WRITING OPTIONS ON FUTURES

Élie Ayache remembers the first options contracts traded through the Matif in Paris in the 1980s.

If we take the Black-Scholes-Merton (BSM) model for pricing options seriously, the market for options should not exist. All traders know this, yet they keep trading anyway.

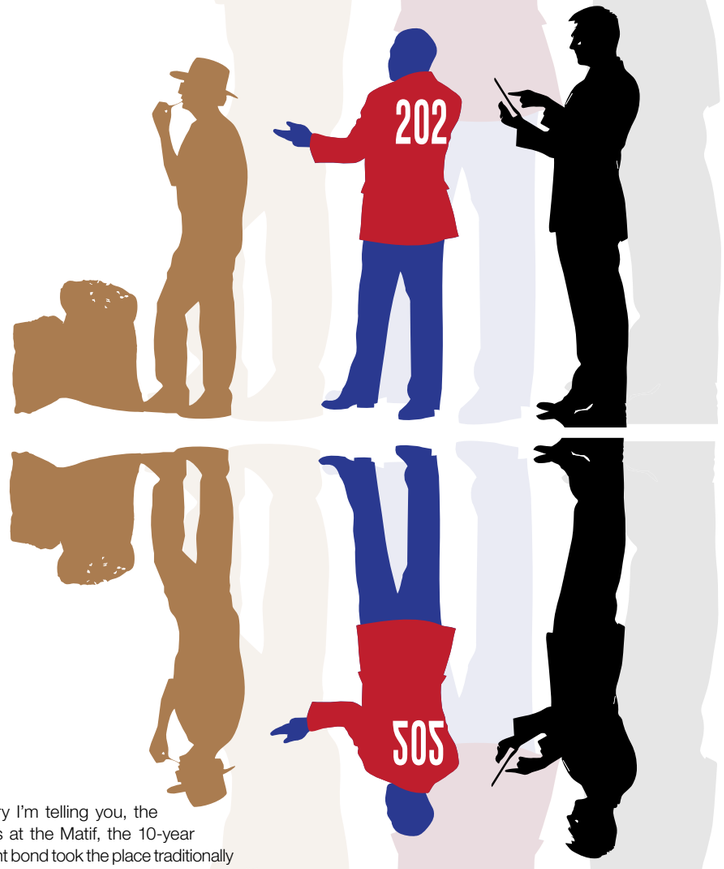
An option is a contract that gives its holder the right but not the obligation to buy or sell an asset at a certain price, up to a certain date we call a maturity. In the 1980s, the BSM model became the paradigmatic theory for valuing options because it was the first to establish a one-to-one relation between the price of the asset and the price that should in theory be charged for the option.

Despite the clear valuation prescription written into BSM, however, every day around the world, vast numbers of options trade at prices that vary independently of the underlying asset. This means that by using BSM as a tool for trading options in options markets, traders end up stepping outside the formal conditions defined by the model. This is a perplexing situation for a mathematician, scientist or anyone who believes that formal theory should always have the last word.

I became an options trader on the Matif's first options desk after studying maths and physics at École Polytechnique, a school of engineering known in France by its nickname "X". The person who hired me was Maroun Eddé, who is now the CEO of Murex, one of the biggest financial software companies. Eddé graduated from X just a year ahead of me and was among the first people in Paris to understand BSM. To apply the model we used a *tableur*, a spreadsheet in a program called Symphony, which he programmed himself when he started the desk in 1986.

Our team specialized in trading on options on the futures of the 10-year French government bond. This might sound complicated at first, but with a little patience I hope that even non-traders can understand why this was our first application of BSM and why it worked.

Like an option, a futures contract is a kind of derivative, but the simplest form. With futures, two parties agree to exchange an underlying asset, like wheat or pork belly, at a certain maturity for a certain price. The futures contract is an obligation. To trade the futures today, is to negotiate and agree to a future delivery price in advance.

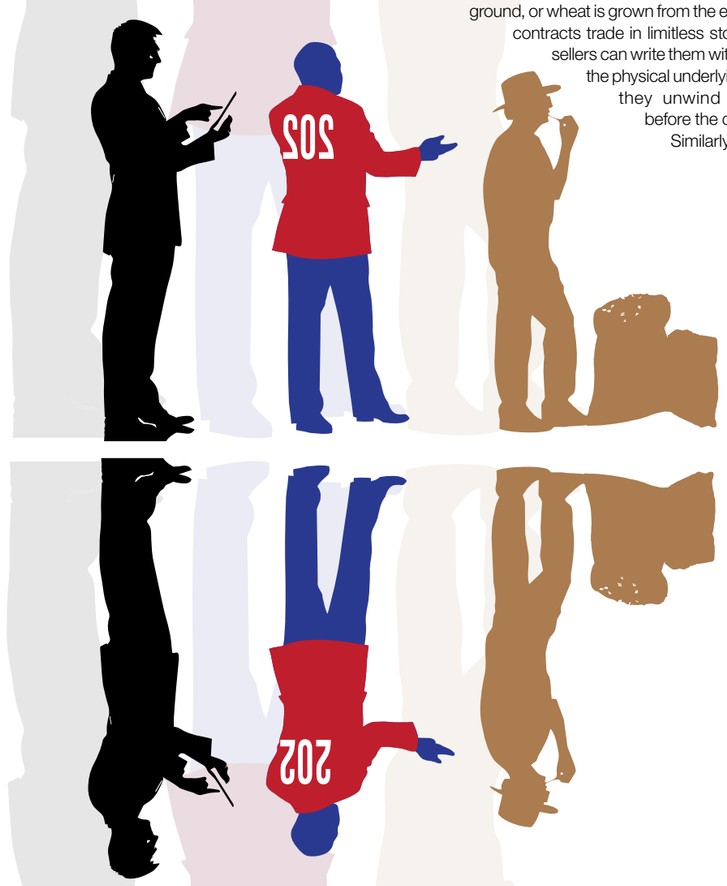


In the story I'm telling you, the first trades at the Matif, the 10-year government bond took the place traditionally occupied by industrial and agricultural commodities; government debt replaced the wheat and pork as the physical goods upon which futures contracts were written.

Before the delivery date arrives on a futures contract it can be bought and sold. In other words, the contractual obligation to receive the underlying can change hands any number of times without the physical asset or government debt moving an inch. This means that futures have their own, constantly moving price.

Now, because there is no physical aspect to the futures contract as a tradable object, when it trades, price itself becomes the commodity. Anyone who buys or sells the future with the intention of unwinding their position before the physical delivery date is only pursuing the movement of price. They buy because they think the price of the future will go up or they sell because they think it will go down. There is no intention to keep the obligation to receive wheat, pork or bonds.

The options on futures my team and I created in the 1980s, recognized that the volatility of price could be transformed into a commodity, because volatility is precisely what options markets help make tradable. Engaging in this kind of a market is a play on the market's own movement. The market starts to reflect itself, in what may rightly be called speculation. This definition of speculation is intrinsic to the logic of free markets, where nothing is supposed to tell the market where to go except the market itself.



The great novelty of BSM lies in how it hedges the option to protect against the unpredictable movement of the market. When options market-makers buy or sell calls and puts for options to clients on demand, they need to do something called dynamic hedging or dynamic replication. At the heart of the pricing model is an algorithm that instructs the options trader to buy or to sell a precise proportion of the underlying, and to dynamically alter that proportion as the maturity of the option approaches and the underlying price varies. The trader's objective is to replicate the exact payoff of the option and suffer no losses.

For this process of dynamic hedging to work, the underlying of the option must be very liquid. This is why we used futures contracts as an underlying for our first options at the Matif.

Futures are remarkably liquid because they are a kind of abstractions, they are not extracted from the physical world the way that metal is mined from the ground, or wheat is grown from the earth. Futures contracts trade in limitless stock because sellers can write them without owning the physical underlying, provided they unwind their trade before the delivery date. Similarly, buyers can write them without the intention ultimately of owning the physical underlying.

Since we were interested in the variability of the price as a commodity, not the physical nature of the commodity itself, a futures contract could serve as an ideal underlying for our first options.

If you follow this story, you will understand why there is no limit on the variety of derivatives that can be created, and how traders are continuously writing and finding new ways of writing them.

When we wrote these options on futures for the first time at the Matif, we were introducing a layer of complexity to the financial edifice. We took a futures contract that was trading independently of its own underlying as our liquid underlying in a second round of derivation.

In theory, you can use BSM to value the option as long as you know the volatility of any liquid underlying. According to the formula, the option value it will project is a deterministic function of the underlying price. Now, if we assuming the price of the underlying changes stochastically, the BSM theory says the option value will follow that price deterministically, and will have no variability of its own. Yet options are meant to trade in their own market. And when they trade, their prices will vary independently of the price of the underlying. So there are two moving prices in the world, not two deterministically connected prices as the BSM model foretold.

The irony is that although BSM does not allow for a market for options, by allowing options to be priced, it has been a major booster in the growth of options markets. You can write a compound option on top of a liquid option which you treat as an underlying. And this compound option can in turn be valued by arguments similar to BSM and end up trading independently in its own market following the same step outside the model.

Options upon futures, derivations upon derivatives. This is the source of the market's complexity, which is potentially infinite.

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