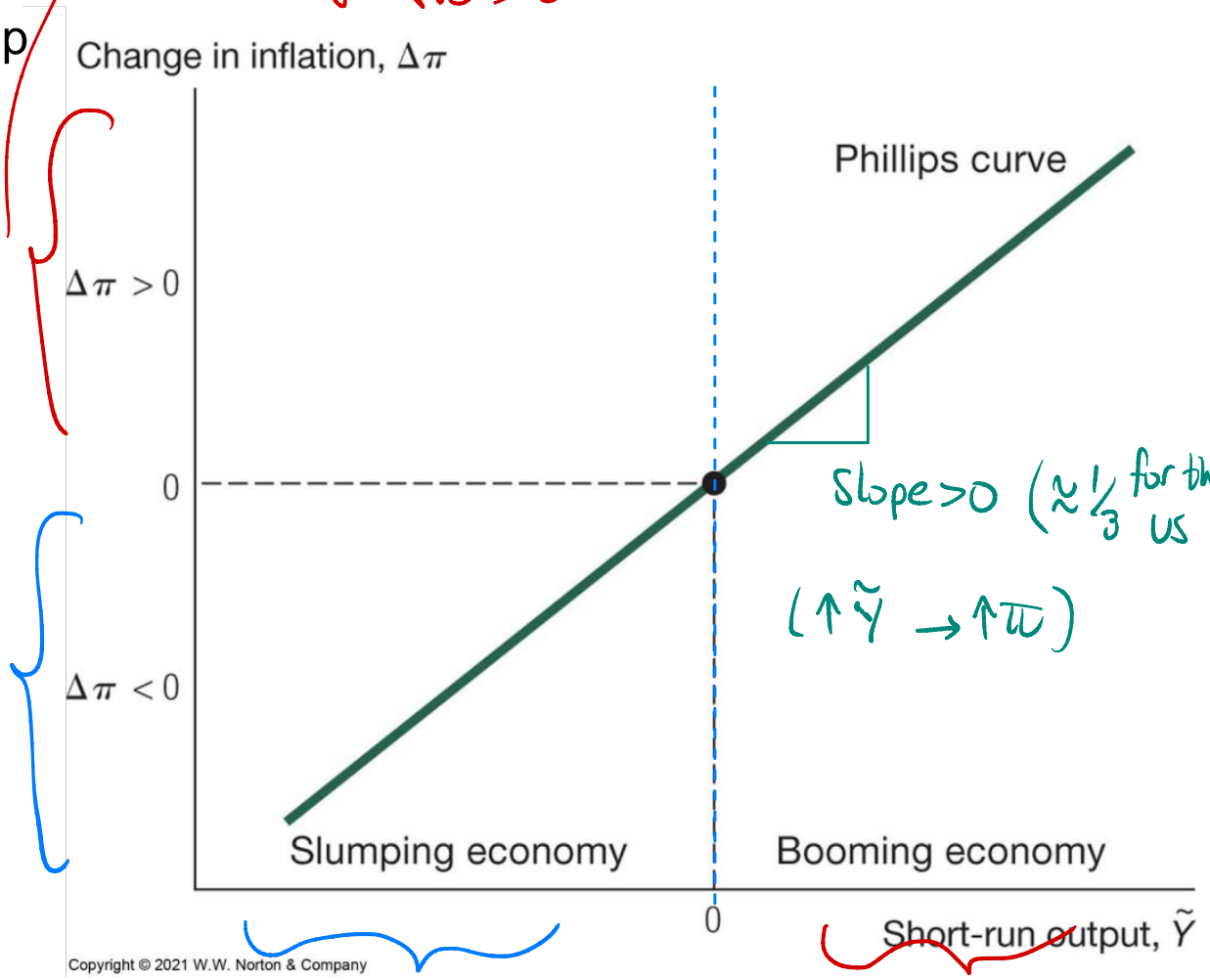
$$(\pi_t = \pi_{t-1} + f(\tilde{Y}, \dots))$$

The Phillips Curve

Depicts the short-run relationship between output and inflation

When the economy is Booming ($\tilde{Y} > 0$) inflation rises

When the economy is Slumping ($\tilde{Y} < 0$) inflation falls



Inflation is increasing $\Delta\pi > 0$

Inflation decreases $\Delta\pi < 0$

Slope > 0 ($\approx \frac{1}{3}$ for the US)

($\uparrow \tilde{Y} \rightarrow \uparrow \pi$)

$\tilde{Y} < 0$

$\tilde{Y} < 0$

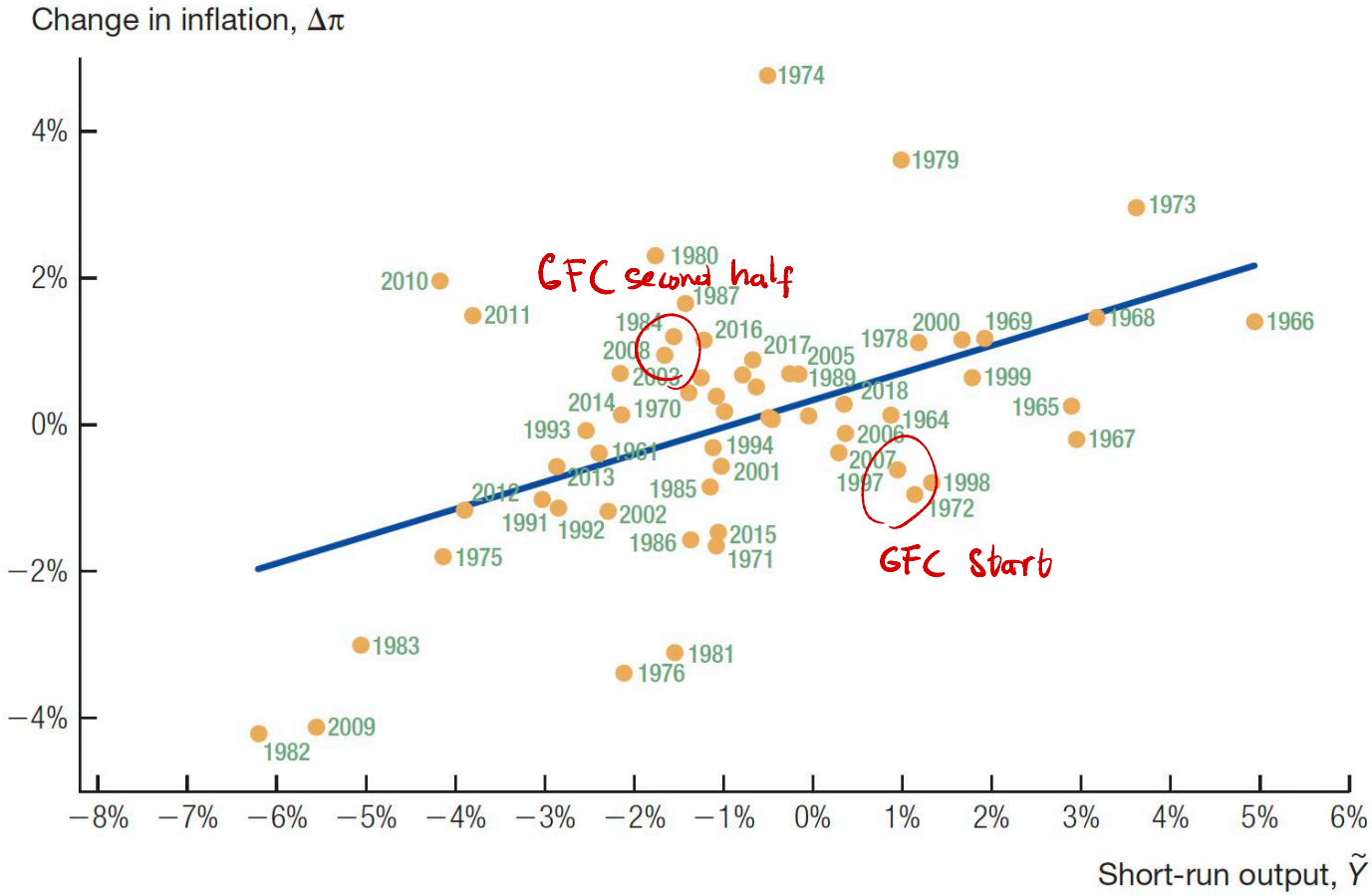
$$\tilde{Y} = \frac{Y - \bar{Y}}{\bar{Y}} \quad (\approx \log(Y) - \log(\bar{Y}))$$

Does the Phillips curve fit the data?

(US Data)

This graph is the basis for the 3% to 1% ratio that we saw in a previous slide

This is the 'best-fit' line running through the data points



Source: FRED. U.S. Department of Commerce.

Some of the outliers can be explained changes in oil prices

→ Relevant for costs of production

(But this positive relationship also holds with core inflation)

Okun's law

Relationship between Y_t & Unemployment (Negative)

Economic fluctuations: Measured either through output or the unemployment rate

- **Recessions** are a time with **higher unemployment and lower output**
- **Booms** are a time with **lower unemployment and higher output**

The more people are working, the higher output an economy will produce

Okun's law depicts the relationship between GDP (output) and the unemployment rate

This is useful because when thinking about a model we can consider only unemployment or only output rather than both variables.

Usually, economists consider output in their models (but keep in mind they are mostly working about the active number of workers in an economy).

Okun's law (cont')

Okun's law is depicted by the following equation:

$$u - \bar{u} = -\frac{1}{2} \times \tilde{Y}$$

actual unemployment ← u

Natural unemployment: Unemployment when economy is at its Potential (long-run) ← $\bar{u}$

$u - \bar{u}$: Cyclical Unemployment

$\tilde{Y}$: Short-run output or Output gap (Set in deviations terms; % of Potential GDP)

Where:

u = Current rate of unemployment

$\bar{u}$ = Natural rate of unemployment (unemployment rate when the economy is at potential output)

$\tilde{Y}$ = Short-run output

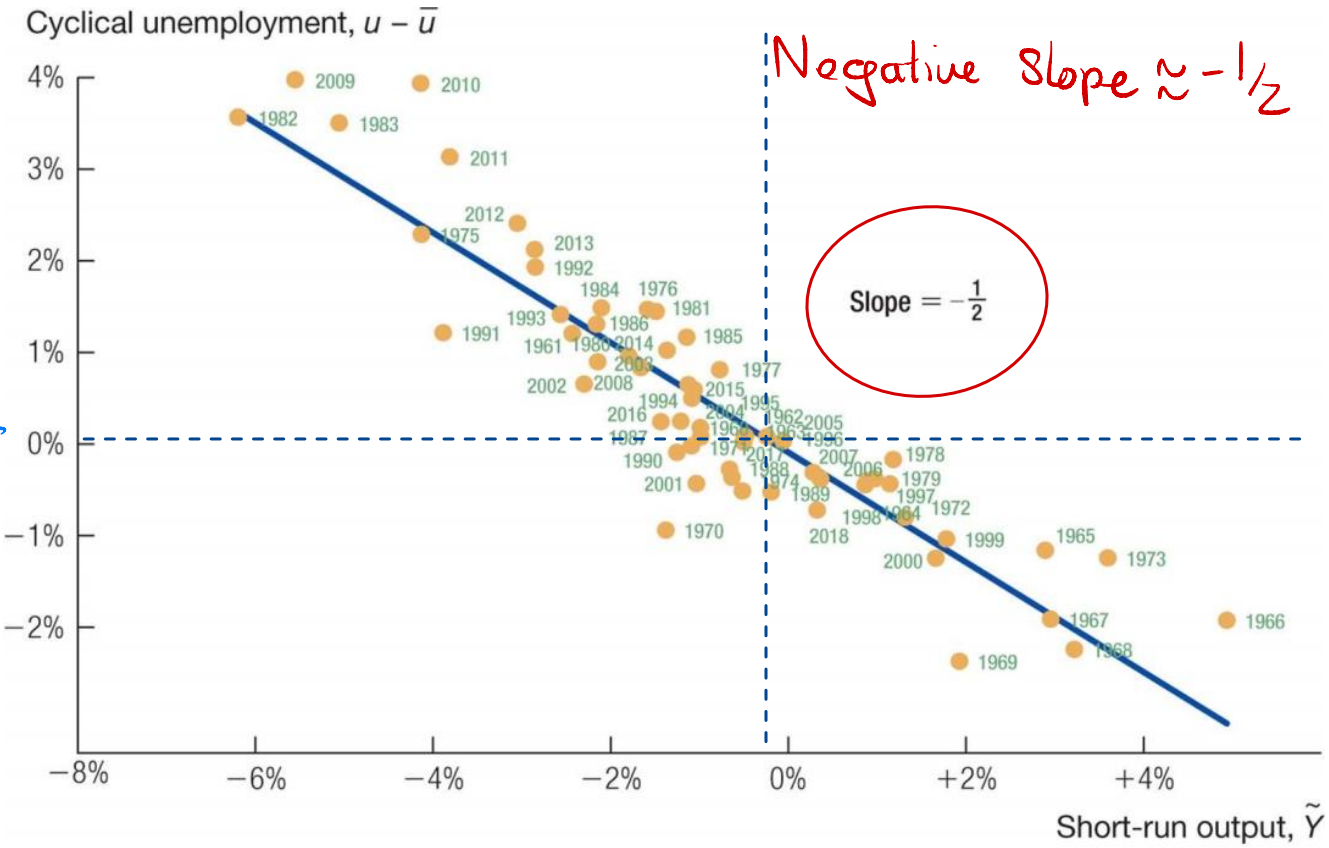
u - $\bar{u}$ = 'Cyclical rate of unemployment' (unemployment that is due to economic cycles)

Does Okun's law fit the data?

(US Data)

Here we can see the level of cyclical unemployment and short-run output for different Years in the US

The **best fitting line** running through these points is where **Okun's law** comes from



Source: FRED. U.S. Department of Commerce.

Unemployment rate is below its "natural level"

↳ Associated with $\tilde{Y} > 0$ (by Okun's Law)

(Overheated economy — Potentially —)

Conclusion

main takeaway: Output → Actual level ①; Potential ②

- Output can be viewed in two ways: deviations of ① from ② : fluctuations → Business Cycles
  - The long-run component associated with potential output (potential GDP)
  - The short-run component that has to do with fluctuations in output
  - Short-run fluctuations: Percentage difference (deviations) between actual output and potential output
- The inflation rate is positively related to output (**Phillips curve**)
  - Approximately at a ratio of 1% inflation to 3% output for the US
  - Note the "approximately": capturing this slope is a current area of study
- **Okun's law** states: A decrease in output below potential output is associated with an increase in unemployment (less than proportional or around ½ percentage)
- We will see later: How **monetary policy and fiscal policy can help mitigate** short-run deviations from potential output

Next: Policies, Shocks (effects of)