



Business Cycles Econ 402 Professor Yamin Ahmad

Lecture 5: Phillips Curve and Economic Policy

- The Phillips Curve
- The Role of Expectations
- Barro – Gordon Model



Key Concepts...

- The relationship between Aggregate Supply and the Phillips Curve
- The short-run tradeoff between inflation and unemployment
- Incorporating expectations:
 - Adaptive Expectations
 - Rational Expectations
- Sargent and Wallace (1977) Policy Ineffectiveness Proposition
- Barro – Gordon Model
- Monetary Policy
 - Active versus Passive Policy
 - Rules versus Discretion
 - Time Inconsistency Problem and Some Solutions

Note: These lecture notes are incomplete without having attended lectures



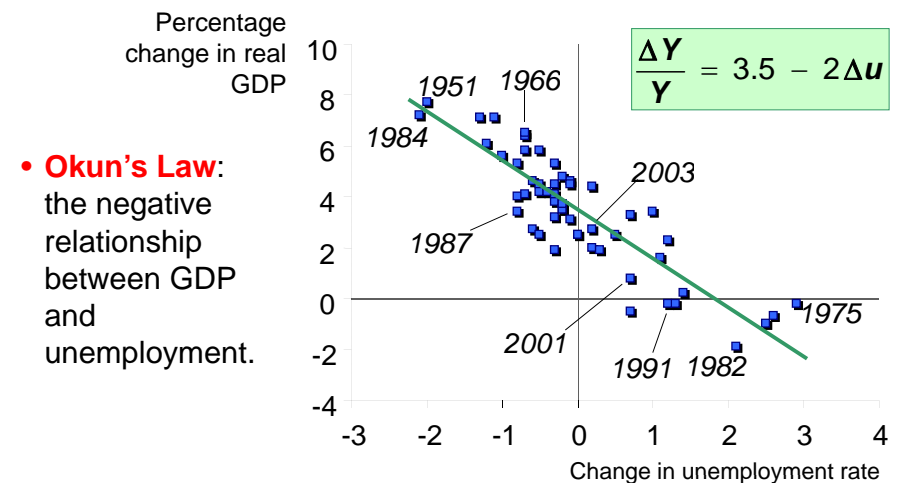
Inflation, Unemployment, and the Phillips Curve

- Governments (and society in general) care about inflation π and unemployment, u , not prices, P and output, Y .
- To go from prices to inflation is fairly straightforward!
- To go from output to inflation, we need Okun's Law

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Okun's Law



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Inflation, Unemployment, and the Phillips Curve

- Aggregate Supply:
$$Y_t = \bar{Y}_t + \alpha(P_t - P_t^e)$$

$$= \bar{Y}_t + \alpha[P_{t-1}(1 + \pi_t) - P_{t-1}(1 + \pi_t^e)]$$

$$= \bar{Y}_t + \tilde{\alpha}(\pi_t - \pi_t^e)$$
- Okun's Law: $-\beta(u - u^n) = \left(\frac{1}{\tilde{\alpha}}\right)(Y - \bar{Y})$
 - ⇒ Phillips Curve: $\pi_t = \pi_t^e - \beta(u_t - u^n)$
 - ⇒ with shock: $\pi_t = \pi_t^e - \beta(u_t - u^n) + v_t$
- So the Phillips Curve is just an alternative way of describing the Aggregate Supply Curve.

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Inflation, Unemployment, and the Phillips Curve

The **Phillips curve** states that π depends on

- expected inflation, π^e .
- cyclical unemployment**: the deviation of the actual rate of unemployment from the natural rate
- supply shocks, v (Greek letter "nu").

$$\pi = \pi^e - \beta(u - u^n) + v$$

where $\beta > 0$ is an exogenous constant.

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The Phillips Curve and SRAS

$$\text{SRAS: } Y = \bar{Y} + \alpha(P - P^e)$$

$$\text{Phillips curve: } \pi = \pi^e - \beta(u - u^n) + v$$

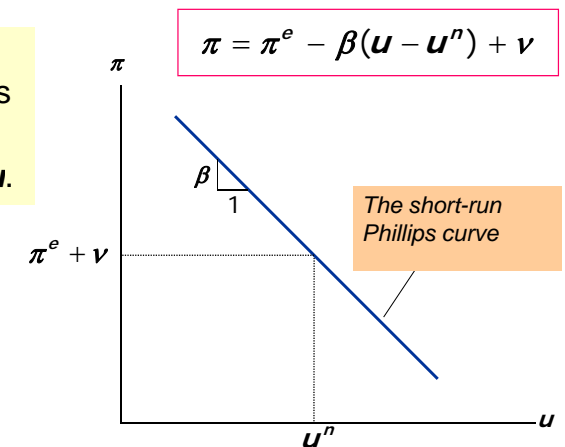
- SRAS curve**:
Output is related to unexpected movements in the price level.
- Phillips curve**:
Unemployment is related to unexpected movements in the inflation rate.

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Graphing the Phillips curve

In the short run, policymakers face a tradeoff between π and u .



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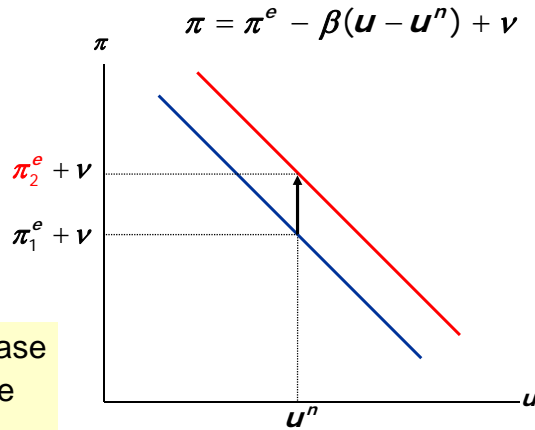
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Shifting the Phillips curve

People adjust their expectations over time, so the tradeoff only holds in the short run.

E.g., an increase in π^e shifts the short-run P.C. upward.



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Two causes of rising & falling inflation

$$\pi = \pi^e - \beta(u - u^n) + \nu$$

- **cost-push inflation:** inflation resulting from supply shocks
Adverse supply shocks typically raise production costs and induce firms to raise prices, “pushing” inflation up.
- **demand-pull inflation:** inflation resulting from demand shocks
Positive shocks to aggregate demand cause unemployment to fall below its natural rate, which “pulls” the inflation rate up.

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Key Question: How are Expectations Formed?

Phillips curve: $\pi = \pi^e - \beta(u - u^n) + \nu$

We will look at two types:

- Adaptive Expectations
- Rational Expectations



Adaptive expectations

- **Adaptive expectations:** an approach that assumes people form their expectations of future inflation based on recently observed inflation.
- A simple example:
Expected inflation = last year’s actual inflation
 $\pi^e = \pi_{-1}$
- Then, the P.C. becomes

$$\pi = \pi_{-1} - \beta(u - u^n) + \nu$$

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Inflation Inertia

$$\pi = \pi_{-1} - \beta(u - u^n) + v$$

In this form, the Phillips curve implies that inflation has **inertia**:

- In the absence of supply shocks or cyclical unemployment, inflation will continue indefinitely at its current rate.
- Past inflation influences expectations of current inflation, which in turn influences the wages & prices that people set.

The Sacrifice Ratio

- To reduce inflation, policymakers can contract Aggregate Demand, causing unemployment to rise above the natural rate.
- The **sacrifice ratio** measures the percentage of a year's real GDP that must be foregone to reduce inflation by 1 percentage point.
- A typical estimate of the ratio is 5 in the US.
- [For UK, a 1% reduction in output for one year lowers inflation by about ¼% point.]

The Sacrifice Ratio

- Example: To reduce inflation from 6 to 2 percent, must sacrifice 20 percent of one year's GDP:

$$\text{GDP loss} = \frac{(\text{inflation reduction})}{4} \times \frac{(\text{sacrifice ratio})}{5}$$

- This loss could be incurred in one year or spread over several years, e.g., 5% loss for each of four years.
- The cost of disinflation is lost GDP. One could use Okun's law to translate this cost into unemployment.

Rational Expectations

Ways of modeling the formation of expectations:

- **Adaptive expectations:**
People base their expectations of future inflation on recently observed inflation.
- **Rational expectations:**
People base their expectations on all available information, including information about current and prospective future policies.



Rational Expectations

- Rational Expectations (Muth): People use available information efficiently, including how the economy works.
- In practice this boils down to assuming agents use the same model of the economy as the researcher (“model-consistent” expectations).
- People can make mistakes, but they do not make **systematic** forecasting errors.
- With rational expectations disinflation is painless: (credible) announcement $\pi \downarrow \Rightarrow \pi^e \downarrow$

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Painless disinflation?

- Proponents of rational expectations believe that the sacrifice ratio may be very small:
- Suppose $u = u^n$ and $\pi = \pi^e = 6\%$, and suppose the Fed announces that it will do whatever is necessary to reduce inflation from 6 to 2 percent as soon as possible.
- If the announcement is credible, then π^e will fall, perhaps by the full 4 points.
- Then, π can fall without an increase in u .

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Calculating the sacrifice ratio for the Volcker disinflation

- 1981: $\pi = 9.7\%$
 - 1985: $\pi = 3.0\%$
- } Total disinflation = 6.7%

year	u	u^n	$u - u^n$
1982	9.5%	6.0%	3.5%
1983	9.5	6.0	3.5
1984	7.4	6.0	1.4
1985	7.1	6.0	1.1

Total 9.5%

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Calculating the sacrifice ratio for the Volcker disinflation

- From previous slide: Inflation fell by 6.7%, total cyclical unemployment was 9.5%.
- Okun’s law:
1% of unemployment = 2% of lost output.
- So, 9.5% cyclical unemployment = 19.0% of a year’s real GDP.
- **Sacrifice ratio** = (lost GDP)/(total disinflation)
= $19/6.7 = 2.8$ percentage points of GDP were lost for each 1 percentage point reduction in inflation.

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Policy Ineffectiveness Proposition

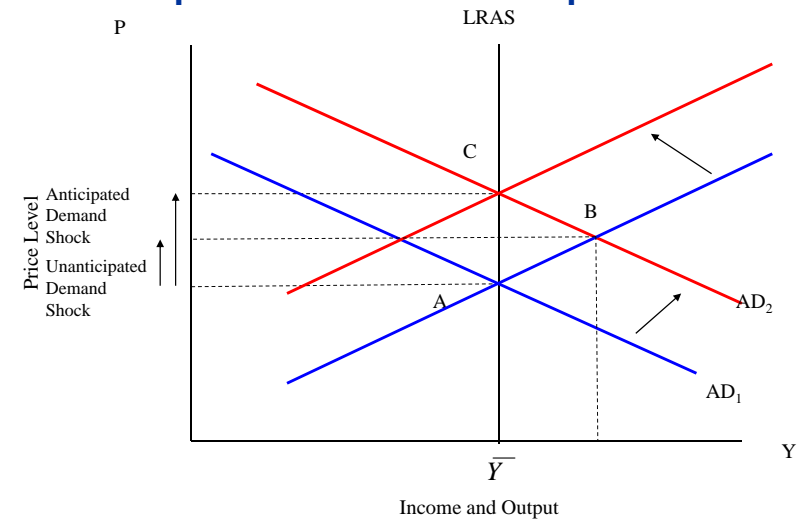
- Rational Expectations + “Surprise” supply function + Market Clearing + Symmetric Information ⇒

Policy Ineffectiveness Proposition (Lucas, Sargent-Wallace): Only **unanticipated** policy matters ⇒ no role for stabilization policy.

- To get a role for policy *either*:
 - the government must have superior information; or
 - agents must be locked into old contracts as in non-market clearing models.



Anticipated versus Unanticipated Shocks



No Price/Wage Adjustment?

Why might wages/prices not adjust?

- “Menu” costs of changing prices;
- Staggering of wage and price changes;
- Co-ordination failure and multiple equilibria.

All of these explanations require some form of market imperfection.



Stabilization Policy: Active or Passive?

- Under the Neoclassical (and Real Business Cycle) view, fluctuations are the efficient response of the economy to shocks (subject to whatever information agents have); no role for active policy.
- With wage and/or price rigidities *theoretical* case for intervention is stronger.
 - With wage/price rigidities, economic policy can have short run effects (- multipliers are non zero in the short run)
- But is this enough? ...

Problems of Activist Policy

- Lags in implementing (**inside lag**) and between policy and target variables (**outside lag**) may be long and variable.
 - Hence, forecasts are needed, but these are often inaccurate.
- “Lucas Critique” suggests that many of the relationships in econometric models will shift with policy (e.g. $\pi = \pi^e - \alpha(u - u^n)$ with $\pi^e = \pi_{-1}$).
- Encourages caution in the use of policy.

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Stabilization Policy: Rules vs. Discretion

- Government’s incentives may not align what is best for economy: they may use economic policy to influence their chances of reelection, not necessarily to the ultimate benefit of the economy (*political business cycle*).
- An announced policy may be “**incredible**” (or “**time inconsistent**”) because the policy maker subsequently has an incentive to deviate (**renege**) from the policy even in the absence of new information.
- Examples...

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Barro Gordon Model (1983)

- Robert Barro (left) and David Gordon (right) highlighted the time inconsistency issue within the monetary policy literature
- 
- 
- In their model, the government cares about inflation and unemployment
 - The government would like both inflation and unemployment to be as low as possible.
 - However, are their policy announcements time consistent?

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Barro-Gordon Model: Time Inconsistency

- **Phillips Curve:** $u - u^n = -\alpha(\pi - \pi^e)$ (1)
- Private Sector sets π^e , then government sets π .
- Government minimizes loss function:

$$L = u + \gamma \pi^2 = u^n - \alpha(\pi - \pi^e) + \gamma \pi^2$$
 (2)

$$dL/d\pi = -\alpha + 2\gamma \pi = 0 \Rightarrow \pi = \alpha/2\gamma > 0$$
- Under **Rational Expectations:** $\pi^e = \alpha/2\gamma$
 - ⇒ Substituting into (1) yields: $u = u^n$
 - ⇒ Loss under discretion: $L^d = u^n + \alpha^2/4\gamma$

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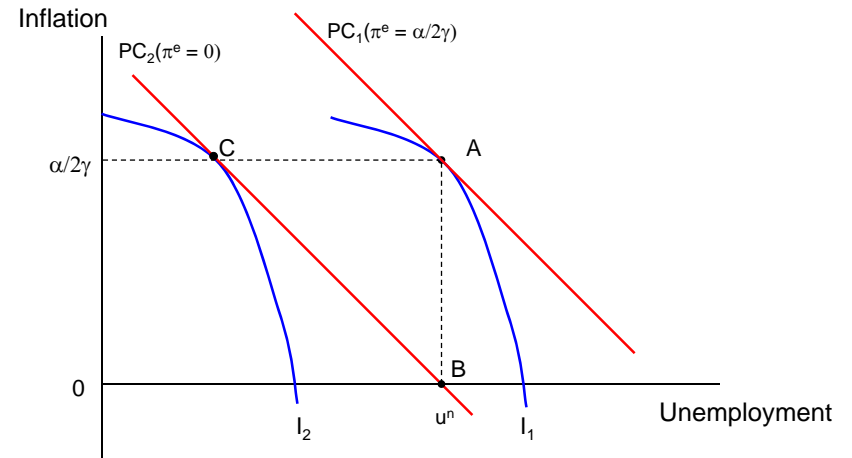
Is Zero Inflation Possible?

- Suppose that the government tries to set inflation to zero (and more importantly, people believe them!)
- Loss with zero inflation policy (L^r): $\pi = \pi^e = 0$ and $u = u^n$
 - Plugging into Phillips Curve (1) yields: $L^r = u^n < L^d$
- However, this optimal policy is not credible!
 - Why?...

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The Inflation Unemployment Tradeoff



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Resolving the Time Inconsistency Issue

- **Constitutional rule**
 - But a fixed rule is very inflexible. Will limit the use of monetary policy to address shocks that hit the economy.
- **Reputation**
 - Government will have an incentive to carry through optimal monetary policy if it cares enough about its reputation.
- **Delegation to an independent authority** with different preferences/incentives
 - Example: An independent central bank who will focus only on inflation, like the ECB.

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What Rule for Monetary Policy?

- Constant money growth (Friedman)
 - Problematic if velocity of money is unstable.
- Nominal GNP target (Meade, Tobin)
 - equivalent to a “velocity corrected” money target.
- Price level/inflation target (Bundesbank, UK govt., ECB)
 - Same as nominal GNP target for AD shocks, but too contractionary in face of adverse supply shocks (e.g. OPEC).
- Interest rate rule, e.g. Taylor rule
- Note: All of these are rules for a **nominal** variable.

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What Rule for Monetary Policy?

Further Reading:

- Robert E. Lucas, J.r., 1976, "Econometric Policy Evaluation: A Critique". In Karl Brunner and Allan Meltzer (Eds.), *The Phillips Curve and Labor Markets*, Carnegie-Rochester Conference on Public Policy, 1, Amsterdam: North Holland, pp. 19 – 46.
- Kydland, F. and E. Prescott, 1977, "Rules Rather Than Discretion: The Inconsistency of Optimal Plans", *Journal of Political Economy*, 85:3, June, pp. 473 – 492
- Barro, R. and D. Gordon, 1983, "A Positive Theory of Monetary Policy in a Natural Rate Model", *Journal of Political Economy*, 91:4, August, pp. 589 – 610.
- Ben S. Bernanke and Frederic S. Mishkin (1997), "Inflation Targeting: A New Framework for Monetary Policy?", *Journal of Economic Perspectives*, 11, (Spring), pp. 97 – 116.