



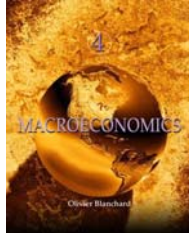
# Intermediate Macroeconomics

ECON 302

Professor Yamin Ahmad

## Lecture 8:

- Phillips Curve
- Expectations
- Policy Ineffectiveness Proposition
- Menu Costs and Coordination Failure



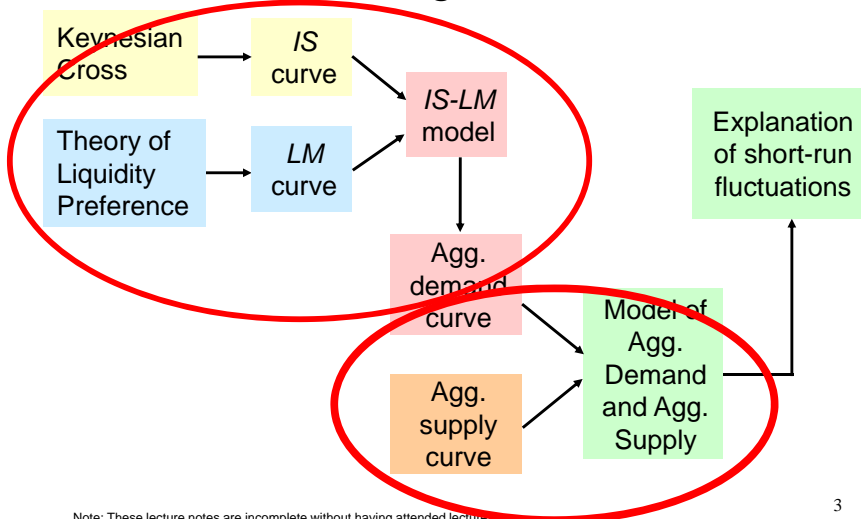
## Key Concepts...

- 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
- Menu Costs and Coordination Failure

Note: These lecture notes are incomplete without having attended lectures



## The Big Picture



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## Inflation, Unemployment, and the Phillips Curve

- Governments care about  $\pi$  and  $u$ , not  $P$  and  $Y$ .
- Aggregate Supply:
 
$$Y = \bar{Y} + \alpha(P - P^e)$$

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

$$= \bar{Y} + \alpha'(\pi - \pi^e)$$
- Okun's Law :  $-\beta(u - u^n) = (1/\alpha')\beta(Y - \bar{Y})$   
 ⇒ Phillips Curve:  $\pi = \pi^e - \beta(u - u^n)$   
 ⇒ with shock:  $\pi = \pi^e - \beta(u - u^n) + v$
- 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  $\pi$  depends on

- expected inflation,  $\pi^e$ .
- **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.



## The Phillips Curve and SRAS

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

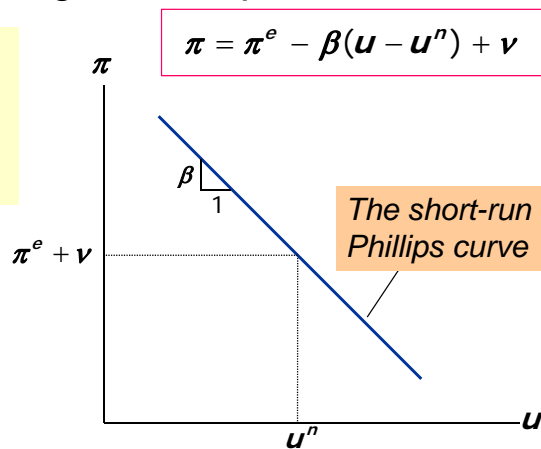
$$\text{Phillips curve: } \pi = \pi^e - \beta(u - u^n) + v$$

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



## Graphing the Phillips curve

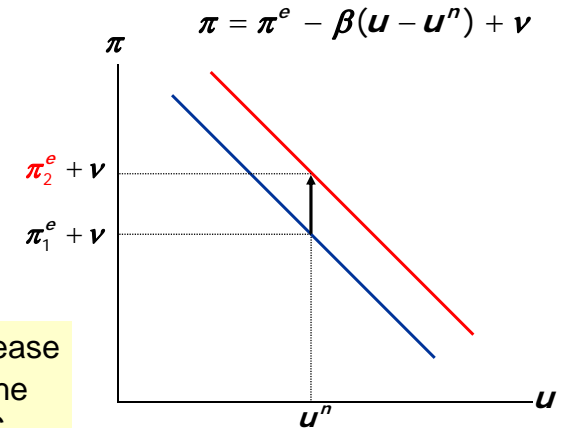
In the short run, policymakers face a tradeoff between  $\pi$  and  $u$ .



## Shifting the Phillips curve

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

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





## Key Question: How are Expectations Formed?

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

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

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

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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.

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## Two causes of rising & falling inflation

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

- **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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## 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.]

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## The Sacrifice Ratio

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

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

$$= 4 \times 5$$
- 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.

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## 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.

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- 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  $\pi^e$  will fall, perhaps by the full 4 points.
- Then,  $\pi$  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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## The natural rate hypothesis

Our analysis of the costs of disinflation, and of economic fluctuations in the preceding lectures, is based on the **natural rate hypothesis**:

Changes in aggregate demand affect output and employment only in the short run.

In the long run, the economy returns to the levels of output, employment, and unemployment described by the classical model.

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## An alternative hypothesis: Hysteresis

- **Hysteresis**: the long-lasting influence of history on variables such as the natural rate of unemployment.
- Negative shocks may increase  $u^n$ , so economy may not fully recover.



## Hysteresis: Why negative shocks may increase the natural rate

- The skills of cyclically unemployed workers may deteriorate while unemployed, and they may not find a job when the recession ends.
- Cyclically unemployed workers may lose their influence on wage-setting; then, insiders (employed workers) may bargain for higher wages for themselves.

Result: The cyclically unemployed “outsiders” may become structurally unemployed when the recession ends.

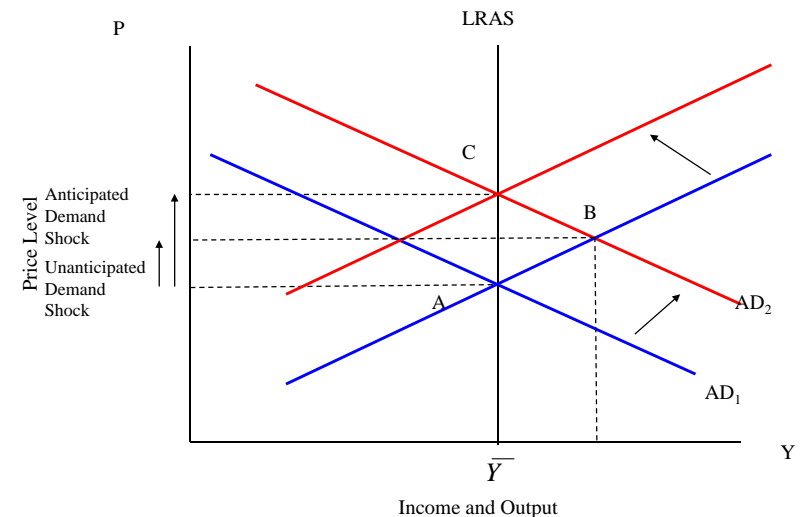


## Policy Ineffectiveness Proposition

- Rational Expectations + “Surprise” supply function + Market Clearing + Symmetric Information  $\Rightarrow$

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

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





## No Price/Wage Adjustment?

### Why might wages/prices not adjust?

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

All of these explanations require some form of market imperfection.



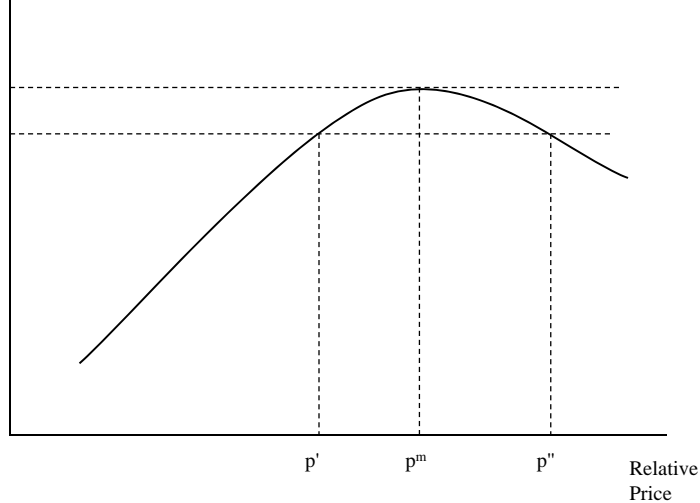
## “Menu” Costs

- At an optimum a small change in price will have little effect on profits ( $d\Pi/dP_i=0$ )
- So small “menu” cost is enough to produce rigidity
- But small change in price can nevertheless have large welfare effects

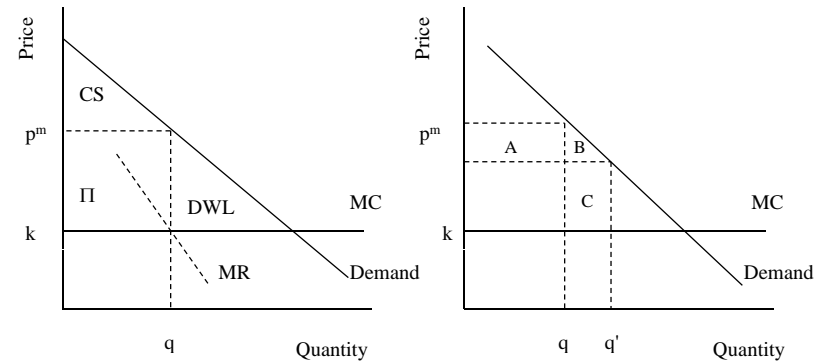


Profits

## Rigidity as a Result of Menu Costs



## Welfare Effects of a Price Change



$$\text{Change in Consumer Surplus} = A + B \quad \text{Change in Profits} = C - A$$

$$\text{Change in Social Welfare} = B + C$$

- Change in social welfare, **B+C** can be large!



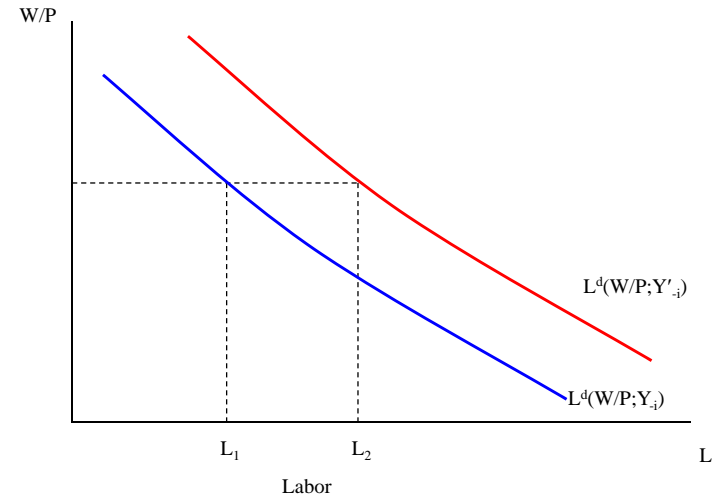
## Coordination Failure

- “Thick-Market” externality: trade is costly, and cheaper in “thick” markets.
- High activity **elsewhere** in the economy lowers costs and raises output and employment.  
(Costs<sub>i</sub> = f(Y<sub>j</sub>, Y<sub>-i</sub>))  
(+) (-)
- If the positive externality is sufficiently strong, you can get multiple equilibria.
- Economy can be stuck at a low level of activity.

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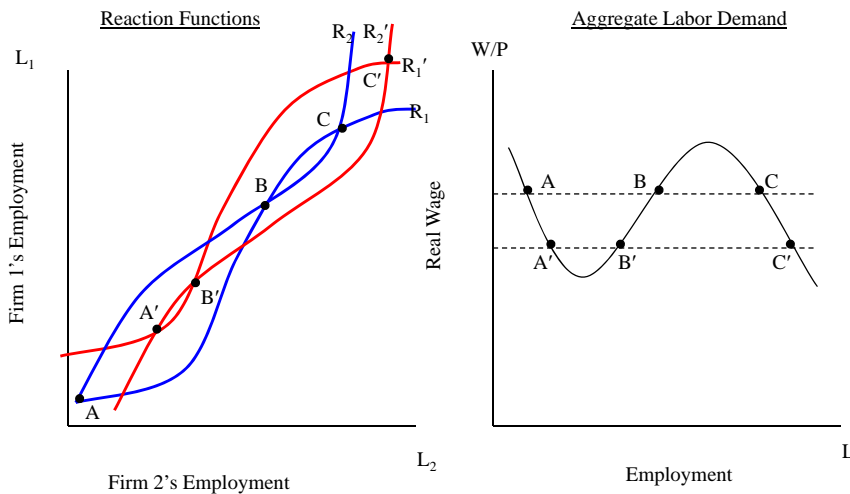
## Labor Demand in Individual Firm



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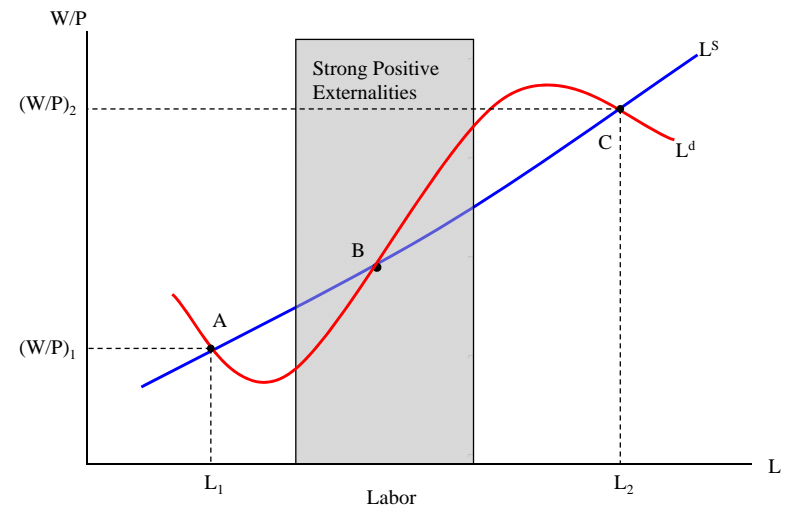
## A Two-Firm Example



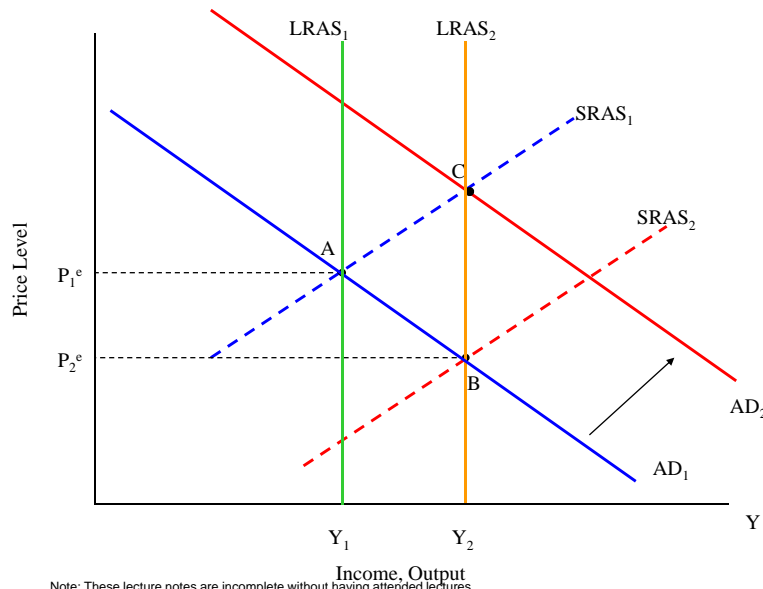
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## Labor Market: Multiple Equilibria

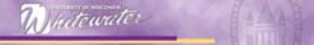


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## Summary

### 1. Phillips curve

- derived from the SRAS curve
- states that inflation depends on
  - expected inflation
  - cyclical unemployment
  - supply shocks
- presents policymakers with a short-run tradeoff between inflation and unemployment

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## Summary

### 2. How people form expectations of inflation

- **Adaptive Expectations**
  - based on recently observed inflation
  - implies “inertia”
- **Rational Expectations**
  - based on all available information
  - implies that disinflation may be painless

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## Summary

### 3. The natural rate hypothesis and hysteresis

- **The Natural Rate Hypotheses**
  - states that changes in aggregate demand can only affect output and employment in the short run
- **Hysteresis**
  - states that aggregate demand can have permanent effects on output and employment

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## Summary

### 4. Policy Ineffectiveness Proposition

- With **Rational Expectations**, the **expectations augmented supply curve**, **market clearing** and **symmetric information**
  - **There is no role for stabilization policy; only unanticipated policy matters**
- Must have either:
  - Some agent has superior information
  - Workers/Agents locked into contracts



## Summary

### 5. Reasons for wages/prices not to adjust:

- Menu Costs
- Staggering of wages and prices
- Coordination Failure and Multiple Equilibria