1 Definition of Finance

Finance is the science and technique underlying the answer to the following question:

> How much is €1 euro worth in one year time?

In other words, finance deals with the time value of money. Money may change its value due to:

- **Opportunity costs**: Surplus of money is used to invest, but the commitment on a given investment may prevent the lender of the money to allocate that wealth in other investment opportunities that may present in the future. This effect is mainly capture by interest rates in its risk free format or inflation.
- **Counterparty risk**: Lending money to someone has always a embedded risk arising from the inability of the borrower to return or face its commitments.
- **Associated costs**: Some wealth may have associated costs, for instance storage and security of cash or renting costs associated to storage of commodities (such as oil, corn, soy, . . .).
- **. . .**

2 Fair Value

Finance has a lot of connections with game theory and thus probability and stochastic calculus have become one of the main tools for professionals in financial markets.

A financial transaction is a deal between two counterparties and for this to occur they both need to assume that the trade is fair. For instance, imagine you decide to go to a casino and are asked to pay an entrance ticket, because all games in the casino are random you will not want to pay an entrance that exceeds you expected gains (otherwise you will lose money if you play many times); on the other hand if you are asked a ticket that is less than the expected gain, it is clear that the casino will shut down earlier than later. Therefore, the transaction (you entering in the casino) only happens when the two counterparties agreed on a fair value (price). In real life applications there are some friction on financial markets which make this idealized situation false, but for the purpose of the course we will consider that this idea holds true.

Coming back to finance questions one may face the following opportunity:

: Example

Imagine you are faced with an investment opportunity.
An investment of €1.000 today can go great and become €1.500 in one year time or go bad and recover only €500. The two outcomes are equally probable.
Would you invest?

As you see, the typical question in finance has many resembles to a game theory problem. In this situation tough we need to introduce additional knowledge to be able to answer the question properly, namely:

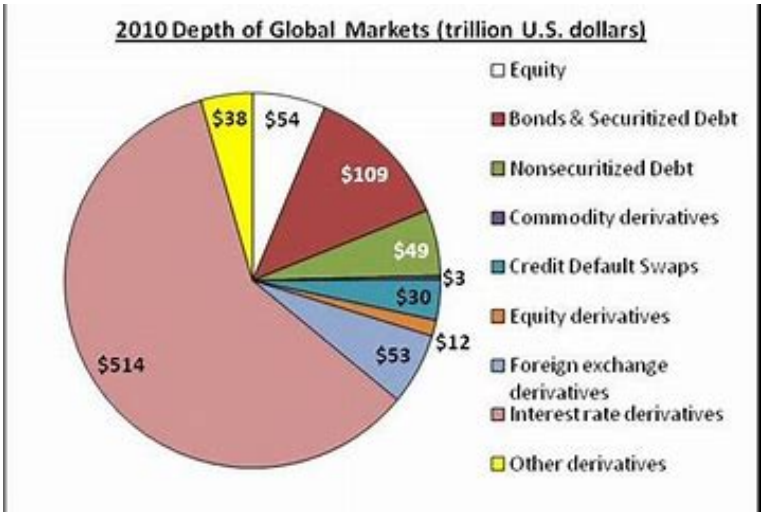
- Is the investment fair?
- What are the interest rates in one year?
- Is there an opportunity cost?
- Is there any possibility that the borrower will go bankruptcy, and you will not recover anything from the investment?

3 Products and Markets

Financial markets vary upon the particularities of the underlying asset that is traded although the principles remain the same. Some of the most important financial markets are:

- **Equity**: The most basic financial instrument also known as stock or share. This asset represents the ownership of a small portion of a company, giving rights to part of its revenues. Companies issue shares to rise capital in order to face investment challenges.
- **Commodities**: Usually raw products such as precious metals, oil, food, ... Prices of products often show seasonal effects and most of the trading activity is done by means of future contracts.
- **Currency (FX)**: Exchange rates, foreign exchange or FX markets are markets that exchange one currency for another. This is one of the preferred markets for arbitrageurs since FX markets should satisfy (mostly) transitivity between triplets of currencies. This is also one of the few markets that are always operative.
- **Indices**: Are means of measuring how the stock market/economy is doing as a whole. A typical index is made of a basket of representative stocks or products (IBEX35, SP500, NSADAQ, ...).
- **Fixed-Income Securities**: These are securities that pay a fixed interest over the life of the financial instrument. Also known as bonds, buying a bond means lending money to a counterpart who has the obligation to pay back the principal and interest stipulated in the bond's statement.
- **Forward and Futures**: A forward contract is an agreement where one party promises to buy an asset from another party at some specified time in the future at a given price today. No money changes hands until the delivery date or maturity. Future contracts are similar but they trade through an exchange market and thus are standardized in their terms.
- **Derivatives**: Instruments which value depends upon the price evolution of another product, named underlying. Virtually anything that has not been defined before.

During this course we will be focusing on examples related to equities only. The following graph depicts the portion of different financial markets. Equity markets might be the most known markets for general public, as they are regularly cited in news and are the most easy market to invest. On the other hand they account only for a small portion of the overall market activity, and hence professional market players trade more volume in other activities (for example interest rate derivative, mainly swaps, are by far the most traded product and usually are reserved to institutional investors).



4 Module Disclaimer

This course aims to be a gentle introduction to finance, showing the building blocks of modern financial engineering techniques. There is a huge gap between theory and becoming a practitioner in financial markets.