AGGREGATE SUPPLY & THE PHILLIPS CURVE

Week 7

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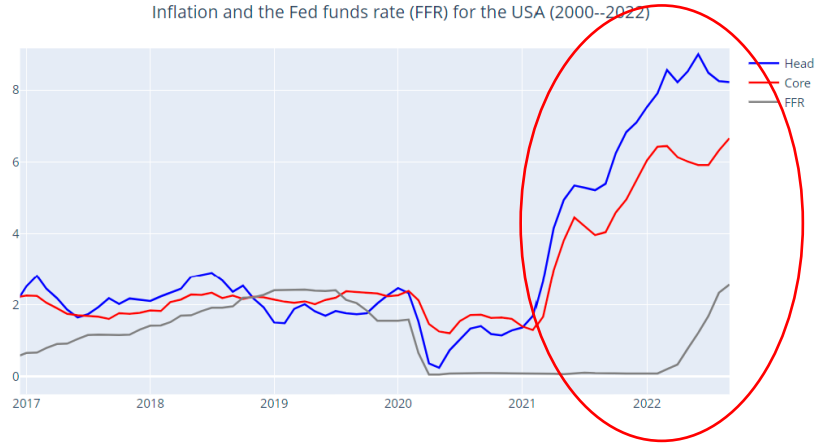
1. The Phillips Curve

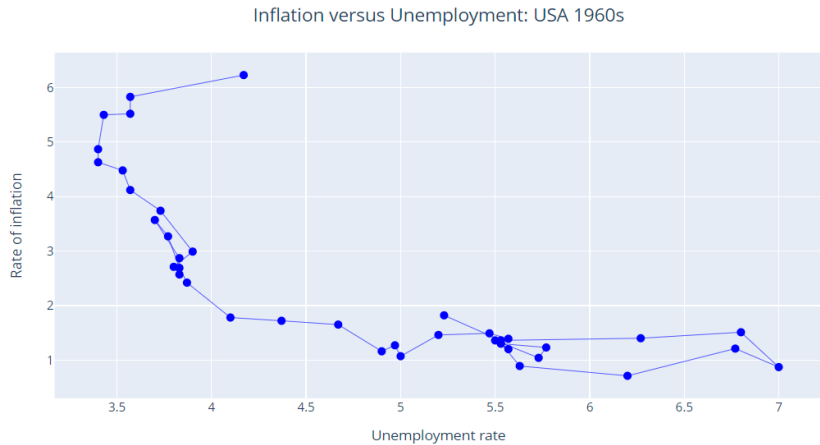
The Pains of Fighting Inflation



"We have got to get inflation behind us. I wish there were a ***painless way*** *to do that.* ***There isn't.****" Jay Powel, Chair of the Fed, 21 Sept. 2022*

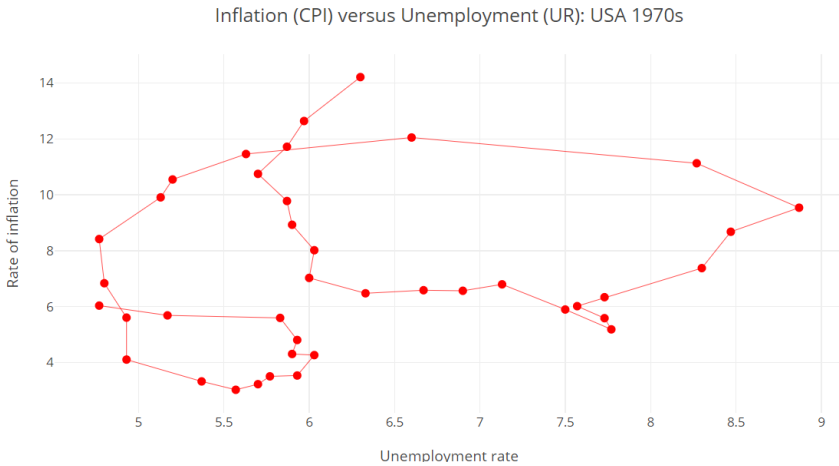
The Phillips Curve (PC)

Almarin Phillips discovered in the 1950s the **kind of pain** we have to suffer from reducing inflation. The PC shows how much more unemployment we will get (U), to reduce the inflation rate (π). The PC was easily confirmed in the 1960s.



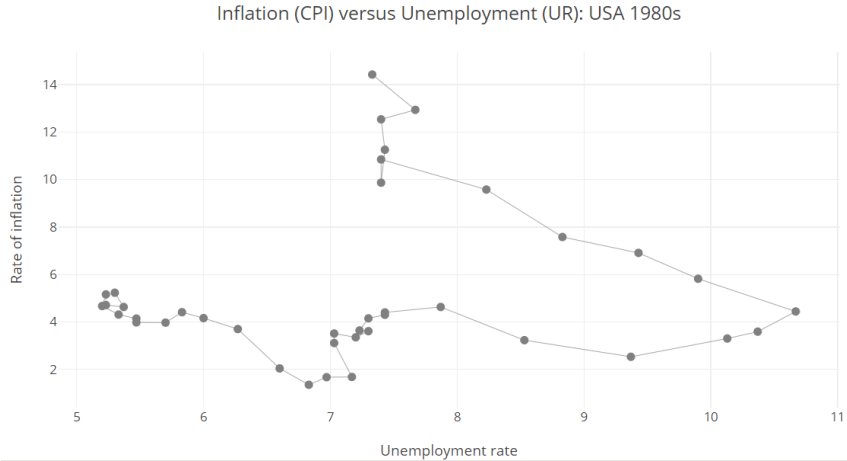
The Phillips Curve in the 1970s

In the 1970s, the PC begins to display a **strange configuration**: it seems to move constantly, looping around.



The Phillips Curve in the 1980s

In the 1980s, the PC seems to have **different slopes**.



The Friedman-Phelps PC Curve

In the late 1960s, Milton Friedman and Edmund Phelps showed that if inflation expectations (π^e) were added to the original PC, we could explain those strange behaviors.

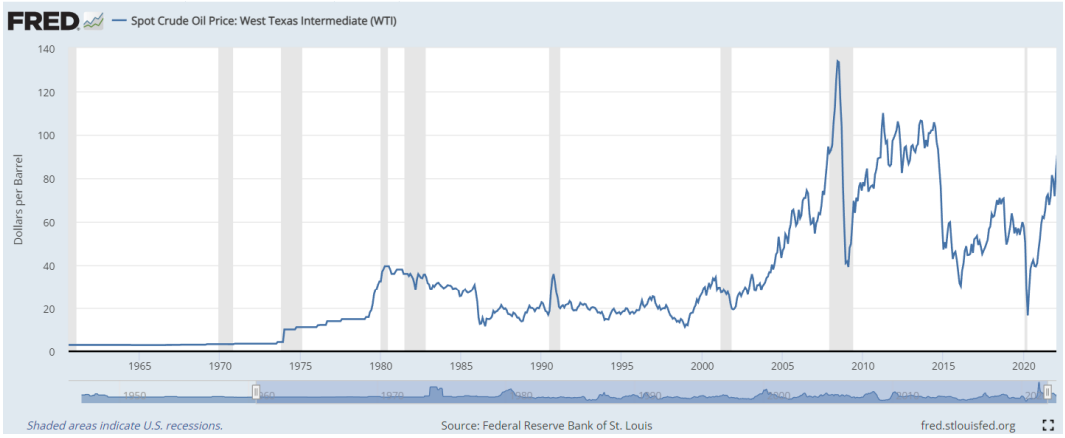
According to them, the **expectations-augmented Phillips Curve** should be:

$$\pi = \pi^e - \omega\,(U - U_n) \tag{1}$$

π inflation rate
π^e expected inflation rate
U unemployment rate
U_n natural unemployment rate
$(U - U_n)$ cyclical unemployment rate
ω is a parameter

Oil Prices Shocks

Large shocks in oil prices have been a recurrent major characteristic of the world economy since the early 1970s.



The PC with Supply Shocks

- Shocks in oil prices affect production costs and as such they interfere in the relationship between inflation and unemployment.
- For example, if oil prices increase a lot, production costs will also rise substantially, and inflation goes up, for every level of unemployment.
- The Covid19 pandemic has been a colossal shock on the supply side.
- The Phillips Curve can easily accommodate these kind of shocks:

$$\pi = \pi^e - \omega \left(U - U_n\right) + \rho \tag{2}$$

where ρ represent the external shocks that hit the production side of the economy.

The PC with Adaptive Expectations

The PC we will work with in this course includes three major ingredients:

1. **Adaptive expectations**: contracts involving wages and prices are linked to past inflation, so inflation expectations adjust slowly to new circumstances:

$$\pi^e = \pi_{-1}$$

2. **Cyclical unemployment**: $U - U_n$

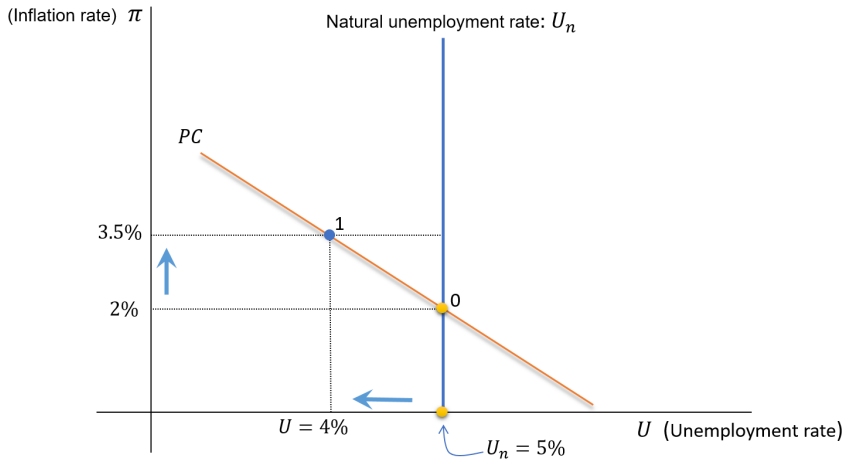
3. **Shocks**: ρ

Therefore:

$$\pi = \pi_{-1} - \omega\left(U - U_n\right) + \rho \tag{3}$$

The Phillips Curve: graphical representation

If we want a lower unemployment rate, we have to accept a higher inflation rate; *assuming everything else constant* (U_n, π^e, ρ).



2. Shifts in the Phillips Curve

Shifts in the PC

The PC will move **to the right** (higher inflation rate for a given unemployment rate) if any of the following facts occur:

- Inflation expectations go up: $\uparrow \pi^e$
- The natural rate of unemployment goes up: $\uparrow U_n$
- A negative supply shock: $\uparrow \rho$
  - Oil prices go up
  - A war cuts the supply of products
  - A pandemic disrupts supply chains

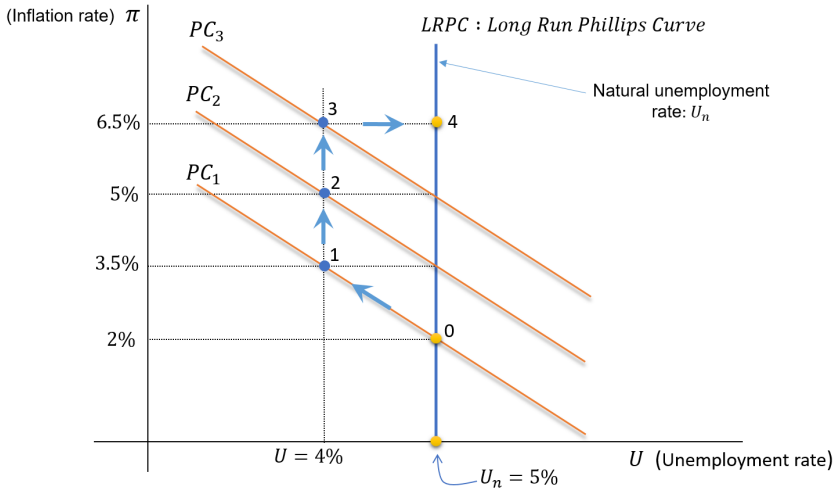
Higher π^e shifts the PC to the Right

$$\pi = \pi^e - \omega\,(U - U_n)\,, \quad \omega = 1.5, \quad \pi_t^e = \pi_{t-1}$$

	Values in percentage points			
Period	Un	U	π^e	π
0	5	5	2	2
1	5	4	2	3.5
2	5	4	3.5	5
3	5	4	5	6.5
4	5	5	6.5	6.5

The Short/Long Run Phillips Curves

Shifts in the PC show a new concept: the Long Run Phillips Curve (LRPC).



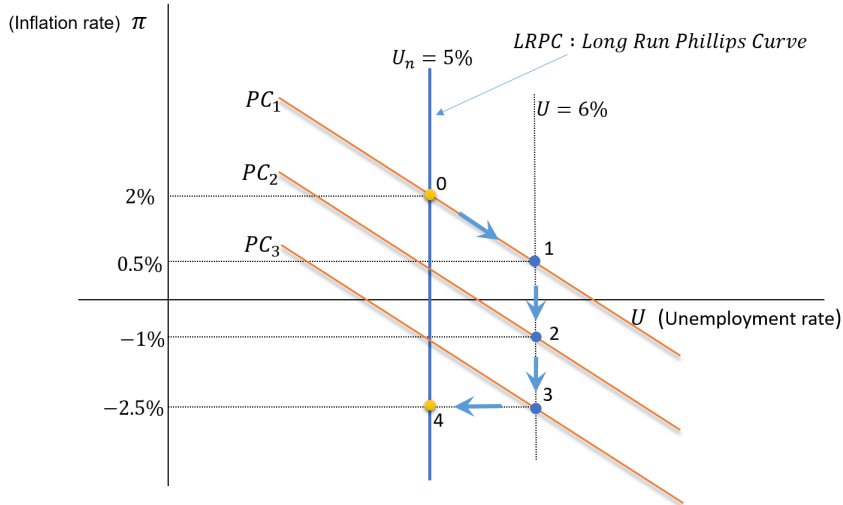
Lower π^e shifts the PC to the left

$$\pi = \pi^e - \omega\,(U - U_n)\,, \quad \omega = 1.5, \quad \pi_t^e = \pi_{t-1}$$

	Values in percentage points			
Period	Un	U	π^e	π
0	5	5	2	2
1	5	6	2	0.5
2	5	6	0.5	-1
3	5	6	-1	-2.5
4	5	5	-2.5	-2.5

The Short/Long Run Phillips Curves

A deflationary process caused by lower π^e



3. The Okun's Law

The Okun's Law

Arthur Okun showed in the early 1960s that there is a negative relationship between cyclical unemployment and the output-gap:

$$\underbrace{U - U_n}_{\text{Cyclical unemployment}} = -\theta \times \underbrace{\left(Y - Y^P\right)}_{\text{Output-gap}} \tag{4}$$

where θ is a parameter, usually

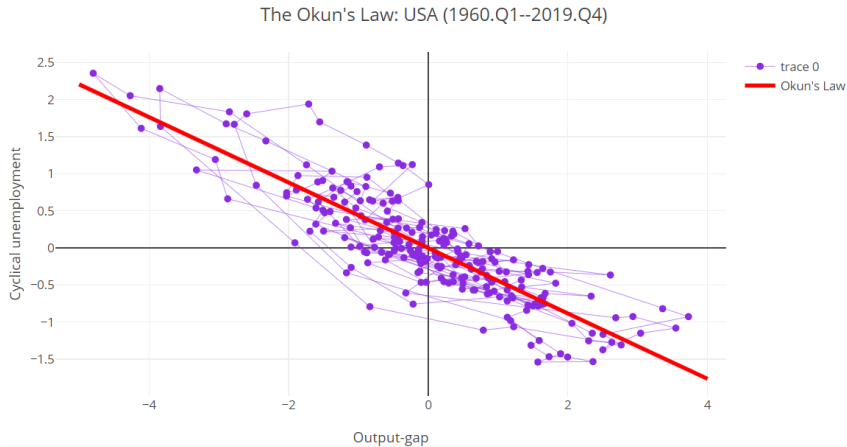
$$\theta \simeq 0.5$$

for the USA economy.

Arthur M. Okun (1962). "Potential GNP: Its Measurement and Significance". Reprinted as Cowles Foundation Paper 190.

The Okun's Law for the USA

The slope of the curve is -0.441392 for the period 1960-2019.



4. The Aggregate Supply Function (AS)

The Short Run AS Curve: Derivation

The short-run Aggregate Supply curve (AS) is obtained by inserting the Okun's law into the Phillips Curve (PC)

$$\pi = \pi^e - \omega(U - U_n) + \rho \qquad U - U_n = -\theta \times \left(Y - Y^P\right)$$

Therefore:

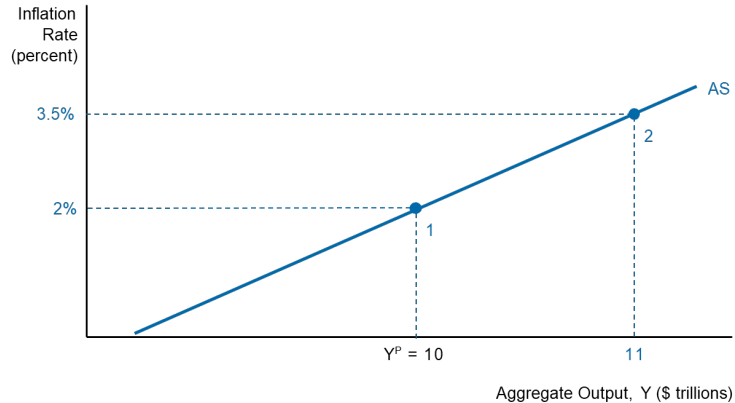
$$\pi = \pi^e - \omega \times \underbrace{\left[-\theta\left(Y - Y^P\right)\right]}_{=U-U_n} + \rho \tag{5}$$

To simplify notation we will use: $\gamma = \omega\theta$.

So, the short-run AS curve is given by:

$$\pi = \pi^e + \gamma\left(Y - Y^P\right) + \rho \tag{6}$$

The Short Run AS Function: Representation



The Long Run AS Function: Derivation

- Suppose there are no shocks: $\rho = 0$
- Suppose inflation expectations are anchored, that is, they are stable:

$$\pi = \pi^e = \pi_{-1}$$

- If we insert these two assumptions in the AS curve

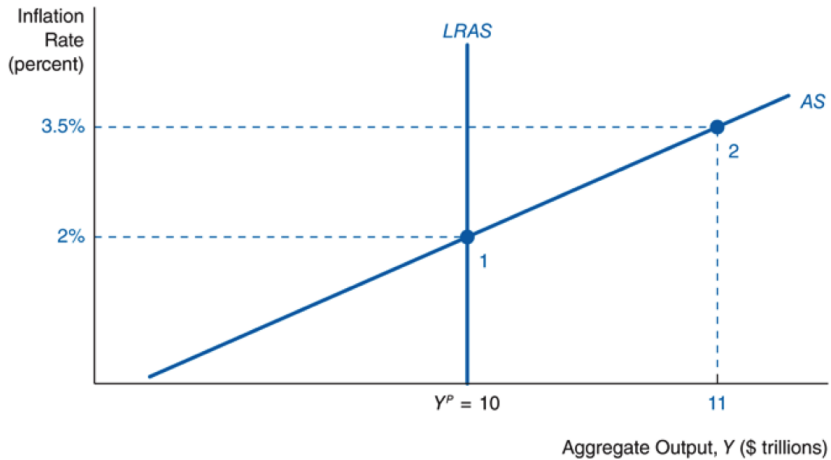
$$\pi = \pi^e + \gamma \left(Y - Y^P \right) + \rho$$

- We will obtain:

$$Y = Y^P$$

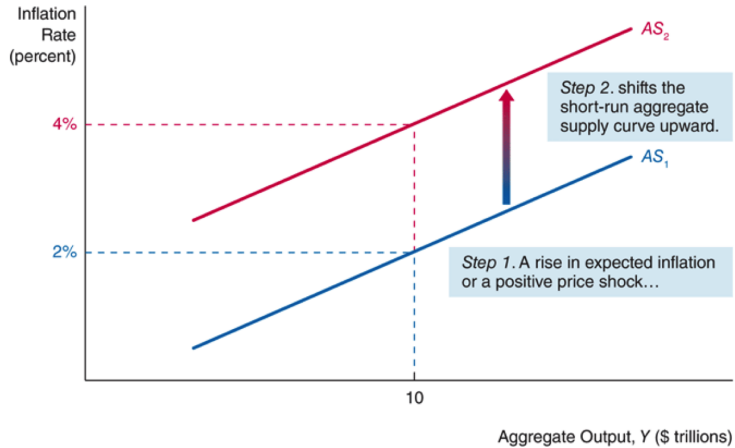
- That is, the PC has to be **vertical in the long-run**.

The Long Run AS Function: Representation



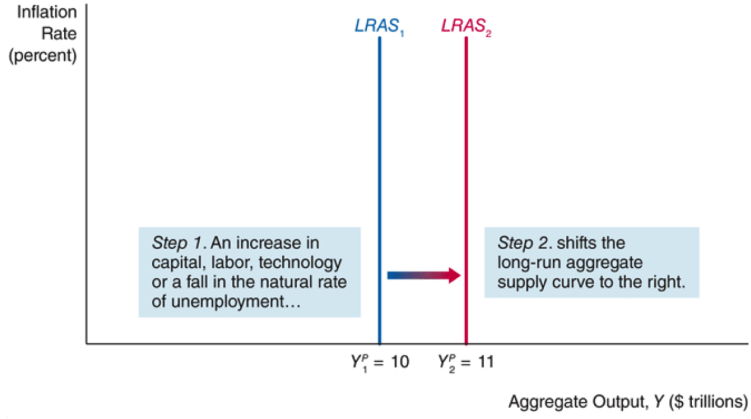
Shifts in the Short Run AS

$$\uparrow \pi^e \ , \ \uparrow \rho$$



Shifts in the Long Run AS

$\uparrow K$, $\uparrow L$, or $\uparrow$ Technology



5. Readings

Readings

- Read Chapter 11 of the adopted textbook:

  Frederic S. Mishkin (2015). *Macroeconomics: Policy & Practice*, Second Edition, Pearson Editors.