Lecture 2
The Phillips curve menu

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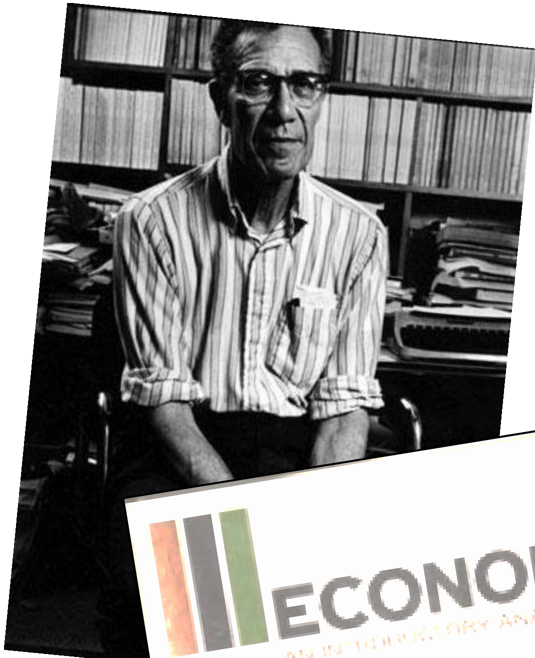
“In 1960, Paul Samuelson and Robert Solow found a Phillips curve in the U.S. time series for inflation and unemployment. They taught that the Phillips curve was exploitable and urged raising inflation to reduce unemployment. Within a decade, Samuelson and Solow's recommendation was endorsed by many macroeconomists and implemented by policy makers’.”

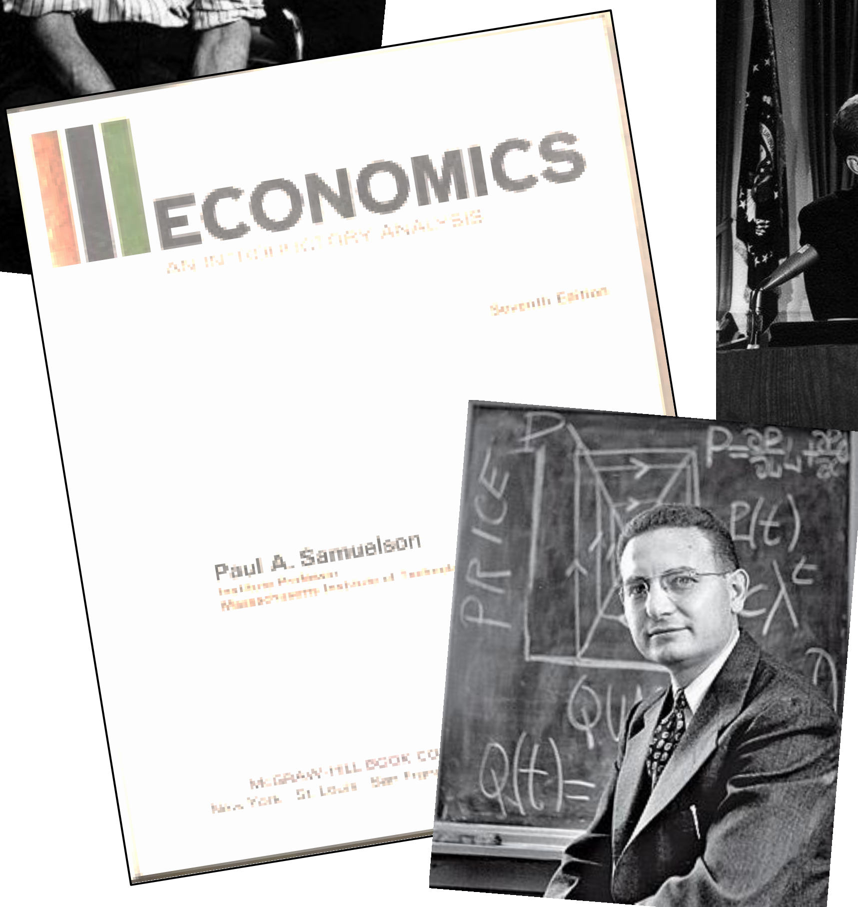
Sargent, 1999

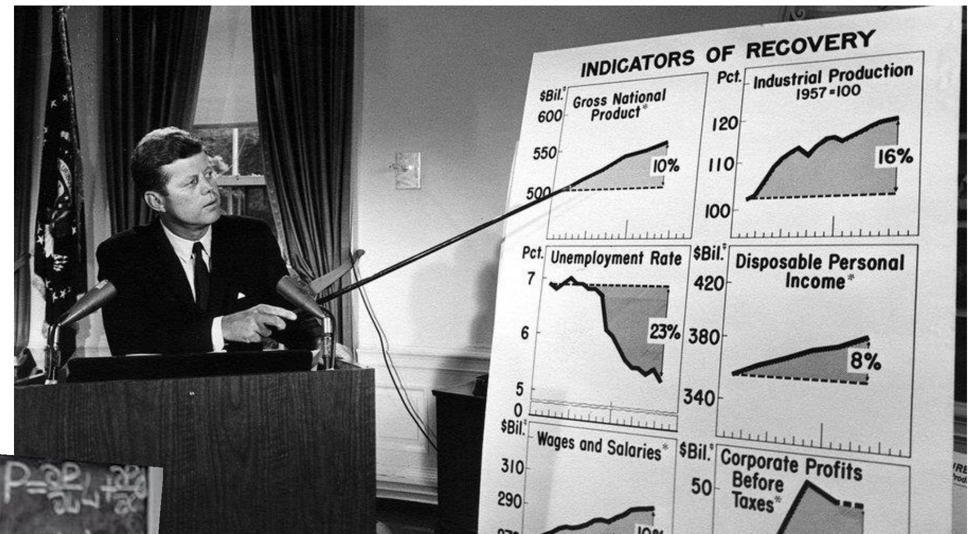
In this chapter

- Full employment and inflation tensions
- The Phillips curve
- Income and price policies
- The Theory of Economic Policy

People in this class







Council of Economic Advisers

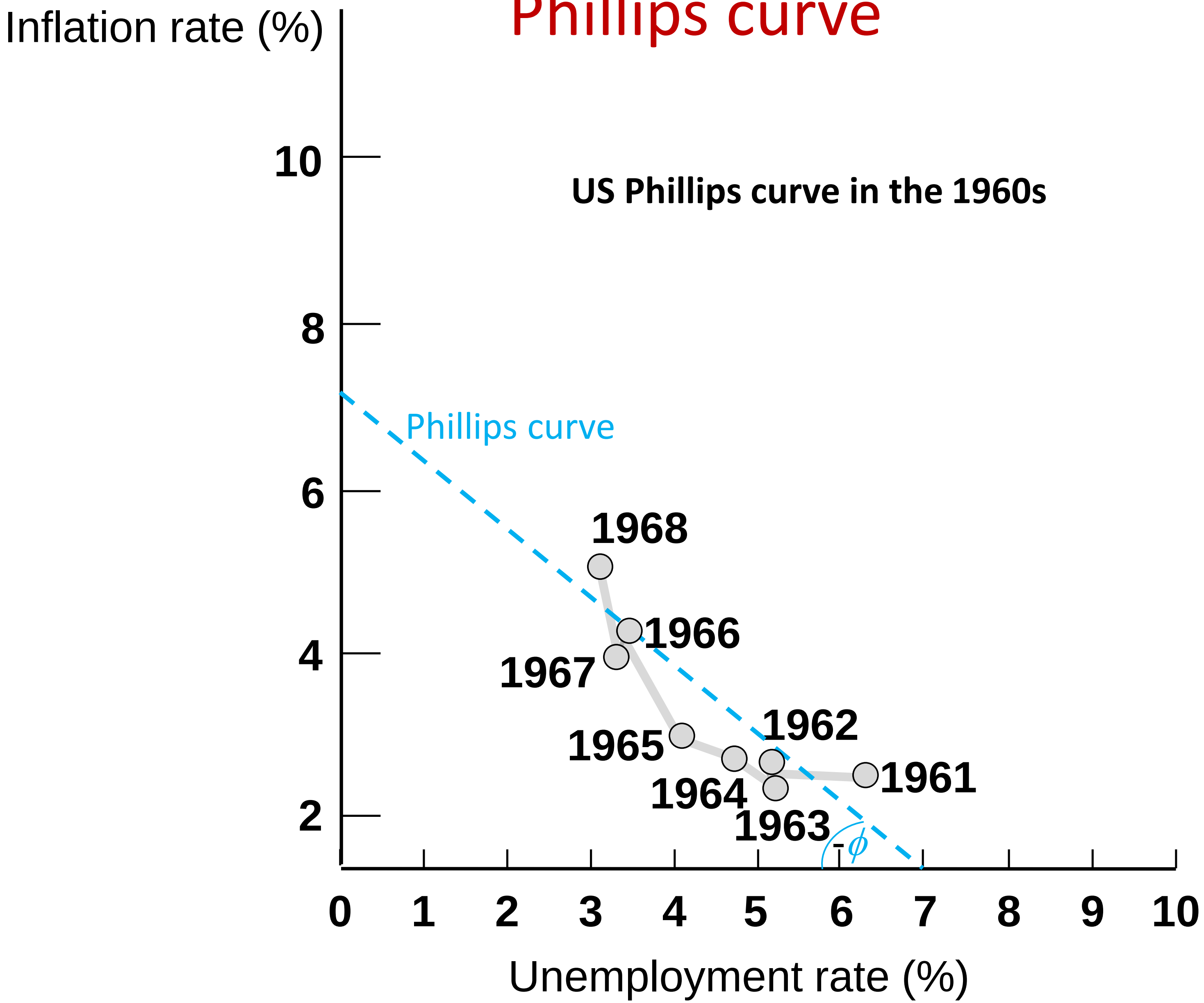
Inflation and unemployment optimal mix

- In the US, the UK, and most developed countries, economic policy of the 1960s was inspired by the principles of the Keynesian neo–classical synthesis
- The 1960s experience was a crucial turning point for the evolution of post–war macroeconomic thought
  - It entrenched the neo–classical synthesis as the then new orthodoxy
  - But, it also triggered consequences that led to its final abandonment
- The 1960s ended with rising inflation which, in a few years, the oil shocks would greatly accelerate – leading to a radical reconsideration of the accepted Keynesian theory

Inflation

- In the 1950s, most Western countries had come back to full employment and inflationary tensions began to emerge in the various markets, especially in the labor market
- A. W. Phillips, in observing data for the UK from 1861 to 1957, noticed a stable negative correlation between unemployment and the rate of change in wages. The relationship came to be called the Phillips curve
- As an empirical relationship, it was further confirmed when the rate of inflation replaced the rate of change of wages.

Phillips curve



Theoretical foundations

- In 1972, Tobin described the Phillips curve as an "empirical finding in search of a theory"
- A theoretical foundation for the existence of an inverse relationship between wages or prices and the unemployment rate was based on
  - imperfect competition
  - expectations

A formal model

Demand equation IS/LM

$$y = \sigma \frac{m - p}{\beta + \sigma} + \beta \frac{\sigma \pi^e + \alpha(g + A)}{\beta + \sigma}$$

Production

$$y = al + (1 - a)k + \ln(A)$$

Employment

$$u = l^p - l$$

Price equation

$$p = w - \gamma + \mu$$

Wage equation

$$w = \delta - \phi u$$

$$p = -\phi u + \delta - \gamma + \mu$$

Phillips Curve

Output, employment, and unemployment

- Given k and technology, by the production function, l determines y and vice versa:

$$y = f(l): \qquad al + (1-a)k + \ln(A) \Rightarrow y$$
$$l = f^{-1}(y): \qquad \left[y - (1-a)k + \ln(A)\right] / a \Rightarrow l$$

- The unemployment rate follows

$$u = l^p - l = l^p - f^{-1}(y)$$

- Given *y*, *l* and *u* are univocally determined

The Phillips menu

- The economic policy can equivalently described by using two well-known models
  - AD/AS model (p and y)
  - Phillips menu (π and u)

Keynesian policies and prices

- Keynesian policies determine the output, employment, and the unemployment rate:

$$\sigma\frac{m-p}{\beta+\sigma}+\beta\frac{\sigma\pi^{e}+\alpha\left(g+A\right)}{\beta+\sigma}\Rightarrow y$$

$$\left[y-(1-a)k+\ln(A)\right]/a\Rightarrow l \qquad l^{p}-l\Rightarrow u$$

- Then inflation is determined by the Phillips curve

$$p=-\phi u+\delta-\gamma+\mu$$

AD/AS model

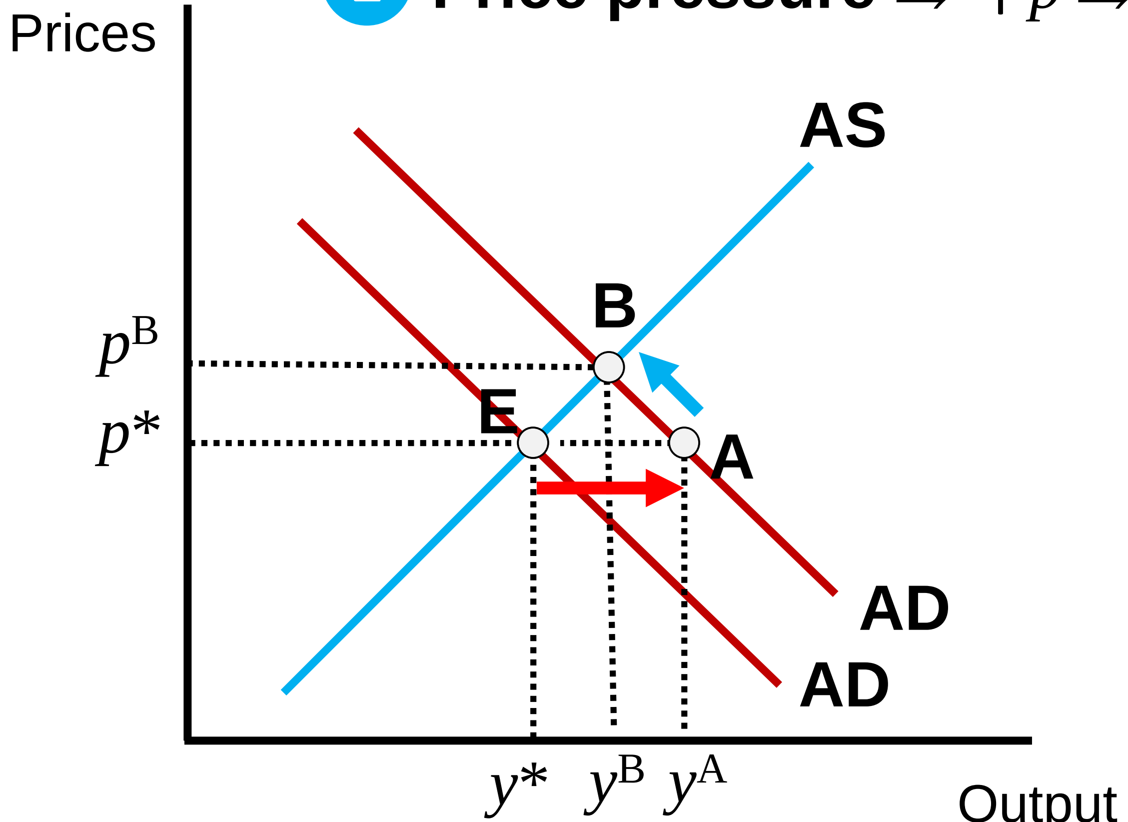
- The model:

$$\begin{cases} y = \sigma \dfrac{m - p}{\beta + \sigma} + \beta \dfrac{\sigma \pi^e + \alpha (g + A)}{\beta + \sigma} \\ p = \delta + \phi \dfrac{y - y^P}{a} - \gamma + \mu \end{cases}$$

- The government's instrument is the monetary–fiscal policy mix (recall different effects on i)

Equilibrium and policies

2 **Price pressure** $\Rightarrow \uparrow p \Rightarrow \downarrow m - p$



1 **Keynesian expansionary policy** $\Rightarrow \uparrow g$ or $\uparrow m$

Phillips menu

- The economy:

$$p = -\phi u + \delta - \gamma + \mu$$

- The government aims to achieve p=0 and u=0 (two targets), but has only one instrument: demand policy, i.e., it can set u and let the market determines p by the Phillips curve.
- Think to Tinbergen!!! 2 targets but 1 instrument

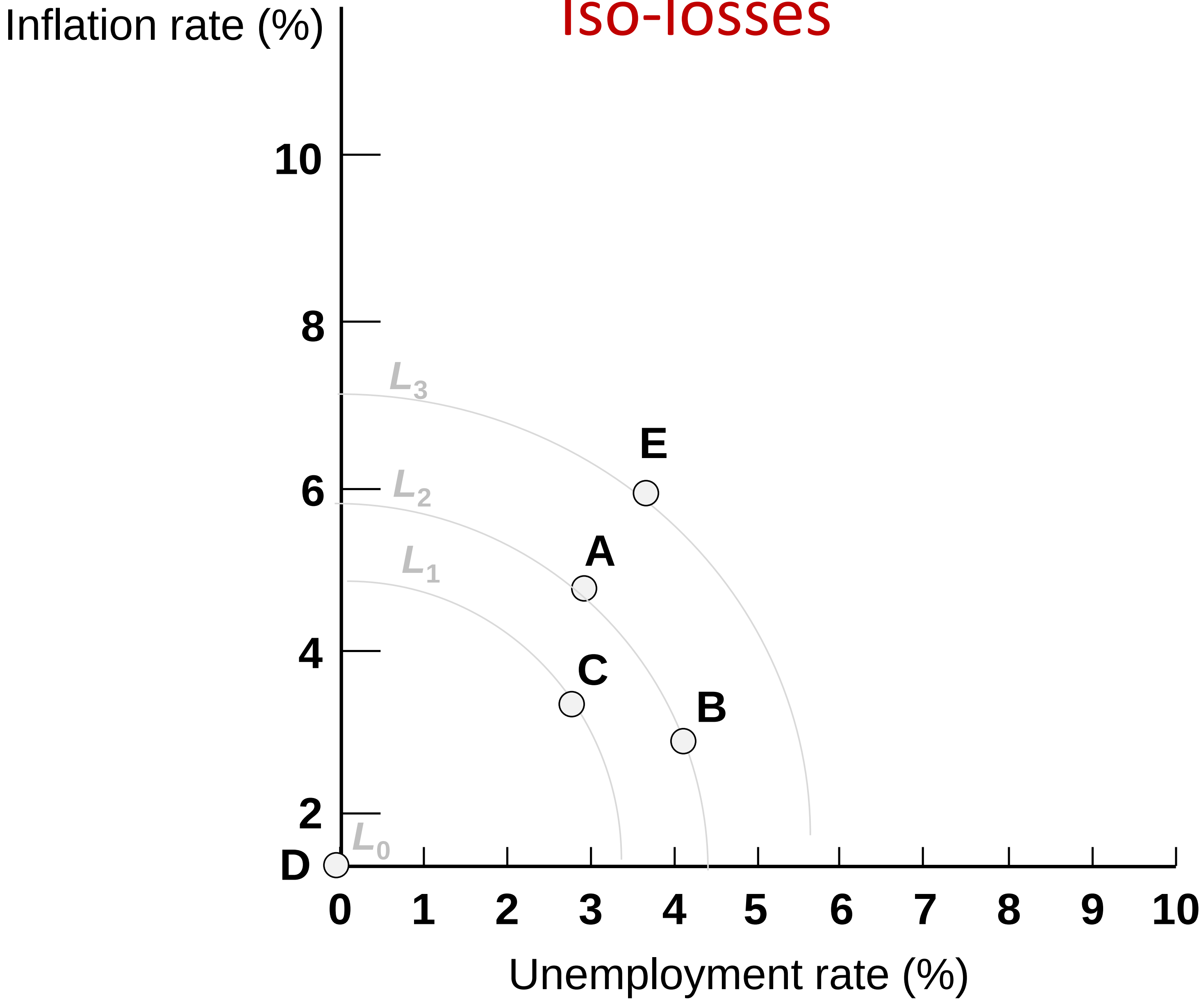
The policymaker’s loss

- Formalization by a loss function:

$$L = a\frac{1}{2}\left(p-\overline{p}\right)^2+\frac{1}{2}\left(u-\overline{u}\right)^2$$

- where $a>0$ is the relative importance (to the policymakers) of preventing excess inflation vs. preventing excess unemployment
- Losses are zero if and only if both inflation and unemployment are equal to the government’s target values

Iso-losses



Inflation rate (%)
10
8
6
4
2
L3
L2
L1
L0
E
A
C
B
D
0
1
2
3
4
5
6
7
8
9
10
Unemployment rate (%)

Policymaker's problem

- The formal problem:

$$\min_u L = a\frac{p^2}{2} + \frac{u^2}{2}$$

$$s.t.\quad p = -\phi u - \gamma + \mu + \delta$$

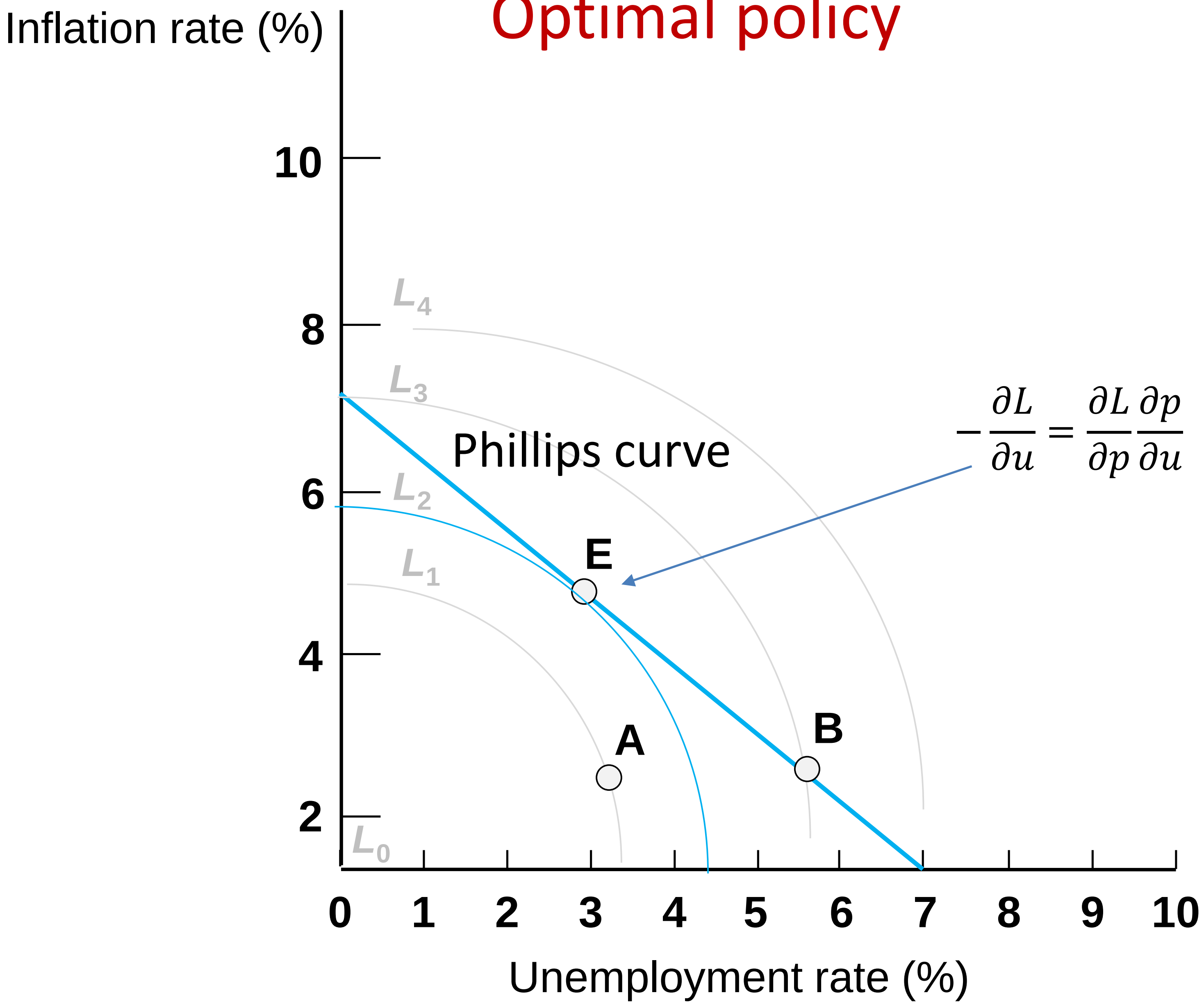
- It follows (first–order condition):

$$-\frac{\partial L}{\partial u} = \frac{\partial L}{\partial p}\frac{\partial p}{\partial u}$$

MB of reducing unemployment (employment)

MC of reducing unemployment (inflation)

Optimal policy

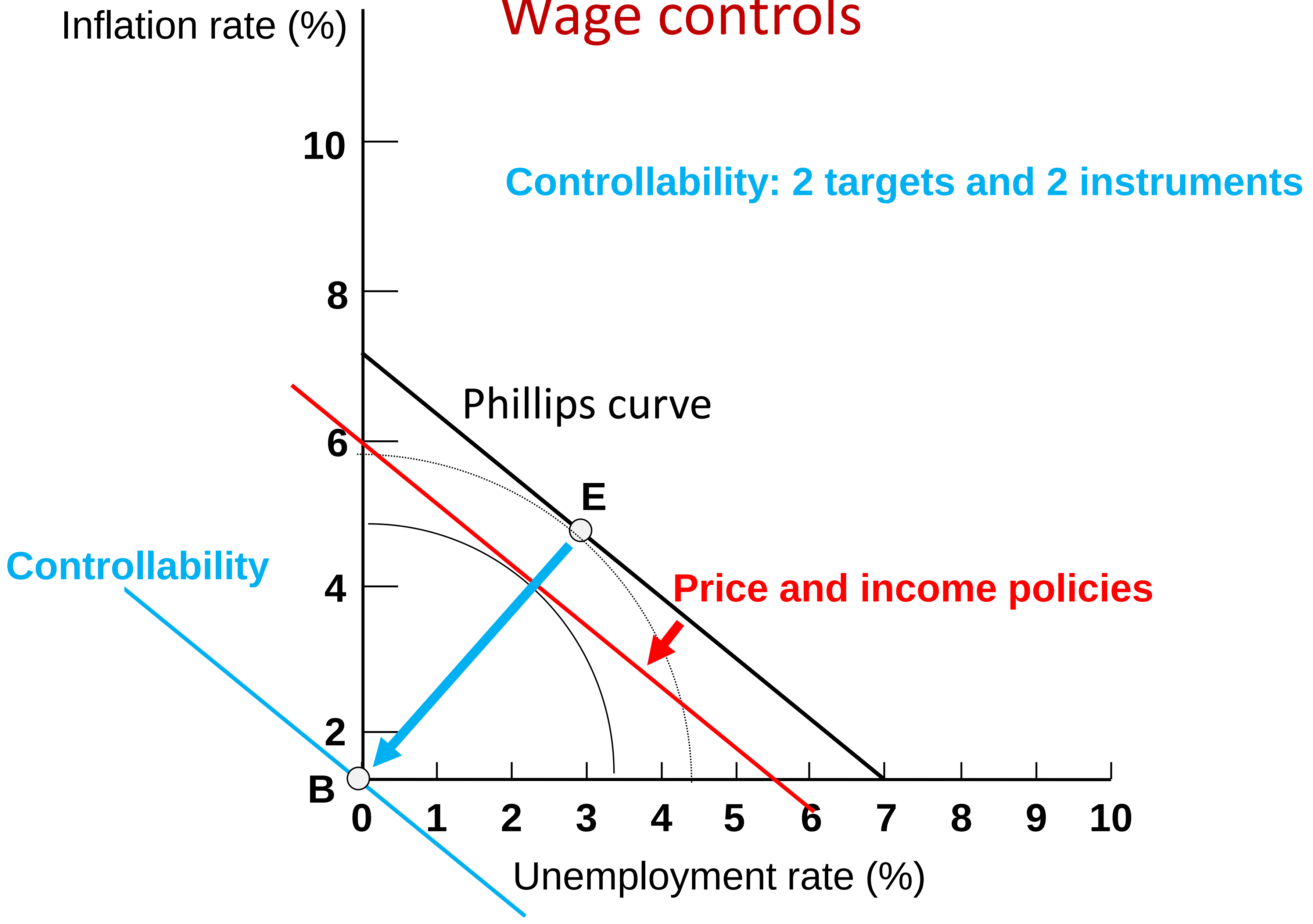


Prices and incomes policies

- Wage pressures can be controlled in different ways, albeit with different consequences
  - A wage setting authority
  - Government's "moral suasion"
  - "Implicit" coordination, as in the case of the guideposts used by the US in the 1960s
  - Wage control by a "social" agreement of the kind used in Finland

$$p = -\phi u + \delta - \gamma + \mu$$

Wage controls



The Theory of Economic Policy

- Now we can generalize the way economic policy is conducted, following the theory developed in the 1950s-1960s by Tinbergen, Theil …
- The Tinbergen–Theil approach underpins the Keynesian interventionist policies in the 1960s
  - by estimating the relationships between aggregate variables using the econometric tools
  - the policymaker could expect to reach a first– or second–best solution – given targets defined by society at large

The Theory of Economic Policy

- Assuming the policymaker aims to achieve exact values (fixed–target values) for some target variables, managing some instruments
- The policymakers must have a number of instruments at least equal to the number of objectives (Golden rule)
- What if this is not the case?
  - Too many instruments (easy)
  - Too many targets $\Rightarrow$ flexible target approach

A general approach

- Two ingredients
  - The model of the economy (target variables as a function of the instrument variables)
  - A loss function defining the preference of the policymakers
- Method: minimizing the loss subject to the economy constraints
- Fixed-target approach as special case

Two instruments (fixed targets)

- The policymaker's problem:

$$\min_{x_1, x_2} L = \left(y_1 - \bar{y}_1\right)^2 + a\left(y_2 - \bar{y}_2\right)^2$$

- s.t. (reduced form model)

$$\begin{cases} y_1 = b_{11} x_1 + b_{12} x_2 \\ y_2 = b_{21} x_1 + b_{22} x_2 \end{cases}$$

$$\begin{cases} y_1 = \bar{y}_1 \\ y_2 = \bar{y}_2 \end{cases}$$

Fixed-target approach (Golden rule) claims

Two instruments (fixed targets)

- Structural form:

$$\min_{x_1, x_2} L = (y_1 - \bar{y}_1)^2 + a(y_2 - \bar{y}_2)^2$$

- s.t. (reduced form model)

$$\begin{cases} y_1 = b_{11}x_1 + b_{12}x_2 \\ y_2 = b_{21}x_1 + b_{22}x_2 \end{cases}$$

Solving the problem

Two instruments (fixed targets)

- First–order conditions:

$$\begin{cases} x_1 = (b_{22}\bar{y}_1 - b_{12}\bar{y}_2)/(b_{11}b_{22} - b_{12}b_{21}) \\ x_2 = (b_{11}\bar{y}_2 - b_{21}\bar{y}_1)/(b_{11}b_{22} - b_{12}b_{21}) \end{cases}$$

- Then

$$\begin{cases} y_1 = b_{11}x_1 + b_{12}x_2 \\ y_2 = b_{21}x_1 + b_{22}x_2 \end{cases} \Rightarrow \begin{cases} y_1 = \bar{y}_1 \\ y_2 = \bar{y}_2 \end{cases}$$

As claimed

One instrument (flexible targets)

- Structural form:

$$\min_{x_1, x_2} L = (y_1 - \bar{y}_1)^2 + a(y_2 - \bar{y}_2)^2$$

- s.t. (reduced form model)

$$\begin{cases} y_1 = b_{11} x_1 \\ y_2 = b_{21} x_1 \end{cases}$$

Solving the problem

One instrument (flexible targets)

- First–order condition

$$\left(y_1-\bar{y}_1\right)\partial y_1/\partial x_1+a\left(y_2-\bar{y}_2\right)\partial y_2/\partial x_1=0$$

i.e., $x_1=\dfrac{b_{11}\bar{y}_1+ab_{21}\bar{y}_2}{xb_{11}^2+axb_{21}^2}$

- Then

$$\begin{cases} y_1=b_{11}x_1 \\ y_2=b_{21}x_1 \end{cases}$$

$$\begin{cases} y_1=\dfrac{b_{11}\bar{y}_1+ab_{21}\bar{y}_2}{b_{11}^2+ab_{21}^2} \\ y_2=\dfrac{b_{11}\bar{y}_1+ab_{21}\bar{y}_2}{b_{11}^2+ab_{21}^2} \end{cases}$$

Limits of the Tinbergen–Theil approach

- Realism of policymakers as “representatives” of undefined groups of citizens
- Problems of implementation cost and political and administrative feasibility
- But the existence of economically stable relations was the Achilles’ heel of the classical theory of economic policy.
  - The problem was the assumption that policy constraints are independent of the expected outcomes of public action (as Lucas will show)