Short Run:Reality, Theory, Policy

Product Pricing, (Un)Employment and Inflation: PC to AS

(part 3/3)

T. Kam

File: 03-cycles_pc.tex
Read: Mishkin, Chapter 11

Outline of Talk

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Learning Objectives

- Using empirical observations of business-cycle data to inform the design of a simple model.

- Model as:

    ▸ interpretive framework for observed behaviour in data
    ▸ laboratory for studying controlled experiments: shocks and policy changes

- We study this in **three** building blocks:

    ▸ previous lecture: the IS curve
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Learning Objectives

We will see:

- How the central bank effectively sets the real interest rate in the short run, and how this rate shows up as the MP curve in our short-run model.

- That the Phillips curve describes how firms set their prices over time, pinning down the inflation rate.

- How the IS curve, the MP curve, and the Phillips curve make up our short-run model.

- How to analyze the evolution of the macroeconomy in response to changes in policy or economic shocks.

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Recap: Empirical Regularities and Modelling Choice

Motivation

What do we see out there?
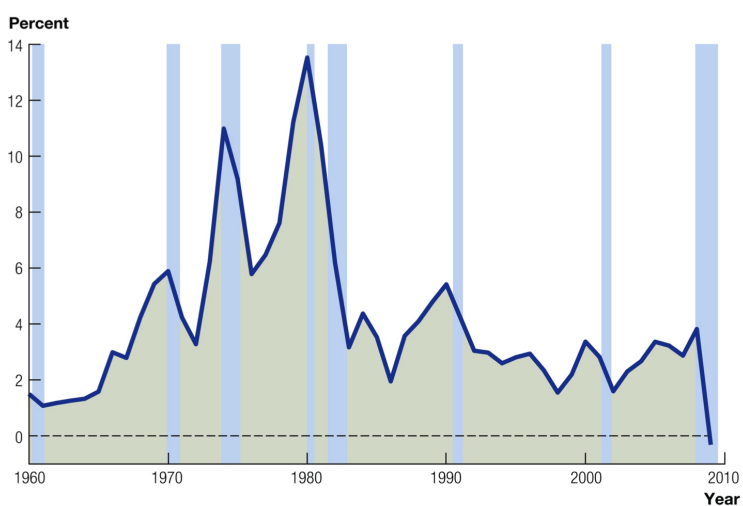
U.S. Inflation

Motivation

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Motivation

What do we see out there?

Cyclical unemployment, $u - \bar{u}$ vs Short-run output, $\tilde{Y}$. Slope $= -1/2$. Data points labelled by year from 1960 to 2009.

Motivation

Recap: some (short run) empirical regularities

1. Observed fluctuations in economic activity (output) around some long-run trend

2. Fluctuations in output appear as cycles of peaks and throughs: with irregular amplitudes and frequencies

3. Recessions typically associated with falls in inflation rate

   ▸ **Procyclical inflation:** Positive correlation between inflation growth and short run output

4. Expansions associated with lower unemployment

   ▸ **Countercyclical unemployment:** Negative correlation between cyclical unemployment and short run output

5. 3 and 4 imply negative correlation between inflation (growth) and unemployment

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Overview
Keep a watch out for these things!

Look-ahead!

Three building-block components: IS, PC and MP. Watch out for:

- *what* each component represents!
- *how* they come together to represent overall equilibrium requirements:
  - IS: Goods/services market
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- *how to use* overall IS-PC-MP to understand various experiments: shocks and policy change case studies.

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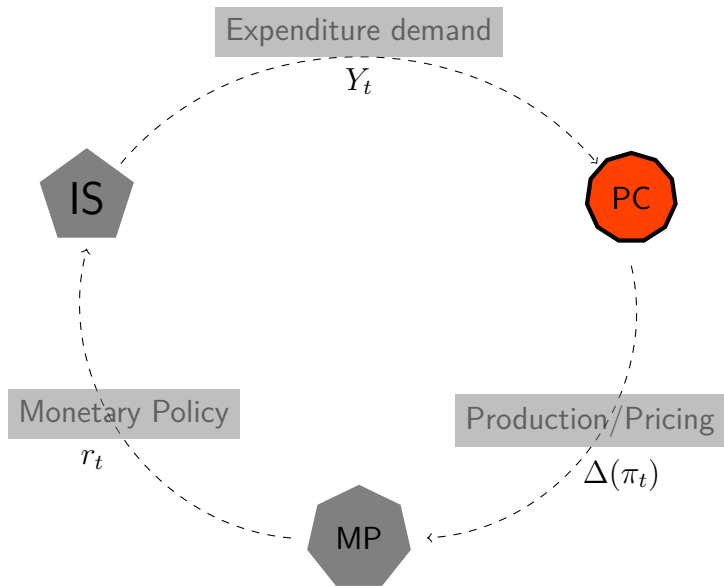# Block 3/3: The PC Curve

Expenditure demand

Y_t

IS

PC

Monetary Policy

r_t

Production/Pricing

$\Delta(\pi_t)$

MP

Look-ahead: Schematic of IS-PC-MP model (to come).

A Phillips Curve

Recall definition of one-period inflation rate in a price level (e.g. CPI):

$$\pi_t := \frac{P_{t+1} - P_t}{P_t}$$

A Phillips Curve

Assumption (a story about firm pricing behavior): in the short run (implicitly) firms are not perfectly competitive.

Firms set their prices on the basis of:

- π_t^e : their expectations of the economy-wide inflation rate; and
- $u_t - \bar{u}_t$: their demand for works (here: written in the converse).

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A Phillips Curve

A "reduced-form" representation of firms' behaviour:[1]

$$\pi_t = \pi_t^e - \omega(u_t - \bar{u}_t) + \rho_t.$$

- $\omega > 0$: sensitivity of actual inflation π_t to gap between current and long run unemployment rates, $\tilde{u}_t = u_t - \bar{u}_t$.

  - governs size of trade-off faced by policymaker in stabilising twin goals of $\tilde{Y}$ (or $\tilde{u}_t$) and π.

- We can interpret the PC as the locus of current inflation and current unemployment rate pairs (u, π) that satisfy:

  - Firms' "optimal" product pricing decisions,
  - in conjuction with their labor hiring decisions,
  - given their beliefs about future inflation and given exogenous shifts ρ.

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  - So current unemployment rate falls below its long run "natural rate"—i.e. $(u_t - \bar{u}_t) < 0$.
  - If firms hire more workers, its real marginal cost of producing output rises, or firm's profit margins fall.
  - To maintain some desirable markup of price over marginal cost, firms with have incentive to raise prices and hence aggregate P_t rises.
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$$\pi_t = \pi_t^e - \omega(u_t - \bar{u}_t) + \rho_t.$$

- Date-t Expectations/Beliefs about inflation next period, π_t^e :
  - How to model this? Whose beliefs? Subjective beliefs? Rational beliefs?
  - No definitive answer.
  - Behind every policymaker's disgreement with each other:
    - how beliefs are formed;
    - what other model assumptions to make!

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A Phillips Curve

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A Phillips Curve
...with adaptive expectations

From firm's pricing behaviour:

$$\pi_t = \pi_t^e - \omega(u_t - \bar{u}_t) + \rho_t.$$

and given model of expectation formation,

$$\pi_t^e = \pi_{t-1},$$

we get a naive-expectations Phillips curve model:

$$\pi_t = \pi_{t-1} - \omega(u_t - \bar{u}_t) + \rho_t. \tag{PC}$$

A Phillips Curve
...with adaptive expectations

$$\pi_t = \pi_{t-1} - \omega(u_t - \bar{u}_t) + \rho_t. \tag{PC}$$

In words:

- PC describes how inflation evolves over time as a function of short-run output; or
- how inflation—conditional on last period's inflation—is positively related to short run unemployment gap.
- long run situation: zero fluctuations implies zero inflation change.

$$\tilde{u}_t = 0 \iff \pi_t = \pi_{t-1} = \bar{\pi}$$
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A Phillips Curve

...with adaptive expectations

$$\pi_t = \pi_{t-1} - \omega\tilde{u}_t + \rho_t. \qquad \text{(PC)}$$

In words:

- If unemployment gap is above potential ($\tilde{u}_t > 0$), prices rise more slowly than long run rate ($\Delta\pi_t < 0$).
- If unemployment gap is below potential ($\tilde{u}_t < 0$), prices rise more rapidly than long run rate ($\Delta\pi_t > 0$).

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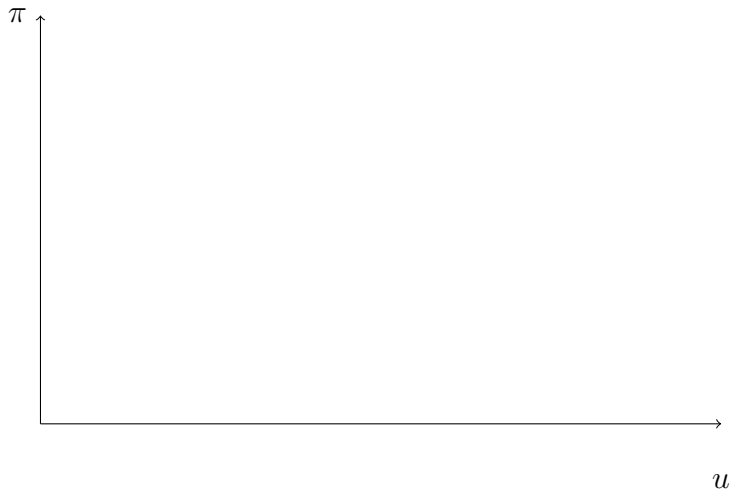
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Exercise

Sketch the graph of PC in (u, π)-space. What causes PC to shift?
Explain. Also sketch the long run PC. What shifts the long run PC?

A Phillips Curve

π

u

Phillips Curve to AS curve

Remember what the data says?

Change in inflation, $\Delta\pi$ versus Short-run output, $\tilde{Y}$

Phillips Curve to AS curve

- Firm's demand for labor, and pricing decisions, are driven by the aggregate demand for their output.

- So when aggregate demand goes up, output goes up, firms demand more workers, and unemployment falls in the short run.

- In the data, this is capture by a statistical relation called Okun's law:

$$u_t - \bar{u}_t = -\frac{1}{2}(Y_t - \bar{Y}_t).$$

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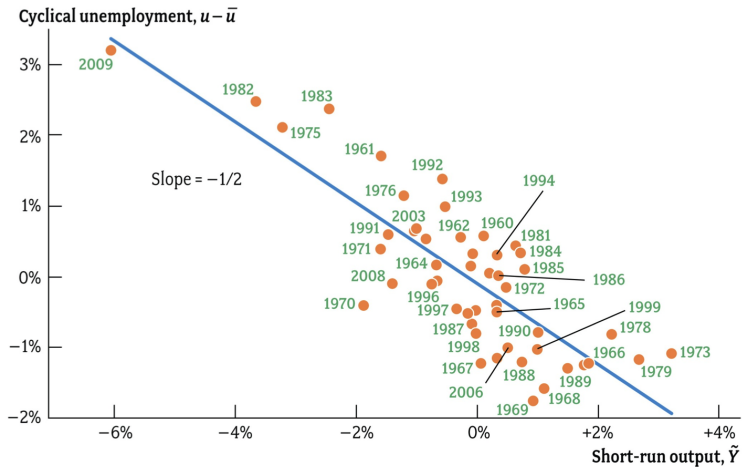- In the data, this is capture by a statistical relation called Okun's law:

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- Also ... Remember we mentioned the micro story:
  - firm's demand for workers (hence unemployment gap in the aggregate) was positively related to their pricing decision and thus inflation?

- Let $\gamma = \omega/2$. Piece all these together and get:

$$\pi_t = \underbrace{\pi_{t-1}}_{\text{Date-}t\text{expected inflation rate}} + \underbrace{\gamma(Y_t - \bar{Y}_t)}_{\text{Demand pull channel}} + \underbrace{\rho_t}_{\text{Cost push channel}} .$$

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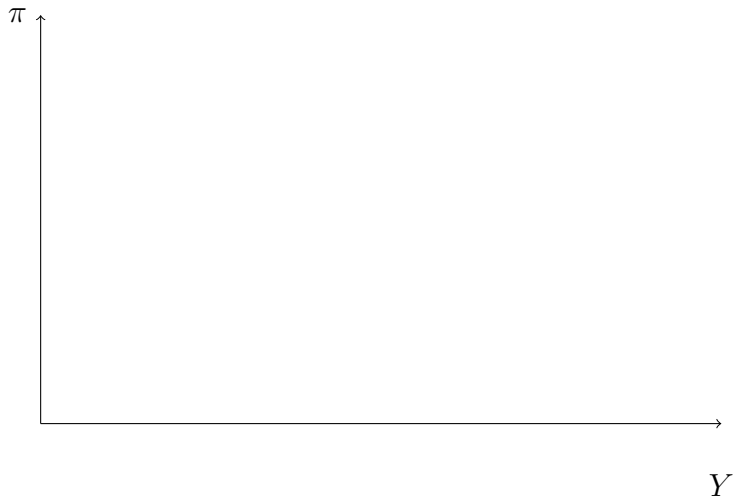
Exercise

Sketch the graph of AS in (Y, π)-space. What causes AS to shift? Explain. Also sketch the long run AS. What can shift the long run AS?

AS curve

AS curve and Reality

Remember what the data suggests?

A Phillips Curve

Cost-push and demand-pull inflation

So what makes inflation grow in this model?

- Price shocks to an input in production:
    - $\rho \gtreqless 0 \Longrightarrow \Delta\pi_t \gtreqless 0$
    - cost push inflation

- Short run output fluctuation $\tilde{Y}_t$:
    - $\tilde{Y}_t \gtreqless 0 \Longrightarrow \Delta\pi_t \gtreqless 0$
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PC and Quantity Theory of Money

A Phillips Curve
and the Quantity Theory of Money

- QTM: An increase in the growth rate of real GDP would reduce inflation.
- PC seems to say a booming economy causes the rate of inflation to increase.
- Which one is correct?

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A Phillips Curve

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The quantity theory

- Long-run model
- An increase in real GDP reflects an increase in the supply of goods, which lowers prices.

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- Part of our short-run model
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- We have provided a story for how short run inflation is related to short run output fluctuation.

  - In the short run, firms production are constrained to meet aggregate demand
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  - pricing behavior takes into account

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... with your loved ones over dinner tonight

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- Phillips curve
- expectations formation; adaptive expectations model
- cost-push, demand-pull inflation
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