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Foundations · market mechanics from the ground up

Why futures and options exist: history, participants and the common thread

Chapter 1 of 10

Futures and options came about to pass on price risk: from the rice merchant in Osaka in 1730 through the Chicago grain exchange to the index future and the option that expires the same day. This chapter tells how they came about, introduces the participants (hedgers, speculators, market makers, arbitrageurs, exchange, clearing house) and shows the chain on which all further chapters hang.

Field	Value
Series	Futures, options and who makes the price
Scope	Chapter 1 of 10
Type	Explanation with worked examples, not a measurement
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In one sentence: Futures and options exist because some want to get rid of a price risk and others take it on for payment, and almost everything that follows in this series is the question of how those who take it on get rid of that risk again themselves.

What this chapter is: the entry into the series. It explains the origin and purpose of the products, introduces the participants and shows how the following chapters connect. The history is told in shortened form, the dates come from the chronicles of the exchanges. **Not a trading recommendation.**

1. The basic problem: a price that changes before delivery

A farmer sows wheat in spring. He can only sell in autumn. What the wheat will cost then, he does not know. If the price falls, the harvest may not cover his costs.

A miller has the opposite problem. He has promised bread deliveries at fixed prices and has to buy wheat in autumn. If the price rises, he loses money.

Both carry the same risk with the opposite sign. The obvious solution: they agree today on a price for delivery in autumn. The farmer knows what he will get, the miller what he will pay. Such a contract is called a **forward transaction**: concluded today, fulfilled later.

Three questions follow from this, and they drive the whole history of these markets:

- **Who is the other side when no suitable miller happens to be there?** Someone has to be willing to take on the risk without needing wheat himself.
- **What if one side does not pay?** If the price falls sharply, the miller has an incentive to break the contract.
- **How do you get out of the contract again?** A contract between two persons is hard to sell on.

The future is the answer to all three.

2. From the rice bill to the future

Osaka, 1730. In Japan, taxes were paid in rice. Warehouses in Osaka issued bills on stored rice, later also on rice from future harvests. These bills were traded. In 1730 the government officially permitted trading at the Dojima rice exchange. What was traded there was not only rice for money but also rice for future delivery, in uniform quantities and with a clearing office. Dojima is therefore regarded as the first futures exchange.

Chicago, 1848 and 1865. Chicago was the hub for the grain of the American Midwest. After the harvest prices fell because everyone delivered at once, in spring they rose. In 1848 merchants founded the Chicago Board of Trade. At first they traded delivery contracts on grain arriving later. In 1865 the exchange turned these into uniform contracts with fixed rules: the same quantity, the same quality, fixed delivery months, and a security deposit that both sides had to post. That is the future in its present form.

Three innovations are contained in it:

- **Standardisation.** Every contract is the same. That is why it can be sold on to anyone.
- **Security deposit (margin).** Both sides post money. Gains and losses are settled continuously. Nobody can let a large loss build up and then disappear.

- **Clearing house.** A central body steps between buyer and seller. Everyone has only it as a counterparty. If a participant fails, it does not hit his trading partner.

This answers the three questions from section 1. The other side no longer has to be a miller but can be anyone who wants to trade at that price. The clearing house carries the default risk. And you get out by selling the same contract again.

3. From grain to the index

For more than a hundred years futures were written on things that can be delivered: wheat, corn, pork bellies, metals. Then, within ten years, two steps created today's market.

1972: futures on currencies. Until 1971 the exchange rates of the major currencies were fixed. When that system ended, they floated freely, and firms with foreign business suddenly had the farmer's problem. The Chicago Mercantile Exchange (CME) introduced futures on seven currencies in May 1972. For the first time a future was written on something purely financial.

1982: futures on a stock index. An index cannot be delivered. It is a number computed from 500 share prices. The solution was **cash settlement**: nothing is delivered at the end, only the difference is settled in money. In April 1982 the CME launched the future on the S&P 500. Anyone who wanted to hedge a share portfolio no longer had to sell hundreds of shares. A single trade was enough.

1992 and 1997: trading becomes electronic and smaller. Until then traders stood in a ring on the exchange floor and shouted prices at each other. In 1992 the CME put its electronic trading system Globex into operation. In 1997 the E-mini on the S&P 500 followed: one fifth the size of the original contract and tradable only on screen. It became one of the most heavily traded futures in the world. Since 2019 there has also been the Micro E-mini at one tenth of that size. In Germany, trading in the DAX future began in 1990 at the Deutsche Terminbörse, which became Eurex in 1998.

4. The option: the right without the obligation

A future binds both sides. The farmer gets his fixed price, but he also gives up the gain if wheat becomes more expensive. Some do not want that. They only want to be protected against the bad case and keep the good one. That is insurance, and insurance on a price is called an **option**: the right to buy or sell at a fixed price, without the obligation to do so. For this the buyer pays a premium up front.

Such contracts had existed for centuries, but only individually negotiated, without an exchange and without a recognised method for determining the fair price. In 1973 both changed in the same year:

- **The first options exchange.** In April 1973 the Chicago Board Options Exchange (Cboe) opened in Chicago. On the first day there were call options on 16 shares. As with the future, the contracts were uniform, and a clearing house stood between the parties. Put options were added in 1977.
- **The pricing formula.** Also in 1973, Fischer Black and Myron Scholes published their formula for the price of an option, and Robert Merton extended it. Its core is not a look into the future but a construction manual: whoever has sold an option can offset its risk by trading continuously in the underlying asset, and the cost of this offsetting is the fair price. This manual is the working basis of option dealers to this day. Chapters 6 and 8 derive it.

After that came the same development as with the future:

- **1983:** options on indices, among them the S&P 500, with cash settlement.

- **1987:** On 19 October the Dow Jones fell by 22.6 % in one day. Since then, options that protect against sharp losses have permanently cost more than the 1973 formula gives. Chapter 6 explains this surcharge.
- **1993:** The VIX is introduced, an index that derives the expected fluctuation of the S&P 500 from option prices.
- **2005 to 2022:** Maturities become shorter. In 2005 options with weekly expiry arrived. Since 2022 an option on the S&P 500 has expired on every trading day. Options that expire on the day they are traded are called 0DTE (zero days to expiration).

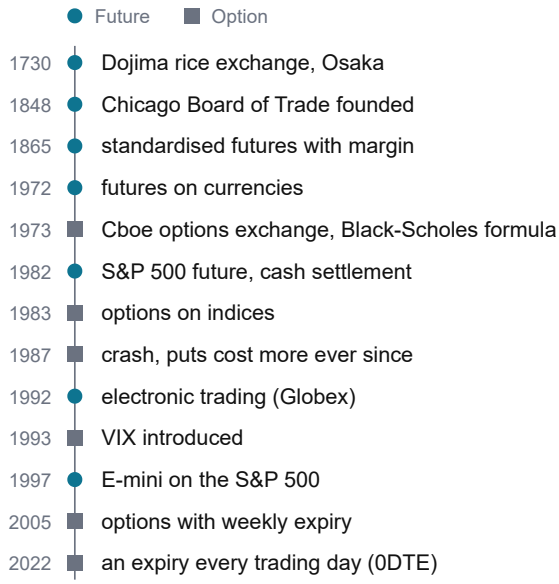


Fig. 1: The stations from sections 2 to 4 in chronological order. Dots stand for the future, squares for the option.

5. From the floor to the computer: who quotes the prices?

For a farmer to be able to sell at any time, someone has to want to buy at any time. On the old exchanges people took on that role: traders on the floor who continuously quoted buying and selling prices for their own account and lived on the small spread in between. This role is called **market maker**, literally: the one who makes the market.

With electronic trading the role moved from people to computers. Today specialised trading firms quote the prices, with programs that adjust their quotes many thousands of times per second. Well-known names are Citadel Securities, Virtu, Jane Street, Optiver, Susquehanna and IMC, plus the trading desks of large banks. They have no opinion on where the market is going. Their business is the spread, many times a day.

Whoever wants to buy or sell immediately and accepts the market maker's price for it is the **market taker**. Chapter 2 shows what this interplay looks like in the order book, what a market maker earns from and what he loses on.

6. Who is in the market today

Six roles are enough to understand the market. One firm can hold several of them.

Role	Who that is	What he wants
Hedger	funds, insurers, pension funds, companies	to get rid of a risk he already has
Investor and speculator	hedge funds, asset managers, private investors	to take a risk because he has a view
Market maker (dealer)	trading firms, banks	to earn the spread, with no view on direction
Arbitrageur	trading firms, banks	to earn from price differences in the same asset
Exchange	CME, Eurex, Cboe	to provide rules, order book and settlement, for a fee
Clearing house	CME Clearing, Eurex Clearing, OCC	to step between all parties and collect collateral

The first two groups bring the orders that move the market. They want something: protection or profit. Market makers and arbitrageurs want nothing of the kind. They react. The market maker takes the other side and tries to offset the risk he has taken on straight away. The arbitrageur makes sure that future, index and option fit together.

This difference is the key to the rest of the series. Whoever wants something trades on his view, and nobody knows that in advance. Whoever only reacts trades by rules that follow from his position. Those rules can be derived.

7. The common thread

One example connects all chapters. A pension fund holds shares worth 35 million USD and wants to protect itself against falling prices for one month.

1. **It buys put options on the S&P 500.** With these it may sell at a fixed price, however far the market falls. What it pays for that and why is shown in chapters 5 and 6.
2. **A market maker sells it the puts.** He now has the risk the pension fund has got rid of: if the market falls, he loses. How strongly his risk reacts to price changes is measured by the Greeks in chapter 7.
3. **He offsets the risk by selling futures on the S&P 500.** If the market falls further, he has to sell even more. This mechanism is the subject of chapter 8.
4. **The future is tied to the index.** If it deviates too far, arbitrageurs step in and trade the future against the shares. Why this works is shown in chapter 4.
5. **Each of these orders lands in an order book,** in which other market makers quote prices. How far an order moves the price depends on how much is resting there at that moment. That is what chapters 2 and 3 are about.
6. **From the positions of all dealers together** comes an estimate of whether their offsetting trades tend to dampen or amplify moves. That is the gamma exposure (GEX) in chapter 9.
7. **Whether this shows up in real prices** is checked in chapter 10 against our own measurements.

A pension fund's wish for protection thus turns, over four stations, into selling pressure in the index. Nobody in this chain has expressed a view on the market, except the pension fund itself.

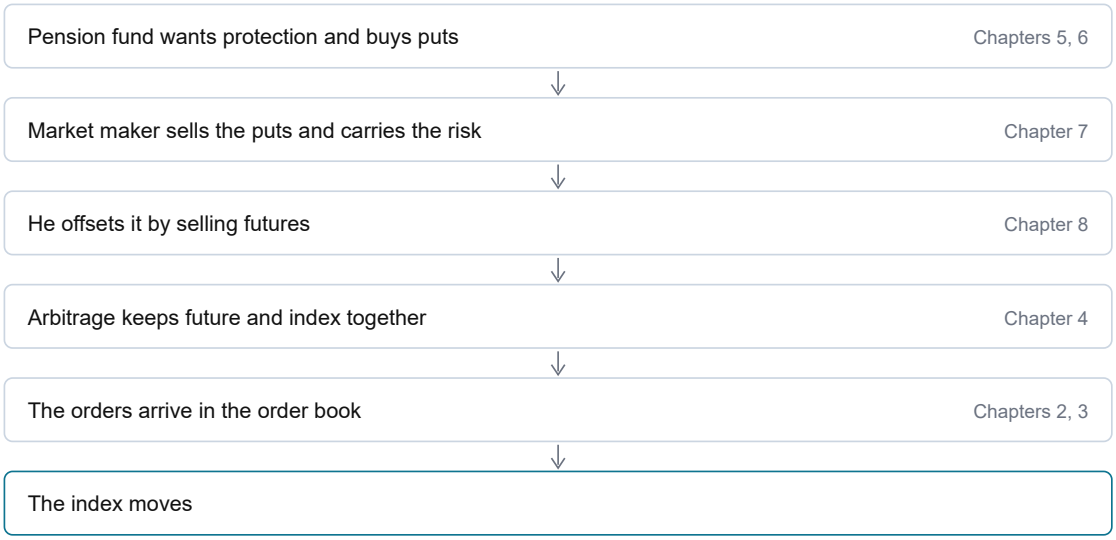


Fig. 2: The chain from the example. Each station is a chapter of this series.

Common misconception

Common misconception: "Futures and options are betting slips with no connection to the real economy." Both came about as hedges: the future for farmers and millers, the option as insurance on a price. This use carries the market to this day. The other half of the sentence is right: whoever trades without a risk to hedge is playing a zero-sum game. What one wins, another loses, and after fees the sum is negative.

What you should understand now

- A forward transaction fixes today the price for later. The future is its standardised form, with margin and a clearing house.
- Since 1982 there have been futures on stock indices. Nothing is delivered, settlement is in money.
- An option is a right without an obligation, that is, insurance on a price. Exchange-traded and with a pricing formula it has existed since 1973.
- The market has participants who want something (hedgers, investors) and participants who react (market makers, arbitrageurs). The behaviour of the second group can be derived.
- The chain of hedging, option, market maker, future and order book connects all chapters of this series.

Limits of this account

- **Shortened history.** Forward transactions existed long before 1730, for instance in the grain trade of antiquity and on the Amsterdam exchange of the 17th century. Only the stations that lead to today's market are named.
- **Simplified roles.** A bank is often hedger, market maker and investor at once. The roles describe activities, not firms.
- **Not covered:** interest-rate and commodity derivatives, swaps and over-the-counter trading. The series stays with futures and options on stock indices.

Continue with chapter 2: how a price forms in the order book and what market makers and market takers do there.

An explanation of market mechanics with worked examples. Not investment advice and not a trading recommendation. Trading futures and options involves the risk of loss up to and beyond the capital employed.