Lecture 1A: Introduction

The course, central banks and the Taylor rule

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International Monetary Relations • AUEB • Winter Semester 2026–27

Outline

The course

What central banks do

The Taylor rule

The Atlanta Fed tool

The questions of the course

The course

Course information

- Instructor: Natassa Zervou-Velez
- Email: *azervouv@aueb.gr*
- Lectures: Monday, 9:00–12:30, Room T101
- Labs: in the computer lab to be announced
- Office hours: Monday/Tuesday, 13:30–14:30, Derigny Building, 4th floor
- Materials: slides, data and starter code on eClass

Objectives

- Understand how modern central banks work, and how monetary policy is designed and transmitted.
- Compare the ECB and the Fed: mandates, institutions, instruments.
- Estimate and interpret reaction functions (Taylor rules) with real data.
- Read central bank communications and research: policy statements, speeches, working papers.

Who is it useful for

Anyone interested in central banks, international organisations, economic policy institutions, or graduate studies.

Course topics

- The analytical toolkit: the New Keynesian model, optimal policy, the Taylor rule
- The open economy: balance of payments, exchange rates, international transmission, the role of the dollar
- Inflation, the labour market, expectations: the Phillips curve, forecasts, communication
- ECB and Fed: credibility, independence, mandates, strategy
- Instruments and transmission: interest rates, quantitative easing (QE), forward guidance
- Monetary union: costs and benefits, optimum currency areas, the euro area crisis
- Empirical applications (Stata): data, inflation measures, estimating Taylor rules for the Fed and the ECB

How we work

- Lectures: two blocks every Tuesday.
- Applied sessions in the lab: data from official sources (FRED, ECB Data Portal, Eurostat, Bank for International Settlements (BIS)) and estimation in Stata. Starter code is provided.
- Real material: ECB and Fed policy statements, press conferences, speeches.
- Papers: few and selected; you will get guidance on what to look for.

What you need

Macroeconomics and basic econometrics (regression, hypothesis testing).

Assessment

- Final written exam: graded out of 10
- Midterm (November): up to $+1.0$
- Project: up to $+1.5$

$$\text{Final} = \text{Exam} + \text{Midterm Bonus} + \text{Project Bonus}$$

Important condition

Bonus points are added only if the final exam score is at least 4.0. Maximum grade: 10.

The project

- An applied empirical exercise: estimating and interpreting monetary policy reaction function(s).
- Builds on the methods of the applied sessions.
- Deliverables: a report in `.pdf`, complete and reproducible code and data.
- Class presentation.
- Late submissions are not accepted.
- AI tools: only in a supporting role (e.g. fixing code or grammar), and explicitly declared in an appendix.

Detailed instructions and the deadline: in class and on eClass.

Course policies

- Attendance.
- Phones on silent and in your bag. Laptops and tablets only for notes and exercises.
- Zero tolerance for cheating and plagiarism.
- Email only from your `@aueb.gr` account, with the course title in the subject line.
- Questions: in class, during office hours, or by appointment.

Central banks

The starting point: what they decided in September 2026

Fed — 16 September 2026

A 25 bp increase in the target range for the federal funds rate: 3.75–4.00%. Unanimous (12–0).

"Inflation remains elevated."

Personal Consumption Expenditures (PCE) inflation, August: 3.4% (core: 3.0%).

ECB — 10 September 2026

A 25 bp increase in all three rates; deposit facility rate (DFR): 2.50%. The second increase of 2026.

Harmonised Index of Consumer Prices (HICP) inflation, August: 3.3%.

- The same move (+25 bp), but the Fed's rate is about 1.25–1.5 percentage points higher than the ECB's.
- Why? Different inflation? A different state of the economy? A different neutral rate? A different mandate?
- By the end of the semester you will be able to examine this with data.

Sources: Federal Reserve, FOMC statement, 16 Sept. 2026; ECB monetary policy decision, 10 Sept. 2026 (in effect 16 Sept.); BBVA Research, ECB Watch, Sept. 2026.

The mandates: two different definitions of the goal

Fed: dual mandate

- Federal Reserve Act: maximum employment and stable prices (and moderate long-term interest rates).
- Target: 2% PCE inflation over the longer run.
- August 2025: end of average inflation targeting.

ECB: primary objective

- Price stability.
- Without prejudice to it, support for the general economic policies of the Union.
- Target: 2% HICP inflation over the medium term, symmetric (2021, reaffirmed 2025).

- A question for the course: does the difference in mandates show up in behaviour?

The instrument: a short-term interest rate

Fed

- Federal funds rate: overnight interbank lending of reserves, unsecured.
- The Federal Open Market Committee (FOMC) sets a target range 25 bp wide: today 3.75–4.00%.
- Market rate: the effective federal funds rate (EFFR), published daily by the New York Fed.
- FOMC: 8 meetings a year, 12 voting members.

ECB

- Three official rates: the deposit facility rate (DFR), the main refinancing operations rate (MRO), the marginal lending facility rate (MLF).
- The DFR (today 2.50%) signals the policy stance.
- Market rate: the euro short-term rate (€STR).
- Governing Council: every 6 weeks; the Executive Board and the governors of the national central banks, with rotating voting rights.

How does the central bank "lock in" the market rate?

The idea: the central bank sets the rates at which it accepts deposits and makes loans. No one lends in the market for less than they would earn at the central bank, and no one borrows for more than they would pay there.

Role	Fed	ECB
Floor	Overnight reverse repo (ON RRP): bottom of the range	Deposit facility rate (DFR): 2.50%
Rate on reserves	Interest on reserve balances (IORB): inside the range	Deposit facility rate (DFR)
Weekly refinancing	—	Main refinancing operations (MRO): 2.65%
Ceiling	Standing Repo Facility (SRF): top of the range	Marginal lending facility (MLF): 2.90%
Market rate	Effective federal funds rate (EFFR): inside the range	Euro short-term rate (€STR): slightly below the DFR

- When policy changes, the central bank moves all these rates together — and the market rate follows.

Why does the market rate stay inside the corridor? (1/2)

Floor: the deposit rate

Banks deposit their surplus liquidity with the safe option, the ECB, overnight and earn 2.50% (deposit facility rate, DFR).

- So no bank will lend to another bank for less than 2.50%: it would take on risk to earn less.
- Arbitrage: if the market rate fell to 2.40%, banks would borrow at 2.40% and deposit at the ECB at 2.50%. The demand would push the rate up.

Ceiling: the lending rate

A bank that needs liquidity can always borrow from the ECB overnight, against collateral, at 2.90% (marginal lending facility, MLF).

- So no bank will borrow from another bank at more than 2.90%: it would go to the ECB.

The interest rate corridor (2/2): a "leaky" floor

The problem: only banks have access to the floor

Non-bank institutions (e.g. money market funds) cannot deposit at the central bank. So they lend to banks slightly more cheaply, and the banks deposit the money at the central bank and earn the difference. The market rate therefore falls slightly below the floor.

ECB

- The market rate, the euro short-term rate (€STR), is slightly below the 2.50% deposit facility rate (DFR).
- There is no broad facility for non-banks, so the leak remains.

Fed: a second floor

- The same leak: the effective federal funds rate (EFFR) is slightly below interest on reserve balances (IORB).
- The Fed added a second, lower floor for non-banks: the overnight reverse repo (ON RRP), at the bottom of the target range.
- Ceiling: the Standing Repo Facility (SRF), at the top. So the EFFR stays inside the range.

Why this way? From quantity to price

Before 2008: scarce reserves

- Reserves were scarce and paid no interest.
- The Fed hit its target by changing the quantity of reserves: buying and selling government bonds every day (open market operations).
- Small changes in quantity moved the rate.

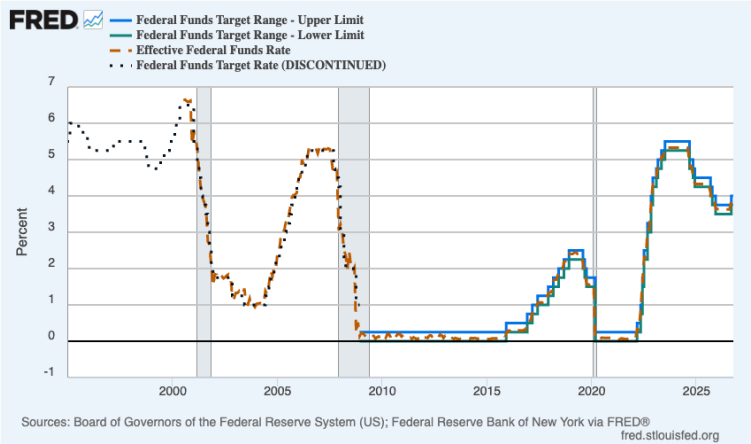
Today: ample reserves

- Quantitative easing (QE) created very large reserves.
- With so many reserves, changing the quantity no longer moves the rate.
- The central bank sets the price directly: the rates it pays (IORB, ON RRP, DFR).

In one sentence

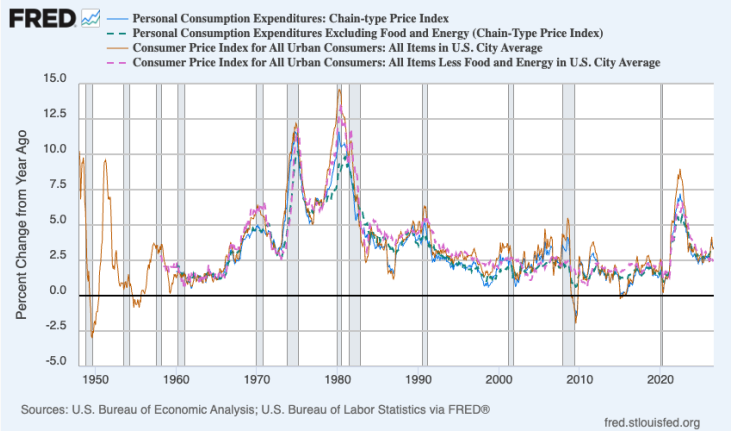
In the past the central bank changed the quantity of money to hit the interest rate; today it sets the rate directly, through the interest it pays.

The Fed's policy rate, 1995–today



Until 2008: a single target (DFEDTAR). From December 2008: a target range, with an upper (DFEDTARU) and a lower (DFEDTARL) limit. Market rate: effective federal funds rate (EFFR). Source: FRED, Federal Reserve Bank of St. Louis.

US inflation: PCE and CPI, headline and core



Year-on-year change (%). Personal consumption expenditures price index (PCE): the Fed's 2% target. Consumer price index (CPI). Core: excluding food and energy. Source: FRED (PCEPI, PCEPILFE, CPIAUCSL, CPILFESL).

Taylor rule

How do we describe a central bank's decisions?

- Central banks do not mechanically follow a formula.
- But their behaviour can be described reasonably well by a simple relationship: the interest rate responds to inflation and to economic activity.
- Taylor (1993): a simple rule describes the Fed's policy over 1987–1992 well.

Two uses of the rule

- Descriptive: what did the central bank do? (estimated from the data)
- Normative: what should it do? (comparison with the rule's prescription)

The Taylor rule (1993)

$$i_t = r^* + \pi_t + 0.5(\pi_t - \pi^*) + 0.5\, y_t$$

- i_t: nominal policy rate
- r^*: neutral real interest rate (Taylor: 2%)
- π_t: inflation (over the last 4 quarters)
- π^*: inflation target (2%)
- y_t: output gap, % deviation of GDP from potential

Interpretation

When inflation is at target and the economy is at potential output, the interest rate equals the "neutral" rate: $r^* + \pi^* = 4\%$.

Taylor, J. B. (1993). "Discretion versus policy rules in practice." Carnegie-Rochester Conference Series on Public Policy, 39, 195–214.

The Taylor principle

Rewriting the rule:

$$i_t = \underbrace{r^* - 0.5\,\pi^*}_{\text{constant}} + 1.5\,\pi_t + 0.5\,y_t$$

- When inflation rises by 1 percentage point, the nominal rate rises by 1.5 percentage points.
- So the real rate $i_t - \pi_t$ rises — policy becomes genuinely tighter.
- If the coefficient were < 1, the real rate would fall when inflation rises.

The Taylor principle

A coefficient on inflation > 1. In the New Keynesian model (next week) it is the condition for a unique, stable equilibrium.

A numerical example

With $r^* = 2\%$ and $\pi^* = 2\%$:

	Inflation π_t	Output gap y_t	Prescription i_t
Overheating	3%	+1%	$2 + 3 + 0.5 + 0.5 = 6.0\%$
On target	2%	0%	$2 + 2 + 0 + 0 = 4.0\%$
Recession	1%	−2%	$2 + 1 - 0.5 - 1 = 1.5\%$
Deep recession	0%	−6%	$2 + 0 - 1 - 3 = -2.0\%$

- The last row: the rule calls for a negative rate. What happens at the zero lower bound (ZLB)?

Exercise: where "should" the ECB's rate be?

September 2026 data: HICP 3.3% (August), core $\approx 2.5\%$ (ECB projection for 2026). DFR = 2.50%. Assume an output gap ≈ 0.

Choice	π_t	r^*	Prescription i_t
Taylor (1993) as is	3.3	2.0	$2 + 3.3 + 0.65 = 5.95\%$
Lower r^*	3.3	0.5	4.45%
Core, lower r^*	2.5	0.5	$0.5 + 2.5 + 0.25 = 3.25\%$

- The prescription moves by almost 3 percentage points depending on our choices.
- Which inflation measure? Which r^*? Which gap? These choices are at the heart of the course.

Illustrative calculations; the output gap and r^* are assumptions, not estimates. Data source: BBVA Research, ECB Watch, Sept. 2026.

What can change in the rule

- Inflation measure: CPI, PCE, core, HICP, forecasts
- Neutral rate r^*: fixed at 2% or estimated (Laubach–Williams, Holston–Laubach–Williams)
- Activity measure: GDP gap or unemployment gap
- Weight on the gap: 0.5 or 1.0

Interest rate smoothing

Central banks change rates gradually:

$$i_t = \rho\, i_{t-1} + (1-\rho)\, i_t^{\text{Taylor}}$$

Typically $\rho \approx 0.85$.

Atlanta Fed

The Taylor Rule Utility of the Federal Reserve Bank of Atlanta

- An interactive tool: computes the prescription for the federal funds rate since 1985 and compares it with the actual rate.
- You choose:
  - the inflation measure (core or headline PCE, SPF expectations)
  - the inflation target
  - r* (fixed 2%, Laubach–Williams, HLW, FOMC projections)
  - the gap measure (GDP, unemployment, U-6)
  - the weight on the gap and the smoothing
- Up to three rules at once, plus heatmaps.

Link

https://www.atlantafed.org/research-and-data/data/taylor-rule

Data are updated monthly.

Live demo: what we look at

1. The 1993 rule (core PCE, $r^* = 2\%$, GDP gap, weight 0.5): how close is it to the actual rate?
2. 2003–2005: the rate below the rule — Taylor's critique of the pre-crisis period.
3. 2009–2015: the rule calls for negative rates; the Fed at zero.
4. 2021–2022: the rule rises well before the rate — "behind the curve"?
5. Today: where is the rule relative to 3.75–4.00%?
6. Change r^* and the smoothing: how much does the prescription move?

Homework exercise (10 minutes)

Build "your own" rule

1. Choose an inflation measure, r*, a gap measure, a weight and the smoothing.
2. Compare it with the 1993 rule and with the actual rate.
3. In one paragraph: which choices make the biggest difference, and in which periods?

- We will discuss it at the start of the next class.
- There is no equivalent tool for the ECB — we will build the rule ourselves in the lab.

Questions

Four questions we will address

1. Mandate: does the Fed respond more to the output gap than the ECB, as the dual mandate suggests?
2. Exchange rate: does it enter the rule, even though neither mandate mentions it?
3. Symmetry: do central banks respond equally when inflation is above and below target? Did anything change after 2021 (ECB) and 2025 (Fed)?
4. Data or forecasts: do they respond to current inflation or to their own forecasts (Greenbook, ECB projections)?

And the monetary union

One interest rate for twenty-plus economies: who is the ECB's rate "right" for?

Next steps

- Today, part B: Global imbalances — the balance of payments, the current account, the net international investment position (NIIP).
- Next week: the New Keynesian model and why the Taylor rule emerges as (an approximation to) optimal policy; the open economy.