Speech in Honor of Robert C. Merton

1999 Mathematical Finance Day Lifetime Achievement Award

by

Robert A. Jarrow

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Good afternoon. I can't seem to find the chalk and the blackboard. I guess the organizers were really serious when they said no equations!

Welcome to this historic occasion. It is an honor and a privilege for me to speak in tribute to Bob Merton. Bob is a great scholar, an outstanding teacher, and a good person. I am proud to be one of his students.

Bob has had a profound impact on finance, economics, and the financial industry. Arguably, the Black-Merton-Scholes option pricing theory has been the most important and influential economic theory in the history of modern economics. Perhaps this is just one of his students boasting, but I don't think so. Neither did the 1997 Nobel Prize committee.

Today, rather than talking about his influence on the more general areas of economics and finance, I will restrict my comments to Bob's influence on only a subset. The subset relating to mathematical finance.

I consider Bob the father of mathematical finance. Some might argue that a better choice would be Louis Bachelier (excuse my French) or Paul Samuelson, but I would disagree. I would say that they are the great grandfather and grandfather, respectively. Although their influence on mathematical finance has been substantial, Bob invented continuous-time finance. And, continuous-time finance is the heart of mathematical finance.

Bob introduced both continuous-time stochastic calculus and optimal control theory to finance. Before his work, no one in the finance profession knew what Ito's lemma was, or for that matter, even cared! Today, countless numbers of finance professors, industry practitioners, and even MBAs can tell you what Ito's lemma is. If you think about it, that's an incredible fact!

Bob applied these new mathematical tools to two areas within finance: consumption-investment theory and derivatives pricing.

In consumption-investment theory, among his many contributions, he derived the intertemporal Capital Asset Pricing Model, or the intertemporal CAPM for short. This extension of the static CAPM made two important contributions. One, it explained how the CAPM can hold in a dynamic setting, the one we live in. Two, it made the model rich enough to be consistent with the evidence, that is, the existence of multiple risk factors – not just one. In sum, it made the CAPM empirically useful.

In derivatives pricing, among his many contributions, he helped create the Black-Merton-Scholes option pricing model. His unique contribution in this regard was the discovery of a perfectly hedged portfolio involving the stock and an option that determines the option's price – and, using only the absence of arbitrage. Alternatively stated, he discovered how to construct a synthetic call option using a dynamic portfolio in the stock and riskless borrowing. Therefore, to avoid arbitrage, the initial cost of constructing this synthetic call must match the price of the traded call. Such a simple, but powerful insight this is! Its simplicity is its strength. Simplicity implies robustness and durability. It implies a fundamental insight, which is what the Merton hedging argument is.

What makes both of these contributions and many of his others so important for mathematical finance, emphasis on mathematical, is that they satisfied two conditions:

One – the use of non-trivial mathematics was essential in their development, and

Two – the discoveries worked in practice!

Let me repeat this. It wasn't just an abstract "ivory tower" theory, useful only for academics. It was theory that could be applied in practice to make profits – the bottom line!

Indeed, the intertemporal CAPM is the intellectual foundation for a vast industry in portfolio management, and the Black-Merton-Scholes option pricing argument is the intellectual foundation for a vast derivatives industry. These two industries represent the modern world of finance.

To my knowledge, nowhere else in business is the flow of ideas between industry and academics as fluid as it is in mathematical finance. A manifestation of this that impacts us, the academics in the audience, is that the financial industry has become a sink for PhD's in finance over the past 10 years. In fact, as a side effect, for many mathematicians and physicists as well! This is a tribute to the power of the techniques, and the original insights of a young professor at M.I.T., Bob Merton, who first used them.

Although most of Bob's accomplishments can be discussed by anyone in finance, there is one side to which only a few of us can speak. That is his brilliance as a mentor. I can't leave this podium without praising his accomplishments in this regard. I will do so by telling you a story about myself, and how Bob changed my life for the better. For that, I will be always thankful. And, it's not that he signed my thesis, although I am glad for that as well!

The story - when I came to M.I.T. as a finance PhD in the late 70s, I entered youthful and arrogant. At least one of these two characteristics I know I've lost! At that time, I didn't take mathematical finance seriously. Don't misunderstand me. I always felt that it was an honorable area of scholarship. But, I viewed mathematical finance as an "Ivory tower" game. This game was simple: learn some facts and create and prove theorems. It was all abstract, or so I thought, and of little practical use.

One of the first classes I took, in the first semester of my first year, was Bob's 15-415 class on portfolio theory. In fact, I still have those notes. That's one asset of mine that has increased in value! We can have an auction of these notes after the presentation for sale at the highest bid price!

He was lecturing from his notes, sitting in the front of the class (as was his practice), talking about utility theory. I had seen this material before as an undergraduate. Of all the topics in finance, I thought utility theory was the epitome of abstraction.

What was different this time was Bob. Unlike my previous professors, he conveyed the intrinsic importance and realism of the subject. He did this by showing that he, himself, truly believed that utility theory could explain human economic behavior.

Seeing this changed me. Somehow, after that lecture, mathematical finance was no longer a game for me. My research tastes and directions were determined by this singular experience.

This is my story, but I know his other students have had similar experiences as well. This story illustrates how unique a mentor Bob Merton is. He teaches by his actions, not just his words. He has been a role model for me and others for many years.

His influence on mathematical finance, the financial industry and society at large has been no less profound.

To Bob, I say congratulations! The lifetime achievement award in mathematical finance is well deserved.

[I now invite President Jon Westling to present Bob the "1999 Mathematical Finance Day Lifetime Achievement Award"]