The Phillips Curve

Evaluating Short-Run Inflation/Unemployment Dynamics

Outline

1. Inflation-Unemployment Trade-Off

2. Phillips Curve

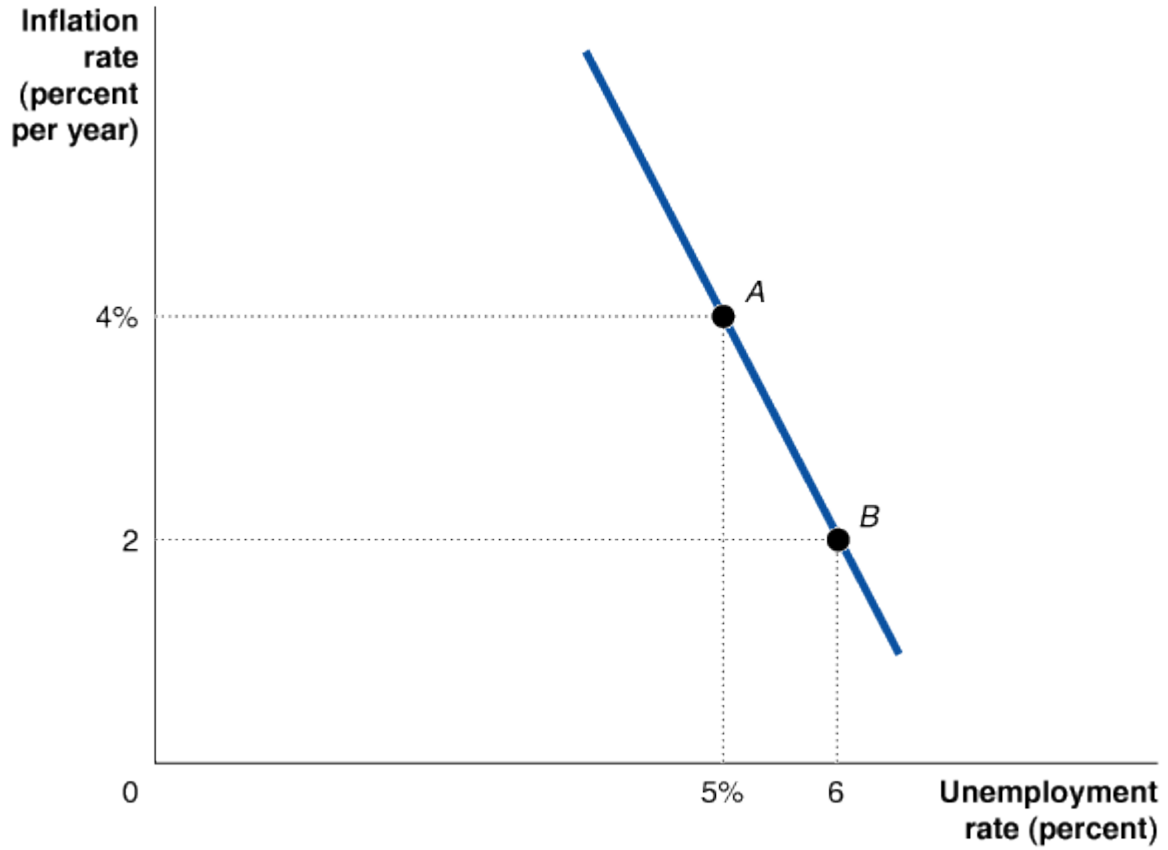
3. Zero Bound for Inflation

- Textbook Readings: Ch. 17

Discovery of Short-Run Trade-Off between π and U

- **Phillips curve**: A curve showing the **short-run inverse** relationship between the unemployment rate and the inflation rate

- Named after economist A. W. Phillips (**1958**)



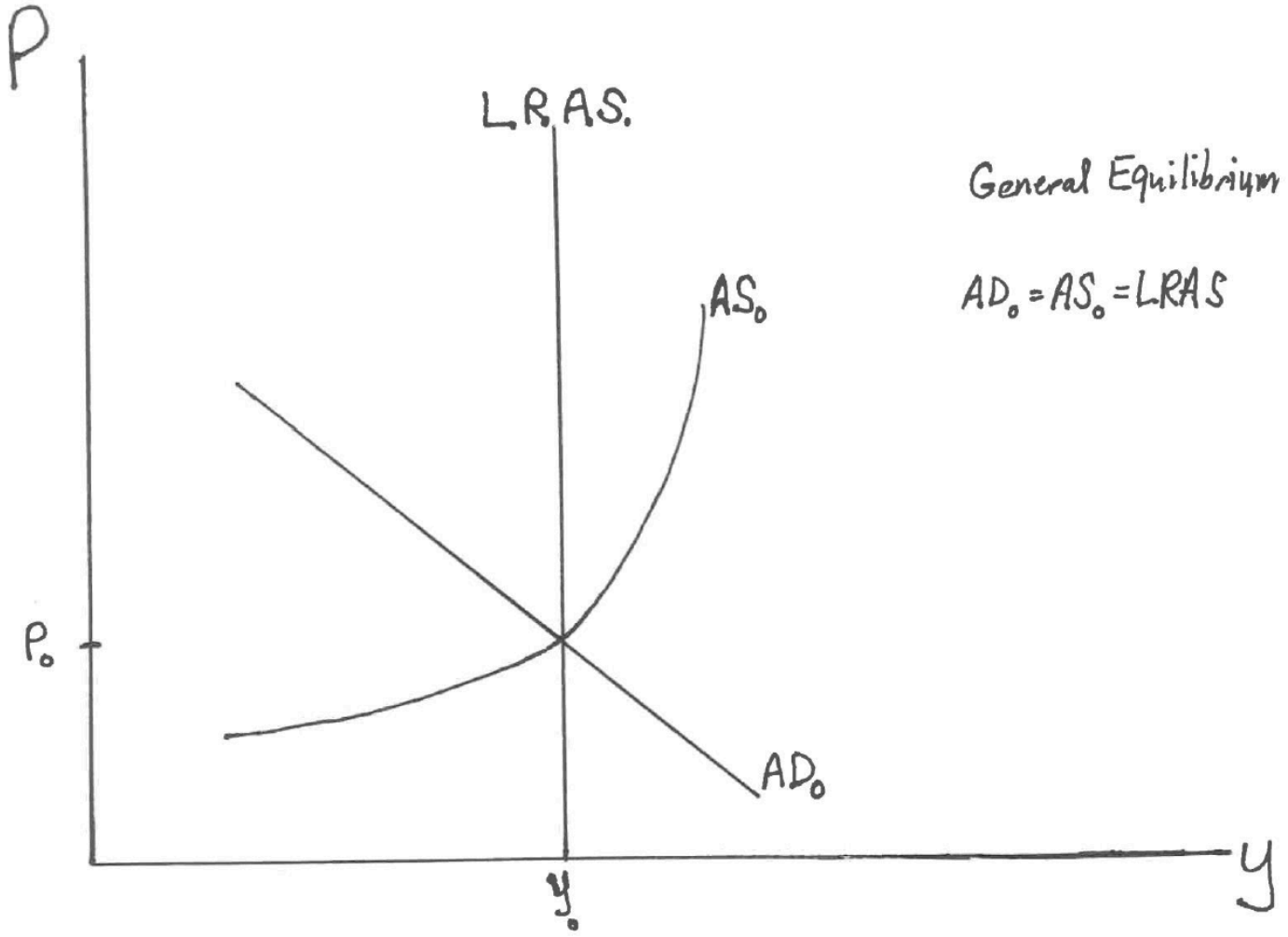
Is The Phillips Curve A Policy Menu?

- During the 1960s, some economists argued that the Phillips curve was a **structural relationship**:
  - A relationship that depends on the basic behavior of consumers and firms, and that remains **unchanged** over a long period

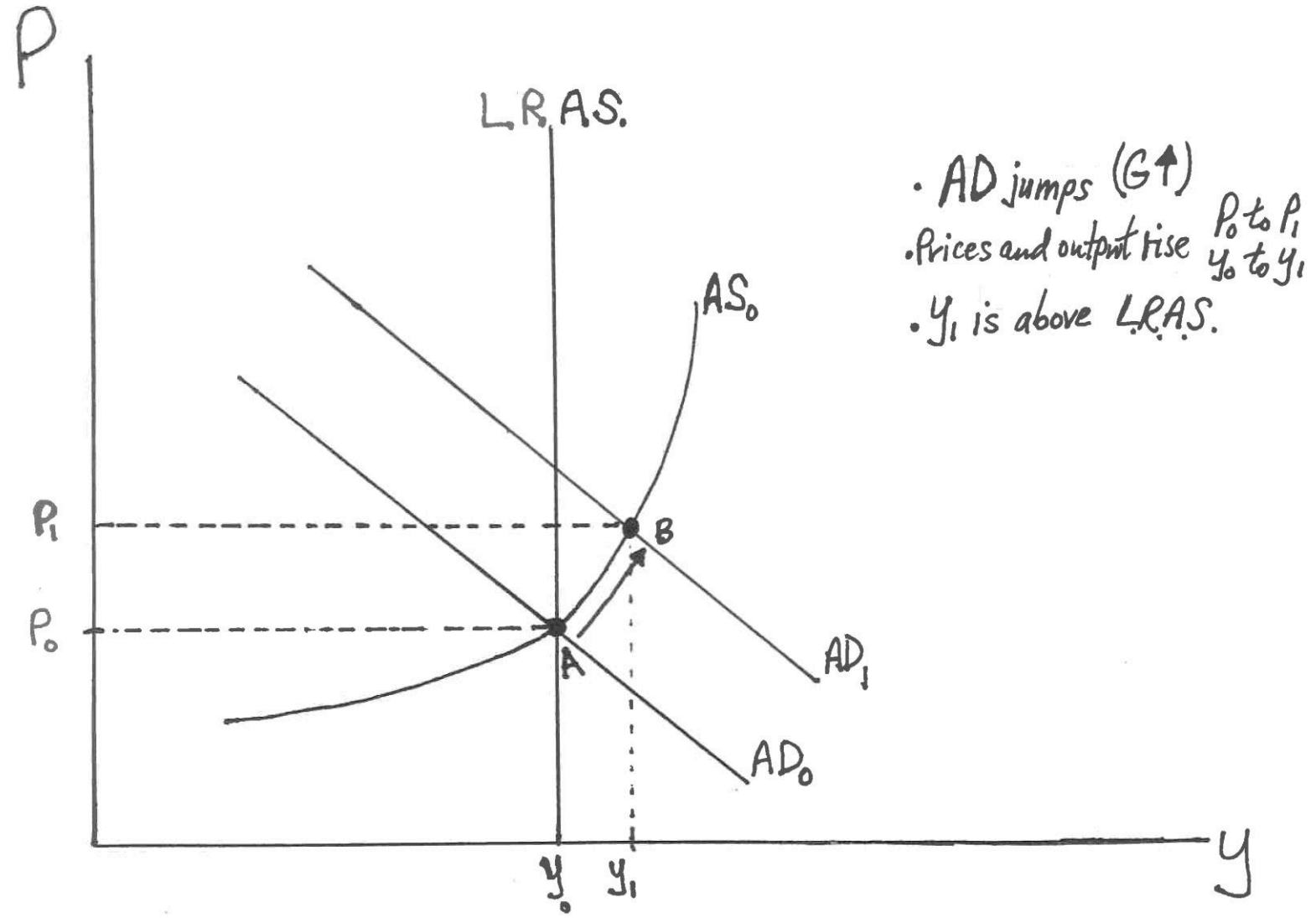
- **If** this was true, policy-makers could choose a point on the curve

AD/AS Model Helps Us Derive the Phillips Curve

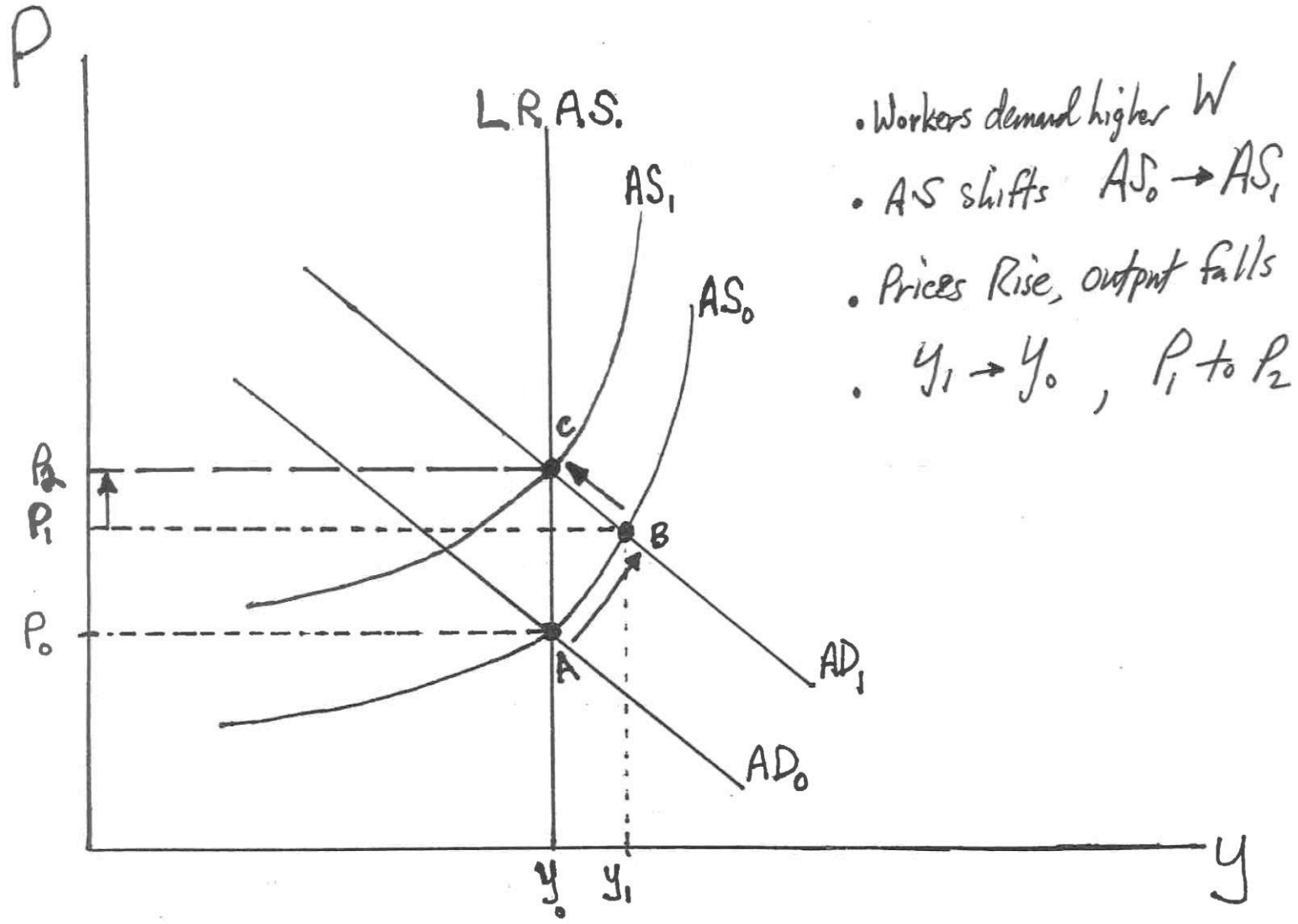
- Recall:
  - The **short-run** macroeconomic equilibrium occurs when the AD and SRAS curves intersect
  - The **long-run** macroeconomic equilibrium occurs when the AD and SRAS curves intersect **at the LRAS**



Short-Run Equilibrium



Long-Run Equilibrium



- Workers demand higher W
- AS shifts $AS_0 \rightarrow AS_1$
- Prices Rise, output falls
- $y_1 \rightarrow y_0$, P_1 to P_2

Short-Run vs Long-Run Equilibrium

- We began in long run equilibrium: AD = SRAS = LRAS
- G increased, increasing AD: AD = SRAS ≠ LRAS
- This drives prices up, wage earners demand increased wages. SRAS shifts leftward: AD= SRAS = LRAS

- Notice we are at the **same** level of **output**: LRAS

- But **prices** are **higher**!

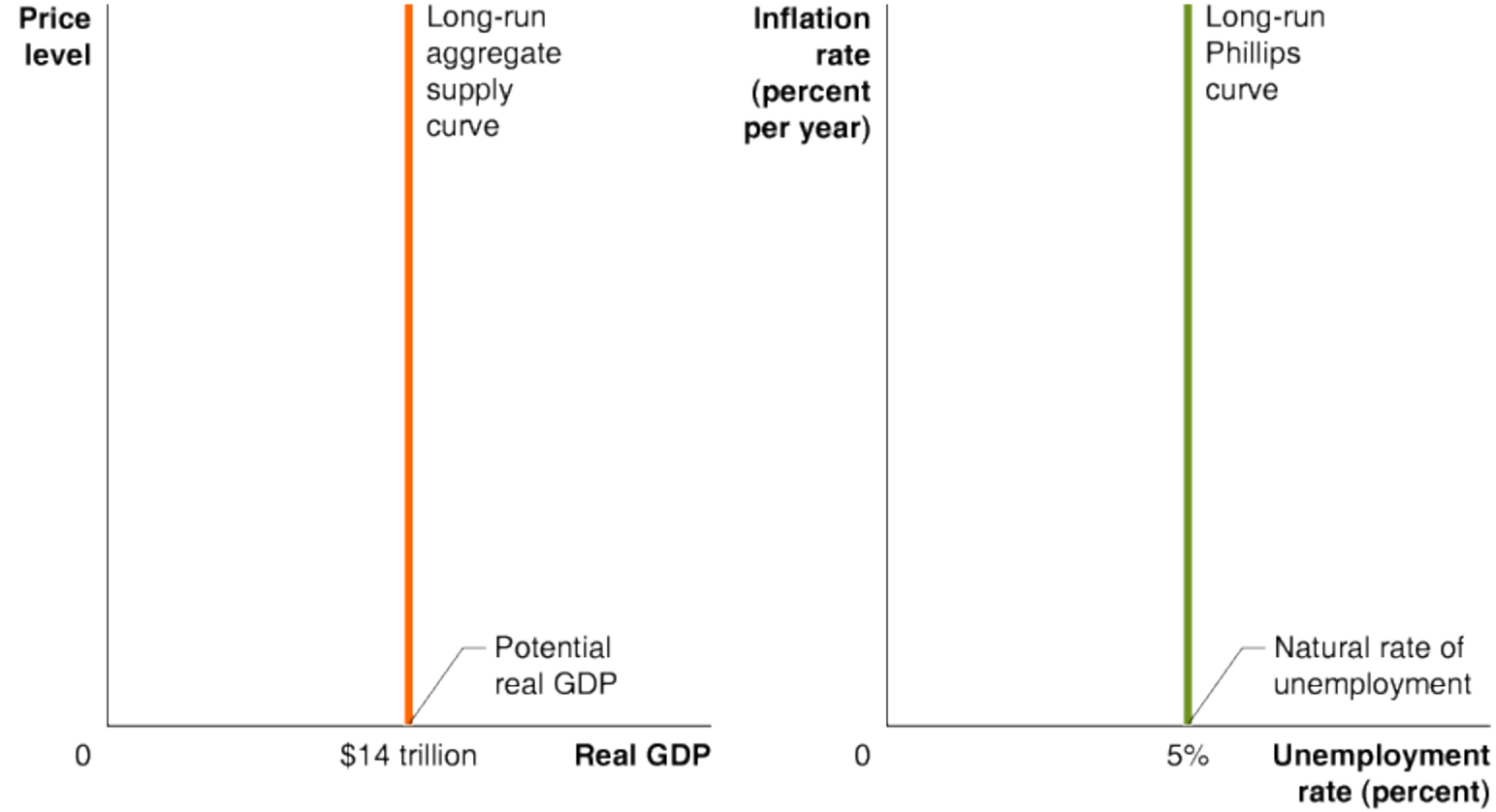
Is The Phillips Curve A Policy Menu?

- We end up with higher P, but the same level of Y (no change in U)
- So there is a **short run** π-U tradeoff, but **NOT** in the **long run**!
  - The relationship is not structural
- Phillips curve should not be used as a policy menu
  - Allowing more π does **not** lead to **permanently** lower U

The Long-Run Phillips Curve

- In the long run, **employment** is determined by output, which in long run does not depend on the price level

- A vertical **LRAS** curve is compatible with a vertical **LRPC**



Relation to LTSG

- Potential GDP grows over time

$$\text{LTSG} = \text{LFG} + \text{LPG}$$

- It **does not depend on prices** → **Vertical LRAS** curve
- Think of LTSG as the speed limit for economic growth
- Monetary policy cannot make LF or LP grow faster

Natural Rate of Unemployment

- Optimal level of joblessness in an economy

- Recall that there are 3 kinds of unemployment:
  - **Structural**: Some people have skills that don't match any available jobs
  - **Frictional**: When people change jobs results in some unemployment
  - **Cyclical**: When economy is operating below full potential, willing workers can't find work

Natural Rate of Unemployment

- At potential GDP, there is **no cyclical unemployment**
  - Only structural and frictional unemployment

- **Natural rate of unemployment**: Unemployment rate that exists when the economy is at potential GDP
  - When unemployment is at the **natural rate**, output equals **potential GDP**

- Actual levels of U and real GDP will fluctuate in the SR but will come back to the natural rate and potential GDP in the LR

What Value for the Natural Rate of Unemployment?

- Economists today are unclear about the natural rate, but many posit that **4%** is a **reasonable estimate**

- **IF** that is right, today's 3.6% rate suggests we need to make sure US economy slows to cruising speed, keeping jobless rate steady

- Why the confusion?
  - LFPR and part-time workers make it hard to tell **how tight** the labor market is today

What If An Economy Operates Below Natural Rate?

- When economy is **below** the natural rate of unemployment there is **great competition for workers**
  - Too many jobs for too few workers

- Firms bid up the price of workers—wage rates—and soon find they need to raise prices to cover their higher labor costs

- Soon **wages and prices are rising rapidly**

When Is It Safe to Exceed the LTSG Speed Limit?

- When **U** is **very high**, the economy can safely grow **faster** than the LTSG pace

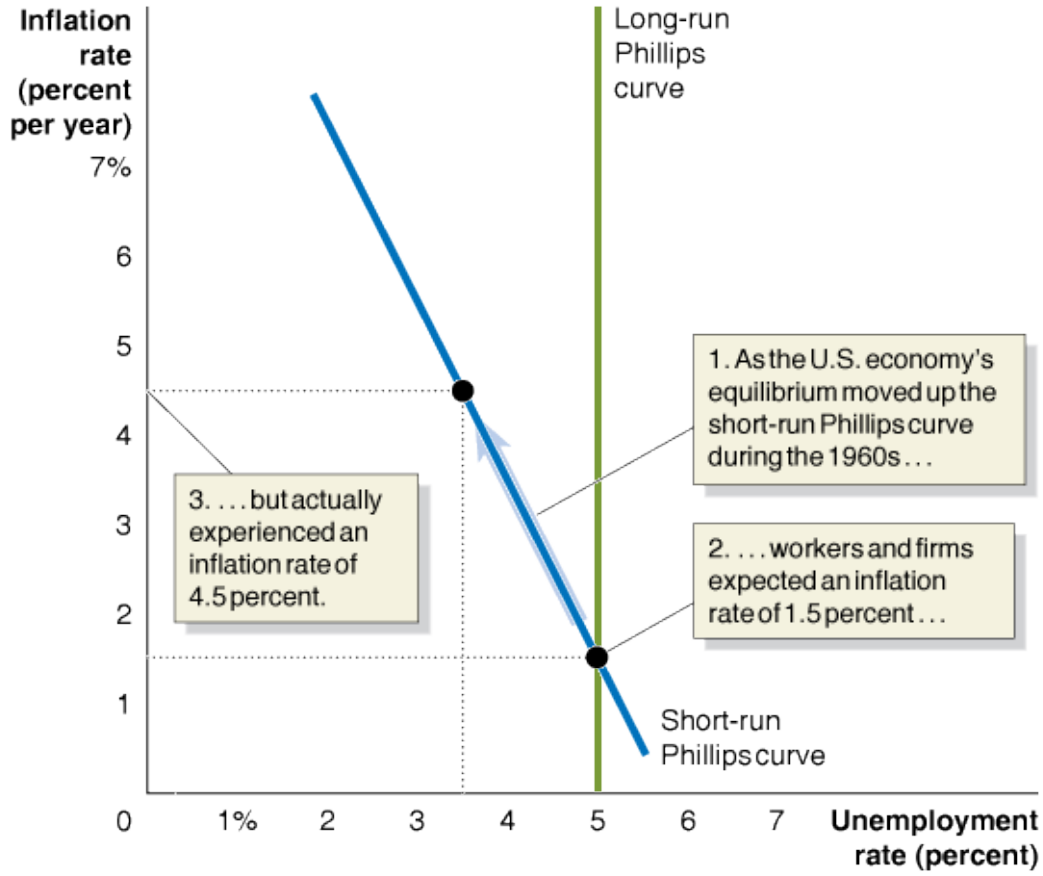
- Why?
  - Economic growth produces jobs for both new entrants to the LF and the cyclically unemployed members of the LF

LRPC and SRPC

- We had 2 curves for aggregate supply
- Here we also have two curves:
  - **Long run** Phillips curve (LRPC)
  - **Short run** Phillips curve (SRPC)
- The curves intersect at π^e

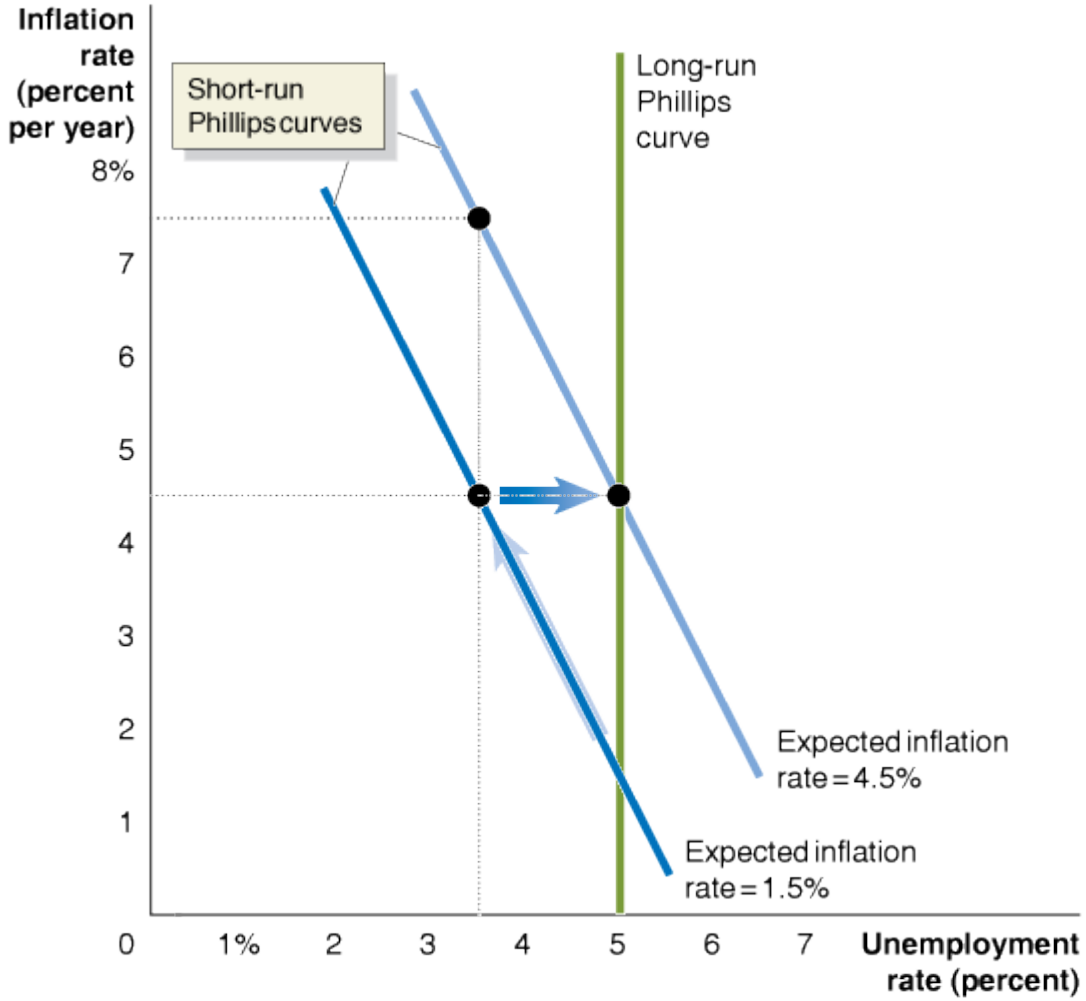
Example: Phillips Curve in the 1960s

- In early 60s, low π (≈ 1.5%)
- Firms and workers **expected 1.5% inflation** (π^e = 1.5%)
- Expansionary policies in place
- Inflation rose and joblessness fell
- Economy **moved along** the **SRPC**
  - U **fell** from 5% to 3.5%, as π **climbed** from 1.5% to 4.5%



Shifts in the Short-Run Phillips Curve

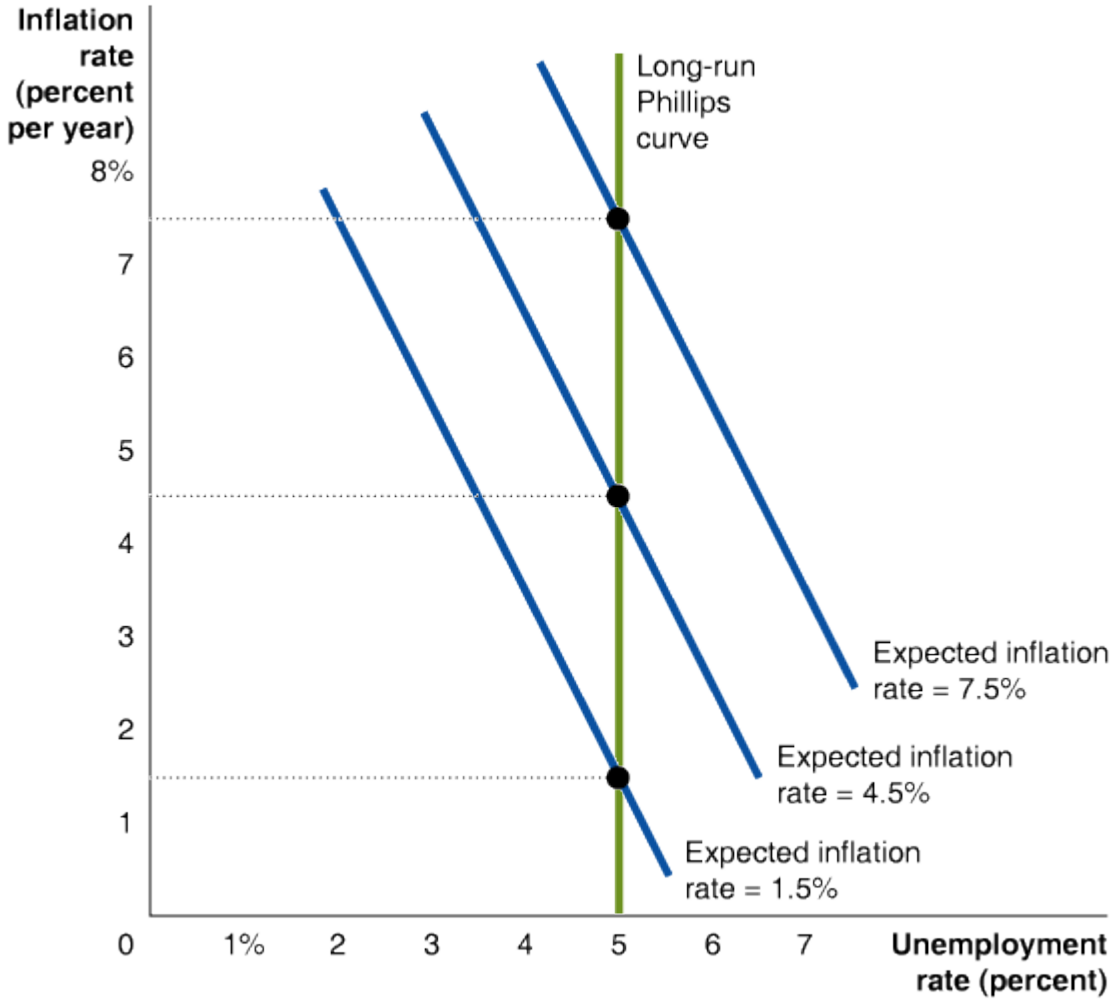
- Agents then **adjusted expectations** for inflation (4.5%)
  - "New normal" inflation became embedded in the economy
  - Now $\pi^e = 4.5\%$
- SRPC **shifts** to the **right**
  - If interest rates increase (driving U = 6%), π will fall but only to 3%
  - U = 3.5% would require another unexpected increase in inflation



A Short-Run Phillips Curve For Every Inflation Rate

- There is a SRPC **for every level** of expected inflation
  - **Each** SRPC intersects the LRPC at the π^e rate
  - A $\pi\uparrow \rightarrow U\downarrow$ only if the increase in π is unexpected

- When $\pi = \pi^e$, the unemployment level is at its natural rate—i.e. the **LRPC**



Implications for Monetary Policy

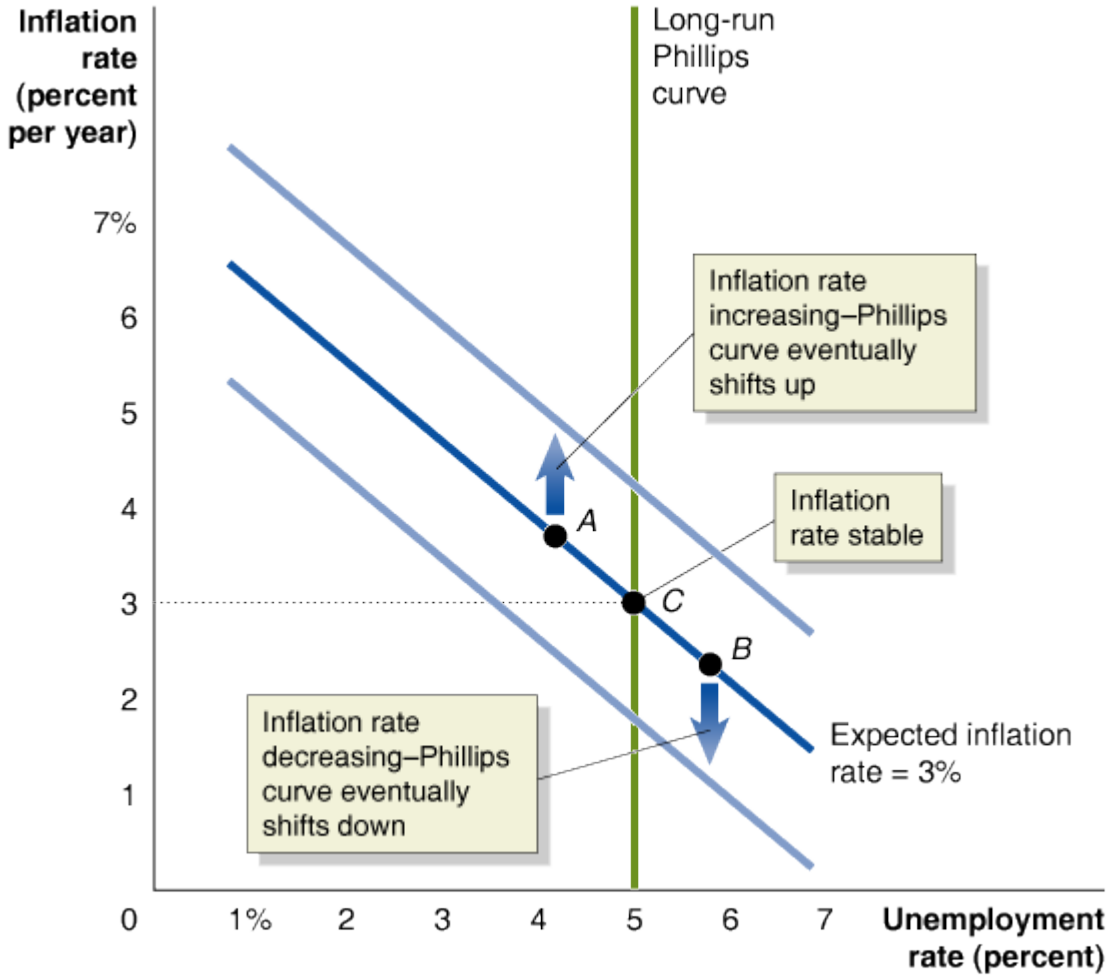
- By the 1970s, most economists agreed that the LRPC was **vertical**
  - It was **not possible** to "buy" a permanently lower unemployment rate at the cost of permanently higher inflation

- To keep unemployment lower than the natural rate, the Fed would need to continually increase inflation
  - With increasing inflation, SRPC would eventually **shift up**

- Or it could decrease inflation at the cost of a temporarily higher unemployment rate

Non-Accelerating Inflation Rate Of Unemployment

- π is stable only when U = U*
- U ≠ U* results in the **inflation rate increasing** or **decreasing**
- So, the natural rate of U is sometimes referred to as the **non-accelerating inflation rate of unemployment**
  - **NAIRU**: Unemployment rate at which the inflation rate has no tendency to increase or decrease



Can We Write A Formula For The Phillips Curve?

$$\pi_t = \pi^e + \alpha\,(U^* - U_t)$$

Inflation in period t = **Expected** inflation in period t-1

+ alpha times the **deviation** of unemployment from NAIRU

What Does the Formula Imply If U is Below NAIRU?

$$\pi_t = \pi^e + \alpha\,(U^* - U_t)$$ assume α=1.4

Phillips Curve π PREDICTION	EXPECTED π	JOBLESS RATE	NAIRU	JOBS GAP
2	2	5.5	5.5	0
4.8	2	3.5	5.5	2
7.6	4.8	3.5	5.5	2
10.4	7.6	3.5	5.5	2

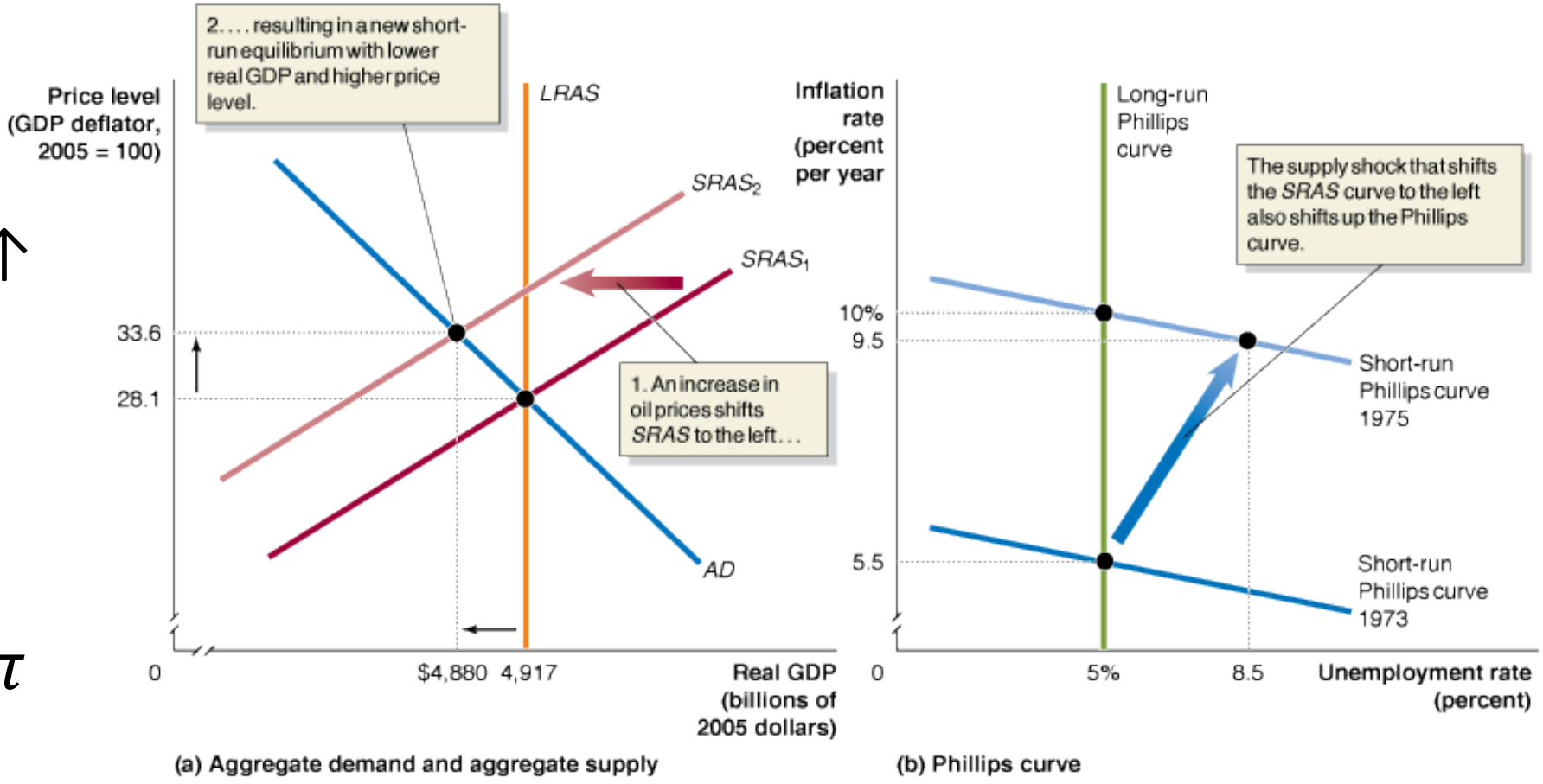
- If U < U*, π accelerates

Rational Expectations and a **Vertical SRPC**

- **Keynesians**:
  - 1950s and 1960s showed an obvious short-run trade-off between π & U
- **R. Lucas** and **T. Sargent** (New classical school):
  - This happened because the Fed was secretive, not announcing changes in policy. If Fed announces its policies, people will correctly anticipate inflation and act in advance to counteract it
- **New Keynesians**:
  - Wages and prices don't adjust fast enough
  - Even if people anticipate inflation correctly, aggregate markets may not clear instantaneously to make the SRPC vertical

Application: Oil Price Shocks in the 1970s

- Start: US in 1973
  - **U = NAIRU**
- 1974: OPEC caused oil prices↑
  - Supply shock: **SRAS shift left**
- U↑ but so people's expectations for π
  - **A higher SRPC**

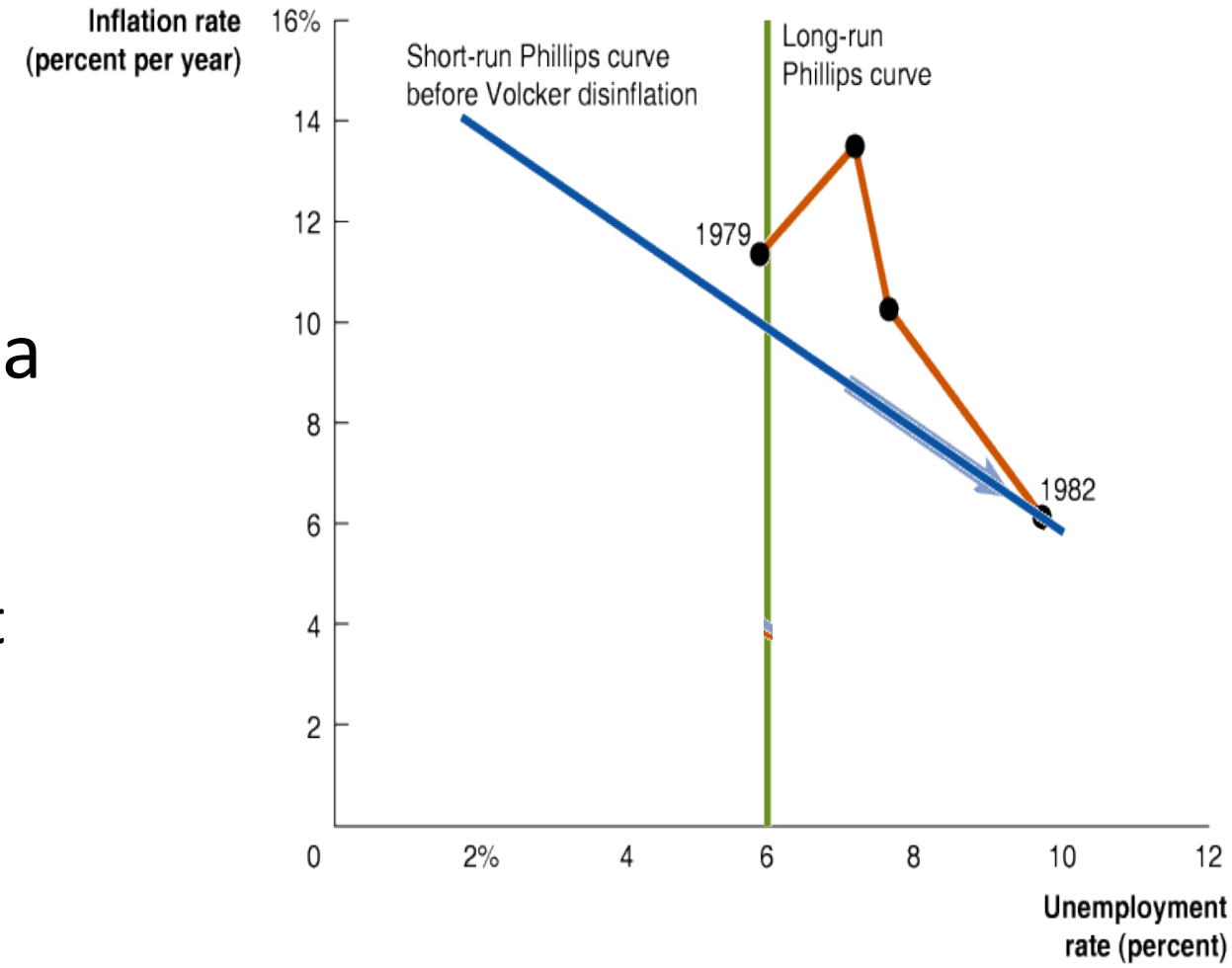


What Could The Fed Do?

- Fed wanted to **fight both** inflation and unemployment
- But the SRPC makes clear that **improving one worsens the other**
- The Fed chose **expansionary** monetary policy:
  - Reducing unemployment, at the **cost** of even **more inflation**
- The newly high inflation was incorporated into people's expectations and became **self-reinforcing**

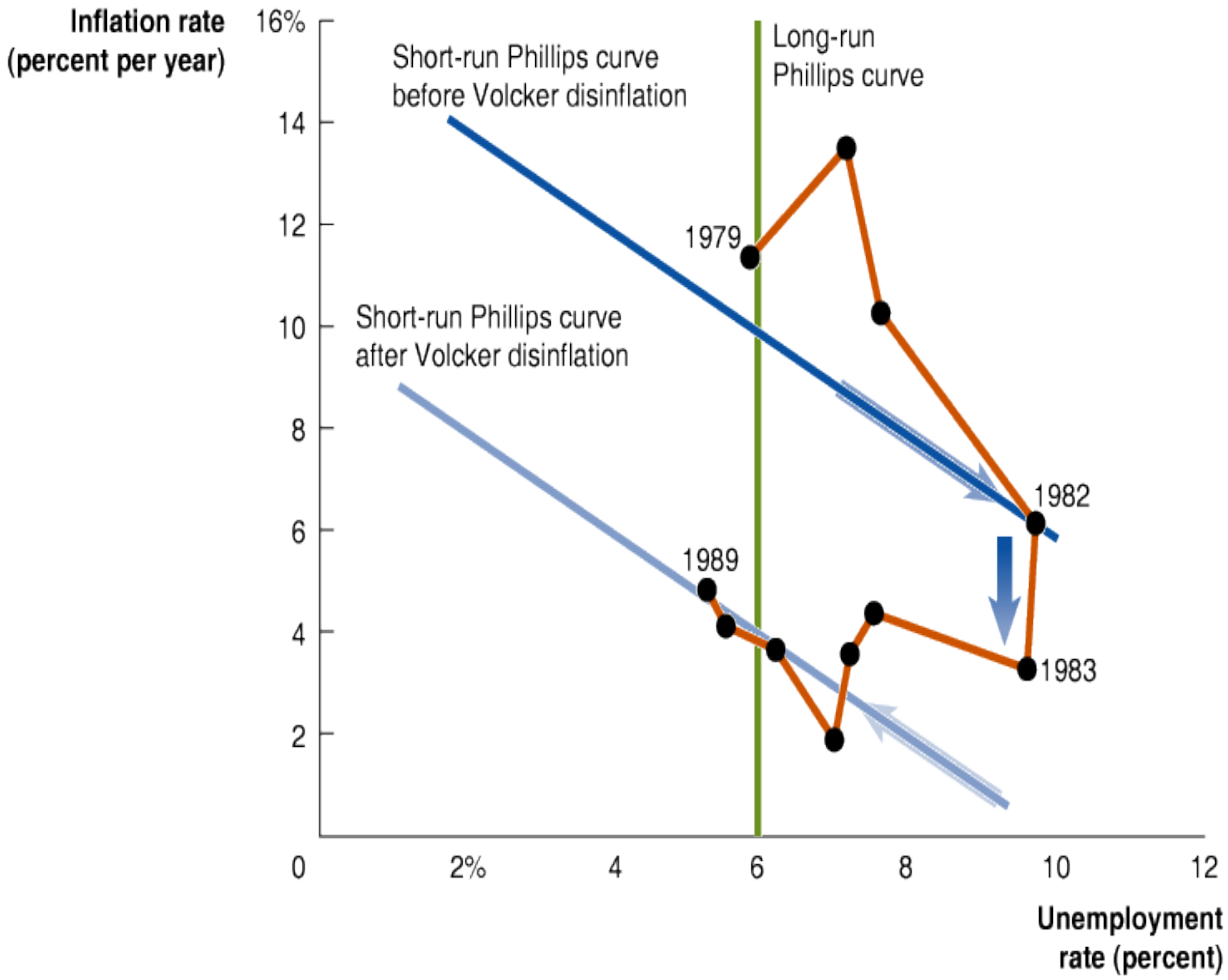
High Inflation: Must It Continue?

- Fed's new chairman P. Volcker **wanted lower inflation**
  - He believed high inflation was hurting the economy
- Volcker announced and enacted a **contractionary** monetary policy
  - If people believed the announcement, they would adjust down to a lower Phillips curve
- But for several years, the Phillips curve appeared **not to move**

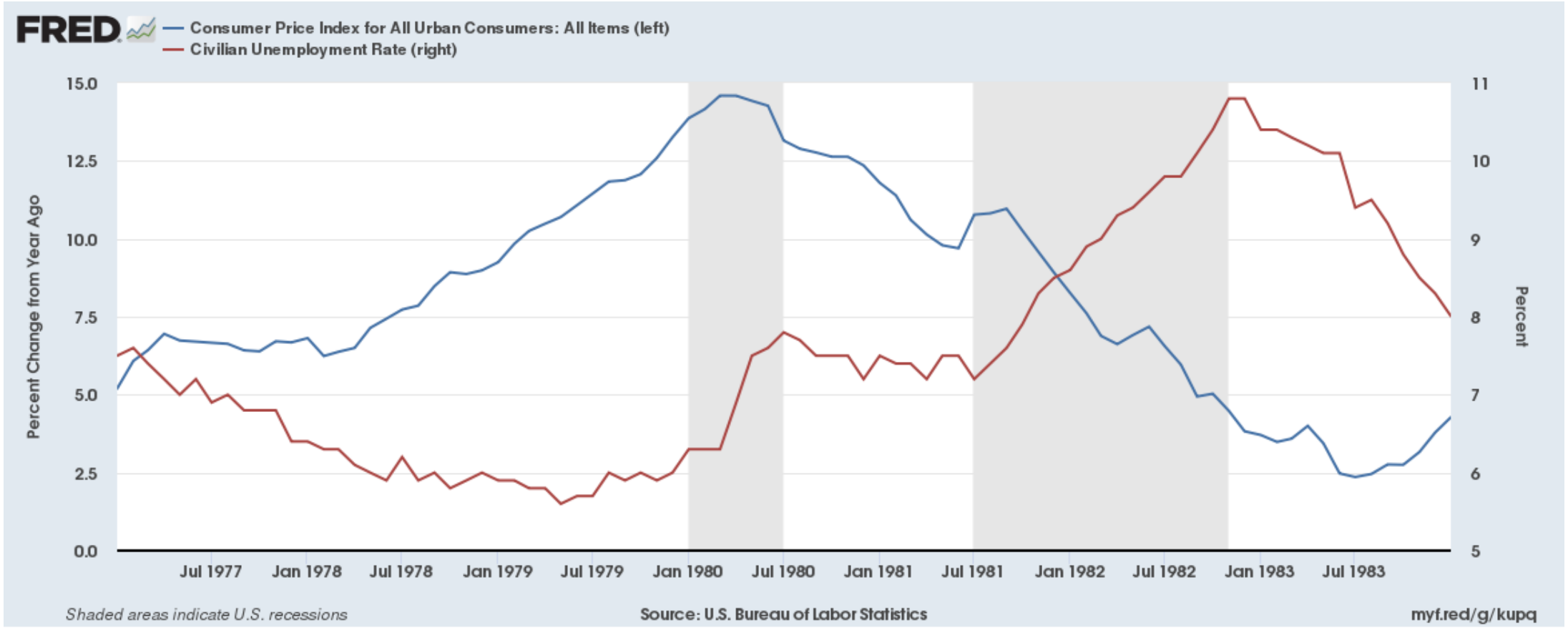


Did Rational Expectations Fail?

- Does this prove people were not forming expectations rationally?
  - Not necessarily
- Fed had a **credibility problem**:
  - Previously, it announced contractionary policy but allowed inflation to occur anyway
- Eventually, **several years** of tight money **convinced people**
  - Price fell and so inflation expectations → New **lower SRPC**



A Demonstration of the Phillips Curve At Work



Volcker Disinflationary Policy

- Brutal real economy effects dominated **expectations** as Volcker triumphed over inflation in early 1980s

- Change in monetary policy to fight π ➞ Back to back recessions
  - A rise of near 11% in joblessness

- Phillips curve explains the fall for π
  - **Credibility** was **very hard to earn**

Predict the Disinflation During Volcker Recessions

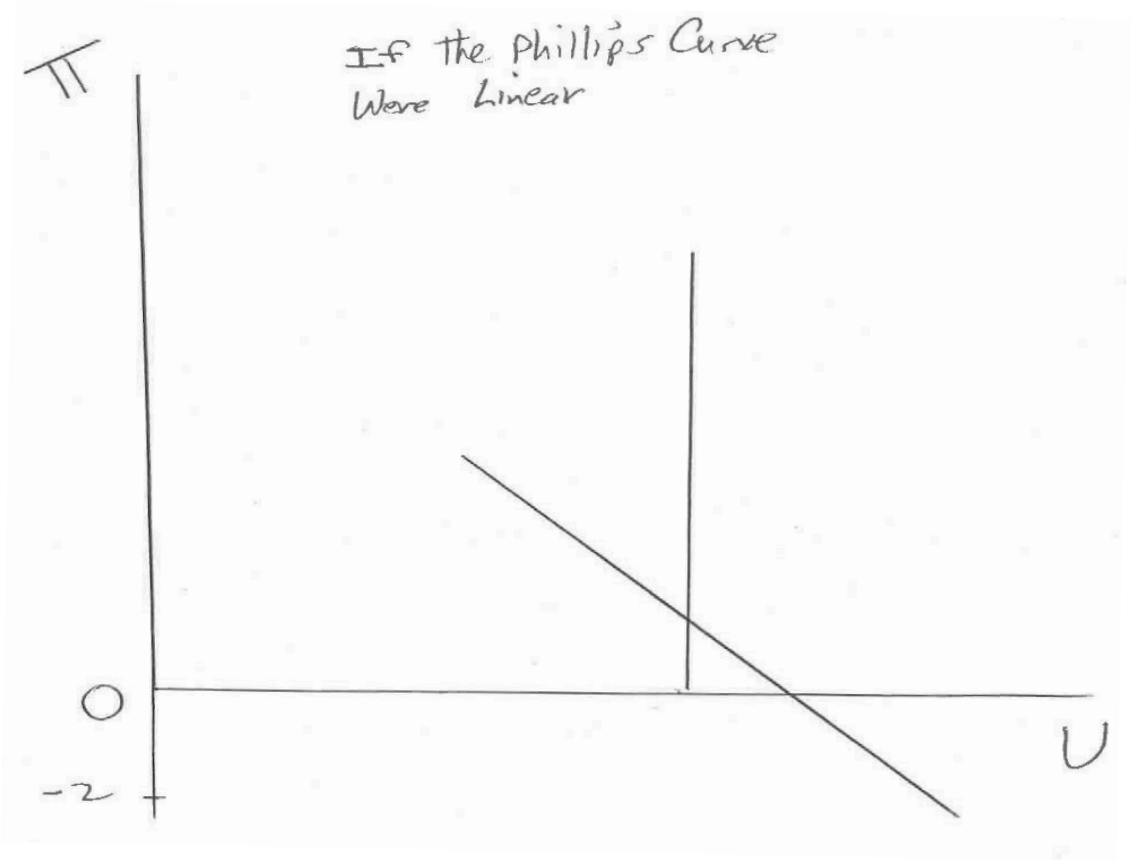
$$\pi_t = \pi^e + \alpha\,(U^* - U_t)$$ assume α=1.4

- Let $\pi^e = \pi_{t-1}$ (last year's inflation)
  - Overstate the case for non-rational expectations

t	π_t	U*	U_t	π_e	π_f
1978	9.5	6.5	6.0		
1979	13.3	6.5	6.0	9.5	10.2
1980	12.5	6.5	7.4	13.3	12.0
1981	8.9	6.5	8.2	12.5	10.1
1982	3.8	6.5	10.7	8.9	3.0

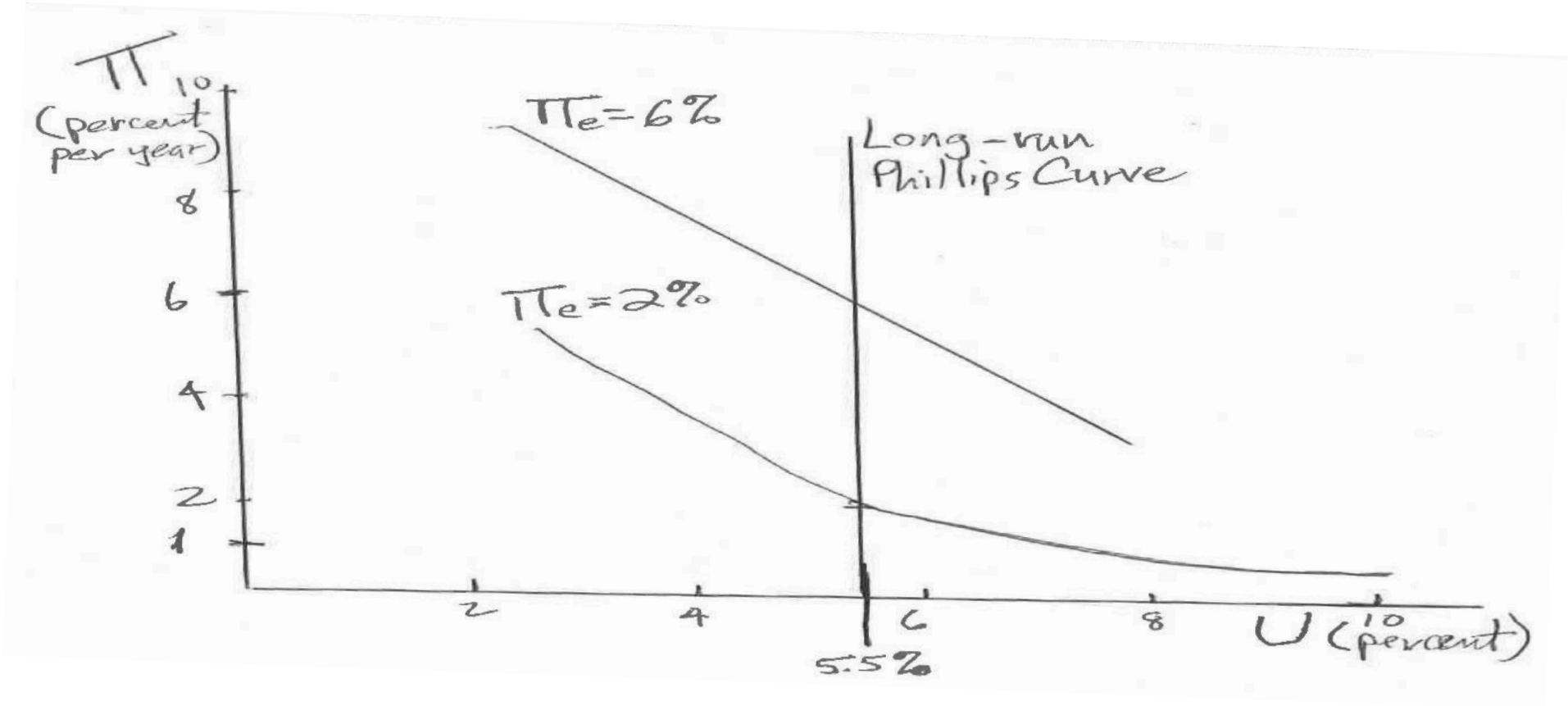
Does the Formula Work for All Inflation Rates?

- We wrote a **linear equation**: At 'high' inflation rates this worked
- Life is **not so simple** as we approach **zero**



Zero Bound is A Problem for Disinflation and PC as Well

- Empirically, the relationship between U and π is not exactly linear



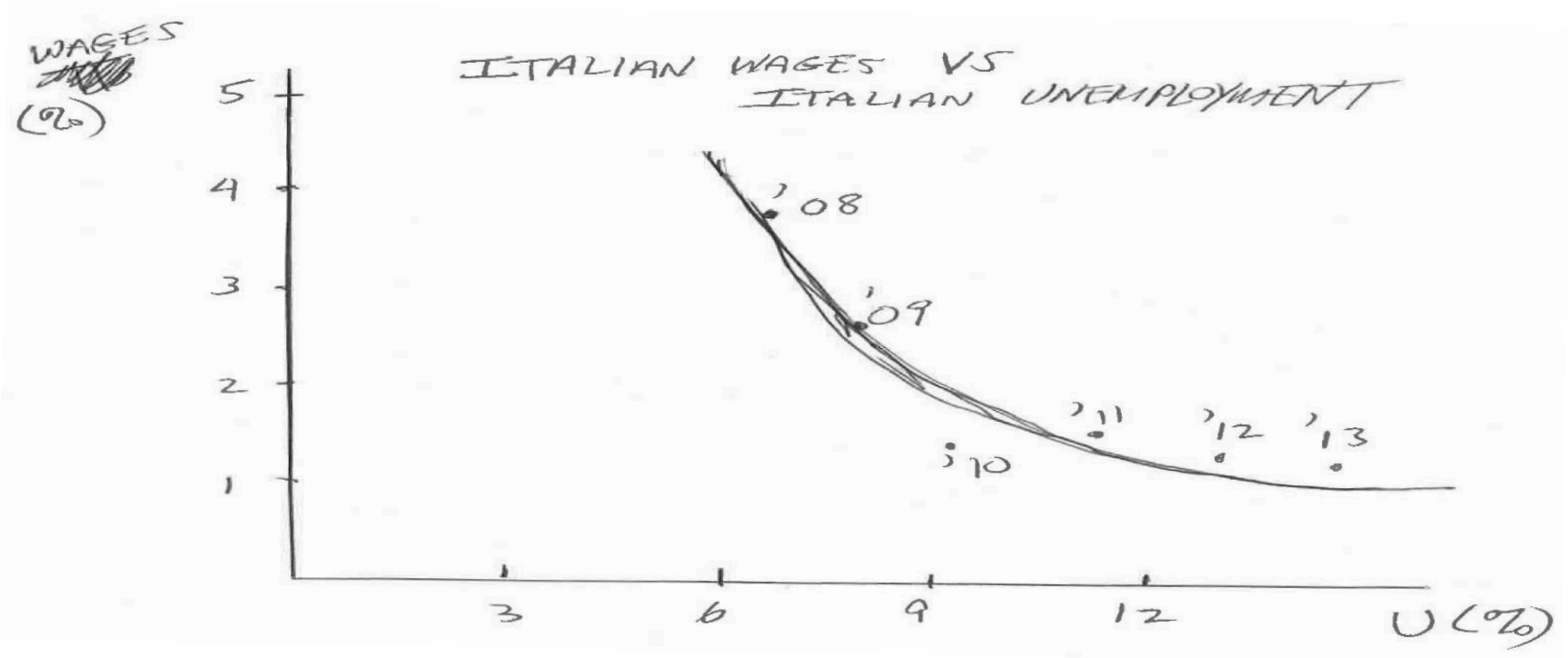
Consider the Italian Experience

- Great recession drove jobless rates to very high levels
- But **inflation did not fall below zero**

Italy	2008	2009	2010	2011	2012	2013	2014
jobless rate	6.8	8.3	8.2	9.5	11.4	12.4	12.3
hourly earnings*	4.0	2.8	1.7	1.4	1.7	1.4	1.1
*(YOY, percent change)							

The Short-Run Phillips CURVE

- Wages bounce along, just **above zero**



- SRPC is indeed a **curve** (not a straight line) → Recall 'curved' SRAS

PLOGs Don't Deliver Deflation

- **P** Persistent
- **L** Large
- **O** Output
- **G** Gaps

- PLOGs –long periods of very high unemployment– **don't** push price and wage gains below zero
  - It seems **slowing** pay and price increases is much **easier than** actually **cutting** wages and prices
- The zero bound for inflation seems to matter

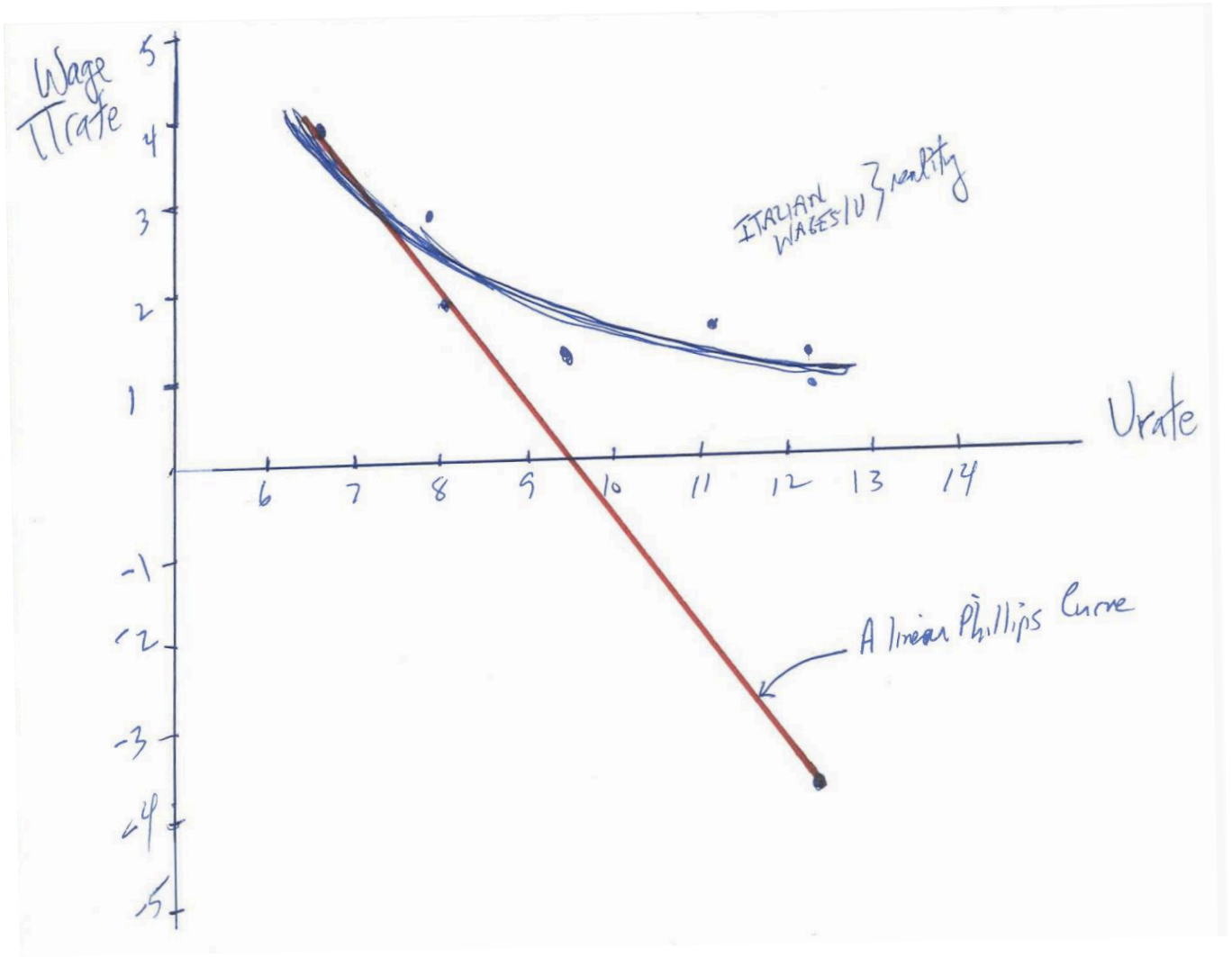
Back to the Italian Example

- Suppose Italy had a liner Phillips curve. Suppose U* = 8%, α = 0.5 and 6 years of a U = 10% on average, where should π be in 2014?

$$\pi_t = \pi^e + \alpha\,(U^* - U_t)$$

- π_{2009} = 4.0% + 0.5 X (8%-10%) = 2.5%
- π_{2010} = 2.5% + 0.5 X (8%-10%) = 1%
- π_{2011} = 1% + 0.5 X (8%-10%) = -0.5%
- π_{2012} = -0.5% + 0.5 X (8%-10%) = -2.0%
- π_{2013} = -2.0% + 0.5 X (8%-10%) = -3.5%
- π_{2014} = -3.5% + 0.5 X (8%-10%) = -5%

Such a Fall for Wages Might Get the ECB's Attention



Divine Coincidence and the Zero Bound

- **Divine coincidence**: Situation where stabilizing inflation is the same as stabilizing output
  - Dual-mandate CB (**both** π and U) vs Single-mandate CB (**only** π)
- **Scenario 1** - Falling prices: Inflation-fighting CB will be as accommodative as a dual-mandate CB
- **Scenario 2** - High U and low π: Dual-mandate CB will step on the gas while other CB fails to see deflation so is less stimulative
  - Over time, cyclical joblessness becomes structural
- **Zero bound** for wage restraint **kills** the **divine coincidence**

Absence of a Divine Coincidence

- It may explain ECB tightening alongside FRB easing in 2008 and 2011