



Ciências
ULisboa

Faculdade
de Ciências
da Universidade
de Lisboa

Principles of Economics and Management I

Session 10 · Money, Banking and Inflation

Introduction



Where We Came From

In the previous session we measured inflation. What is missing is explaining **where it comes from**.

The answer forces us to understand what **money** is and, above all, who creates it. 

And it ends where the next session begins: with the **Eurosystem**.





Today's Map

1.  The functions of money and the monetary aggregates
2.  How banks create money
3.  The quantity theory and inflation
4.  Nominal rates, real rates and bonds
5.  The Eurosystem

Part 1 · Money and Banks

A World Without Money

Imagine trading directly: you give bread to whoever cuts your hair.

You need to find someone who wants bread **and** cuts hair. This is the “double coincidence of wants”. Hard. 

Money solves this. That is why it appeared in almost every civilization.

The Functions of Money

Why does money exist? It solves the problems of direct barter.

 **Medium of exchange:** accepted in all transactions, it avoids direct barter.

 **Unit of account:** we measure prices in the same unit.

 **Store of value:** it carries purchasing power into the future.

 Source: OpenStax *Macro 3e*, [§14.1](#) “Defining Money by Its Functions”, “Barter and the Double Coincidence of Wants”, “Functions for Money” and “Commodity versus Fiat Money”.



Monetary Aggregates

Not all “money” is the same. We measure it in decreasing order of liquidity.

M1: the most liquid. Notes, coins and overnight deposits.

M2: M1 plus time and savings deposits. Less liquid, but near money.

In the euro area, it is the **Eurosystem** that defines and monitors these aggregates. 

 Source: OpenStax *Macro* 3e, [§14.2](#) “Measuring Money: Currency, M1, and M2”. The definitions there are the US ones; the euro area draws the lines slightly differently, but the ordering by liquidity is the same.

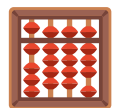


Banks Create Money

Banks **create** money when they lend.

You deposit €1000. The bank keeps a **reserve** and lends out the rest.

Whoever receives the loan deposits it at another bank, which keeps a reserve and lends again. And so on. 



The Money Multiplier

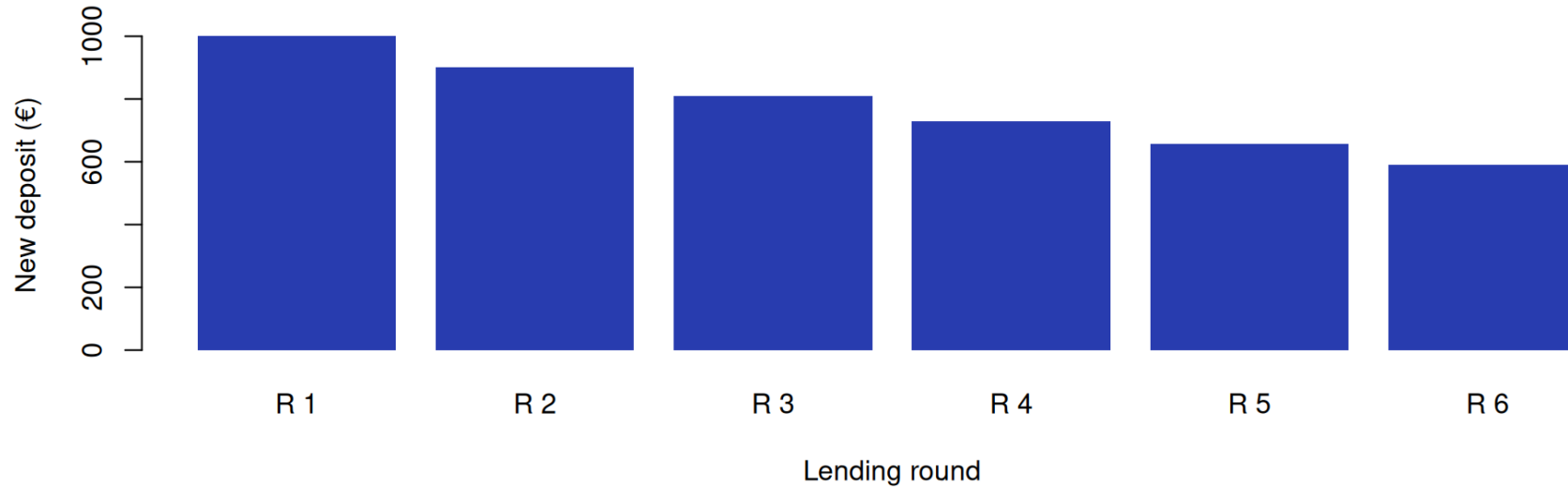
With a reserve ratio rr , an initial deposit D generates total deposits of:

$$D \times \frac{1}{rr}.$$

Money multiplier: $1/rr$. With 10% reserves, each euro of base money can become **10 euros** of deposits.



The Money Multiplier



Each round generates a smaller deposit (here, with 10% reserves). The sum converges to €10,000.

Source: OpenStax *Macro 3e*, §14.4 “How Banks Create Money”, which walks the cascade through the balance sheets of First National and Second National bank by bank.



What the Multiplier Really Is

Treat $1/rr$ as an **upper bound** on money creation.

The story above has causality running from reserves to loans. In practice a bank makes the loan first, creating the deposit as it does so, and finds the reserves afterward.

What actually binds is **capital requirements**, the bank's own risk appetite, and above all the **demand for credit**.

Since 2008 euro area banks have held reserves far above any requirement, and the multiplier has been nowhere near its bound. Money did not multiply, because nobody wanted to borrow.



Keep the arithmetic, drop the mechanism. It is a ceiling on money creation.

 The book makes the same warning: OpenStax *Macro* 3e, [§14.4](#), "Cautions about the Money Multiplier".



A System Built on Trust

Banks do not keep all the money: they lend most of it out.

This works as long as depositors **trust** the system and do not withdraw everything at once.

When trust breaks down, there is a **bank run**. This is where the central bank comes in. 

 Source: OpenStax *Macro* 3e, [§14.3](#) “The Role of Banks”, “A Bank’s Balance Sheet” and “How Banks Go Bankrupt”, where the asset-liability time mismatch is spelled out.

? Multiple Choice 1

Which function of money allows purchasing power to be carried into the future?

A. Medium of exchange.

B. Unit of account.

C. Store of value.

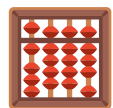
D. Multiplier.

☒ **C.** Money as a store of value preserves purchasing power over time.

? Multiple Choice 2

A central bank injects reserves into the banking system. Deposits barely move. The best explanation is:

- A. The reserve ratio must have risen to exactly offset it.
 - B. Banknotes were printed instead of deposits being created.
 - C. The quantity theory has been refuted.
 - D. The multiplier is a ceiling, and the binding constraint was demand for credit, not reserves.
- ✓ **D.** Reserves permit lending; they do not cause it. If firms and households do not want to borrow, or banks lack capital to lend, extra reserves simply sit on the balance sheet. This is the euro area after 2008.



Numerical Question

The reserve ratio is 20 percent and the monetary base is 500 euros.

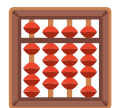
- a) Compute the multiplier and the maximum total deposits.
- b) Banks voluntarily hold an extra 5 percent in excess reserves. Recompute.
- c) Which of the two is closer to the euro area since 2008?
- d) What does the central bank control directly, and what does it not?



Solution

- a) Multiplier = $1/0.20 = 5$, so deposits reach at most $500 \times 5 = 2,500$ euros.
- b) The effective ratio is 0.25, so the multiplier falls to 4 and deposits to 2,000 euros. Voluntary reserves cut money creation just as required ones do.
- c) (b), and by a wide margin. Excess reserves have dwarfed required ones for over a decade.
- d) It controls the **monetary base** and the rate paid on reserves. It does **not** control how much banks choose to lend, nor how much anyone wants to borrow. 

Part 2 · Money and Inflation



The Quantity Theory of Money

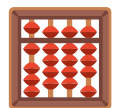
An identity linking money and prices:

$$M \cdot V = P \cdot Y.$$

M money, V velocity, P the price level, Y real output.

As written this is an **identity**: V is *defined* as PY/M , so it cannot be false. It becomes a **theory** only once you assume V is stable and Y is set by real factors. ⚠️

Over decades, and at high inflation, it holds well. Over a few quarters V moves a lot, which is why no central bank now targets money growth. 📈



The Quantity Theory of Money

If V and Y are stable, in percentage changes:

$$\frac{\Delta M}{M} \approx \frac{\Delta P}{P} = \pi.$$

Too much money chasing the same goods generates **inflation**. “Inflation is always and everywhere a monetary phenomenon” (Friedman). 

 Source: OpenStax *Macro* 3e, §15.5, “Unpredictable Movements of Velocity”, which plots how unstable velocity actually is.

The 2% Target

This is why the ECB's job is to keep inflation **low and stable**. Since V moves too much to target money directly, its instrument is the interest rate (session 11).

The target is **2%** over the medium term. Neither high inflation (which erodes savings) nor deflation (which paralyzes the economy).

A clear, public target helps keep **expectations** stable. 



Nominal vs Real Interest

For finance, what matters is the **real** return. The Fisher equation links the two:

$$i \approx r + \pi.$$

The **nominal** rate i is the real rate r plus expected inflation π . If inflation rises, nominal rates tend to rise. 

Exactly, it is $(1 + i) = (1 + r)(1 + \pi)$, so $i = r + \pi + r\pi$. The cross term is negligible at 2 percent and very much not at 20. 

And mind which π : **ex ante** the relevant one is *expected* inflation, which is what you contract on. **Ex post** it is realized inflation, which is what you actually earned. The gap between them is session 9's redistribution. 

 Source: OpenStax *Macro* 3e, [§9.4](#), which works the same arithmetic through a saver earning 5% nominal at 0%, 5% and 10% inflation, and then through a borrower.



Inflation and Bond Prices

A bond pays fixed **nominal** flows. If inflation erodes their real value, its price **falls**.

A rise in expected inflation, a rise in nominal rates, a **fall** in bond prices. This is interest rate risk. 

? Multiple Choice 3

M grows sharply and inflation does not follow. This shows that:

A. V fell, which the identity $MV = PY$ permits but the quantity **theory** assumes away.

B. The identity $MV = PY$ is false.

C. Real output must have fallen.

D. The money supply was mismeasured.

✓ **A.** $MV = PY$ cannot fail, because V is defined as PY/M .
What can fail is the extra assumption that V is stable.

? Multiple Choice 4

A bank offers 5 percent nominal for one year, and you expect 3 percent inflation. If inflation turns out to be 6 percent, your **ex post** real return is roughly:

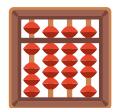
A. Plus 2 percent, as you expected.

B. Minus 1 percent.

C. Plus 5 percent, since the rate was fixed.

D. Minus 6 percent.

✓ **B.** $r \approx i - \pi = 5 - 6 = -1$ percent. Ex ante you contracted for plus 2; ex post you got minus 1. The 3 point surprise moved value from you to the bank's borrowers.



Numerical Question

Money grows 7 percent a year, real output grows 2 percent, and velocity is stable.

- a) Find approximate inflation.
- b) With a real rate of 1 percent, what nominal rate does Fisher imply?
- c) Compute the exact Fisher nominal rate and compare.
- d) Velocity in fact falls 3 percent. Redo (a).



Solution

a) From $\Delta M/M + \Delta V/V = \pi + \Delta Y/Y$: $\pi \approx 7 - 2 = 5$ percent.

b) $i \approx r + \pi = 1 + 5 = 6$ percent.

c) $(1.01)(1.05) = 1.0605$, so $i = 6.05$ percent. The cross term is worth 5 basis points here, and would be worth 200 at 20 percent inflation.

d) $\pi \approx 7 + (-3) - 2 = 2$ percent. Money grew just as fast and inflation is far lower, which is question 3 in numbers. 

Part 3 · The Eurosystem



What a Central Bank Does

The central bank is the “bank of banks”. Its main functions:



Issues currency and manages the monetary base.

Conducts monetary policy to maintain price stability.



Supervises banks and acts as **lender of last resort** in crises.

 Source: OpenStax *Macro* 3e, [§15.1](#) “The Federal Reserve Banking System and Central Banks”, “What Does a Central Bank Do?”; supervision, deposit insurance and the lender of last resort are [§15.2](#) “Bank Regulation”.



Lender of Last Resort

In a bank run, a solvent bank can run out of liquidity.

The central bank lends to it at that moment, stopping the **panic** before it spreads.

This happened repeatedly in the 2008 crisis and in the euro debt crisis. 🔥



Lender of Last Resort

The classic rule (Bagehot): lend **freely**, against **good collateral**, at a **penalty rate**.

Every clause is doing work. Freely, to stop the panic. Against collateral and at a penalty, so that only banks genuinely short of liquidity come forward.

Because if the central bank rescues **insolvent** banks too, it has just written free insurance against bad lending. Which is session 6's **moral hazard**, at the scale of a banking system. 🤔

And in a panic the distinction is close to impossible to make in real time. That is the hard part of the job. 🕒

The Eurosystem

In the euro area, monetary policy is **single** across 20 countries.

Eurosystem: the European Central Bank (ECB) plus the national central banks (such as the **Banco de Portugal**).

Decisions are taken in Frankfurt, at the ECB, and carried out by each national central bank. 



Independence and Mandate

The ECB is **independent** of political power.

The reason: to avoid the temptation of printing money to finance governments, which would generate inflation.

Its primary mandate is clear: maintain **price stability** (inflation close to 2%).

 OpenStax *Macro* 3e, [§15.5](#) puts both sides of this argument: “The Case for Greater Democratic Control of Monetary Policy” against “The Case for an Independent Central Bank”. Worth reading before you decide you agree with the slide.

? Multiple Choice 5

Bagehot's rule says to lend at a **penalty** rate. The reason is:

- A. To make a profit for the central bank during a crisis.
 - B. To punish the bank's management for poor decisions.
 - C. So that only banks genuinely short of liquidity come forward, limiting moral hazard.
 - D. To keep inflation on target while lending.
-  **C.** A cheap standing rescue is free insurance against bad lending, and banks would price it in. The penalty makes the facility unattractive to anyone who does not truly need it: exactly the deductible logic from session 6.

? Multiple Choice 6

The Eurosystem is made up of:

A. The ECB and the national central banks of the euro area countries.

B. The ECB alone.

C. All commercial banks operating in the euro area.

D. The ECB together with the International Monetary Fund.

☒ **A.** Decisions are taken in Frankfurt and executed by each national central bank, such as the Banco de Portugal. Note it is not the same as the European System of Central Banks, which also includes non euro EU members.

Discussion Question

A bank faces heavy withdrawals and runs out of liquidity overnight.

- a)** What can the central bank do, and under what conditions?
- b)** Why does the answer depend on whether the bank is solvent?
- c)** Why is that distinction so hard to make during a panic?
- d)** What does the ECB's independence have to do with any of this?



Solution

- a) Lend as **lender of last resort**: freely, against good collateral, at a penalty rate.
- b) Lending to a solvent bank stops a panic and gets repaid. Lending to an insolvent one converts a private loss into a public one, and teaches every other bank that risk is subsidized.

- c) Solvency depends on asset values, and in a panic those are exactly the prices collapsing. That makes the test hard to apply in real time. 
- d) An independent central bank can refuse. One that answers to a government facing bank failures in an election year cannot credibly say no. 

Wrap-Up

What to Take From This Session

 Money is a **medium of exchange**, a unit of account and a store of value; it is measured by aggregates (M1, M2).

 Banks **create money** when they extend credit: the multiplier is $1/rr$ with a reserve ratio rr .

 By the quantity theory ($MV = PY$), sustained inflation is a **monetary phenomenon**.

 Distinguish **nominal** from **real** interest: that difference determines the return on a bond.



To Review

OpenStax *Macro* 3e, the sections this session used:

- **Ch. 9, Inflation:** [§9.4](#)
- **Ch. 14, Money and Banking:** [§14.1](#) · [§14.2](#) · [§14.3](#) · [§14.4](#)
- **Ch. 15, Monetary Policy and Bank Regulation:** [§15.1](#) · [§15.2](#) · [§15.5](#)

For the formal treatment: Blanchard, Amighini and Giavazzi, chapters 4, 14 and 17.

Then problem set 10.

Next Session

Monetary Policy.

We know what the ECB is. Now we see what it **does**, and how that reaches the economy and portfolios.

See you next week. 