

II. Finance I: domestic money

1. Basic forms of money and the Central Bank

What is money?

A trademark of economics is that its most important concepts are never precisely or rigorously defined: market, wealth, capitalism, good, development, capital, ... and money. A childish definition is that money is anything generally considered money. Another approach is to define money through examples (the so-called monetary aggregates: M0, M1, M2, M3, ...). The mainstream textbook approach is to characterize money in terms of its basic functions: since money has been associated with three functions, anything capable of fulfilling three functions can be taken to be money.

Classical functions attributed to what money does

- Being a means of payment and instrument for canceling debts. This function emphasizes the interest of the user of money, who wants to use it to purchase goods, services or financial assets, or settle monetary debts.
- Being a store of value (or wealth). This function emphasizes the interest of the saver of money, who wants to use it in the future and wishes to preserve the ability of money to be a means of payment at least as good in the future as in the present (the value of money).
- Being a unit of account. This function emphasizes the interest of the creator of money, who wants money to be recognized as an instrument of measurement and comparison of the value of everything that is potentially exchangeable for money (to be bought or sold) or redeemable in money (debts, obligations or damages). Money as a unit of account becomes a kind of common economic language that is understood, shared and used.

Basic forms of money

Modern money has three basic forms: cash, reserves and deposits (designated E, R and D, respectively). Cash is physical, tangible money; reserves and deposits are electronic money (numbers in computers). Deposits are created by banks. Deposits are 'bank money' and constitute 'private money'.

The term 'deposits' is misleading since a bank deposit does not need for something to be deposited in a bank. Cash money lives in our pockets; bank money (deposits) lives in bank accounts.

The monetary aggregate M1 (called money stock, monetary mass, quantity of money) is the sum of cash and deposits: $M1 = E + D$. The ECB defines M1 as 'the most liquid measure of money'. The proportion of deposits in M1 is, for most advanced economies, above 95% (at least if M1 is redefined for deposits to include not just sight deposits, but also savings deposits and term deposits).

Central bank

The central bank (CB) of an economy is the monetary authority of the economy and the supervisor of the financial sector.

- The CB creates money; in particular, it has a monopoly on the issuance of certain forms of money: cash and reserves. The term 'reserves' is short for 'central bank reserves'. The term is misleading

because reserves are not reserves of anything. The central bank's money (or 'public money' or monetary base or monetary aggregate M0) is cash plus reserves: $M0 = E + R$.

- The CB is responsible for making and implementing monetary policy decisions. The most important monetary policy measure is setting the value of certain interest rates (loosely speaking, an interest rate is the price to be paid for getting a money loan). Once set by the CB, these rates influence other interest rates in the economy.
- As the supervisor of the financial sector, the CB regulates the activities of banks and ensures the smooth functioning of the economy's payment system. The CB oversees the stability of the entire financial sector.
- The CB acts as a lender of last resort (the CB acts as a bank for banks) in situations of crisis or financial instability. The CB has no financial limit to what it may lend. Specifically, CB reserves are created 'out of thin air', hitting keyboard keys.

Central bank goals

A CB has two main objectives. One objective, in the short to medium term, is 'inflation control': that the real sector maintains price stability. The European Central Bank (ECB) defines price stability as achieving an annual inflation rate of around 2%.

The second objective, in the medium to long term, is to guarantee the financial stability of the financial sector: to ensure the solvency of the main private financial institutions and to prevent the private sector from accumulating an 'excessive' volume of debt.

Central bank → banks → real sector → inflation

Despite having an objective on the functioning of the real sector ('moderate' inflation), the CB does not have instruments to directly influence the real sector. Banks are the intermediaries between the CB and the real sector. The decisions of the CB influence the banks' decisions (mainly, the volume of credit they grant), which influence the decisions of families and companies in the real sector, whose decisions determine the results of the real sector (GDP growth, employment growth, dynamics of the inflation rate...).

The CB faces an asymmetry. The conventional strategy of a CB when the inflation rate of the economy is systematically above the target rate is to force banks to make credit more expensive (by raising the interest rates set by the CB). The increase in credit tends to reduce private sector borrowing and this tends to contract the level of economic activity (and contributes to increasing unemployment and the destruction of businesses). Therefore, reducing the inflation rate by causing economic contraction is relatively easy.

On the contrary, when the inflation rate is persistently lower than the target rate, increasing it is comparatively more difficult: the CB can set the conditions to stimulate economic activity (lower its interest rates) and for this stimulus to contribute to reflation, but the intermediary (the banks) does not always collaborate with this objective by increasing the volume of credit supplied to the real sector.

In short, contracting economic activity (in order to reduce the inflation rate) is easier to achieve than expanding it (to increase the rate). And this is the asymmetry: raising interest rates eventually becomes a sufficient condition to dampen unwanted inflationary processes, but lowering them is not enough (for almost a decade, the ECB has reduced the interest rate to zero and inflation rates have not recovered and, on occasion, were negative).

Fig. 1 shows the mechanism of transmission of effects that is conventionally attributed to the monetary policy implemented by a CB.

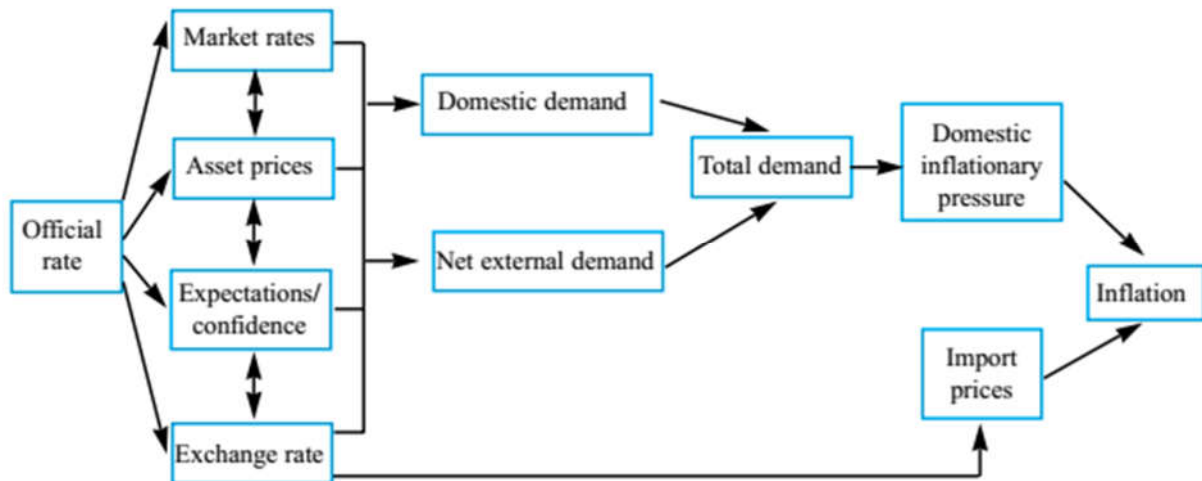


Fig. 1. The monetary policy transmission mechanism according to the Bank of England

<https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/1999/the-transmission-mechanism-of-monetary-policy>

Central bank money: cash

Cash is the set of coins (metallic money) and banknotes (paper money). Coins and banknotes are physical money but fiat money: they have no intrinsic value (their usefulness lies in acting as money).

The ECB is responsible for minting coins and printing banknotes, as well as designing them (for example, the ECB has already created two series of euro banknotes). The ECB is also responsible for putting them into circulation, recycling them and, if necessary, destroying them.

In August 2025, <https://data.ecb.europa.eu/publications/ecbeurosystem-policy-and-exchange-rates/3030618> reports that there were 217.69 million €500 notes in circulation and 15,064 million €50 notes; in value, the €500 notes amounted to €108.85 EUR billions and the €50 notes to 753.20 EUR billions (the ECB uses the short-scale for billions, which is the current international standard: 1 billion = 1,000,000,000).

On coins, for instance, in August 2025, there were 8,638.39 millions 1€ coins and 40,448.76 1 cts coins in circulation; their value, 8,638.39 EUR millions and 404.49 EUR millions, respectively.

Central bank money: reserves

Reserves are electronic money (or computer money) created on the CB's computer. The users of reserves are banks, the government, foreign central banks, some foreign banks and some foreign governments. Using reserves means having an account at the CB (just as using a deposit requires having an account at a bank).

Reserves are not transferable to families or companies: the non-bank private sector cannot receive or use reserves.

Banks make interbank payments with reserves, so reserves are the main form of money that banks use in their mutual transactions. Fig. 3 shows. Banks also use reserves in transactions with the CB.

The primary market for reserves is where they are created. The CB necessarily intervenes in this market: reserves are created when the CB purchases financial assets or makes loans.

The secondary reserve market is where already created reserves are exchanged. The secondary reserve market is, in essence, an interbank market (where banks buy and sell reserves among themselves). Although banks exchange reserves, they do not leave the balance sheet of the CB: reserves are a liability of the CB that circulates as an asset between banks and other institutions with accounts in the CB.

The interest rate on the interbank market in the eurozone is called Euribor (European Interbank Offer Rate). There is a one-day, one-week, one-month, three-month, one-year Euribor ...

When the CB makes decisions on interest rates that the CB itself controls, its most immediate objective is to influence interest rates on the interbank market (changes in these rates will then influence the rest of the interest rates in the economy). In particular, it is about altering the shortest-term interest rate: the overnight interest rate.

Until October 2019, the name of this interbank rate in the eurozone was EONIA; since then it has been known as €STR, or ESTER, an acronym for Euro Short-Term Rate; see Fig. 2. The €STR is a rate calculated by the ECB that estimates the cost of obtaining reserves from the ECB for one day.

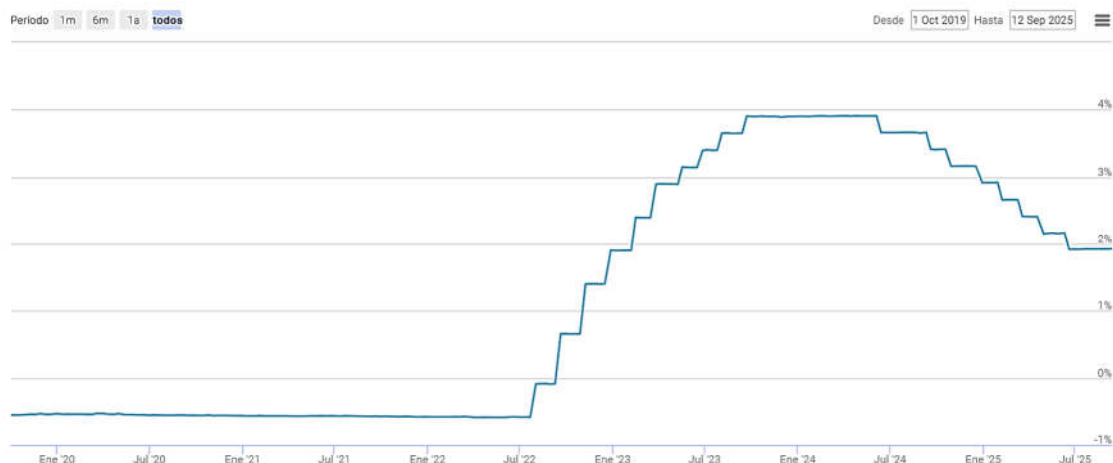


Fig. 2. Evolution of the €STR, the interest rate that the ECB aims to control

<https://www.global-rates.com/es/tipos-de-interes/ester/>

**Bank money:
deposits**

Banks have the legal privilege of creating (and destroying) the form of electronic money called a deposit. Like reserves, deposits are accounting records in computers (or, more picturesquely, numbers on a computer screen). The term 'deposit' is misleading, as it suggests that the depositor has deposited something (cash) with the bank. In reality, a deposit is an accounting record of a debt owed by the bank to the depositor.

This privilege means that for all purposes bank money is equivalent (in value and functions) to the money created by the CB. Fig. 3 shows that, in the eurozone, the part of M1 created by banks (deposits) dwarfs the part of M1 created by the CB (cash): the E/M1 ratio is 14.48% and the E/D ratio is 16.93%.

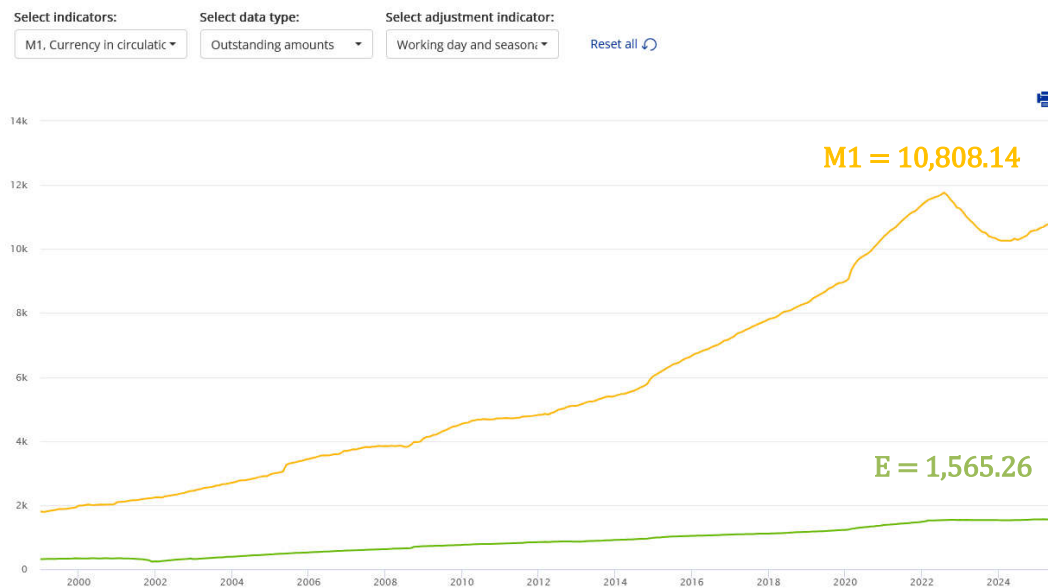


Fig. 3. M1 and currency in circulation, eurozone, July 2025, EUR billions
<https://data.ecb.europa.eu/publications/money-credit-and-banking/3031796>

Banks are the only agents (other than the central bank) with the privilege of creating ‘legal tender’. There is parity in the value of the different forms of money, since

- one unit of cash is worth one unit of reserves;
- one unit of cash is worth one unit of deposits;
- one unit of deposits from one bank is worth one unit of deposits from any other bank.

Deposit creation

Mainstream textbooks overlook the reality of deposit (and loan) creation. Those textbooks presume that, in order to lend money, a bank has to collect money previously. In reality, banks create loans and deposits from nothing (‘out of thin air’). When a bank makes a loan (or extends credit) to an individual or a business, it is not lending money from some previous customer or money sitting in safes waiting to be used. The bank ‘lends’ money that it itself creates (in the form of a deposit).

For example, when a bank grants a loan of 1000 EUR to a student, the bank modifies its balance sheet as follows (for simplicity, the interest rate on the loan is zero):

BANK	ASSETS	Loans +1000
	LIABILITIES	Deposits +1000

The bank records the loan as a new asset: the bank has the right to receive a payment of 1000 from the student in the future. At the same time, the bank creates and records a liability: a deposit. If the

student did not have an account with the bank, the bank creates one and records a balance of 1000; if the student already had one, then the bank increases the account balance by 1000. It all comes down to hitting keys on a computer keyboard and modifying the bank's database.

For the student, the accounting reality is the opposite: he has the right to use a deposit of 1000 to make payments and assumes the obligation to return the amount received from the bank.

STUDENT	ASSETS	Deposits +1000
	LIABILITIES	Loans +1000

The above implies that a bank creates bank money (deposits) at will and, therefore, could create any volume of bank money. Theoretically this is so, if the consequences of granting loans and creating deposits are not taken into account.

Fig. 4 summarizes the process using T-accounts (rights and assets are represented on the left-hand side of the account; duties and liabilities, on the right-hand side). Suppose a student asks a bank for a loan of €1000 to pay for tuition (for simplicity, the interest payment of the loan is zero). Then the bank simultaneously creates two financial assets. On the one hand, the bank creates the loan, which is an asset for the bank and a liability for the student. On the other, the bank creates a deposit, which is an asset for the student (and represents the loan from the student's perspective: the money borrowed from the bank) and a liability for the bank.

The accounting perspective aside, the creation of the two financial assets can be viewed as involving an economic transaction in which the bank transfers a financial asset (a deposit) to the student and the student transfers another asset (a loan) to the bank.



Fig. 4. Loans and deposits can be simultaneously created by banks

What determines how much bank money is created?

Granting a loan is not a final transaction, as would be the purchase of a good that is paid for immediately. A loan is granted with the expectation that it will be repaid. For this reason, there are at least two factors that condition and set limits to the creation of bank money.

- A microeconomic factor: the confidence that the borrower will repay the loan. No matter how high or low the interest rate, it does not seem justified to grant a loan if there is no confidence that the borrower will repay it¹.

¹ As for what limits bank money creation, the orthodox (conventional) answer would be the interest rate. The interpretation is that, as is understood to happen with commodities, the quantity supplied of loans depends positively on their price (the interest rate can be interpreted as the price of a loan): a higher interest rate encourages banks to offer more loans and a lower rate encourages them to offer fewer.

- A macroeconomic factor: the financial health (liquidity and solvency) of the banking system. The fact that other banks may have liquidity or solvency problems would justify the decision to be more cautious and conservative in granting loans. The fact that other banks increase the granting of loans motivates and encourages granting more. In general, the state of the economy is a signal about whether it is appropriate to lend more or less.

In addition, by creating a deposit (or increasing the value of an existing deposit), the bank provides purchasing power to the depositor. The creation of the deposit creates purchasing power virtually: the depositor has the right to pay with the deposit. But once the depositor instructs the bank to make a payment against a deposit, how does the bank effectively transfer purchasing power to a third party? The answer lies in reserves and how banks make payments to each other and have access to reserves.

Myths and ignorance about the activity of banks

Mainstream textbooks present banks as intermediaries between savers (lenders) and investors/consumers (borrowers). In this presentation a bank can only lend cash that has previously been deposited with the bank. Therefore, the money a borrower receives is someone else's money. The bank is an agent that merely transfers money from one person to another and has a neutral role as a facilitator of a transaction between lender and borrower.

An implication of this representation of the banking system is that there is no (productive) investment without prior savings. In parallel, it is considered that investment can only increase if savings previously increase; and, symmetrically, that a reduction in savings causes a reduction in investment.

According to the 2009 survey in the UK 'Public attitudes to banking' by *The Cobden Centre*:

- 74% of respondents consider that they are the legal owners of the cash deposited in a bank, which would act as a 'deposit box' (when in reality the cash belongs to the bank and the depositor only has an enforceable right to the bank);
- 66% do not know what the bank uses the money in the checking account for;
- 33% do not support deposit guarantee funds or the CB as a lender of last resort;
- 61% believe banks take money from savers and transfer it to borrowers;
- 33% are against the bank lending money in their current accounts because they have not given the bank permission to lend it.

https://www.cobdencentre.org/wp-content/uploads/2019/09/aje_2010_PublicAttitudes.pdf

Properties of the basic forms of money

Following Bjerg², the three forms of money can be characterized on the basis of three properties. Each of the three basic forms of money (cash, reserves and deposits) satisfies two of the following three properties.

²Bjerg, Ole (2017): "Designing New Money: The Policy Trilemma of Central Bank Digital Currency", Copenhagen Business School, CBS. MPP Working Paper.

- (a) Created by the central bank
- (b) Being electronic (digital)
- (c) Be universal (accessible to everyone)

Each property is associated with a question about the forms of money.

- Who supplies the form of money? (Who is its creator?)
- What is the nature of the money form? (What kind of 'thing' is it?)
- Who is authorized to use it? (Who are its recipients?)

Cash is a form of money that satisfies properties (a) and (c), but not (b): cash is created by the CB to be universally accessible, at the expense of being physical money (cash consists of coins and banknotes). The CB supplies cash when owners of bank deposits want to transform them into physical money.

Reserves are a form of money that satisfies properties (a) and (b), but not (c): the CB creates reserves as digital money (reserves are electronic records) and can only be used by those who have an account with the CB. Banks, the government (its Treasury) and foreign central banks are the entities that typically have an account with the CB.

Deposits are a form of money that satisfies properties (b) and (c), but not (a): banks create deposits as digital money (bank deposits are also electronic records) for any economic agent.

Money destruction

Textbooks rarely point out that money extinguishes (cancels out, is uncreated). Specifically, the three forms of money have in common that they are destroyed when returned to their creators (deposits are created by banks; cash and reserves are created by the CB).

- The cash that returns to the CB disappears from the CB's balance sheet and ceases to exist as a form of money.
- The reserves paid to the CB also disappear from its balance sheet (an obligation that becomes a right is cancelled).
- Any payment made to a bank with its own deposits also cancels the deposit (it is a situation analogous to someone who writes on a piece of paper 'I will pay the bearer 1000 EUR' and the document is returned to the person who wrote it: the debt recognized in the document disappears).

The basic forms of money as debts between sectors

Cash can be understood as a promise of payment from the public sector to the non-banking private sector (households and businesses). Reserves, as promises from the public sector to the banking private sector (banks). And bank money, as promises from the banking private sector to the non-banking private sector. Fig. 5 shows the forms of money as rights that one sector creates in favor of another.

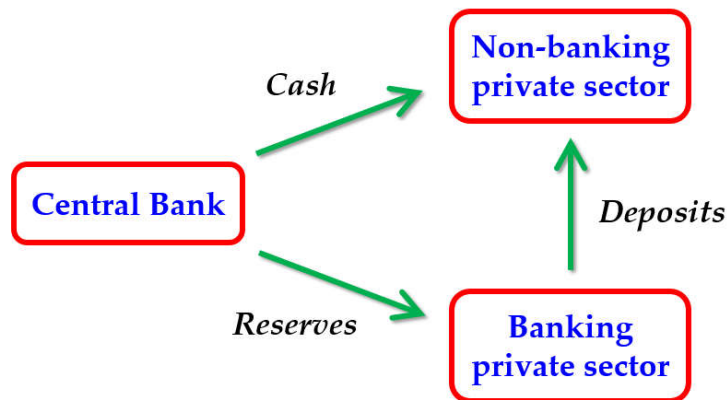


Fig. 5. The basic forms of money as promises of payment between sectors

The basic forms of money as accounting records

The fact that basic forms of money express rights and obligations between sectors means that they can be interpreted from an accounting point of view: the creator of a form of money imposes an obligation on himself (creates a liability) and the user of a form of money exercises a right (has an asset). Fig. 6 illustrates the meaning of forms of money from an accounting point of view: as assets or liabilities in sectoral balance sheets.

Central bank		Banking sector		Non-banking sector	
Assets	Cash	Reserves	Deposits	Deposits	Debts
	Reserves	Other assets	Debts	Cash	
				Other assets	

Fig. 6. The basic forms of money in sectoral balance sheets

Reserves as an interbank clearing tool

The reserve system created and maintained by a central bank makes it possible to clear payments between banks. Banks must hold sufficient reserves each day to facilitate interbank clearing. The diagram in Fig. 7 (taken from Sergio Rossi, 2007, *Money and payments in theory and practice*, Routledge) shows how payments in an economy cause banks to exchange reserves with the central bank and highlights the relationship between a bank's deposits and the reserves it must hold.

Initially, there is a purchase and sale involving agents A (the buyer of a good) and B (the seller). Agent A has a current account (a deposit) in bank X. Agent B has a current account (a deposit) in bank Y. The price of the good is m monetary units. The buyer does not pay for the good using cash but makes a deposit transfer to the seller (this is what would imply making the payment with a credit or debit card, or with a mobile application).

The transfer involves changes in the accounting balance sheets of bank X, bank Y and the central bank. It can be interpreted that the payment from A to B takes place on the balance sheet of the central bank. On the one hand, the payment that A makes to B implies a reduction of m units in its deposits in bank X and an increase of m units in B's deposits in bank Y. Consequently, bank X

reduces its liabilities and bank Y increases them. In each bank, a compensating item for these changes is required: the movement of reserves that each bank has at the central bank: the payment between buyer and seller (with deposits, which are created by banks) implies a payment between their banks with money created by the central bank (reserves).

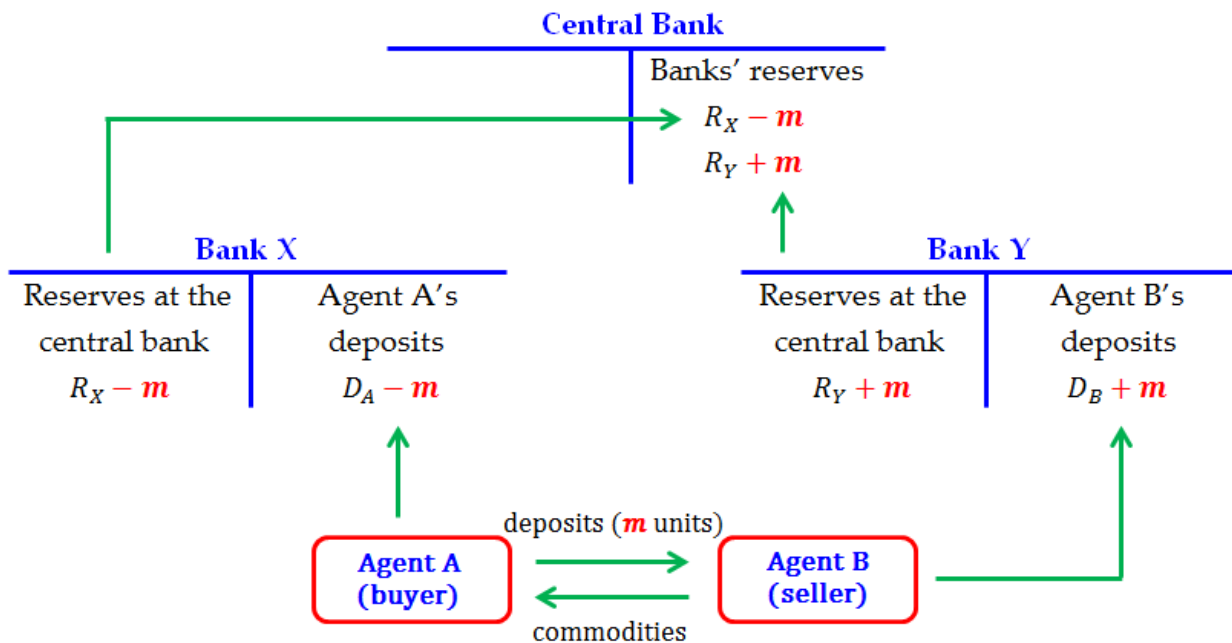


Fig. 7. The clearing of payments through central bank reserves

Bank X compensates for the reduction in its liabilities (decrease in agent A's deposits D_A by m units) with a reduction in its assets (decrease in its reserves R_X also by m units). In parallel, bank Y compensates for the increase in its liabilities (increase in agent B's deposits D_B by m units) with an increase in its assets (reserves R_Y expand by m units).

Since reserves involve the central bank (reserves are 'central bank money' and are recorded as a liability of the central bank), the movements of reserves between banks X and Y are also reflected in the balance sheet of the central bank. Specifically, the liability item of the central bank that records the reserves of bank X is reduced by m units and, simultaneously, the reserves of bank Y are increased by m units.

The central bank's liabilities remain unchanged because the total value of the reserves is not altered: reserves have merely changed hands, m units of reserves from bank X are transferred to bank Y.

All of the above accounting records assume that the price of the initial purchase, the deposits, and the reserves are all measured in the same monetary units. That is, the m units that measure the value of the good, the m units in which the deposits at the two banks change, and the m units in which the banks' reserves at the central bank change are all the same units. This means that there is parity of value between the different forms of money. Specifically, one unit of bank deposits (one unit of bank money) is equal to one unit of reserves (one unit of central bank money). A similar interbank payment system operates when international payments are made and two currencies are involved.

Fig. 7 suggests that bank X will only need to mobilize reserves if the transfer of deposits is to be made to another bank. If agents A and B (buyer and seller) had deposits in the same bank, there would be no need to transfer reserves: in this case, bank X would simply move deposit balances on its own balance sheet (decreasing A's balance and increasing B's).

Therefore, if A and B share a bank, there is no third level in the payment: the central bank does not participate because there is no flow of reserves. Similarly, if A were to pay B in cash, there would be no second or third levels: the cash payment involves no banks, no deposits, no reserves, and no central bank.

It follows from the above that the larger a bank, the more likely it is that a payment with bank money from a bank client will be to another client of the same bank and, consequently, the bank will have more incentive to create deposits because fewer reserves will be needed.

Conversely, a small bank (in terms of customer market share) will be more likely to need to make a reserve payment when its customers make payments against deposits. The greater need to hold or obtain reserves will tend to dampen the bank's drive to create deposits.

**Payment systems
and amount of
money**

The payment system of an economy determines the minimum amount of money needed to make payments. This is relevant for banks, since (as Fig. 7 makes evident) banks will be interested in having to mobilize the smallest volume of reserves to make interbank payments.

Example. Three agents (A, B and C) must make some payments. The agents could be banks and the payments, reserves. A must pay 9 monetary units to B; B must pay 7 to C; and C must pay 4 to A.

- Payment system 1: payments are made simultaneously. In this case, $9 + 7 + 4 = 20$ monetary units are needed to make the payments effective.
- Payment system 2: payments are made sequentially starting with A. A's payment requires 9 units; these units are sufficient for B to pay 7 to C; and the 7 units are sufficient for C to pay A. Therefore, 9 is sufficient.
- Payment system 3: payments are made sequentially starting with B. B's payment requires 7 units; these units are enough for C to pay 4 to A; and now A only needs 5 more units to pay B. In total, $7 + 5 = 12$ units are needed.
- Payment system 4: payments are made sequentially starting with C. C's payment requires 4 units; for A to pay 9 to B, 5 more must be added; and for B to pay 7, the 9 units received from A are sufficient. The total number of units is $4 + 5 = 9$.
- Payment system 5: payment clearing. In a clearing system each agent pays the difference between the payments to be made and the payments to be received. Thus, A must pay $9 - 4 = 5$; B must pay $7 - 9 = -2$; and C must pay $4 - 7 = -3$. The clearing makes the payment (or income, if the payment is negative) impersonal: A does not have to pay 5 to anyone specific. It can be interpreted that a fourth agent (a clearing agent, which could simply be a computer program) receives and makes the payments. Since the clearing agent pays the same as it receives, the sum

of the net payments of the three agents is zero: the 5 units that A must pay coincide with the 2 + 3 units that B and C must receive.

Once the net payment of each agent has been determined, a sequential implementation of the net payments could be added (as in systems 2, 3 and 4), but it is more consistent with the logic of compensation that the payments are made simultaneously. In short, since only A has to make payments, only 5 monetary units are needed.

The analysis of the example suggests that, of the five payment systems considered, the clearing system is materially more useful, since it requires the least amount of money to be mobilized. Electronic money payment systems, at a national or international level, employ payment clearing.

One might think that the use of a payment clearing system would minimize the creation of bank money; in fact, it actually encourages its creation (since the compensation of bank money debts is not done with bank money, but with central bank reserves).

In the United Kingdom, on average, before the global financial crisis of 2008, banks had 1.25 pounds in reserves per 100 pounds of deposits. Even in the period immediately after the crisis, banks had an average of 7.14 per 100 of deposits³. In short, in the worst case scenario, banks could create bank money at their discretion and only worry about getting 7% of the value created in the form of reserves (for the purposes of making the interbank payments that the creation of deposits brings). Should it then come as a surprise that Spanish banks have achieved record profits in 2024?⁴

**Banks and asymmetry
between real and
financial sectors**

A feature of modern economies is that the financial sector is much larger than the real sector: the value of all financial assets can be tens to hundreds of times higher than GDP.

The process of bank money creation tends to widen the size gap between the financial and real sectors. One reason is that a borrower who can guarantee or back a loan with other assets (typically, financial assets) gives a bank more confidence in the repayment of the loan than a borrower who backs the loan with the result of a productive activity. Accordingly, a bank has more incentives to finance financial speculation (and, by extension, speculation in real estate, raw materials, agricultural production, oil...) than it does to self-employed entrepreneurs, small businesses, industry, or start-ups.

³ Ryan-Collins, John; Tony Greenham; Richard Werner; Andrew Jackson (2012): "Where does money come from? A guide to the UK monetary and banking system", NEF, section 4.5.

⁴ Despite the decline in interest rates, in 2024, the profits of the three largest Spanish banks were: BBVA, record profit of 10,054 MEUR (33% more than the previous year; MEUR = million euros); Santander, record profit of 12,574 MEUR (13% more); CaixaBank, record profit of 5,787 MEUR (20% more).

<https://www.abc.es/economia/bbva-bate-record-beneficios-2024-10054-millones-20250130075853-nt.html>

<https://www.swissinfo.ch/spa/banco-santander-anuncia-un-beneficio-r%C3%A9cord-de-12.574-millones-de-euros-en-2024/88828093>

<https://efe.com/economia/2025-01-30/beneficio-record-caixabank-2024/>

Central bank digital money

The acronym CBDC (central bank digital currency) designates a form of money that satisfies the three money properties (a), (b) and (c).

The CBDC that the ECB is considering to create is the 'digital euro' (https://www.ecb.europa.eu/paym/digital_euro/html/index.es.html). The state of development of CB digital currencies can be followed at <https://cbdctracker.org/>. In October 2020, the Bahamas launched the first CBDC, the sand dollar. The second, eNaira, was created in Nigeria in October 2021; it does not appear to have been a success (the associated website of the Central Bank of Nigeria, <https://www.cbn.gov.ng/currency/enaira.asp>, has no content).

A CBDC is a deposit recorded electronically on the balance sheet of the CB: numbers on the central bank's computers. Unlike reserves, anyone could hold the deposits. A potential drawback of a CBDC is that, as a form of money, it would compete with the other three.

- A CBDC would be like cash with the advantage of being spared all the inconveniences, restrictions, limitations and costs of using, maintaining and managing cash. It would be easier, more convenient, safer and faster to pay with a CBDC and would not be exposed to loss or theft. A CBDC could be defined as electronic cash.
- A CBDC would be like reserves with the advantage of being accessible to more economic agents and therefore there would be fewer restrictions on use: CBDC could be obtained from everyone and CBDC could be transferred to everyone. A CBDC could be defined as universal reserves.
- A CBDC would be like deposits with the advantage that there is no risk of losing them, since a central bank (unlike a bank) never goes bankrupt. A CBDC could be defined as central bank deposits.

There is some opposition to the introduction of a CBDC, because a CBDC does not preserve for everyone all the advantages that other forms of money have.

- Cash thieves and, in general, anyone who carries out illegal activities would not be able to continue their activities if cash were replaced by a CBDC: the anonymity and privacy that cash makes possible disappears with a CBDC (since every movement of the CBDC would be recorded in the central bank's computers).
- Banking secrecy would disappear with the disappearance of reserves, to the extent that all transactions between banks would be reflected in the central bank's balance sheet.
- If a CBDC displaces deposits, banks lose the privilege of creating money and, in practice, lose their *raison d'être*. In fact, banks would become what the orthodox view presents them to be: mere intermediaries between lenders (savers of the CBDC) and borrowers (investors of the CBDC). The banking sector would have an incentive to prevent the adoption of a CBDC.

An example of the 'monetary circuit'

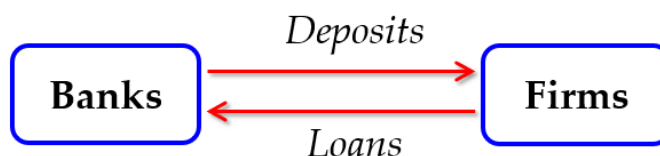
The following example, very stylized, illustrates the fact that bank money is created and also destroyed. The process of creation and destruction defines a kind of 'monetary circuit' where the creators of money (banks) put it into circulation, the money circulates among its users (individuals and non-bank private sector firms)

and finally returns to its creators. The circuit consists of four stages and involves three agents: banks, firms and worker-consumers.

- **Stage 1.** Initially, banks create credit in favor of firms for a value of 10 (to make the example simple, without paying interest). Banks deliver deposits (bank money) to firms in exchange for the latter delivering to the banks the financial asset 'loan' (through which they undertake to return in the future the bank money they have received). Accounting-wise, the transaction would be recorded as an equivalent increase in assets and liabilities of banks and firms.

Banks		Firms	
Loans +10	Deposits +10	Deposits +10	Loans +10

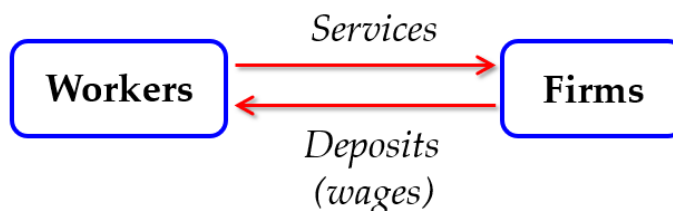
Economically, the operation takes the form of the following transaction (granting of credit):



- **Stage 2.** The firms use the deposits to pay the workers' wages, worth 10. The value of the production done by the workers is 20.

Workers		Firms	
Deposits +10		Deposits -10	Net worth +10
Services -10		Goods +20	

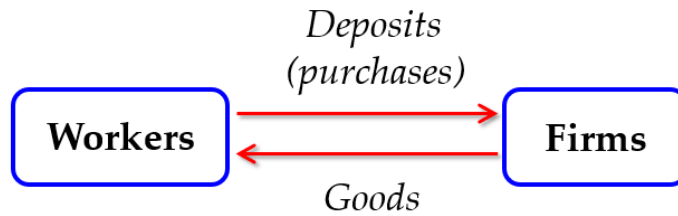
Economically, the operation takes the form of the following transaction (payment of wages):



- **Stage 3.** Workers use the deposits to pay for the purchase of firm goods.

Workers		Firms	
Deposits -10		Deposits +10	
Goods +10		Goods -10	

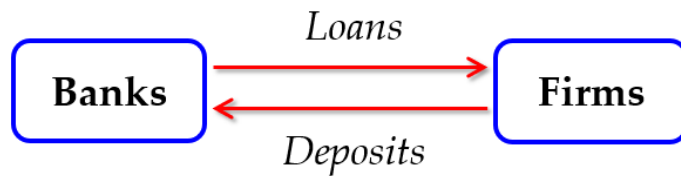
Economically, the operation takes the form of the following transaction (purchase and sale of goods: workers acquire the goods that firms sell):



• **Stage 4.** Finally, firms cancel their debt to banks. The end result is that the initial increase of 10 in bank deposits is offset by the reduction of 10 in deposits when firms use them to repay bank loans. The entry of deposits into banks as counterpart to the repayment of loans leads to the elimination of deposits.

Banks		Firms	
Loans -10	Deposits -10	Deposits -10	Loans -10

Economically, the operation takes the form of the following transaction (return of loans):



2. Financial assets and interest rates

Properties of financial assets

The holder of a financial asset has the right over another to demand payment of an amount of money. There are four basic properties related to this right.

- Maturity. Date on which payment can be demanded (when the right can be exercised).
- Default risk. The probability that the right will not be respected when the asset matures.
- Liquidity. Ease and speed with which the asset can be converted into cash (can be sold) before maturity (ease and speed with which the right can be exercised earlier but partially).
- Rate of return. Quotient between the benefit provided by the asset and the cost of obtaining the benefit (value of the right in relation to the cost of being the beneficiary of the right).

Financial assets are, in a sense, imitators of money. But since they generally cannot have maximum liquidity, they must offer something attractive as a compensation.

- Liquidity versus profitability. If two assets differ only in liquidity and profitability, the more liquid one will have less profitability and vice versa (cash and T-bills).
- Risk versus return. If two assets differ only in risk and return, the one with the highest risk will have the highest return and vice versa (shares and deposits).
- More profitability (being a positive trait) will be accompanied by less attractive features: more risk and/or less liquidity.
- More liquidity (being a positive trait) will be accompanied by less attractive features: more risk and/or less profitability.
- More risk (being a negative trait) will be accompanied by more attractive features: more profitability and/or more liquidity.

Why a financial asset cannot be expected to enjoy maximum liquidity, minimum risk and high profitability? After all, being all three pleasant properties, it will attract plenty of demand. But, as with almost everything in an economy, there are two sides: in trading, whatever is favourable for the purchaser, is at the same time unfavourable for the seller. Accordingly, no one will be interested in issuing financial assets with maximum liquidity, minimum risk and high profitability: it will too costly for the issuer. Each benefit enjoyed by the buyer of a financial asset is simultaneously a cost that the seller has to bear.

Negotiable and non-negotiable financial assets

Financial assets are instruments for transferring money (to make and receive a loan of money) from those who want to lend to those who want to borrow.

Financial assets can be classified in two categories: marketable assets (that can be bought and sold) and non-marketable assets. A tradable financial asset is also called a security. Types of securities: property (stocks), debt/credit financial instruments (T-bills, corporate promissory notes) and rights (options). Securities are initially sold (by the issuer) in a primary market. Subsequent sales are made

in a secondary market. A financial asset is non-marketable if it does not have a secondary market and is therefore an illiquid asset (example: deposits or mortgage loans).

[Remark. Shares issued by a company (or equity) are, strictly speaking, not financial assets, because they represent real, not financial, wealth. Shares are a fraction of the property of a firm: they are real not financial variables. Though shares give the owners the right to collect dividends, firms are not obliged to distribute them. Nonetheless, in practice, shares are not bought to accumulate properties or get dividends, but to sell them subsequently at a higher price, like most financial assets. In practice, shares behave like financial assets and therefore are treated as such. Something similar occurs with some commodities, which are bought and sold to profit from price oscillations, not to consume them or use them in production activities. Examples include agricultural products (coffee, corn, cotton, sugar, wheat), energy products (raw materials such as crude oil and natural gas) and metals (copper, gold, silver). What makes commodities amenable to a financial asset market treatment is that (being basic goods, raw materials or primary products) they can be traded in large quantities and enjoy a relative uniform quality.]

Securitization is a process for selling non-marketable financial assets: illiquid or poorly liquid assets that generate a stream of income (for example, mortgage loans, consumer loans and car loans) are pooled and shares in the pool income are sold. This ‘financial alchemy technique’ is considered one of the close causes of the 2008 global financial crisis.

**Rates of return
and interest rates**

The interest rate associated with a financial asset is the rate of return (or profit) on the asset (which is not easy to establish for complex financial assets). As already told in 1.3, for a T-bill (probably the simplest financial asset) that promises to pay the face value V and is purchased at price P , the interest rate (as a fraction of one) is

$$i_{T\text{-bill}} = \frac{\text{profit}}{\text{cost}} = \frac{V - P}{P}.$$

There are almost as many interest rates in an economy as there are financial assets. All of them, as a rule, tend to move in unison: if some financial asset (discounted the effects of other characteristics) offers a profitability higher than the average, the demand for this asset will expand, its price will increase and (as a preview of a result presented later) its profitability will decline, getting again in line with the average profitability.

Consequently, it seems reasonable to adopt the fiction that there is only one interest rate i in the economy, interpretable as the average interest rate on a typical cash loan.

Important remark: the representative interest rate (and any other interest rate) is defined for time interval, that corresponds to the period between the issuance of the associated financial asset and its maturity. Data on interest rate, if nothing else is explicitly stated, should be interpreted as annualized rates: lending one monetary unit with interest rate i implies, one year later, obtaining a payment of $1 + i$ monetary units.

The discount factor

The discount factor between time t and time $t + 1$ expresses the value in time t of one monetary unit of time $t + 1$. Given the fiction that there is a representative interest rate i between times t and $t + 1$, the interest rate transforms today's money into tomorrow's money (1 today is worth $1 + i$ tomorrow). The discount factor δ does the opposite by transforming tomorrow's money into today's money (1 tomorrow is worth δ today).

The interest rate i generates future values out of present values: it is forward-looking. The discount factor δ determines present values out of future values: it is backward-looking. The next sketch

	time t		time $t + 1$
interest rate	1	\rightarrow	$1 + i$
discount factor	δ	\leftarrow	1

helps to justify the equation that relates interest rate and discount factor (both between t and $t + 1$):

$$\delta = \frac{1}{1 + i}.$$

This formula answers the question with which the discount factor is associated: what value in t becomes value 1 in $t + 1$ under interest rate i ? The answer is $\frac{1}{1+i}$: by lending $\frac{1}{1+i}$ at interest i , the future value is $\frac{1}{1+i}(1 + i) = 1$.

Arbitrage and speculation

Arbitrage consists of

- buying or selling goods (or assets),
- when the prices of the goods (or assets) differ,
- with the aim of obtaining a profit.

Arbitrage is a strategy to make a sure profit by taking advantage of price differences. Speculation is defined in the same way. The difference is that in arbitrage the result of the purchases and sales is known from the outset (the profit is certain), while in speculation the result is uncertain (the intended profit may ultimately result in a loss).

Whereas a speculator is taking a risk, an arbitrageur obtains a risk-free profit. Almost nothing lies outside the scope of arbitration and speculation: commodities, bonds, currencies, shares, options, real estate, derivatives, futures contracts...

Arbitrage is a conceptually interesting mechanism because, as will be shown in topic 3, it contributes to integrate markets: arbitrage operates as a force of market integration. On the other hand, it will be argued that speculation is more likely to be a market destabilizing force.

Interest rate and asset prices

A fundamental macroeconomic financial informal result asserts the price of financial assets and the interest rate move in opposite directions (leaving aside 'disturbing events'). Equating interest rate with 'the price of money' (cost of a loan), the result says that the price of financial assets and the price of money move in the reverse.

Example: T-bills. The above informal claim can be justified for specific financial assets. Let the financial asset be the T-bill. The T-bill is issued in t and matures in $t + 1$. The price of the T-bill in t , when issued, is P . The face value of the T-bill is V , which means that, in $t + 1$, the T-bill pays V to the owner of the T-bill. Let i be the interest rate between t and $t + 1$, so i represents the profit of making a loan with the same maturity as the T-bill. An investor having P monetary units may consider two options.

- Option 1: lend P . When the loan matures, in $t + 1$, the investor gets $(1 + i)P$.
- Option 2: buy the T-bill. When the T-bill matures, in $t + 1$, the investor gets V .

For both options to be equally attractive, the outcomes must coincide $(1 + i)P = V$. That is,

$$P = \frac{V}{1 + i}. \quad (1)$$

Since V is a fixed given value, (1) means that the larger i , the smaller P .

The presumption that $(1 + i)P = V$ is equivalent to the presumption that both the loan and the T-bill have the same rate of return (the same associated interest rate). In fact,

$$\begin{aligned} (1 + i)P &= V \\ P + iP &= V \\ iP &= V - P \\ i &= \frac{V - P}{P} = i_{T\text{-bill}} \end{aligned}$$

and, therefore, the rate of return i of the loan equals the rate of return $i_{T\text{-bill}}$ of the T-bill. Why this equality? Abstracting from the rest of properties of the loan and the T-bill, if the rates are different, the financial asset with a smaller rate would have no demand and, consequently, the asset would not exist (as no one is buying it). Given that both financial asset are supposed to exist, there must be demand for both and, hence, their rates of return should be the same (if other properties, like risk or liquidity, are a bit different between the assets, then the conclusion would be that the rates of return are sufficiently similar).

Financial arbitrage

Under financial arbitrage, an arbitrageur buys and sells financial assets to obtain a sure profit. It will be next argued that financial arbitrage justifies the inverse relationship between the price of a T-bill and the interest rate established by (1).

To this end, suppose (1) is false; that is, $V > (1 + i)P$ or $V < (1 + i)P$. Only the former inequality is analysed, the latter being left as an exercise. The economic logic of the proof relies on the idea that arbitrage opportunities (the possibility of making sure profits) cannot last. Thus, outcomes that create arbitrage opportunities cannot be stable nor be taken as good economic predictions. Specifically, the proof will show that:

- (i) $V > (1 + i)P$ creates arbitrage opportunities; and that
- (ii) the act of profiting from arbitrage opportunities make such opportunities disappear.

So let $V > (1 + i)P$. An arbitrageur can obtain sure profits as follows, even having no money.

- Step 1: the arbitrageur borrows P monetary units in t and thus has to repay $(1 + i)P$ monetary units in $t + 1$.
- Step 2: the arbitrageur purchases in t a T-bill with the P monetary units.
- Step 3: reached $t + 1$, the T-bill pays V monetary units and, owing to $V > (1 + i)P$, the arbitrageur repays the loan and pockets a profit of $V - (1 + i)P > 0$ monetary units.

Many arbitrageurs will be attracted by the prospect of sure benefits. Hence, significant amounts of money will be borrowed in step 1. In this case, mainstream analysis predicts a rise in the interest rate of a loan: an expanding demand for something (goods, services, assets, raw materials...) causes an increase the price of that something. As a consequence, the term $(1 + i)P$ on the right-hand side of the inequality $V > (1 + i)P$ goes up. Because of this, the profit $V - (1 + i)P$ would diminish.

On the other hand, the purchases of T-bills executed in step 2 represents an increase in the demand for T-bills. By the same argument as before, the price of T-bills is pushed upwards, the term $(1 + i)P$ in $V > (1 + i)P$ increases and the profit $V - (1 + i)P$ falls.

In sum, as long as $V - (1 + i)P > 0$, demand for money loans and for T-bills both go up, as well as the respective prices i and P , so $V - (1 + i)P$ will tend to zero. Once $V - (1 + i)P = 0$ arbitrage opportunities disappear and neither i nor P are under downward pressure.

Given that arbitrageurs will borrow money and buy T-bills until the gap between V and $(1 + i)P$ disappears, $V > (1 + i)P$ is inconsistent with financial arbitrage and thus unstable.

**Asset prices
as present
values**

The concept of present value (associated with that of discount factor) also justifies (1). In fact, the value in $t + 1$ (the future value) of a T-bill is V . With interest rate i between t and $t + 1$, the value P of V in t (its present discounted value) is

$$V \cdot \frac{1}{1 + i}$$

where $\frac{1}{1 + i}$ is the discount factor between t and $t + 1$. In view of this, equation (1) states that the price of a T-bill coincides with the present discounted value of its face (future) value.

Orthodox financial economics has developed theories on how to price extremely complex financial assets using this premise: the price today of any financial asset can be defined as the present appropriately discounted value of all the payments the asset generates up to its maturity (the T-bill is simple in that it generates a single payment at maturity; most assets, like bonds, generate a stream of payments).

3. Monetary policy

Monetary policy instruments

A CB has several monetary policy instruments (or tools) at its disposal. There are mainly three.

- A quantitative tool: changes in the supply of reserves for the banking system through open market operations or direct lending through standing facilities.
- A price tool: changes in the interest rates at which the CB lends.
- A formal regulatory tool: changes in mandatory reserves (also called 'minimum' or 'required' reserves). This tool is more of a historical relic: currently, CBs of some advanced economies do not seek to regulate reserves. The CBs of the US (since 2020), Australia, New Zealand, Sweden and Hong Kong do not require minimum reserves.

A CB has other tools that are not explicitly regulated or assigned.

- The control of the volume of bank credit is an informal, unofficial and extralegal regulatory tool: the CB informs banks of the permitted increase in loans and penalizes non-compliance.
- Forward guidance is a communication tool through which the CB (in press conferences, press releases, conferences, speeches...) makes public its intentions in relation to upcoming monetary policy decisions (typically, the CB's interest rates) and based on the CB's outlook for the evolution of the inflation rate (or of the financial sector or of the economy in general).

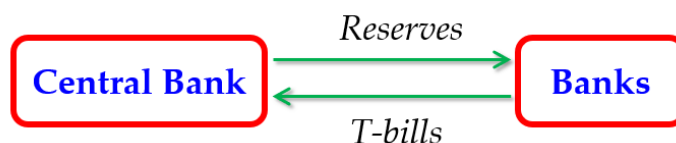
https://www.ecb.europa.eu/ecb-and-you/explainers/tell-me/html/what-is-forward_guidance.es.html

Remind that all those tools serve two basic goals: the short to medium term objective of maintaining price stability in the real economy, by keeping some inflation rate (defined from some consumer price index) around some targeted value; and the medium to long term goal of ensuring financial stability.

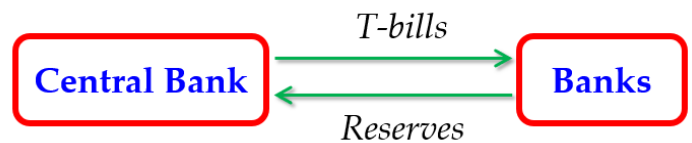
Monetary tools I: open market operations

The open market operations (OMOs) of a CB are purchases or sales of financial assets (usually public debt securities, such as T-bills, and CB certificates) with specific counterparties (generally, the main banks in the economy). Mainstream textbooks tell that the immediate objective of OMOs is the control of the money stock. Actually, CBs do not (and cannot) control the amount of money in the economy. There is plenty of evidence supporting the heterodox view that money is endogenous: it is not controlled by the CB, but generated by the banks' lending.

An expansionary OMO increases reserves by purchasing financial assets: the CB obtains financial assets and pays for them with reserves. The sketch on the right outlines an expansionary OMO.



A contractionary OMO (as sketched on the right) reduces reserves by selling financial assets: the CB 'injects' financial assets in the economy and drains reserves from the banking system.

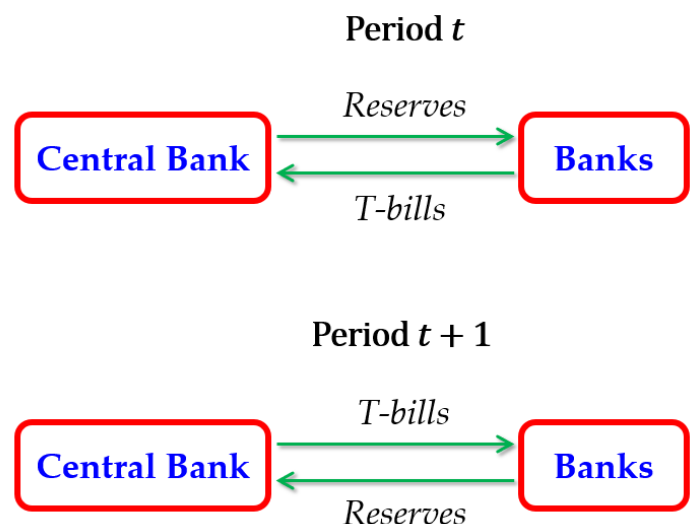


- **Outright transactions.** An outright transaction is an OMO in which the rights represented by the financial asset purchased or sold are permanently transferred to the buyer. The asset is said to be bought or sold outright.

- **Repo transactions.** A reverse transaction (or repurchase agreement) is an OMO in which the rights represented by the financial asset purchased or sold are temporarily transferred to the buyer.

In a reverse transaction that takes the form of a repurchase agreement (repo), the seller of a financial asset agrees to repurchase it at a future date at a predetermined price. In a repurchase agreement transaction, the CB temporarily withdraws (absorbs) reserves: the CB sells financial assets with the commitment to repurchase them in the future.

- **Reverse repo transactions.** A reverse repurchase agreement (or reverse repo, for short) is an OMO in which the buyer of the financial asset must sell it back in a future date and at a preestablished price. By means of a reverse-repo transaction reserves are supplied by the CB temporarily: the CB purchases financial assets with the obligation to sell them in the future. The sketch on the right displays the structure of a resale agreement (or reverse repo) where the CB temporarily provides reserves.



Monetary tools
II: standing facilities

A standing facility is a procedure through which banks, on their own initiative, can borrow reserves directly from the CB or lend reserves directly to the CB.

Under OMOs, the CB takes the initiative and intervenes directly in financial markets. Under the facilities, the CB deals directly with certain entities (the main banks) and then lets the markets determine how reserves are distributed among participants. Facilities are passive tools to neutralize excessive volatility in reserves markets and to ensure that market rates are in line with (not too far from) the CB's target interest rate, as signalled by the CB's interest rate policy (the €STR for the European Central Bank, ECB).

- **Deposit facilities.** A deposit facility is a standing facility that grants certain banks that have excess reserves that have no outlet in the interbank market the possibility of depositing the excess in the CB in exchange for a remuneration that is normally lower than the market rate.

- **Credit facilities.** A credit facility is a permanent facility that grants certain banks that cannot obtain short-term (overnight) reserves in the interbank market the possibility of borrowing them directly from the CB, usually at an interest rate higher than the market rate.

**Monetary tools
III: central bank
interest rates**

Each quantitative tool has an associated interest rate, determined by the CB. The main interest rate set by the CB is the OMO rate. The ECB announces the interest rate for the most prominent OMO: the main refinancing operations (MRO), which are expansionary OMOs implemented by auction. When the media mention ‘the official money price’ or ‘the interest rate that the ECB has changed’, they refer to the MRO rate.

The ECB chooses one of two options. One, to pick a fixed interest rate for the MROs. This is the current option and the one chosen in the initial stage of the ECB. In the interim period, the second option was chosen: to announce a minimum interest rate for the MROs. The MRO execution procedure (an auction) determines the specific interest rate for the MRO.

The other interest rates chosen by the CB correspond to the standing facilities. There is a deposit facility interest rate (the rate a bank earns when it accumulates reserves at the CB) and there is a credit facility interest rate (the rate a bank must pay the CB for lending reserves). Fig. 8 shows the three main rates set by the ECB. The OMO rate is between the facility rates, and the credit facility rate is obviously higher than the deposit facility rate. Currently, the OMO rate is 2.15%, the credit rate is 2.40% and the deposit rate is 2.00%.

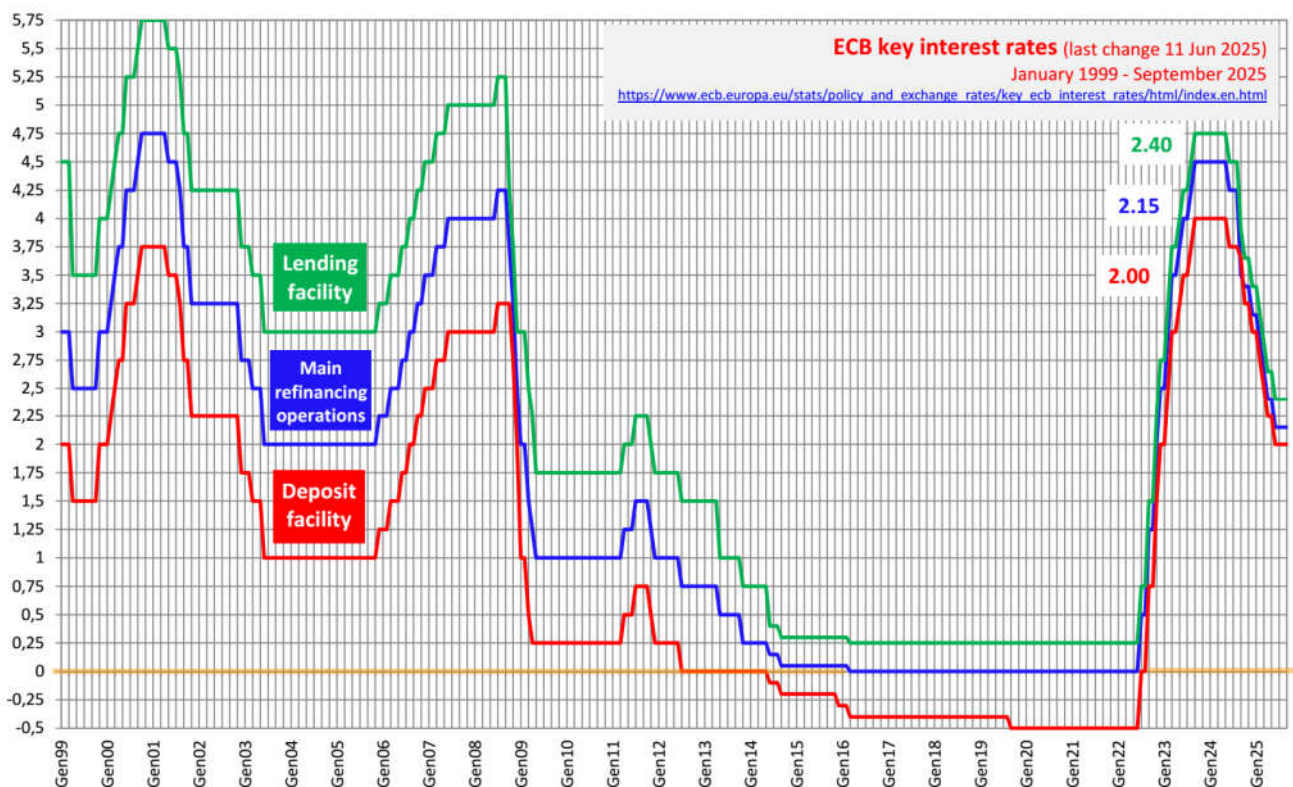


Fig. 8. European Central Bank interest rates, January 1999 to September 2025

https://www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html

Central bank auction with variable rate

Example. The CB plans to supply banks with reserves worth 100 through a variable interest rate auction. The minimum interest rate set by the CB for participation in the auction is 5%. Four banks are represented, making the following reserve demands, for interest rates of 8%, 7%, 6% and 5%; see Fig. 9.

interest rate	Bank 1	Bank 2	Bank 3	Bank 4	accumulated	remaining	B1	B2	B3	B4
8%	0	10	0	0	10	90	0	10	0	0
7%	10	15	0	5	40	60	10	15	0	5
6%	15	21	30	24	130		10	14	20	16
5%	20	30	40	30	250					
Allocation of reserves							20	39	20	21

Fig. 9. Example of a reserve auction with variable interest rate (from a minimum rate)

For instance, Bank 2 demands reserves worth 10 at 8%, 15 at 7%, 21 at 6% and 30 at 5%, totalling reserves worth 76. The total demand for reserves by all the banks (250) is greater than the CB supply (100). The auction is a mechanism for allocating the supply of reserves. The CB starts by allocating reserves at the highest rate on the list. At 8% there is a total demand of 10, so it can be completely satisfied. Specifically, the CB allocates to B2 the demand of 10 that the bank makes.

With all demand satisfied at 8%, there is a remainder of 9 : the initial value of 100 minus the value of 10 assigned to 8%. At 7%, there is a total demand of 30. Since 90 remain to be assigned, it is possible to satisfy all demand at 7%. Specifically, B1 receives 10; B2, 15; and B4, 5. Now the remainder is $90 - 30 = 60$.

At 6% the total demand 90 for reserves exceeds the remaining 60. In this case, the proportion in which a demand of 90 can be satisfied when there are 60 to allocate is calculated. The proportion is the quotient $60/90 = 2/3$. This means that the BC can satisfy $2/3$ of each demand made at 6%. Consequently, B1 receives 10 (two-thirds of B1's demand 15 at 6%); B2, 14; B3, 20; and B4, 16.

The result of the allocation: B1 receives $10 + 10 = 20$; B2, $10 + 15 + 14 = 39$; B3, 20; and B4, $5 + 16 = 21$. In total, 100: the volume of reserves that the CB wanted to allocate. The marginal rate of the auction is the smallest rate (from the list provided by the banks) at which any demand for reserves is satisfied (even if only partially).

For Fig. 9, the marginal rate is 6%. This value is easily identified: starting with the highest rate, it is the interest rate where the accumulated demand for reserves first exceeds the supply of reserves. In the 'accumulated' column the first value greater than the 100 supply of the BC is 130, which corresponds to 6%.

What do banks pay for reserves? In the Dutch auction (or single-rate auction), a single rate is paid: the marginal auction rate. In the American auction (or multiple-rate auction), each partial allocation of reserves is paid at the list rate. Thus, B2 would pay the first volume 10 of reserves at 8%; the second volume 15 at 7%; and the last 14 at 6%.

Central bank auction with fixed rate

Example. In this case, banks only inform the CB of the volume of reserves they want to acquire at the fixed rate predetermined by the CB. Using the information in Fig. 9, assume that the CB fixed rate is 6%, the CB wants to supply 60 reserves and that the banks' demand for reserves is as in the table in Fig. 9 at 6%. Then the total demand for reserves is 90. The CB would determine the proportion in which it can satisfy the demand (60 out of 90 or 2/3 or 66.66%) and would apply this proportion to the demand of each bank. Thus, B1 would receive 10 (two-thirds of B1's demand 15); B2, 14 (two-thirds of B2's demand 21); B3, 20; and B4, 16.

Central bank target interest rate

The target interest rate (the policy interest rate) of the CB is the short-term interest rate that the CB uses to make public the objective and orientation of monetary policy. By making the target interest rate public, the CB attempts to bring market interest rates closer to the target rate.

OMO and standing facilities are tools for aligning market rates close to the target rate. Knowing the CB's willingness to intervene to adjust market rates to the target, banks usually agree to borrow and lend at the target rate established by the CB. If the CB prefers to regulate market conditions without directly intervening (intervention might be too frequent or voluminous), then banks can solve liquidity problems (due to excess or deficiency) by using standing facilities.

The interest rate corridor refers to the CB's use of standing facilities and the target interest rate in order to maintain market interest rates within a corridor (fluctuation band) around the target rate. Fig. 10 shows a stylized view of the corridor.

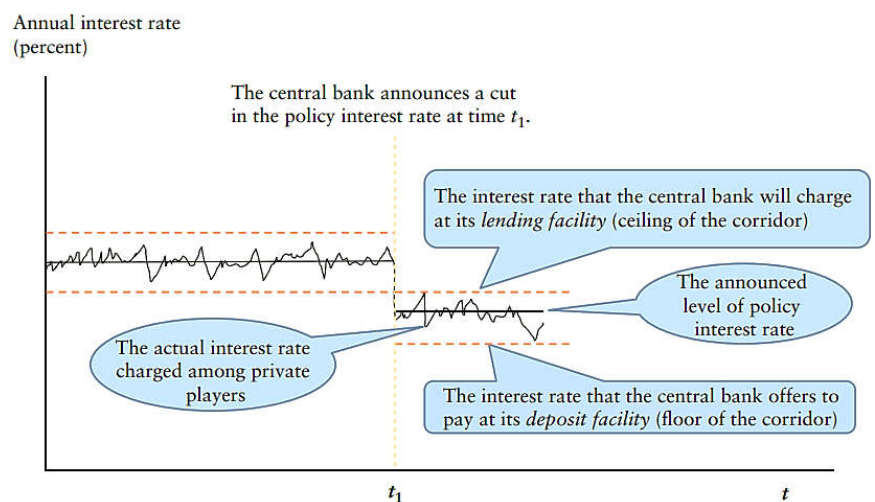


Fig. 10. The interest rate corridor (Moenjak, Thammarak (2014): *Central Banking: Theory and Practice in Sustaining Monetary and Financial Stability*, Wiley, p. 128)

The interest rate that the CB charges for the use of the credit facility is higher than the target interest rate to induce banks to first look to the markets for a solution to the lack of reserves. This makes the credit facility interest rate a ceiling on short-term market rates. Symmetrically, the deposit facility rate is a floor on market rates to induce banks with excess reserves to find borrowers in the interbank market and to make banks deposit funds with the CB as a last resort.

The ECB target interest rate is the €STR (or ESTER, euro short-term rate). The Bank of Spain describes the €STR as follows:

“The €STR is designed to reflect the cost for banks of borrowing funds on a very short-term basis (overnight) from various counterparties without providing collateral. These

counterparties can include banks, money market funds, investment or pension funds, and other financial actors such as central banks.

Therefore, its scope is broader than that of the EONIA, which was only based on interbank transactions. Additionally, compared to the EONIA, a larger number of banks provide the data on actual transactions that the European Central Bank uses to calculate the €STR. This broader scope protects the €STR from manipulation and makes it a reliable reflection of the price of unsecured loans in the euro area.” [EONIA = Euro Over-Night Index Average, the ECB’s previous target rate: the one-day Euribor.]

<https://www.bde.es/webbe/es/estadisticas/recursos/glosario/conceptos/estr.html>

Monetary tools
IV: reserve requirements

The reserve system created and maintained by a CB makes it possible to settle payments between banks. Banks must hold sufficient reserves each day to facilitate interbank settlement. Required reserves are the minimum balance of reserves that banks must hold in their accounts with the CB (bank reserves at the CB are accounting entries, like deposits: both are electronic money). Not all CBs impose them. Required reserves are usually calculated as a fraction of deposits.

The ECB does not remunerate mandatory reserves (they were in the past) and non-compliance is penalized (some points above the ECB marginal lending rate). The ECB also publishes at <https://www.ecb.europa.eu/ecb/sanctions/html/index.en.html> the sanctions imposed for failure to hold minimum reserves.

The conventional view is that reserves help control the money stock by altering the portion of all deposits that must be retained or by modifying the cost to banks of lending. An increase in reserves is understood to have a contractionary effect on the stock and a reduction has an expansionary effect.

In reality, banks need reserves to cover transactions with other banks (and other institutions that can use reserves). Non-bank private sector deposits are, in practice, a right to obtain reserves: when a bank’s customer makes a purchase using their deposits, the buyer’s bank sends reserves to the seller’s bank (if they are different banks). The granting of credit by a bank means creating in someone’s favor the right to obtain reserves. Given the willingness of the CB to supply reserves on demand, that the bank does not have them at the time of granting credit is irrelevant (if the bank has assets that the CB accepts in exchange for lending reserves).

The recourse to the CB is the last resort. Banks continuously exchange reserves in the interbank market, where banks with excess reserves (relative to those they want or need to have) lend them to banks lacking reserves.

What stops banks from granting credit is rather, on the one hand, the solvency of the recipient and, on the other, the cost of reserves. If there is no one considered solvent who accepts credit at a rate higher than the price of reserves, the bank will not grant it. Minimum reserves, by reducing the volume of loanable reserves, raise the cost of obtaining reserves.

Monetary policy effects

Fig. 11 displays the conventional scheme on the effects of monetary policy. Fig. 12 summarizes monetary policy design. It is worth noticing what Google informs on monetary policy lags, the time it takes for monetary measures to produce full effects.

“Monetary policy effects typically manifest with significant lags, though the precise timing varies. Initial impacts can be seen within weeks, with effects on consumption appearing in less than a week. However, it can take six months to a year for a noticeable impact on output and prices, and the full effect on the economy can take 18 months to two years, with some estimates suggesting even longer.”

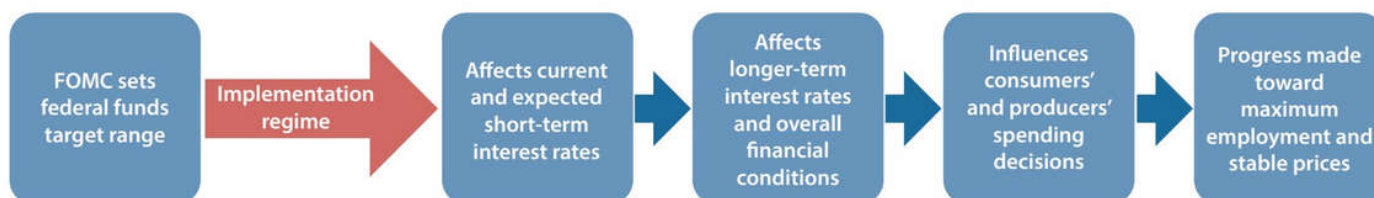


Fig. 11. Transmission of monetary policy decisions to the real sector (Federal funds rate = interest rate in the US interbank reserve market)

<https://www.stlouisfed.org/publications/page-one-economics/2020/08/03/the-feds-new-monetary-policy-tools>

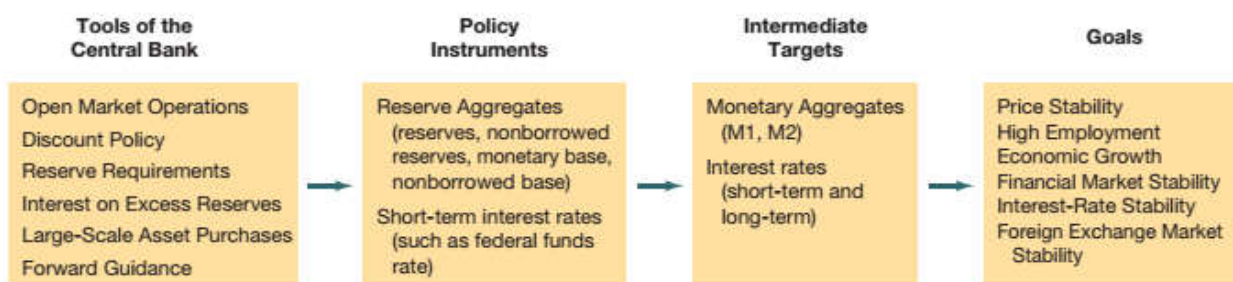


Fig. 12. Monetary policy design: tools, intermediate objectives and final goals (Mishkin, Frederic S. (2019): *The economics of money, banking and financial markets*, Pearson)

Superpowers of central bankers

The US news magazine Time declared Ben Shalom Bernanke, then chairman of the Federal Reserve (the US central bank), person of the year 2009⁵.

On the 24th of December, 2008, the US news magazine Newsweek published the ranking of the world's most powerful people. Three of the top six were central bankers.

“Ben Bernanke of the US Federal Reserve, Jean-Claude Trichet of the European Central Bank and Masaaki Shirakawa of the Bank of Japan are ranked fourth, fifth and sixth respectively.”



<https://m.rediff.com/news/2008/dec/24slide5-top-20-powerful-people-of-the-world.htm>

⁵ https://content.time.com/time/specials/packages/article/0,28804,1946375_1947251_1947520-5,00.html

“They’re technocrats, schooled in subjects that bore most people. They are appointed – not elected – to top government jobs, and what they do is not well understood. But they are enormously powerful, and in 2009 they may determine whether the global economy avoids calamity. ‘They’ are central bankers: Ben Bernanke of the U.S. Federal Reserve; Jean-Claude Trichet of the European Central Bank (ECB); Masaaki Shirakawa of the Bank of Japan; and, to a lesser extent, counterparts in China, India, Brazil, Mexico and elsewhere.”

<https://www.newsweek.com/newsweek-50-bernanke-trichet-shirakawa-83099>

The president of the ECB in 2012 is widely credited with having saved the euro. At the time, the eurozone was experiencing a potentially devastating financial instability. Google summarizes the situation nicely:

“The 2012 Euro crisis, a critical phase of the wider European sovereign debt crisis, intensified fears of the single currency’s breakup due to high sovereign debts, austerity measures, and banking stress in countries like Greece, Portugal, and Spain. Key developments in 2012 included the creation of the European Stability Mechanism (a permanent bailout fund), the signing of a new fiscal pact to enforce budget discipline, and the European Central Bank’s commitment to preserving the euro, which helped to calm markets and diminish the immediate threat to the currency.”

Draghi’s committed the ECB to preserving the euro in a speech⁶ he gave on 26 July 2012. The speech is a dramatic example of forward-looking orientation. At the time, as Google reminds, eurozone countries such as Spain were experiencing the most severe consequences of the ‘euro crisis’, in the form of doubts about the solvency of its public debt. One measure of these doubts was the risk premium: roughly speaking, the difference in the profitability of Spanish public debt with German public debt (the one regarded as safest). Fig. 13 shows Spain’s risk premium, which in July 2012 exceeded 600 basis points: the interest rate on Spanish public debt was the German rate plus 6%.



Fig. 13. Spain’s risk premium, December 2006 – September 2025

<https://datosmacro.expansion.com/prima-riesgo/espana>

⁶ See <https://www.ecb.europa.eu/press/key/date/2012/html/sp120726.en.html>.

That high risk premium maintained for a long time represented a threat to the viability of the euro, since it made the borrowing cost of some eurozone countries more expensive and increased their risk of insolvency.

The European Central Bank's mandate prohibits direct financing of eurozone governments. It is a very strange mandate, because countries with their own currency can always resort to their central bank precisely to avoid risks of public debt insolvency.

Mario Draghi delivered words that, in practice, amounted to a bailout of struggling governments by the European Central Bank. Fig. 13 suggests that the speech removed tensions over Spain's risk premium and, de facto, rescued Spain (and other eurozone countries) with the forward-looking orientation that it would be rescued if necessary.

The most significant words of the speech:

"When people talk about the fragility of the euro and the increasing fragility of the euro, and perhaps the crisis of the euro, very often non-euro area member states or leaders, underestimate the amount of political capital that is being invested in the euro (...) We think the euro is irreversible."

"But there is another message I want to tell you. Within our mandate, the ECB is ready to do whatever it takes to preserve the euro. And believe me, it will be enough." (Emphasis added)

The expression 'whatever it takes' was the tool that, in retrospect, is considered to have saved the euro in an episode of severe crisis where it was seriously considered that some countries would recover their national currencies.

Draghi's speech is known as the 'whatever-it-takes speech'. The need to make it can be seen as an indication that the European Central Bank has been poorly designed: it is a central bank with no government to serve. And if a central bank cannot bail out its government, but can bail out private banking, what is its ultimate purpose?

The vignette on the right, by KAL, is arguably the best explanation of the nature of the beast that central bankers have to tame.



The Economist cover, 1st November 1997, 'A week on the wild side', by KAL (Kevin Kallauger, <https://www.kaltoons.com/>)