Money

- Paradoxical? Money is everything considered money. Money has three main functions.
- Medium of exchange. Goods can be generally obtained in exchange for money, that is, money must can be used to make purchases of goods.
- Store of value. Money has the ability to preserve (at least part) of its purchasing power in time: it is a way of accumulating purchasing power.
- Unit of account. The value of goods is expressed in terms of money (this was the € from 1999 to 2002).

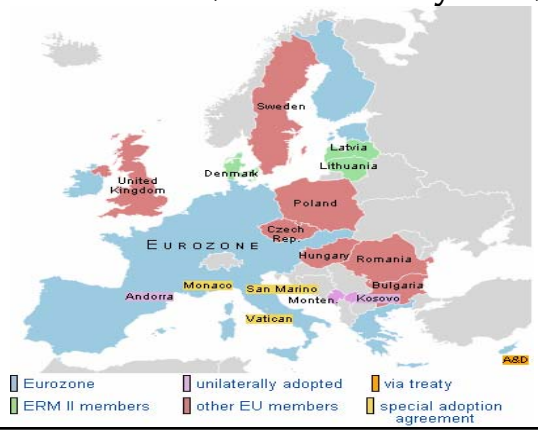
Fiat money

- In essence, money is anything which is generally accepted as a payment for goods.
- But money is accepted in exchange for goods because of the belief that it will be subsequently accepted in exchange for goods.
- To reinforce that belief, originally money had to have intrinsic value: money itself was a good (like cattle or silver: commodity money). With time, it became unnecessary for money to have intrinsic value. Money is now fiat money: intrinsically worthless pieces of paper and metal.

Our currency: the €

- The euro (sign: €; code: EUR) is the official currency (= physical money) of the 17 members of the Eurozone: A, B, C, E, FI, FR, GE, GR, IR, IT, L, M, N, P, SLVA, SLVE, and SP.
- The euro was born in Jan. 1999 as a unit of account and became currency on 1 Jan. 2002. It is managed by the Eurosystem: the European Central Bank plus the central banks of the eurozone members.
- It is the 2nd most traded currency in the world, after the $. By mid-2010, it surpassed the $ as the currency with highest value in circulation (€800 b.).

The Eurozone (as of February 2010)



The business of making money

- In a (modern) monetary economy, goods are typically not exchanged for goods but for (fiat) money.
- Therefore, the first activity in which people must engage in a monetary economy is raising money.
- One way of raising money consists of selling goods others want. Thus, one may sell his/her time for a wage or a good he/she can produce for a price.
- What if one has no good others may want? Then one can raise money by issuing a financial asset, which is little more than a promise of payment.

Financial assets

- In essence, a financial asset is an IOU: a paper where someone acknowledges a debt (*"I owe you"*).
- A final asset can be viewed as a substitute for money, as it represents a promise today of payment of money in the future.
- So you do not have money today, but presume that you will have in the future. A financial asset is like a time machine allowing you to take your money back from the future: you issue an IOU and sell it today for money. Problem: part of your future money is lost when reaches the present.

Interest rates

- Suppose you will have 1000€ in a month and need (or want) them today. You then issue a financial asset stating that you will pay 1000€ in a month to the bearer (owner) of the asset.
- But it will illusory to expect to sell that asset for 1000€, for the buyer gives 1000€ and receives 1000€ in a month: the buyer losses the possession of 1000€ for a month in exchange for nothing.
- So the asset should be sold for less than 1000€. The interest rate of the asset is its implicit rate of return.

Rate of return of an asset

- Let V the nominal (face) value of the asset: how much it promises to pay in the future.
- Let P be the price at which the asset is sold.
- Then the (implicit) rate of return i_A (or rate of profit) of the asset is the profit $V - P$ obtained from buying the asset per monetary unit invested in the purchase. The formula is (multiply the right-hand by 100 to get a percentage):

$$i_A = \frac{V - P}{P} .$$

- For instance, if $V = 1000$ and $P = 800$, then $i_A = 25\%$.

Functions of financial assets

- From the perspective of the purchaser, the financial asset is a way of saving purchasing power (a way of sending it from the present to the future).
- From the perspective of the issuer (or the seller, if the buyer becomes a seller), the financial asset is a way of acquiring purchasing power (a way of bringing it from the future to the present).
- A financial asset is an instrument to get money if you need it from someone not needing it now. Put it briefly, a financial asset is a loan of money.

Properties of financial assets

- Liquidity. Ease and rapidity with which the asset can be turned into money (can be sold).
- Risk. The likelihood that the compromise of repayment will not be respected.
- Rate of return. Ratio of the profit to the cost of obtaining that profit.
- Maturity. The date at which the issuer must pay the face value to the holder of the asset.

A selection of financial assets (I)

- Currency. It is an extreme case of financial asset: instant maturity (1€ pays 1€ now), no return, no risk, and maximum liquidity.
- Bank deposit. By depositing money in a bank, the depositor is purchasing an asset issued by the bank: the deposit. This asset is riskier than currency: if the bank goes bankrupt, the money is lost.
- Loan. The loan is the reverse of the deposit: it is as if the bank deposited money on you in exchange for a premium and the repayment of the deposit.

A selection of financial assets (II)

- Bonds. A bond is a debt security that, in exchange for the face value V, pays a certain amount (the coupon) at fixed periods before maturity and repays V at maturity. A 4-year 100€ bond offering an annual 5% pays 5€ at the end of years 1, 2, 3, and 4, and repays the 100€ at the end of year 4.
- Variations: perpetuities (bonds with no maturity), floating-rates bonds, inflation-linked bonds…
- Zero-coupon bonds. Bonds issued (like T-bills) at a discount, that is, sold for less than the face value.

Shares (stocks)

- Commercial paper. They are promissory notes issued by firms to fund operational expenses.
- Shares. The share of a firm is an indivisible unit of the firm's capital. Shares are equity security. A security is a fungible, negociable instrument representing financial value.
- Securities are divided into debt securities (like bonds) and equity. Having an equity means owning part of a firm; having a bond issued by the firm means being a creditor of the firm.

Are shares financial assets?

- In a strict sense, shares of a firm are not financial assets, since they represent parts of a firm: the owner of shares is a shareholder.
- Unlike debt securieties, shares do not entitle to a regular payment: the payment of dividends is discretional.
- But shares typically represent such a small part of the value of a firm that they are bought and sold not because of their intrinsic value, but because of the expected evolution of their price.

Goods turned to financial assets

- Hence, buying shares is a form of saving, and selling them is a form of raising money. Thus shares are indistinguishable from financial assets.
- Any good sold and bought according to the expected evolution of its price behaves like a financial asset: it is not sold or bought due to intrinsic qualities, but as a tool for making money by exploiting price changes.
- This may generate "speculative bubbles". Known cases: oil, real estate, raw materials, stamps…

Trade-off between properties

- Financial assets can be viewed as money imitators. But as they cannot have maximum liquidity, they must offer something in return to be attractive.
- Liquidity and profitability. If 2 assets differ only in liquidity and profitability, the more liquid must be the less profitable and vice versa (money vs bonds).
- Risk and profitability. If two assets differ only in risk and profitability, the riskier should be the more profitable and vice versa (shares vs deposits).

Inverse relationships

- Having more of the favourable properties is balanced by having more of the desfavourable ones.
- More profitability will be accompanied by less attractive qualities: more risk and/or less liquidity.
- More liquidity will be accompanied by less attractive qualities: more risk and/or less profitability.
- More risk will be accompanied by more attractive qualities: more profitability and/or more liquidity.

The nominal interest rate

- The rate of return associated with each financial asset is the nominal interest rate of the asset.
- An economy has nearly as many interest rates as financial assets. Fortunately, all the them move in parallel, so it is reasonable to adopt the fiction that there is a unique interest rate i for the economy.
- That unique rate could be taken to be the interest rate of a loan, which is itself a reference interest rate. From now on, i will represent the average interest rate charge for a typical loan.

Meaning of the interest rate (I)

- Defined as the rate of return of a loan (of currency), having an interest rate of i means that a moneylender receives at maturity $1 + i$ for every unit lent. So 1 (in t) becomes $1 + i$ (in $t + 1$).
- For the moneylender, i measures the profit of lending 1 unit of currency. For the borrower, i measures the cost of receiving a loan of 1.
- For the moneylender, i is the reward of saving: by giving up 1 today, (s)he gets $1 + i$ tomorrow. For the borrower, i is the cost of bringing currency from the future.

Meaning of the interest rate (II)

- On the one hand, i represents the profit of sending money to the future: the reward for saving.
- On the other, i also represents the profit of cost of bringing money from the future: the cost of a loan.
- It can also be interpreted as a measure of patience: the higher i, the more a borrower is willing to pay for having 1 unit of currency today instead of tomorrow, so the less patient the borrower is.
- A positive i expresses a preference for the present: better to have money today than tomorrow.

The discount factor

- The interest rate transforms today's money into tomorrow's money: 1 today is $(1 + i)$ tomorrow.
- The discount factor does the opposite: it transforms tomorrow's money into today's money. It determines present values out of future values as follows.

t		$t + 1$
1	$\longrightarrow$	$1 + i$
?	$\longleftarrow$	1

- The discount factor transforms 1 into ?. That ? is the value that, with interest rate i, becomes 1.
- By the rule of three, $? = \frac{1 \cdot 1}{1 + i} = \frac{1}{1 + i}$ is the discount factor (it depends on i).

Interest rate and asset prices

- The price of an asset and the price of money (= the nominal interest rate) move in opposite directions.
- Illustration. A T-bill has face value V and price P. Let i be defined for a loan with the same maturity as the T-bill. If you have P €, you have two options.
  - Option 1: lend P. At maturity, you get $(1 + i) \cdot P$.
  - Option 2: buy the T-bill. At maturity, you get V.
- If the results must be equal, then $(1 + i) \cdot P = V$, so

$$P = \frac{V}{1 + i} \quad \text{: the larger } i\text{, the smaller } P.$$

Arbitrage in action

- Suppose $V > (1 + i) \cdot P$. An arbitrageur can then obtain sure profits (even having no money at all).
- First, P € are borrowed, so $(1 + i) \cdot P$ must be repaid the next period. A T-bill is purchased with the P €.
- At maturity, the T-bill pays V. As $V > (1 + i) \cdot P$, the arbitrageur repays the loan and pockets a profit of $V - (1 + i) \cdot P$. If $V = 1000$, $P = 800$, and $i = 10\%$, each T-bill financed by a loan generates a profit of 120.
- If this is done by many arbitrageurs, both i and P tend to rise, so $V - (1 + i) \cdot P$ diminishes.

Prices of assets as present values

- The future value of the T-bill is V. With interest rate i, the present discounted value of V is

$$\frac{1}{1 + i} V, \quad \text{where } \frac{1}{1 + i} \text{ is the discount factor.}$$

- Therefore, the condition

$$P = \frac{V}{1 + i}$$

states that the price of a T-bill coincides with the present discounted value of its face (future) value.

Equalization of rates of return

- It is reasonable to expected the equalization of the interest rates of all financial assets, for otherwise the assets with smaller rate will have no demand.
- The interest rate i_B implicit in the T-bill is $i_B = \dfrac{V-P}{P}$ and i represents the interest rate of a loan.
- Accordingly, the equalization $i = i_B$ of rate leads to

$$i = i_B = \frac{V-P}{P} = \frac{V}{P} - 1, \quad \text{so } 1 + i = \frac{V}{P}.$$

- Solving for P yields the condition $P = \dfrac{V}{1+i}$.

The real side

- The real side of an economy comprises all the activities related to the production, exchange, and consumption of goods.
- All the identities showed in PART 2 of these slides represented outcomes of the working of the real side.
- The main variables summarizing what occurs in the real side are the real GDP, the inflation rate associated with the CPI, and the unemployment rate.

The financial side

- The financial side of an economy comprises all the activities related to the issuing, purchasing, and reselling of financial assets.
- The (nominal) interest rate is one of the main variables summarizing what occurs in the financial side. It is probably the main price in that side.
- As regards quantities, one of the most important is the amount of money in the economy, which is called money stock, money supply, or monetary mass. Several ways exist of measuring that mass.

Monetary aggregates

- Monetary aggregates are technical ways of measuring the amount of (and defining) money.
- M0 = monetary base = high-powered money = E + R
  - E = currency held by the public (cash)
  - R = bank reserves = currency in bank vaults + the banks' deposits at the central bank
- M1 = E + D
  - D = deposits = non-interest-bearing accounts at banks
- M2 = M1 + savings deposits
- M3 = M2 + time deposits + others

Technical definitions of money (ECB)

- ***Narrow money (M1)*** *includes currency, i.e. banknotes and coins, as well as balances which can immediately be converted into currency or used for cashless payments.*
- ***"Intermediate" money (M2)*** *comprises narrow money (M1) and, in addition, deposits with a maturity of up to two years and deposits redeemable at a period of notice of up to three months. Depending on their degree of moneyness, such deposits can be converted into components of narrow money.*
- ***Broad money (M3)*** *comprises M2 and marketable instruments issued by the MFI (Monetary Financial Institutions) sector. Certain money market instruments, in particular money market fund (MMF) shares/units and repurchase agreements are included in this aggregate. A high degree of liquidity and price certainty make these instruments close substitutes for deposits.*

Relationship between M0 and M1

- The cash reserve ratio $r = R/D$ is the amount of reserves banks must hold per euro of deposit. It is the percent of deposits banks cannot lend.
- Define $l = E/D$ to be the amount of currency that people hold per euro of deposits (liquidity ratio).
- The money multiplier is $mm = \dfrac{1+l}{r+l}$.
- It then follows that M1 = mm·M0, so mm = M1/M0. Hence, if mm remains constant, ΔM1 = mm·ΔM0.

The money multiplier

- Calling M1 the money stock, the money multiplier *mm* indicates how many units of money stock is generated by one unit of monetary base.
- In fact, M1 = E + D and l = E/D imply M1 = lD + D = D(1 + l). In addition, M0 = E + R, l = E/D, and r = R/D imply M0 = lD + rD = D(r + l). Therefore,

$$\frac{\text{M1}}{\text{M0}} = \frac{\text{D}(1+l)}{\text{D}(r+l)} = \frac{1+l}{r+l} = mm.$$

- In sum, M1 (the money stock) is a fixed multiple (*mm*) of M0 (the monetary base).

Spontaneous money creation /1

- Suppose individual i steals 6000€ from the ECB (the same effects would happen if the ECB purchased something from i and paid 6000€).
- With l = 0.2, i must allocate the 1000€ in cash and deposits to make the increase in cash ΔE divided by the increase of deposits ΔD be 0.2, so ΔD = 5·ΔE. Since ΔE + ΔD = 1000, ΔE = 1000 and ΔD = 5000.
- As a result, i deposits 5000 on a bank. Suppose r = 0.1. This means that the bank must hold 500€ as reserves and may lend 4500€. Assume people are willing to borrow any amount offered by banks.

Spontaneous money creation /2

- Now, the people borrowing the 4500€ will spend them purchasing goods. The sellers of the goods will then receive 4500€ and they face the same situation as i at the beginning: they must retain a part ΔE in cash and deposit the rest 4500 – ΔE on banks so that the ratio is 0.2.
- In this case, ΔE = 750 and ΔD = 3750. Of these deposits, banks hold r·ΔD = 375 as reserves and offer the rest (3375€) to potential borrowers.
- And the cycle recommences: borrowers spend 3375 and sellers maintained a part of 3375 in cash (562.5) and deposit the rest (2812.5) on banks.

Spontaneous money creation /3

- The initial robbery has increased M0 by 6000.
- Deposits have grown continuously: 5000 + 3750 + 2812.5 + 2109.375 + … In the limit, the sum converges to 20000.
- What fraction of the 6000 is finally held in cash? The sum 1000 + 750 + 562.5 + 421.875 + …, which converges to 4000.
- Since M0 = E + R, ΔM0 = ΔE + ΔR. That is, 6000 = 4000 + ΔR. Thus, ΔR = 2000. This is also the value to which the sum 500 + 375 + 281.25 + 210.9375 + … converges.

Spontaneous money creation /4

- M1 = E + D yields ΔM1 = ΔE + ΔD. Given that ΔE = 4000 and ΔD = 20000, ΔM1 = 24000.
- To recap, an increase of 6000 in the monetary base has multiplified itself into an increase of 24000 in the money stock.
- This suggests that the money multiplier must be 4: 6000 have been transformed into 24000. In effect, *mm* = (1 + l)/(r + l) = (1 + 0.2)/(0.1 + 0.2) = 12/3 = 4. The money stock is four times the monetary base and ΔM1 = *mm*· ΔM0 = 4·6000 = 24000.

The money multiplier process

- The example shows that the money multiplier captures the total effect on the currency held by the people and the deposits generated by the process

  … ⇒ ↑deposits ⇒ ↑loans ⇒ ↑expenditures ⇒ …

  …⇒ ↑revenues ⇒ ↑deposits ⇒ ↑loans ⇒ …
- This proces illustrates the <u>interaction between the financial side</u> (deposits and loans) <u>and the real side</u> (purchases of goods).
- The process also operates the other way around: ↓deposits ⇒ ↓loans ⇒ ↓expenditures ⇒ ↓revenues ⇒ ↓deposits …

Source: ECB

Euros in circulation /1

Table 1: in quantities (millions), outstanding amounts, end of period

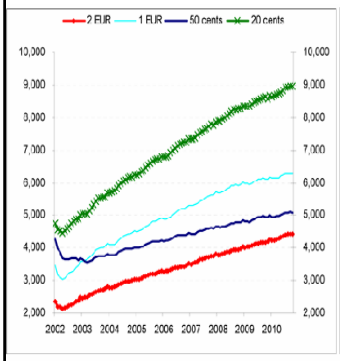
Year	Total	€ 500	€ 200	€ 100	€ 50	€ 20	€ 10	€ 5
2008	13116	530	170	1381	4912	2618	2030	1476
2009	13643	564	178	1472	5199	2690	2042	1498
2010	14171	576	181	1551	5550	2752	2039	1522
2010 Q2	13505	571	181	1498	5231	2611	1953	1461
2010 Q3	13550	569	180	1506	5260	2618	1953	1465
2010 Q4	14171	576	181	1551	5550	2752	2039	1522
Oct.	13601	570	180	1508	5273	2635	1969	1467
Nov.	13587	572	180	1514	5288	2612	1951	1469
Dec.	14171	576	181	1551	5550	2752	2039	1522

Table 3: in quantities (millions), outstanding amounts, end of period

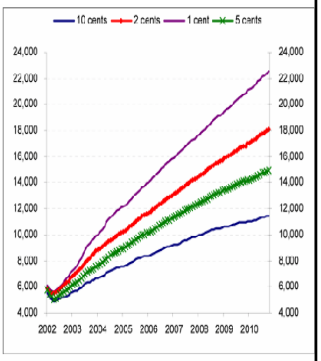
Year	Total	€ 2	€ 1	€ 0.5	€ 0.2	€ 0.1	€ 0.05	€ 0.02	€ 0.01
2008	82314	4033	6015	4835	8336	10597	13376	15779	19343
2009	87457	4264	6184	5005	8665	11061	14218	17000	21059
2010	92894	4521	6345	5143	9021	11566	15118	18299	22880
2010 Q2	89938	4371	6232	5041	8836	11261	14617	17650	21930
2010 Q3	91465	4429	6290	5097	8961	11422	14877	17992	22398
2010 Q4	92894	4521	6345	5143	9021	11566	15118	18299	22880
Oct.	91834	4439	6287	5089	8973	11460	14949	18092	22546
Nov.	91991	4455	6289	5092	8953	11462	14965	18128	22647
Dec.	92894	4521	6345	5143	9021	11566	15118	18299	22880

Source: ECB

Euros in circulation /2



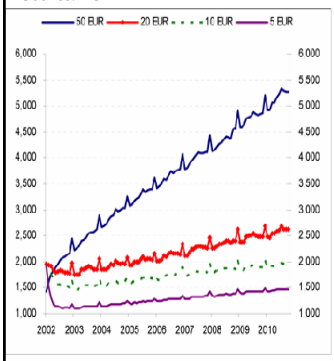
High denomination coins in circulation (in quantities, millions)



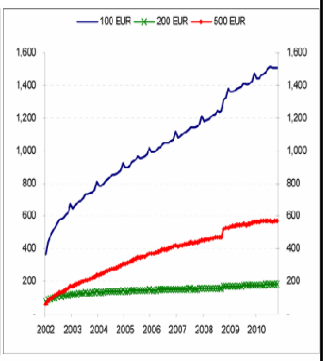
Low denomination coins in circulation (in quantities, millions)

Source: ECB

Euros in circulation /3



Low denomination banknotes in circulation (in quantities, millions)



High denomination banknotes in circulation (in quantities, millions)