LECTURE 2.2

The Phillips Curve

ECON42240 Advanced Macroeconomics

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Where We Are

1. Time Series Methods

- 1.1 Time Series and Macro
- 1.2 Vector Autoregressions
- 1.3 VARs: Applications
- 1.4 The Kalman Filter
- 1.5 Solving RE Models

2. Structural Models

- 2.1 The RBC Model
- **2.2 The Phillips Curve**
- 2.3 The New Keynesian Model
- 2.4 Estimating DSGE Models
- 2.5 The Smets-Wouters Model

3. Finance and Policy

- 3.1 Credit and Banking Crises
- 3.2 Fiscal Policy, and What Next

Last Week's Lecture

Last week built the first model in which households and firms choose:

1. **The Planner's Problem.**
   One planner, one technology shock, no frictions.
2. **The First-Order Conditions.**
   From a Lagrangian to six equations.
3. **Log-Linearising.**
   Around a non-stochastic steady state.
4. **What the RBC Model Gets Wrong.**
   Money, propagation, and hours worked.

Lecture Plan

1. **The Expectations-Augmented Curve.**
   Friedman, and the 1970s.
2. **Calvo Pricing.**
   How a firm sets a price that may last years.
3. **The New Keynesian Curve.**
   Derived from Calvo pricing, then solved forwards.
4. **Inflation Persistence.**
   What the forward-looking curve misses.

SECTION 1

The Expectations-Augmented Curve

Monetary Policy Needs a Price Friction

Without price or wage frictions, policy cannot change real output or the real rate.

Sticky Prices Let Policy Influence the Real Rate

With sticky prices, the central bank can influence the real interest rate. A higher real rate lowers output, which lowers inflation.

This section follows the last link, the Phillips curve, from 1958 onwards.

An Empirical Regularity, Before Any Theory

Phillips found low unemployment alongside fast nominal wage growth (Phillips, 1958):

- **The Sample:** The United Kingdom, 1861 to 1957, published in 1958.
- **The Replication:** Samuelson and Solow found the same in US data (Samuelson & Solow, 1960).

Phillips Fitted a Curve and Did Not Derive One
Phillips reported a statistical relationship in the data. No model of price-setting stands behind it.

US Inflation and Unemployment in the Phillips Curve Era

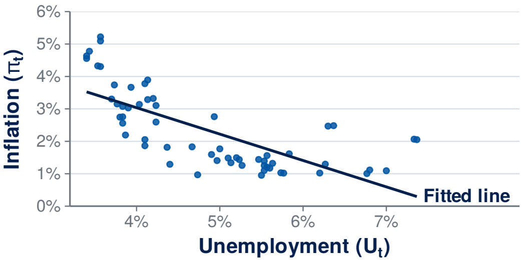

Figure 1: GDP-deflator inflation against unemployment, United States, 1955–1969.

> **Higher Unemployment Came with Lower Inflation**
> A downward-sloping line fits the 1955–69 quarters, with correlation -0.73. The relationship did not survive the 1970s.

The Curve Became a Menu for Policy

Within two years the curve was read as a menu: lower unemployment, bought with higher inflation.

> **A Correlation Was Treated as a Constraint**
> Policy debate assumed the curve would hold whatever policy did. Nothing in Phillips's finding said so.

Friedman’s Objection: Nominal Wages Are Not Real Wages

Friedman’s 1967 presidential address found a basic defect in Phillips’s analysis (Friedman, 1968):

- **The Defect:** Phillips failed “to distinguish between nominal wages and real wages.”
- **The Hidden Assumption:** Phillips wrote for a world expecting stable prices.
- **The Repair:** Restate Phillips in anticipated real wages, and “it all falls into place.”

> **Excess Labour Supply Slows Nominal Wage Growth**
> Excess supply shows up as wages rising more slowly than anticipated prices. It need not show up as falling wages.

The Natural Rate of Unemployment

At the natural rate, real wages grow at their normal secular rate on average.

> **A General Equilibrium Rate**
> Friedman's natural rate is "ground out by the Walrasian system of general equilibrium equations".
> Market imperfections are included.

Lower unemployment signals excess labour demand, which pushes real wage rates upward.

Friedman’s Prediction: Holding Unemployment Down Accelerates Inflation

Friedman traced an attempt to hold unemployment below the natural rate by monetary stimulus:

1. Spending rises, and at first “much or most” of the rise is output.
2. “Employees will start to reckon on rising prices of the things they buy.”
3. Holding unemployment down then needs faster money growth, and faster again.

> **Only Accelerating Inflation Holds Unemployment Down**
> Friedman: the rate “can be kept below the ‘natural’ rate only by inflation. And … only by accelerating inflation.”

Inflation and Unemployment Since 1955

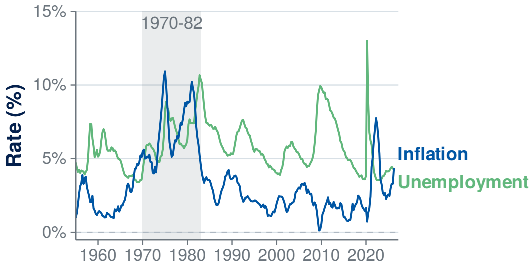

Figure 2: Inflation and unemployment, United States, 1955–2026, with 1970–82 shaded.

> **Both Rates Rose Together Through the 1970s**
> The 1970s brought high inflation alongside high unemployment. Friedman's prediction is dated 1967.

The 1955–69 Line Failed After 1969

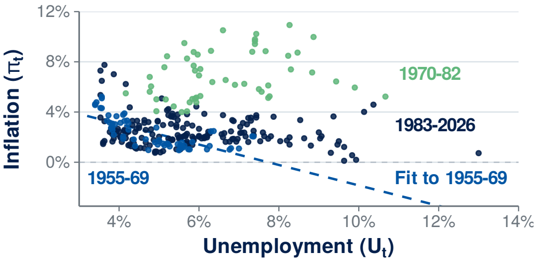

Figure 3: Inflation against unemployment, United States, 1955–2026, in three spans.

> **Every 1970–82 Point Lies Above the Line**
> All 52 quarters sit above the 1955–69 line, by 6.1 points on average. Over 1955–2026 the correlation is 0.11.

The Expectations-Augmented Phillips Curve

Friedman used no equations, but a rough model adds expected inflation (π_t^e) to the curve:

$$\pi_t = \pi_t^e - \gamma \left(U_t - U^* \right) \quad (1)$$

where:

- U_t, U^*: unemployment and natural rate
- γ: slope on the unemployment gap

Exploiting the Tradeoff Shifts the Curve Up
Sustained inflation raises π_t^e and shifts the curve up. With $\pi_t^e = \pi_t$, unemployment sits at U^*.

Adaptive Expectations Give the Accelerationist Curve

Adaptive expectations set $\pi_t^e = \pi_{t-1}$, so the curve explains the change in inflation ($\Delta\pi_t$):

$$\pi_t = \pi_{t-1} - \gamma\,(U_t - U^*) \qquad \Longleftrightarrow \qquad \Delta\pi_t = -\gamma\,(U_t - U^*) \tag{2}$$

Below the Natural Rate, Inflation Keeps Rising

With $U_t < U^*$ inflation rises every period, so the price level accelerates. The curve is named for that.

The Accelerationist Curve Held Until 2008

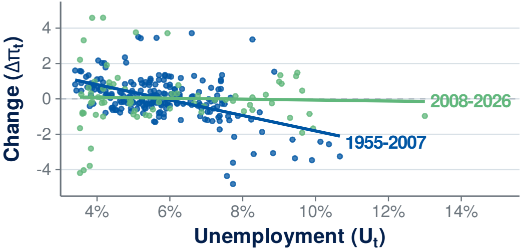

Figure 4: Change in inflation against unemployment, United States, 1955–2026.

> **The Slope Went Flat After 2007**
> Before 2008, higher unemployment went with falling inflation: slope -0.44. Since 2008 the slope is -0.03.

Estimating the Natural Rate

Nobody observes U^*, so estimate it, with lag weights (ω_i) summing to one:

$$\pi_t = \alpha - \gamma U_t + \sum_{i=1}^{N} \omega_i \pi_{t-i} \qquad \Longrightarrow \qquad U^* = \frac{\alpha}{\gamma} \tag{3}$$

The NAIRU Holds Inflation Steady

Steady inflation cancels the lags, so the intercept α equals γU^*: the non-accelerating inflation rate of unemployment.

Inertial Inflation Makes Disinflation Expensive

Estimated curves of this kind are used in policy analysis, with three implications:

- **Inflation Is Inertial:** A shock to inflation today takes a long time to disappear.
- **Speed Is Costly:** Getting inflation down quickly takes a lot of unemployment.
- **Probably Go Slowly:** Policy should probably reduce inflation gradually.

> **The Weights Change with the Regime**
> The Lucas critique (Lecture 1.5) says the ω_i change with the policy regime. Estimated NAIRUs inherit that problem.

Was 2021 a Phillips Curve Episode?

Inflation rose sharply in 2021 and 2022, then fell while unemployment stayed low.

> **Question**
> Was 2021–22 a point on a stable Phillips curve, or did the curve shift? What evidence would decide?

Take answers from the room.

SECTION 2

Calvo Pricing

New Keynesians Answered the Critique with Sticky Prices

Under rational expectations, unemployment leaves U^* only on an unpredictable inflation surprise.

> **New Keynesians Chose Sticky Prices**
> Of the many frictions tried, sticky prices became the most common. With them, systematic monetary policy has real effects.

A sticky price needs a price-setting firm and a rule for changing its price.

A Firm Needs a Price of Its Own

Each firm sells a distinct good, with elasticity of demand $\varepsilon > 1$ (Dixit & Stiglitz, 1977):

$$Y_t(i) = Y_t \left(P_t(i)/P_t\right)^{-\varepsilon} \tag{4}$$

where:

- Y_t, P_t: aggregate output and price level
- $Y_t(i)$, $P_t(i)$: firm i's output and price

A Flexible Price Is a Fixed Markup
With no friction, a firm charges a fixed markup over marginal cost, the cost of one more unit.

Calvo Pricing: A Random Fraction Resets Each Period

Each period a random fraction $1 - \theta$ of firms may reset their price (Calvo, 1983):

- **Everyone Else:** A fraction, the non-reset probability (θ), keeps last period's price.
- **The Draw Is Random:** The chance to reset is the same however stale the price.

> **Whelan Writes Alpha Where This Deck Writes Theta**
> His α is the fraction that cannot reset. This deck uses θ, because α is 2.1's capital share.

A Price's Expected Life Is a Geometric Sum

A price survives each period with probability θ, so its expected life is a geometric sum:

$$\text{expected duration} = \sum_{k=0}^{\infty} \theta^k = \frac{1}{1-\theta} \tag{5}$$

At $\theta = 0.75$ in quarterly data, a price lasts four quarters on average.

> **Micro Data Put Durations Under a Year**
> Bils and Klenow found a median US duration of four to six months (Bils & Klenow, 2004). Excluding sales, later work finds eight to eleven (Galí, 2015).

Prices Outstanding at Three Values of Stickiness

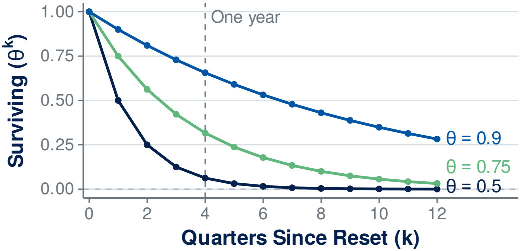

Figure 5: Share of prices set today still in force after k quarters.

Stickiness Compounds Across Quarters

At θ = 0.9 two thirds of today's prices survive a year. At θ = 0.5 one in sixteen does.

A Firm Resetting Today May Be Stuck for Years

A price set today may still hold in k periods, so the firm weighs each future period:

$$\text{weight on period } t+k \;=\; \underbrace{\theta^k}_{\text{still in force}} \times \underbrace{\beta^k}_{\text{discounting}} \tag{6}$$

The Reset Price Looks Ahead

The firm cannot choose when its price ends. It prices against marginal cost over the price's expected life.

The Price Level Mixes Old Prices and New

Resetting firms are identical, so all choose one reset price (X_t). The price level averages that price with last period's level:

$$P_t^{1-\varepsilon} = (1-\theta)X_t^{1-\varepsilon} + \theta P_{t-1}^{1-\varepsilon} \qquad \Longrightarrow \qquad p_t = (1-\theta)x_t + \theta p_{t-1} \tag{7}$$

where:

- p_t, x_t: logs of P_t and X_t

> **The Elasticity Drops Out**
> Around zero inflation, log-linearising cancels every $(1-\varepsilon)$ term.

The Reset Price Maximises Expected Discounted Profit

The firm chooses X_t against expectations (E_t, Lecture 1.5), weighting period $t+k$ by $(\theta\beta)^k$:

$$\max_{X_t} \; E_t \sum_{k=0}^{\infty} (\theta\beta)^k \left[\text{real profit at } t+k \text{ with price } X_t\right] \tag{8}$$

A Markup over Average Future Marginal Cost

The solution marks up a weighted average of nominal marginal costs (MC_{t+k}), current and future:

$$X_t = \frac{\varepsilon}{\varepsilon - 1} \cdot \frac{E_t \sum_{k=0}^{\infty} (\theta\beta)^k Y_{t+k} P_{t+k}^{\varepsilon-1} MC_{t+k}}{E_t \sum_{k=0}^{\infty} (\theta\beta)^k Y_{t+k} P_{t+k}^{\varepsilon-1}} \tag{9}$$

With No Stickiness, the Static Markup Returns

Only the $k = 0$ term survives, so the price is the static markup on today's marginal cost.

Should a Resetting Firm Price Ahead of Rising Costs?

Suppose marginal cost is expected to rise steadily over the next two years.

> **Question**
> A firm resets today, with $\theta = 0.75$. Is its price above or below the markup on today's cost? Would a flexible-price firm differ?

Take answers from the room.

SECTION 3

The New Keynesian Curve

Two Log-Linear Equations Describe the Pricing Model

Log-linearising both pricing equations around zero inflation gives a pair in log marginal cost (mc_t):

$$p_t = (1 - \theta)x_t + \theta p_{t-1} \qquad x_t = \underbrace{(1 - \theta\beta)\sum_{k=0}^{\infty}(\theta\beta)^k E_t\, mc_{t+k}}_{\text{discounted expected marginal costs}} \qquad (10)$$

Rising Costs Raise Today's Reset Price

Output and the price level drop out, and the weights sum to one. Costs expected to rise put x_t above mc_t.

Reverse-Engineering the Infinite Sum

The sum is a forward solution, so recover the equation it solves:

$$x_t = (1 - \theta\beta)\, mc_t + \theta\beta\, E_t x_{t+1} \tag{11}$$

A Known Sum Gives Back Its Recursion

Lecture 1.5 went from a recursion to its sum; this step runs backwards. It needs $\theta\beta < 1$.

Eliminating the Reset Price

No data record a reset price, but the Calvo price level reveals it:

$$x_t = \boxed{\frac{p_t - \theta p_{t-1}}{1 - \theta}} \tag{12}$$

Put that into the recursion, today and, in expectation, next period:

$$\boxed{\frac{p_t - \theta p_{t-1}}{1 - \theta}} = (1 - \theta\beta)\, mc_t + \theta\beta \boxed{\frac{E_t p_{t+1} - \theta p_t}{1 - \theta}} \tag{13}$$

Collecting Terms Leaves Only Prices and Costs

Multiplying by $1 - \theta$ and collecting p_t leaves no reset price:

$$p_t\left(1 + \theta^2\beta\right) - \theta p_{t-1} = \theta\beta\, E_t p_{t+1} + (1 - \theta)(1 - \theta\beta)\, mc_t \tag{14}$$

The New Keynesian Phillips Curve

With the reset price gone, inflation depends on expected inflation and real marginal cost:

$$\pi_t = \beta E_t \pi_{t+1} + \frac{(1-\theta)(1-\theta\beta)}{\theta} \underbrace{(mc_t - p_t)}_{\text{real marginal cost}} \tag{15}$$

Expectations Come from Price-Setting

Inflation now follows from firms choosing prices. Expected inflation enters because a reset price may last many periods.

Stickier Prices Flatten the Curve

The slope on real marginal cost falls from infinity to zero as θ rises.

> **The Weight on Expected Inflation Is Derived**
> The expectations-augmented curve set that weight to one by assumption. Here the derivation returns β.

A flat estimated curve therefore implies long-lived prices.

Marginal Cost Rises with the Output Gap

With diminishing returns to labour, a higher output gap ($\tilde{y}_t$) raises real marginal cost:

$$mc_t - p_t = \eta\,\tilde{y}_t, \qquad \tilde{y}_t = y_t - y_t^n \tag{16}$$

where:

- y_t^n: flexible-price output
- η: marginal cost's output elasticity

> **The Natural Level Is Not the HP Trend**
> A flexible-price economy would produce y_t^n. The filtered trend (y_t^*) of Lecture 1.1 is a different object.

The New Keynesian Curve in the Output Gap

Substituting for real marginal cost puts the gap in the curve, with slope on the gap (κ):

$$\pi_t = \beta E_t \pi_{t+1} + \kappa \tilde{y}_t, \qquad \kappa = \frac{\eta(1-\theta)(1-\theta\beta)}{\theta} \tag{17}$$

> **Eta Here Is Not the CRRA Curvature**
> Lecture 2.1 used η for CRRA curvature. Here, as in Whelan, it links marginal cost to the gap.

Inflation Depends Only on Expected Future Gaps

Solving forwards, as in Lecture 1.5, gives inflation as a discounted sum of expected gaps:

$$\pi_t = \kappa \sum_{k=0}^{\infty} \beta^k E_t \tilde{y}_{t+k} \tag{18}$$

The New Curve Only Looks Like the Old One

Both curves carry an expectations term and a pressure term. The resemblance stops there:

- **The Old Curve:** Adaptive expectations tie today's inflation to yesterday's.
- **The New Curve:** Only expected future output gaps enter, with no lag.

> **Whelan: Lagged Effects Are an Artefact**
> The model's inflation has no intrinsic inertia. Lagged effects in conventional models are "a statistical artefact".

The Literature Adds a Cost-Push Shock

The derived curve has no shock term, yet many price movements do not fit it:

$$\pi_t = \beta E_t \pi_{t+1} + \kappa \tilde{y}_t + \epsilon_t^{\pi} \tag{19}$$

A Cost-Push Shock Raises Inflation at a Given Gap

A cost-push shock (ϵ_t^{π}) is any disturbance outside the gap. Random shifts in desired markups are one source.

Can a Central Bank Disinflate for Free?

Set the cost-push shock aside: inflation then depends only on expected future output gaps.

> **Question**
> A bank credibly promises a zero output gap in every period from today. What does the curve say inflation does? Do you believe it?

Take answers from the room.

SECTION 4

Inflation Persistence

Measured Disinflations Have Cost Output

On the forward-looking curve, a credible disinflation ends inflation at once, with no output cost.

> **27 of 28 Disinflations Came with Low Output**
> Ball studied 28 disinflations in nine countries, 1960–1990 (Ball, 1994). In 27, output averaged below normal.

Romer reads this as overwhelming support for inflation inertia (Romer, 2019).

A Lagged Inflation Term Has to Be Earned

A hybrid curve adds lagged inflation, with forward and backward weights (γ_f, γ_b) as in Lecture 1.5:

$$\pi_t = \gamma_f E_t \pi_{t+1} + \gamma_b \pi_{t-1} + \kappa \tilde{y}_t \tag{20}$$

> **A Better Fit Is Not a Derivation**
> Adding a lag improves fit by construction. The price-setting model derived $\gamma_b = 0$.

Testing the Curve Needs Two Things Nobody Observes

Estimating the curve needs proxies for the output gap and for expected inflation:

- **The Gap:** Whelan proxies y_t^n with a trend, so $\tilde{y}_t$ is detrended output.
- **Expected Inflation:** Realised π_{t+1} replaces $E_t\pi_{t+1}$, with instruments for its noise.

> **The Trend Is an Outside Assumption**
> Detrending assumes output returns to y_t^n on average. The model does not supply that assumption.

The Output Gap Enters with the Wrong Sign

Estimated on detrended output, the gap coefficient κ usually comes out negative.

> **The Model Requires a Positive Slope**
> A positive gap raises real marginal cost, so κ should be positive. A negative κ says booms lower inflation.

Whelan: “shocking to some but actually not so surprising once you work through it.”

The Accelerationist Correlation Produces the Negative Sign

Take expected inflation left; with β near one and realised inflation, that side is a change:

$$\kappa\,\tilde{y}_t = \pi_t - \beta E_t \pi_{t+1} \;\approx\; \pi_t - \pi_{t+1} \;=\; -\Delta\pi_{t+1} \tag{21}$$

1. Before 2008, $\Delta\pi$ was negatively correlated with unemployment.
2. So $\Delta\pi$ was positively correlated with the output gap.
3. Regressing $-\Delta\pi_{t+1}$ on the gap then returns a negative coefficient.

Section one's accelerationist figure shows the correlation in item 1.

ACCELERATIONIST CURVE UNTIL 2008

Galí and Gertler: Use the Labour Share Instead

Galí and Gertler argued that a deterministic trend tracks y_t^n badly (Galí & Gertler, 1999). They proxied real marginal cost by the labour share:

$$\pi_t = \beta E_t \pi_{t+1} + \gamma s_t \tag{22}$$

where:

- s_t: labour share of income
- γ: slope on the labour share

> **Estimated This Way, the Slope Is Positive**
> Whelan: the result was "seen as putting the NKPC back on a sound empirical footing."

The US Labour Share Since 1955

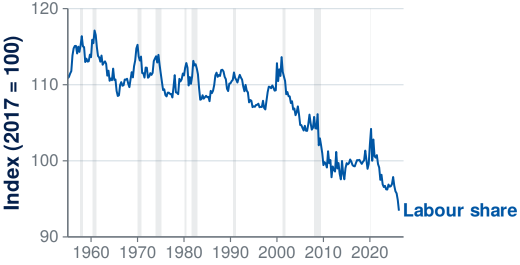

Figure 6: Labour share, US nonfarm business sector, 1955–2026; recessions shaded.

> **The Share Rose in Six of Ten Recessions**
> Real marginal cost should rise in booms. The share has also fallen by about a sixth since 2000.

Rudd and Whelan: The Labour Share Result Fails

Rudd and Whelan update the estimates (Rudd & Whelan, 2007), and Whelan questions the proxy:

- **The Update:** Updated estimates leave the labour share coefficient insignificant.
- **The Cyclicality:** Real marginal cost should rise in booms, through overtime and bottlenecks.
- **The Data:** The labour share has “generally spiked upwards in recessions” instead.

> **Rudd and Whelan Prefer Detrending**
> Naive detrending “may have problems”, but it seems to proxy the gap better than the labour share.

The Forward-Looking Curve Forecasts Inflation Badly

If s_t measures real marginal cost, the curve predicts inflation from forecast labour shares:

$$\pi_t = \gamma \sum_{k=0}^{\infty} \beta^k E_t\, s_{t+k} \qquad \text{against} \qquad \pi_t = \rho\, \pi_{t-1} + \gamma \sum_{k=0}^{\infty} \beta^k E_t\, s_{t+k} \tag{23}$$

- **The Test:** Forecast s_{t+k} with a VAR, then fit each equation.
- **The Result:** Fits are “pretty terrible” until lagged inflation, with weight ρ, enters.

The Lags Seem to Provide the Fit
The forward-looking terms are not significant once lagged inflation enters (Rudd & Whelan, 2006).

Whelan Calls the Hybrid Curve's Foundations Weak

Two stories supply the lag, each by assuming a backward-looking rule (Christiano et al., 2005; Galí & Gertler, 1999):

- **Rule-of-Thumb Setters:** Some firms set prices backward-looking; the rest optimise.
- **Indexation:** Non-optimising firms raise prices in line with past inflation.

Whelan: both are "just as open to Lucas critique" as traditional models.

Gordon's History of the Phillips Curve

Gordon titles his history of the Phillips curve "Consensus and Bifurcation" (Gordon, 2011).

> **Read Gordon Before the Exam**
> Gordon is one of five papers listed for section two, part one. Whelan strongly recommends reading it.

Section Two Asks You to Appraise a Paper

The exam asks three things of whichever paper you pick. Prepare all three:

- **The Contribution:** What the paper established that was not established before.
- **What You Learned:** The claim that changed how you read the field.
- **Criticism or Extension:** Where the argument is weakest, or what it leaves undone.

> **Question**
> Take Rudd and Whelan's objection to the labour share. Is it a criticism, an extension, or both?

Take answers from the room.

Which Reading of 2021 Does the Evidence Support?

The New Keynesian curve offers three readings of the 2021 surge.

> **Question**
> Was 2021 a cost-push shock, a positive output gap, or a shift in expectations? Which evidence would separate the three?

Take answers from the room.

Before Lecture 2.3

1. **Play:**
   Plot θ^k in R and find the θ giving a two-quarter price.
2. **Apply:**
   Derive the NKPC from the two log-linear equations, without the handout.
3. **Read:**
   Rudd and Whelan on inflation dynamics, before Lecture 2.3 (Rudd & Whelan, 2007).

Next Lecture

Lecture 2.3 assembles the three-equation New Keynesian model:

1. **The Three Equations.**
   IS, Phillips curve, policy rule.
2. **The Taylor Principle.**
   What makes the equilibrium unique.
3. **Optimal Policy Under Commitment.**
   A promise to pull the price level back.
4. **Discretion and the Model Appraised.**
   Re-optimising every period, and the model's record.

Thank you

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BACKUP

Appendix

Notation, Part I

Symbol	What it is	First met
U_t	unemployment rate	The Expectations-Augmented Phillips Curve
U^*	natural rate of unemployment	The Expectations-Augmented Phillips Curve
γ	slope on the unemployment gap	The Expectations-Augmented Phillips Curve
γ	slope on the labour share	Galí and Gertler: Use the Labour Share Instead
π_t^e	expected inflation	The Expectations-Augmented Phillips Curve
$\Delta\pi_t$	change in inflation	Adaptive Expectations Give the Accelerationist Curve
ω_i	lag weights	Estimating the Natural Rate
Y_t	aggregate output	A Firm Needs a Price of Its Own
P_t	aggregate price level	A Firm Needs a Price of Its Own
$Y_t(i)$	firm i's output	A Firm Needs a Price of Its Own
$P_t(i)$	firm i's price	A Firm Needs a Price of Its Own

Notation, Part II

Symbol	What it is	First met
ε	elasticity of demand	A Firm Needs a Price of Its Own
θ	non-reset probability	Calvo Pricing: A Random Fraction Resets Each Period
p_t	log of P_t	The Price Level Mixes Old Prices and New
x_t	log of X_t	The Price Level Mixes Old Prices and New
X_t	reset price	The Price Level Mixes Old Prices and New
MC_{t+k}	nominal marginal costs	A Markup Over Average Future Marginal Cost
mc_t	log marginal cost	Two Log-Linear Equations Describe the Pricing Model
y_t^n	flexible-price output	Marginal Cost Rises With the Output Gap
η	marginal cost's output elasticity	Marginal Cost Rises With the Output Gap
y_t^*	filtered trend	Marginal Cost Rises With the Output Gap
$\tilde{y}_t$	output gap, $y_t - y_t^n$	Marginal Cost Rises With the Output Gap

Notation, Part III

Symbol	What it is	First met
κ	slope on the gap	The New Keynesian Curve in the Output Gap
ϵ_t^{π}	cost-push shock	The Literature Adds a Cost-Push Shock
s_t	labour share of income	Galí and Gertler: Use the Labour Share Instead
ρ	weight on lagged inflation	The Forward-Looking Curve Forecasts Inflation Badly
π_t	inflation rate	Lecture 1.5
α	intercept	Lecture 1.1
β	discount factor	Lecture 1.5
E_t	time-t expectation	Lecture 1.5
y_t	log real output	Lecture 1.1
γ_f	forward weight	Lecture 1.5
γ_b	backward weight	Lecture 1.5

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