

Subject: 4/02/2008 MIT Technology Review: On Markets and Complexity



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MIT Technology Review
On Markets and Complexity

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Robert C. Merton, currently the John and Natty McArthur University Professor at Harvard Business School, shares the 1997 Nobel Prize in economics for his work on the Black-Scholes model for determining the value of a stock option--work that led to the creation of options and futures markets in the early 1970s, and thus to a revolution in financial markets around the world. Merton has also seen firsthand what a modern market crisis looks like: he was a founder of Long Term Capital Management, a hedge fund that saw enormous success followed by enormous losses in the mid-1990s, and which became a symbol of the limits of financial engineering.

Today's financial crisis is often blamed on a system so complex as to be beyond the comprehension of even its practitioners. (See "The Blow-Up.") We asked Merton what he thinks of complexity--and whether he thinks markets have too much of it.

Technology Review: Is it fair to say that the current financial system is too risky?

Robert Merton: Let me give you this analogy. If you're driving in inclement weather, you'd say that a four-wheel-drive car is safer than a two-wheel-drive car. Now suppose that we observed that over the last 15 years, the number of passenger accidents per passenger mile driven hadn't changed at all. And someone says, Now wait a minute: Has four-wheel drive made us safer? And the answer would be, Technically, no, because we're having just the same number of accidents we used to have. So, was this all a waste, or were we wrong? I think you know the answer, as I do. What really happened is that people get something that will unambiguously make you safer if you behave the same way you did before. That's the key element to understand first. The amount of risk we take personally, individually, or collectively is not a physical given constant. We choose it. What happens is, we look at some new, safer instrument and we say, Yes, we could be safer doing the same thing. Or, we could take the same amount of risk and do things that were too risky to do before. So with a four-wheel-drive car, you look

out the window and see six inches of snow, and you say, That's okay: I'm going to go over and visit my family. So the question to ask is not, Are we safer? The question to ask is, Are we better off?

TR: So do we have a better financial system than we did 10 years ago?

RM: Unambiguously. For example, I believe the people at almost every central bank are far more knowledgeable about the various financial markets than they were 10 years ago. Also, in general, we know how to measure and manage risk better than we did 10 years ago. And I think there's more transparency than there was 10 years ago, in the following sense: One of the big areas with the current crisis is in credit. Bank loans are the prototypical, classic credit of the past. Bank loans were not repriced, like a mutual fund, due to market conditions. So when a crisis came, they were very opaque. There were loans sitting in these banks that had been sitting there for years, and nobody really knew what they were, and when a crisis came, all they know was that they were worth less. That's not transparency--that's opaqueness. Today, we have a credit-default swap market. On a daily basis, that market prices what sophisticated institutions were really willing to pay to guarantee the credit of probably 500 to 700 companies and virtually every sovereign country in the world. You can see that price every day. That's a very big increase in transparency. Also, we have much more global diversification of risk. And look at mortgages. If you go back to the 1980s, virtually all mortgages were originated through thrift institutions. Today, you have a national mortgage market. Even in these tough times, mortgage money is available. It's not that there aren't problems, but as a technological matter and as an operating matter, those are all the pluses.

TR: So why aren't we safer?

RM: You have to ask, What have we done with all of these improvements? We've gone to much greater complexity. We have many more instruments. Firms and individuals have been more willing to cut back on their equity cushions and leverage more. To go back to our car analogy, we're more willing to drive faster because of the better tools at our disposal and great transparency.

TR: So where does complexity come into all this?

RM: Sometimes the term "complex" is used as a euphemism for "less-well understood." People sometimes say, "Things have gotten more complex," but what they're really saying is, "I understand things less well."

TR: But in your time, have things gotten a lot more complex?

RM: Yes, they have. Let me give you an extreme example. For certain very specialized hedge funds that do what's called very high frequency trading, the location of the outsider's server and the exchange's server matters.

TR: It's that tight.

RM: Yes--speed of light. So in fact one of the exchanges used to delay just slightly the information going out from the East Coast to allow a little more parity for those on the West Coast. Today, they rent or auction space for people to put their servers near the exchange server, so the speed of time between exchanges is reduced by that metric. And the number of trades that get offered in this thing is vastly greater than the number of trades that actually get done. So the volume of activity is orders of magnitude greater than the number of trades you would record as the actual volume. The reason I'm taking you into all this is to say that there is no one who can sit and watch those trades directly and apply anything to them. So what do we do? We build computer programs to extend our human skill, and we try to audit what's going on, but at the end of the day, the computers do the trading. Yes, there can be a dysfunctional aspect to that, but it's not as if people are setting things on their computers and then going to the Bahamas.

TR: So do you not think that the complexity of what the quants are building is a problem?

RM: There's no question it can have dysfunctional aspects. Anything we do can have a dysfunctional side effect. That doesn't mean that, net, it's not worth doing. Of course, when you have this speed of transactions and executions going on, there can be times, because they are driven by a computer, that if something happens that is not understood, the programs are going to end up continuing to try to trade, and that can affect markets. But that's not prima facie saying it's out of control--that these people don't know what they're doing, or that it was better before. Things used to get out of control without computers.

TR: So how do you think about technology generally, as it affects the functioning of markets?

RM: Well, first of all, it's very important to it. Second--and I say this a bit tongue in cheek--the people who are in the chip business ought to be very, very happy. If anyone worries about whether, with the advance of Moore's Law, we'll get to the point where computing is so excessively fast that we don't need anything faster: any time we think we get there, at least in the financial applications, all we have to do is add one more variable in our equations we want to solve, and you move yourself to the frontier of computing. But that's just an aside. Technology is a huge thing. If you look at the costs of transferring risk around the world, it's just remarkable what technology has done. That's the good side. The bad side is that things are--much more complex and much faster. Does that say it's riskier than before? No.

TR: So what do you make of the current crisis?

RM: Anything I or anyone else tells you about it has got to be speculation, because the pathology hasn't been done. We really don't have all the data, and so very good stories we come up with now may not turn out to be the accurate explanation. And certainly I don't have the access that many other people who are in this have. But I would point out a couple of things that are structural that fit this. You'll hear in this case as in the past, "Look at all this financial innovation or financial engineering--it's caused too much complexity, and now the system has run off the tracks." To that I would say, structurally, one would expect that in the case of a successful innovation, the infrastructure to support it properly will lag behind. Why is that? It's because if you have 100 innovations, maybe 2 of them will be successful. So it is not practical to build a full infrastructure--regulatory, educational, et cetera--for all 100 innovations. Innovations are going to run ahead of the infrastructure. That, we have to recognize, is structural. It's not about bad people, it's not about incompetent people, it's not about greedy people. It's not about having a market system or a nonmarket system. Whether the problems are addressed by external regulation or a combination of that along with internal regulation--whatever set of ways, we have to be prepared when innovations come in to have some degree of oversight modulation. If you do too much of that and you stifle innovation, that's not good. If you do none at all, that's not good either. So there's something in between. Sometimes we don't do enough of it, or the growth of innovation is too quick, but the point is that there is a reason why you will typically find that financial crises are often connected with what are perceived as new things, big changes--innovations.

TR: Okay. So when you overhear people say, "The market is more complex today," what do you most want to tell them?

RM: Yes, the markets are more complex today than they were five or ten years ago. On the whole, I believe that complexity is a reflection on improvements in the system that made possible greater complexity within an acceptable risk range. The benefits came from performing the functions of the financial system either more efficiently or [from] performing more of them. That said, complexity also raises the specter of risks that can cause a crisis in which you don't fully understand what's happening, because you're in a new environment where the structures are different from what they were ten years ago. There's a psychological reason for that. We tend to be much more comfortable doing something familiar than we are with doing something new, even if the risk is the same in both cases. I'm not saying that bad things haven't happened. But if you take a horizon of, say, ten years, on the whole, the system is structurally better, but we probably have had a mismatch between the infrastructural growth and the growth of the innovations such that we find ourselves in a situation that is very costly and expensive and unnerving.

TR: Back in 1973, when you had enhanced the Black-Scholes model for the pricing of a stock option, did you have any idea about the growth of complexity that was going to unleash?

RM: Well, I couldn't have anticipated the enormous growth. But we did recognize, even back then, that its applicability went far beyond options. Also, it was coincident with the 1970s, when the world got turned upside down. You had the breakdown of Bretton Woods [the international agreement, set up in 1944, that created rules and institutions for international trade, and which pegged currencies to gold], so you suddenly had all these currencies floating; you had interest rates in double digits in the United States, which probably hadn't been seen since the Civil War; you had inflation rates in double digits; you had the stock market between 1973 and the end of 1974 fall by 50 percent, which was a greater fall than had been seen since the Great Depression; and you had the oil shocks. All of this created a high need for the development of risk sharing. So the futures market and the options market were all created back then. It was a response to need. It wasn't about capability, it was about need. You can have all the technology in the world, you can have all the great models in the world, and if there isn't a perceived need, it doesn't get adopted.