

● ROBERT MERTON & MYRON SCHOLES

Were it not for Robert Merton (right) and Myron Scholes, the multitrillion-dollar derivatives market would likely be a whole lot smaller — if it existed at all. In 1970, Merton teamed up with fellow Massachusetts Institute of Technology Sloan School of Management professor Scholes and the late Fischer Black, then an economist with management consulting firm Arthur D. Little in Boston, to work on a way to value options. The result was the Black-Scholes option pricing model, which traders on the then-newly formed Chicago Board Options Exchange began using soon after it was published in May 1973. Black died in 1995 and so did not share in the Nobel Prize awarded Merton and Scholes in 1997. In addition to their academic pursuits, both Merton, 62, and Scholes, 65, have spent time in the private sector, most notably as partners with former Salomon Brothers vice chairman John Menwether at the failed hedge fund Long-Term Capital Management, which lost \$4.6 billion in 1998.

Photographed by Marvi Laca, February 28, 2007, in Rye Brook, New York



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Theory & Practice

The Nobel laureates chat about the importance of spending time in both the ivory tower and the private sector — and the unintended consequences that can result.

Myron Scholes: Let me start, and Bob will correct me. I believe that being able to produce good theory requires that you have experience or enjoy experience. Experience alone may not produce great results, and theory alone may not produce great results, but when you combine the two, I think you have a richer outcome.

Robert Merton: Experience is very important. I traded in the markets from the time I was a teenager. I thought I knew what I was doing, although I didn't, but the experience of doing that helped me immensely in providing the confidence about what abstractions to make when doing theoretical work or designing models.

Scholes: The world is our laboratory. But basically, it gives you a lot of information, and the information set is very diffuse.

Merton: When I first met Myron, he and Fischer Black were working on option pricing models. From my perspective, the important insight they had was that they could do a dynamic trading strategy — in a stock, an option and a riskless cash asset — in such a way as to hedge out the systematic risk of the option to create a zero-beta portfolio that could be priced by the Capital Asset Pricing Model. At first, I thought this couldn't work because it seemed like they were trying to hedge out the nonlinear payoff on the option using a linear trading strategy in the stock. However, I quickly changed my mind.

I had been working separately on dynamic portfolio theory and how to model portfolio strategies in a context of continuous trading in continuous time. I found that modeling mathematics made it possible to represent the outcomes — not just their expectations, but their sample paths.

Applying this tool to their trading strategy, I was able to show that when you can trade very frequently, you could actually eliminate all the risk of their hedged portfolio — not just its systematic risk, but its total risk — and that the option could be priced by simply ruling out arbitrage opportunities. So in some respects it was a more robust derivation — although Fischer disagreed — because it showed that their pricing formula didn't depend on assuming a particular equilibrium model, in this case the Capital Asset Pricing Model.

Scholes: One of the great things about science is sometimes you have something so different that people think it has to be wrong, especially when you have young professors who are doing it. That was one reason, I think, that it took so long for Fischer and me to get our paper published.

Another reason was that people thought it was maybe too arcane. So we had to rewrite the paper to show where the general applicability was, as opposed to the specific insights that we had with regard to the formula.

Merton: The other thing to point out is that their paper was published in the *Journal of Political Economy*, which is one of the most prestigious general economic journals. Today, six Nobel Prizes later, finance is seen as a very vibrant part of the general field of economics. But at that time, there was a pretty substantial chasm between finance, which was largely thought of as living in business schools, and what would be thought of as general economics.

Scholes: It's fascinating to me that when they started trading options on the Chicago Board Options Exchange, the first risk management models, which were built in 1973, were as good as or probably in line with the models that are currently used by the banks to measure things such as value at risk. But the models were built not because a government regulator said to but because this was the only way that the bankers who financed the floor traders could monitor them. They used Black-Scholes at the time to actually measure the various risks that their traders had.

Merton: It begins there, with Black-Scholes, but it carries through to today. If you look at finance as a field, particularly as a branch of economics, it's the only area where, when I say I have a model, it's a model of what should happen or what is expected to happen. And the model has an error term. It shouldn't be there, but since no model is complete, you always have an error.

In a certain way, finance is all about the error term. If there were no uncertainty, finance would be a very boring field; you could teach the whole course in an afternoon — it's the time value of money.

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Scholes: We were always very well accepted among our peers in the finance world and in the practitioner world of finance because of the technology itself and how valuable it is for running businesses and pricing. But when you receive the Nobel Prize, then you have more of a general following. It's a wonderful recognition. Both of us — and we've said this many times — wished that Fischer Black were alive and could have received the prize as well.

Merton: Well, I echo what Myron said. I do think we had — relative to many who received a Nobel, particularly in other fields — much more of a platform for getting our ideas heard and understood. And as

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a practical matter, it does pretty much open the door to meeting or seeing anyone that you want. But that makes it sound so pragmatic, and really it's just a singular honor. I just don't think there's anything comparable to it.

Scholes: I think in terms of Long-Term Capital, things in the press got magnified because of the Nobel. It gets to be disproportionately out of context because of different choices that were made at the time. Well, obviously, we didn't want investors to lose money. But I feel my career and everything else that I've accomplished in the profession stands on its own.

Merton: While it sounds like a sensible exercise, you really can't separate out all the things that you did. You don't have the choice to go back and say, "Oh, I wish this hadn't happened, but I wanted everything else to happen." If you move one thing, you change everything. So if you're asking us whether there was some new scientific insight or principle that was a consequence of the failure of Long-Term Capital, then I would say no. I think I learned a lot of things from it, but I don't think that there was some grand new insight that came from this that needs to be shared with the world.

We all know the crisis occurred. Now, after the fact, you can say, "Oh, yes, it's obvious, you should have done this or that." But I think that's the nature of crises. We know crises will occur, but by their definition they're outside of your anticipation.

Scholes: Obviously, you reflect on the experience and think about the general way in which you approach things. I guess I've spent more time trying to address the idea of crises and how to respond and what the implications of crises are for society and for finance. The experience reoriented my thinking to some extent about the questions you can ask in advance and how to respond afterward. Do you wait until something happens, or are there things you can do beforehand that can mitigate the effects of a crisis?

Merton: In many ways, being an academic and a practitioner have a lot in common. Both are stressful, but they're also both very exciting and potentially rewarding. I would characterize the people who are doing academic research at schools like the University of Chicago, Stanford, Harvard and MIT as entrepreneurs. Their jobs are all-encompassing; they work weekends. The things that Myron and I have always done have been very much in the entrepreneurial sphere.

Scholes: Well, I have one expression, which I developed when I worked at Salomon Brothers in the early 1990s and someone asked me, "What's the difference between being a practitioner and being an academic?" I would say, "Well, being a practitioner is dog eat dog. Being an academic is exactly the opposite."

Merton: I like that one.

— *Interviewed by Michael Peltz*

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