

Inflation and Unemployment

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Objectives

This section is about the trade-off between inflation and unemployment.

In this section you will learn:

1. How and when expansionary monetary policy reduces **unemployment**.
2. When does it generate **inflation** instead.
3. The importance of **expectations** for monetary policy.

The Question

Monetary policy stimulates aggregate demand.

Why not always use it gain more employment / output?

Answer: Lax monetary policy creates inflation.

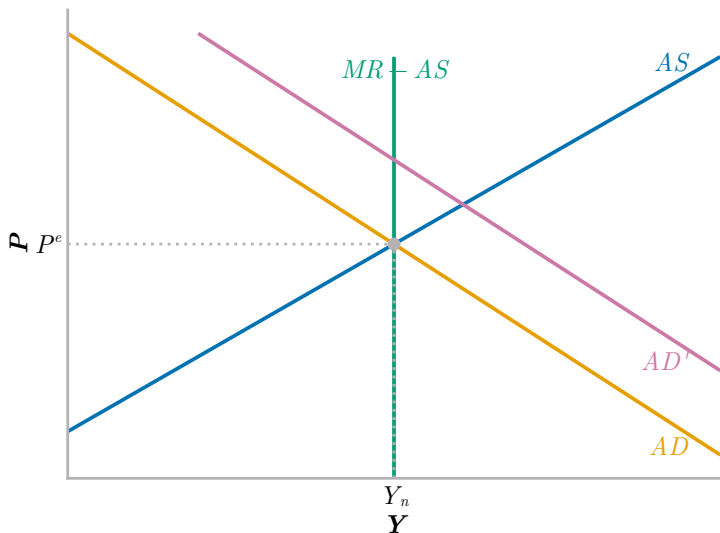
Key issue

Can we buy more employment with more inflation?

What do the data show?

And what does the AS/AD model predict?

Higher inflation \Rightarrow more output?



What happens if the Fed keeps shifting AD out?

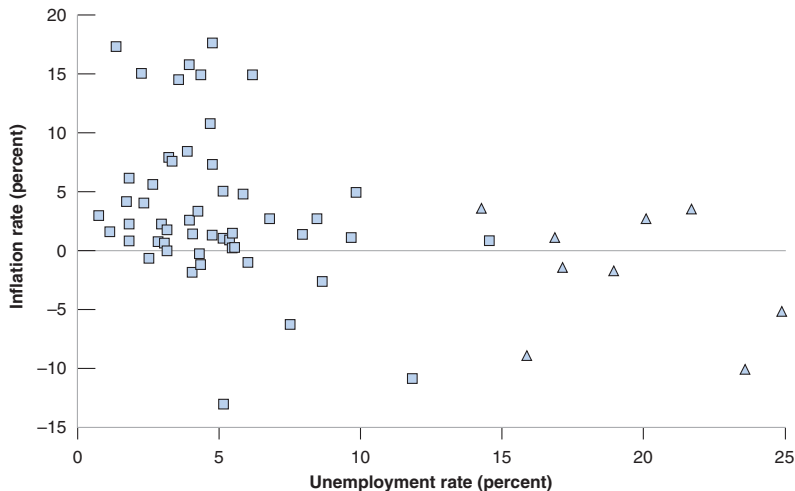
Model Prediction

The Fed can buy higher output with higher inflation.

Intuition...

Is the intuition plausible?

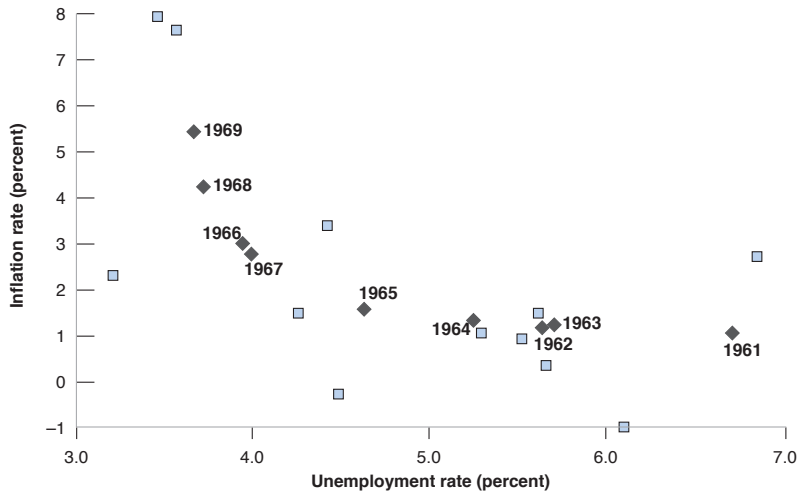
The Data: 1900-1960



High inflation seems associated with low unemployment.

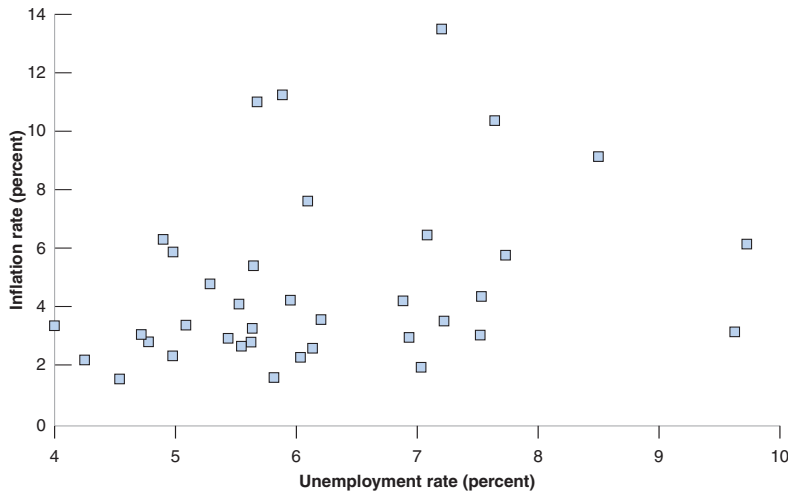
► “Phillips Curve”

The Data: 1960s



The 1960s are especially clear.

Modern Data: 1970-2010



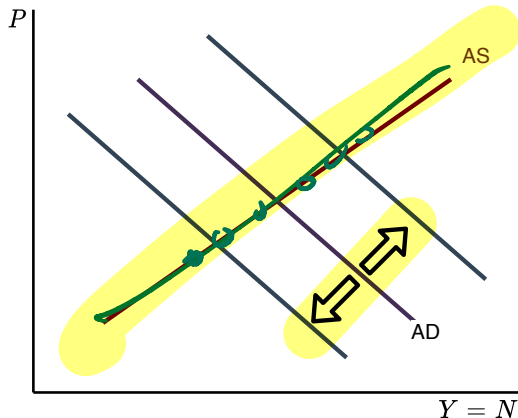
Breakdown of the Phillips Curve

Phillips Curve: Intuition

Assume that economic fluctuations are mostly driven by *AD* shocks.

- ▶ The *AS* curve is stable over time.

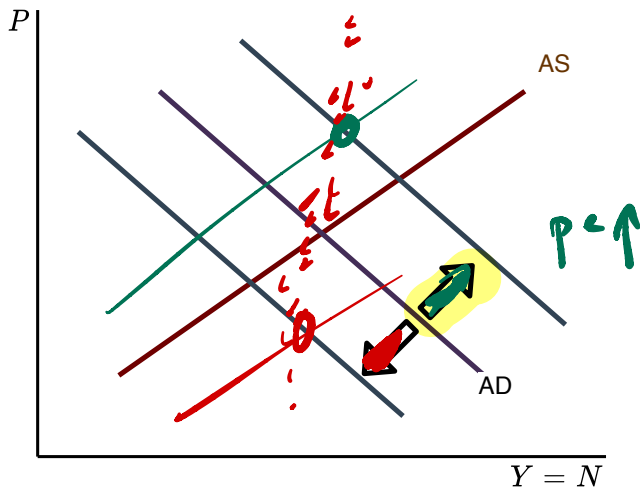
Then we get a positive correlation between inflation and unemployment.



1960s

Phillips Curve: Intuition

How does the analysis change when the price changes are expected?



Why Might the Phillips Curve Break Down?

We know: only **unanticipated** inflation increases output

$$Y^s = F\left(\frac{P}{P^e} \frac{1}{1+m}, z\right) \quad (1)$$

A natural idea:

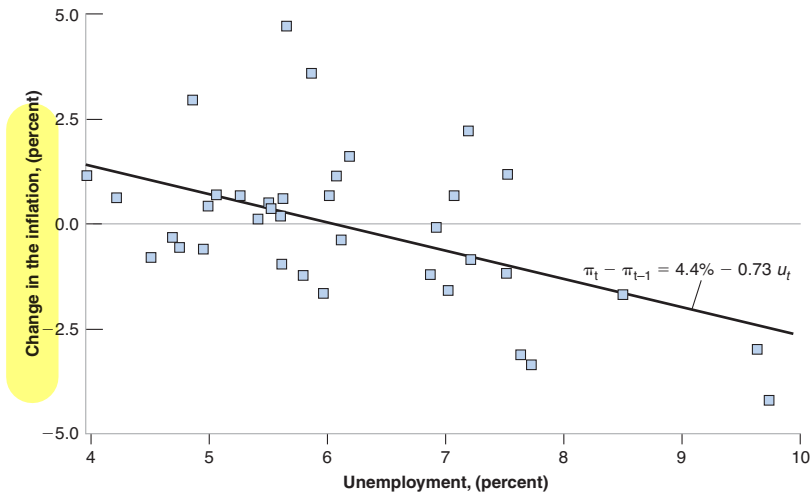
- ▶ up to the 1960s inflation was unanticipated
- ▶ afterwards it was anticipated and hence did not affect output

We need a measure of **unanticipated inflation**.

A simple measure: the change of the inflation rate

- ▶ Can we buy more output by **raising** inflation?

The New Phillips Curve: 1970-2010



Rising inflation – low unemployment

Summary

Until 1960

- ▶ higher inflation was associated with lower unemployment

After 1960

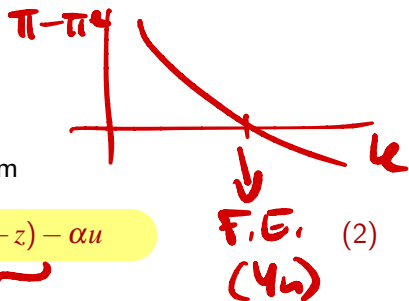
- ▶ rising inflation was associated with lower unemployment

Questions:

1. Why the change?
2. Can be buy persistently higher employment with ever rising inflation?

Theory Underlying the Phillips Curve

Deriving the Phillips Curve



We derive a Philips Curve of the form

$$\pi = \pi^e + (m + z) - \alpha u$$

AS shifters

F.E. (2)
(4u)

In words:

- ▶ holding fixed π^e : there is a stable Philips Curve inflation and unemployment are negatively related
- ▶ in general: there is a “modified” Philips Curve that relates **unexpected inflation** to unemployment

Deriving the Philips Curve

Start from aggregate supply

$$Y^s = F\left(\frac{P}{P^e} \frac{1}{1+m}, z\right) \quad (3)$$

Divide by last period's prices:

$$\frac{P}{P^e} = \frac{P}{P_{-1}} \frac{P_{-1}}{P^e} = \frac{1 + \pi}{1 + \pi^e} \quad (4)$$

- ▶ $\pi \equiv (P - P_{-1})/P_{-1}$: **actual** inflation rate
- ▶ $\pi^e \equiv (P^e - P_{-1})/P_{-1}$: **expected** inflation rate

Deriving the Philips Curve

The Philips Curve is now

$$Y^s = F\left(\frac{1+\pi}{1+\pi^e} \frac{1}{1+m}, z\right) \quad (5)$$

In words:

- ▶ For P to pull ahead of P^e by 5%, we need 5% unanticipated inflation
- ▶ I.e.: $\pi = \pi^e + 5\%$
- ▶ Or $\frac{1+\pi}{1+\pi^e} = 1.05$

Simplification

Approximately

$$\frac{1 + \pi}{1 + \pi^e} \approx 1 + \pi - \pi^e \quad (6)$$

Example:

$$\pi = 0.05, \pi^e = 0.03 \implies \frac{1 + \pi}{1 + \pi^e} - 1 = 0.0194 \approx 0.02 \quad (7)$$

$$Y^s = F\left(\frac{1 + \pi - \pi^e}{1 + m}, z\right) \quad (8)$$

$\pi - \pi^e$

Deriving the Phillips Curve

In words:

- ▶ AS supply rises when prices are higher than expected
- ▶ or when inflation is higher than expected

Anticipated inflation is built into wage demands

- ▶ it is “neutral” (does not affect real AS)

Next step: translate changes in Y^S into changes in unemployment.

Relationship with unemployment

$$u = \frac{L - N}{L} = 1 - \frac{N}{L} \quad (9)$$

where:

- ▶ u : unemployment rate
- ▶ N : employment
- ▶ L : labor force

In words:

unemployment rate = 1 - employment rate.

Relationship with unemployment

$$Y = N$$

Recall the aggregate production function:

$$\underline{Y/L} = \underline{N/L} = \underline{1 - u} \quad (10)$$

or

$$u = 1 - Y/L = 1 - F\left(\underbrace{\frac{1 + \pi - \pi^e}{1 + m}}_Y, z\right) / L \quad (11)$$

Implications

$$u = 1 - F\left(\frac{1 + \pi - \pi^e}{1 + m}, z\right) / L \quad (12)$$

1. $\pi^e \uparrow$: Need higher π to support the same u

Intuition:

2. $m \uparrow$: $u \uparrow$ for given π, π^e

Intuition:

3. Given π^e , we have a Phillips curve ($u \uparrow \implies \pi \downarrow$)

Intuition:

Simplification

Take a linear approximation:

$$u = \beta_m m + \beta_z z - \beta_\pi (\pi - \pi^e) \quad (13)$$

But typically the Phillips curve is written as:

"inflation is a decreasing function of unemployment"

$$\pi - \pi^e = \frac{\beta_m m + \beta_z z - u}{\beta_\pi} \quad (14)$$

Or even simpler:

$$\pi = \pi^e + (m + z) - \alpha u \quad (15)$$

$-\alpha$ is the slope of the Phillips Curve.

The Phillips Curve shifts around over time as labor market conditions $(m + z)$ change.

DERIVING THE TC

AS $y = F\left(\frac{P}{P^e}, \frac{1}{1+m}, z\right)$

Approximately $\frac{P}{P^e} \approx 1 + \pi - \pi^e$

prices are higher than
expected when π is
higher than expected

In words: γ is high
when

- $\pi - \pi^e$ high
- m low (high w/q)
- z low

When $\gamma \uparrow$ $N \uparrow \Rightarrow u \downarrow$
Linear approximation:

$$\pi - \pi^e = m + z - \alpha k$$

Policy Implications

Can governments exploit the Phillips Curve?

A key result that is central for all of monetary policy

For money to be non-neutral, inflation must be **unexpected**

This is the key difficulty of monetary policy.

Simply raising inflation every year cannot work.

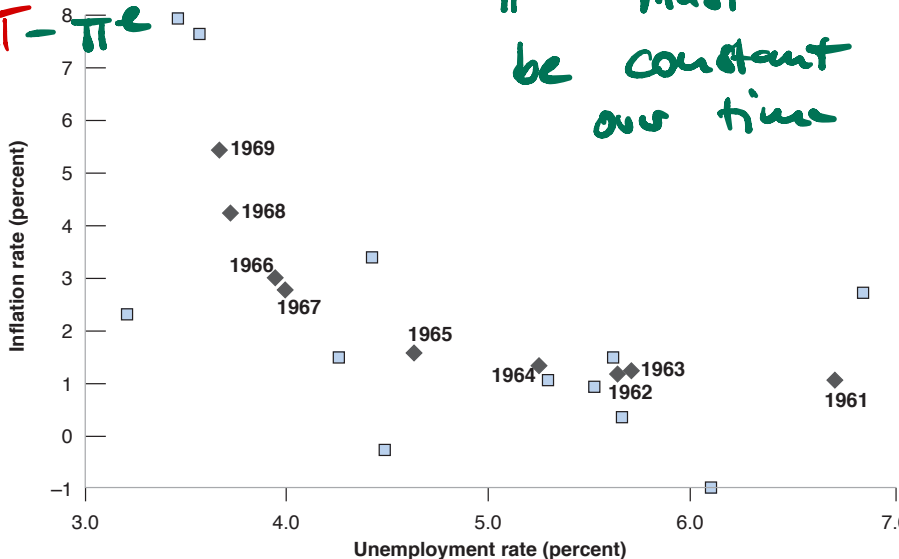
Note: There is nothing new here. That's what AS/AD implies

The Phillips Curve Through Time

The 1950s and 60s

$\pi - \pi^e$

π "must"
be constant
over time



The economy moves up along a stable Phillips Curve

Interpretation

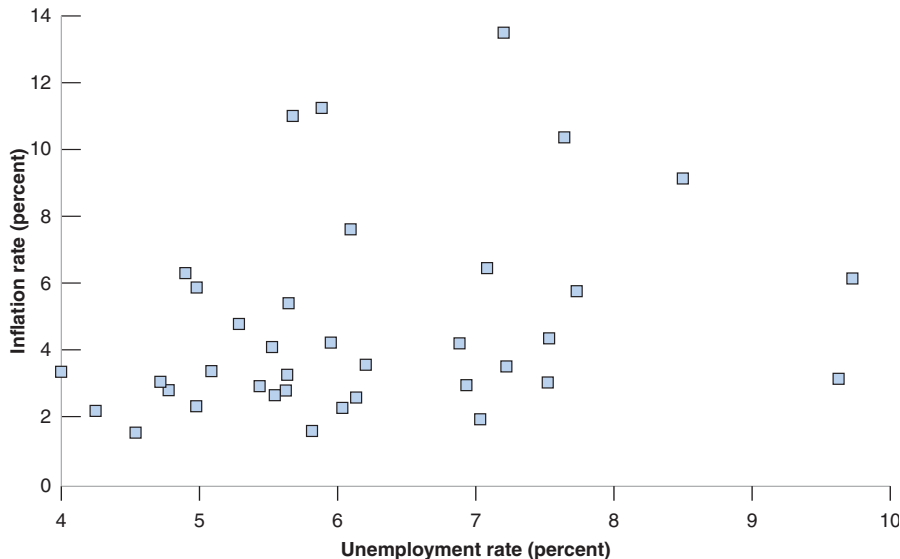
~~Inflation had been stable for a long time~~

π^e remained roughly fixed

Then the original Phillips curve emerges

$$\pi = \underbrace{\pi^e}_{\text{fixed}} + (m + z) - \alpha u \quad (16)$$

The 1970s and Beyond

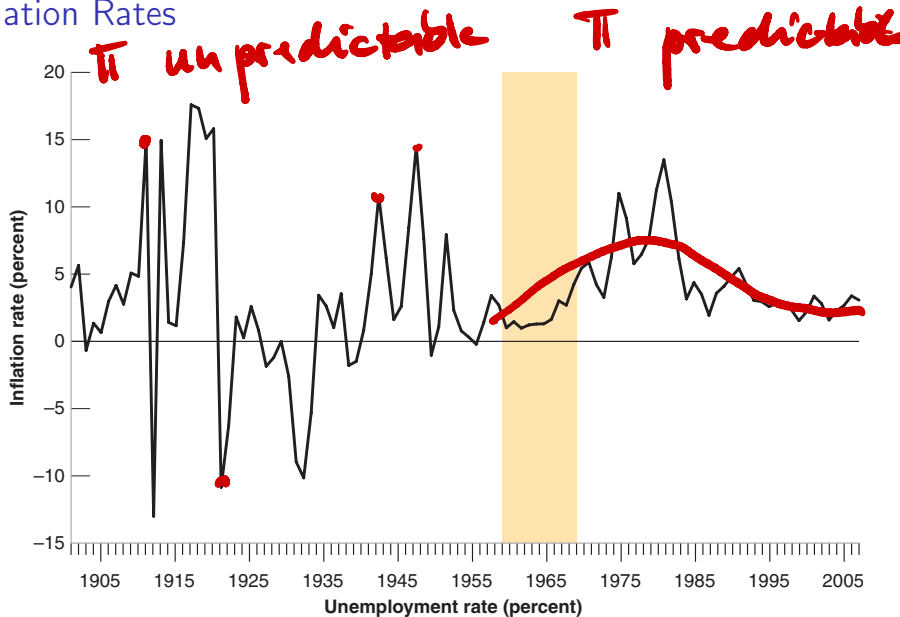


No relationship between inflation and unemployment

Interpretation

- ▶ A change in inflation expectations.
- ▶ Before the 1960s: inflation fluctuated around 0
 - ▶ little persistence
- ▶ It was reasonable to expect roughly zero inflation
- ▶ After 1960s: inflation was generally positive
 - ▶ strong persistence
- ▶ Zero inflation would have been a poor forecast

Inflation Rates



Modified Phillips Curve

Assume that agents form expectations according to

$$\pi_t^e = \theta \pi_{t-1} \quad (17)$$

Of course, one could do better than that...

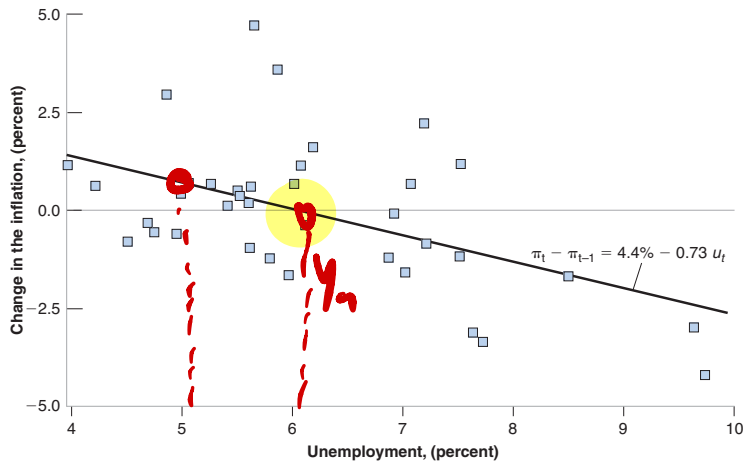
A coarse approximation:

- ▶ 1960s: $\theta = 0$
- ▶ 1970s: $\theta = 1$

Modified Phillips Curve

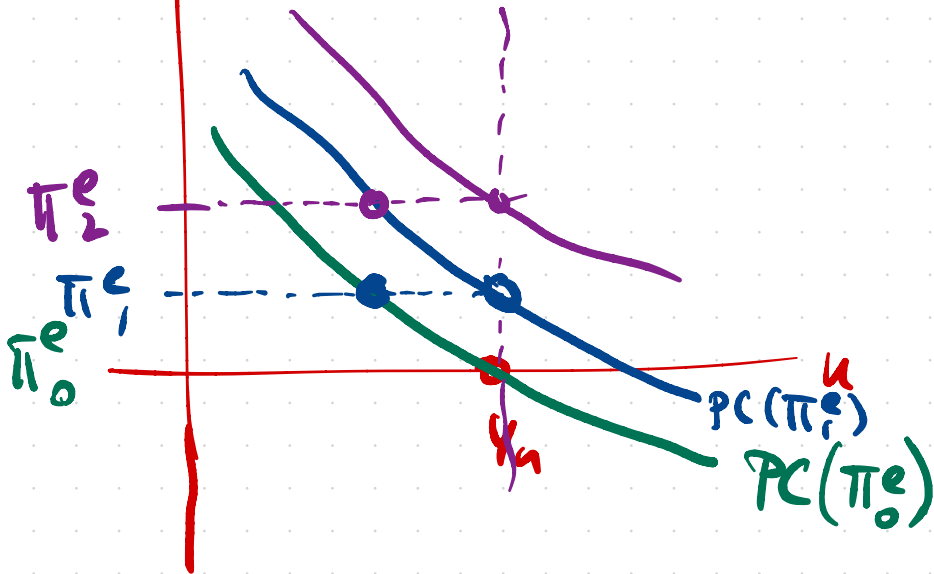
$$\pi_t - \pi_{t-1} = (m + z) - \alpha u_t \quad (18)$$

Modified Phillips Curve



π

$$\pi = \pi^e + m + z - \alpha u$$



Implications

- ▶ Original Phillips Curve:
 - ▶ government can buy lower unemployment by raising inflation
 - ▶ intuition: wage setters never catch on to the fact that tomorrow's prices will be higher than today's
- ▶ Modified Phillips Curve:
 - ▶ government can buy lower unemployment by raising inflation over time
 - ▶ intuition: wage setters never catch on to the fact that tomorrow's inflation will be higher than today's
- ▶ Clearly, this can't work either (at least not forever)

Reading

Text: Blanchard and Johnson (2013), ch 8

References I

Blanchard, O. and D. Johnson (2013): *Macroeconomics*, Boston: Pearson, 6th ed.