



Brian Sentance

Not Right but Good

Brian Sentance speaks to Yuval Millo about derivatives pricing, social sciences, and how the model became the market

Performativity, according to John Longshaw Austin, is an utterance that performs an act. In economics, performativity refers to the interplay between theories of the economy and the economy. In the words of Michael Callon, the economy is performed by economic practices. In the broader sense of the term, economics performs, shapes, and formats the economy, rather than passively observing how it functions. Yuval Millo, a researcher and lecturer in accounting at the London School of Economics and Political Science (LSE) suggests that the adoption of the Black-Scholes model represents a strong example of performativity in economics.

In 2003, Millo published a paper with Donald MacKenzie from the University of Edinburgh entitled *Constructing a Market, Performing Theory: The Historical Sociology of a Financial Derivatives Exchange*, which describes the success of options-pricing theories, particularly the Black-Scholes model as a risk management and trading tool, and evaluates the phenomena it created. “Donald Mackenzie was my Ph.D. supervisor when we worked together in Edinburgh. Donald comes more from sociology, and I used ideas more from economics, so we joined forces to write the papers on performativity,” says Millo. It is this paper and Millo’s Ph.D. thesis on the evolution of the financial derivatives market that contributed to the emerging field of social studies of finance (SSF).

Studying the Black-Scholes model, Millo

realized that successful models did not necessarily produce accurate results. His interest in the reasons why particular models boom resulted in his 2009 paper *The Usefulness of Inaccurate Models: Towards an Understanding of the Emergence of Financial Risk Management*. This paper provides insight on the technical aspects of performativity, revealing the significant impact of risk management methodology in decision making, regardless of its inability to produce accurate results.

“This paper looks at the mechanics of performativity and tries to answer the question, how do people come to trust something? How did people come to trust the Black-Scholes model, albeit its inaccurate results?” Millo explains.

He saw that the success of the Black-Scholes model did not lie with its ability to generate accurate results. Also, participants who accepted the need for a pricing model did not assume that the model was correct. Millo wanted to make sense out of the model’s success, despite its inaccuracy.

“When I started studying the Black-Scholes model, I realized that the formula was not accurate to begin with but, curiously, it *became* accurate and it affected the market. People started trading and using Black-Scholes as a risk management tool and trading tool and it affected the fields that they were trying to describe and performativity – it performed the market,” says Millo.

The displacement of individual market makers and small firms by larger markets starting in 1977 increased complexities. To take a position on an entire industrial sector, options of a given stock need to be traded across several markets. Millo believes that the Black-Scholes model reduced the complexity of geographically distributed portfolios, and that it is the Black-Scholes model’s accessibility and its ability to generate a simple common metric that solved the quandary.

“When I studied the Black-Scholes model,” says Millo, “I also looked at other models at that time – Black-Scholes was not the only one. There were models that were fairly close to that – Kassouf’s model, for example – that were ‘beating around the bush’, in some sense. The Black-Scholes model came from academia, unlike others who worked on similar models, around the same line, but chose to keep them secret; Black-Scholes was readily and freely available. There was no proprietary knowledge and the paper was published in an academic journal, which was a big advantage [to the model’s ease of adoption].”

Millo further comments on the recent furor over Black-Scholes, particularly the views of Nassim Taleb. “It is not only the history of ideas that matters; it is the history of your ideas being converged into working systems. If you come up with a nice theory, but people don’t pick up the theory into their computers and start trading according to that, this means you didn’t really affect the market and it didn’t become an interesting model.

“Secondly, the Black-Scholes model was based on many assumptions, and some of those are not realistic and are in fact preposterous. For example, one assumption about the construction of a portfolio of stock and cash to replicate an option; that it could be constructed using entirely borrowed funds and/or stock; that it could be adjusted instantaneously; and that its construction and adjustment entailed no transaction costs. Because of these assumptions and the fact that the market gradually altered accordingly, this model managed to produce nice numbers – numbers that were very useful for organizations and for people to make decisions. Again, this is one of the main reasons for the rise of VaR: it gives you a number that you can deal with and it gives you at least an illusion of control – ‘Oh, I know what I am dealing

with, even though there is so much uncertainty.’ Sometimes, there is anxiety about making decisions in the market place; you don’t know what’s happening so you need some kind of aid – a communicative organizational aid,” he added.

The apprehension of inaccuracy of the Black–Scholes model did not weaken the market’s dependence on it. Seemingly, the usefulness of the model supersedes its need to be accurate. Although it is realized that the Black–Scholes model is not an accurate measurement of risk, its use fulfilled a number of different needs and maintained significant operational efficiencies. Millo believes that the success of the model-based risk management lies with its ability to tackle a variety of operational, organizational, and political challenges.

People were ignorant to the model’s inaccuracies, relying on it continuously, as it made their lives on the floor easier.

“If you are Morgan Stanley or Goldman Sachs, or an investor of this type, you would have options traded in Chicago and the stocks on which the options are based traded in New York City. You would be sitting in the headquarters somewhere and you would want to set up a trading strategy for the day. So, you would have to buy and sell in New York and buy and sell in Chicago in order to maintain whatever positions you wanted to maintain. Performing a trading strategy in such an environment can be very complicated, as you will need to give different people (your brokers on the floors) different buy and sell orders. What the Black–Scholes model helps to do (as it uses implied volatility) is to provide you with some guideline, ‘Look, today we want to maintain 10 percent annualized volatility according to the implied.’ And that’s it – the traders would just say ‘Ok, how am I standing with the model? Oh, I still have some risk to take on because I’m still at 7, or I’m a 12 – I should buy a few stocks to cover my positions.’ Instead of having the portfolio manager sitting in New York, explicitly giving orders to everyone and basically going crazy because he or she has a thousand positions to look after, he or she will just say, ‘Look, just fold them all – we will use the implied volatility as our guideline here.’ So, it was not used primarily as a risk management

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tool, although it was sold and being trusted as such. But it was used as an operational tool,” explains Millo.

The figures provided by the model not only act as a point of reference against which the market players can work out their own comfort level in terms of margin of accuracy or inaccuracy, but also act as a tool for strategy making.

“It was not like you had an idea and you just wanted to double check the Black–Scholes, and it allowed you to see the market. It was a source – a generator of ideas. It became binoculars, a view finder. It really allowed you to see the market in a different way. It was very useful, even though it was realized that it was not very accurate to begin with and that some elements in the theory behind it were fairly flawed,” Millo says.

He further adds that the role of model-based applications acting as guidelines is linked to social process in the markets.

“There is an ongoing project to find a limited set of simple rules that would govern everything. This is the motivation behind the use of formulas and looking to physical phenomena to try to explain the social systems – this is one movement. The other movement is the one that says, ‘Well, we found science behind it – now let’s move on to engineering.’ Physical sciences have helped engineers build bridges, cars, airplanes. This means that we can actually engineer the market; *we can turn it into a machine rather than a social phenomenon.*”

Millo points out that the physical sciences are all about discovering something that is objectively there – like Brownian motion. Any finding, even the options contract prices of the Black–Scholes model, by some means was discovered from something that is objectively there. Millo believes that one should go one step further and talk more about the *construction* of price using technological

tools, rather than the discovery of it. Looking at it from the social sciences point of view, players’ interactions play a vital role.

“These tools are used in pricing but they are constructed, rather than discovered. When we compare the players of Black–Scholes with the particles of Brownian motion, the latter derives its characteristics from movement of the particles on the surface of a liquid, but there is a fundamental difference between these two. The particles of the Black–Scholes model react consciously.

People analyze their situation, look for the proper formula to use, and play according to these rules – whereas the particles in Brownian motion are not aware of the fact that they have to follow the Brownian rules. People represent a completely different form of dynamics, which then lead to things like performativity,” Millo says.

Crashophobia

Memories of the fall from 1987 haunt the market. Millo explains that the sustained presence of the volatility smile until the 1990s was an effect of a collective trauma.

“Post-1987 was an interesting period. Black–Scholes affected the market to follow it, causing the model to be an excellent fit to observed prices. Subsequently, after the crash, within a few days, people came back to the market; they continued trading options at much smaller volumes for quite a while. Then, they realized gradually that there was this volatility smile. People in fact were paying too much for ‘out of the money’ put options. So, the question is, why does that happen? There is a nice explanation by behavioral finance that says that people still remembered the crash and that it is a behavioral effect. There would be more demand for these way-out-of-the money put options because they

There is a whole stratum of people working in and out of the markets who do not look at the fundamentals, and rely predominantly on what the model tells them, thereby losing their instincts

just want to make sure that if another crash happens, they are protected. So, this is where behavioral finance, in a logical sense, applies.

“We also looked at the organizational or technological explanation, and what we found is that it’s not only people who remember the crash, but that this memory was actually etched into computer programs. The out-of-the-money puts, the margin for them was kept at a very high level – it was at about a 100 percent margin, rather than just calculating it according to a risk model. Basically, it would be more expensive for the traders to hold positions that included such put options because the clearing corporation of options also remembered the collapse and has institutionalized that memory into their rules and into their computer programs.

“Post-1987, performativity did not have the same effect because it is not only people who have been hit or ‘burnt’ once and want to make sure that it doesn’t happen again, but also institutions that have a memory, and institutional memories are longer and more pervasive than people’s memories. This is why you see the smile lasting for many, many years. It lasted up until the late 1990s – research still shows that there was market inefficiency then. People were actually leaving money on the table, and we were really asking why. And we are saying that it is the effect and reaction of the performativity that happened, both at the individual and the organizational levels,” explains Millo.

The outcomes of both crises were similar. The reliance on a formula is due to the convenient number. But it wasn’t the communicative factor of it that affected the decisions. Rather, it was the political factors that skewed things.

Millo illustrates, “Your boss is pressuring you to approve a lot of mortgages, and the numbers provided by a formula help you legitimize your compliance, so you think, ‘Oh well, the formula is not telling me that it is extremely risky, and this formula is crap or I don’t trust the formula, but my boss is pressuring me, and with this number I can hang on to something.’ So, the outcome is similar to what happened in Black-Scholes but the dynamics are slightly different.

“The general, and I think the more important, insight is that we really need to be aware of the fact that physical analogies are very useful but they are very different from what we see in the market. At the end of the day, we see the market as social – it is made up of people. So, we need to be aware of the nature of the process; just looking at it as something that is similar to atoms clashing with each other, or turbulences in water [will not do]. For example, I have a two-year-old. I’m typing on my computer and now he can come and imitate what I’m doing. He’ll be typing on the computer, but of course he won’t be *writing*. So, you may be looking at prices, and those prices have some nice correlations between the price movements and are like Brownian motion, something you can produce from a formula – *but the process is very different*, in the same way that my son is typing; he may look like he’s typing, and my typing looks the same, but it is very different: I’m actually writing words, he is just listening to the noise on the keyboard. So, you have to be aware of the process within markets, which is very much a social process.

“So, this is a specific answer I would make to the question – can we actually see similar processes happening?” says Millo.

Being aware of the process, describing it,

and then trying to control it is part of science. Recognizing this will make some changes to people’s perspective of wanting to control, say, a force of nature. Nevertheless, the application of controlling something as social as markets would remove the major dimension of being an actor in a market – the ability to create something.

The idea of actively being involved in creating something has possibly been lost since the acceptance of Black-Scholes. After Black-Scholes, it became so much easier to distill things down to a particular number, and everything really became numbers, and many people became divorced from the reality underpinning these numbers.

The Black-Scholes model “moves” people away from the real world. There is a whole stratum of people working in and out of the markets who do not look at the fundamentals, and rely predominantly on what the model tells them, thereby losing their instincts. Millo believes everyone realizes that something is happening, yet they keep on sailing in the same direction. It is the trust of the market in models that will affect their choices. The Black-Scholes model works on many levels. It not only gives people accurate predictions, it also helps them to calm their nerves.

The recognition of this social aspect will provide an apt way for social studies of finance to be an aid to decision making in the area of quantitative finance. It is believed that we have reached a point where a critical mass of people recognize the need to move beyond the physical science paradigm and consider the influence of techno-social factors.

Millo explains that the recognition of the techno-social viewpoint in financial risk management by influential individuals in the financial market, such as Emanuel Derman, is evidence for the growing acceptance of techno-social factors. It is the acceptance and trust of many that will act as determinants to the success of theories. “If people like these think that the existing models are not satisfactory, and that they have to look at phenomena such as performativity, how the organizations fit in, how people and machines interact, and distributed cognition, then, yes, I think there has been a change.”