A conversation between David and Bob

David Booth, founder and Co-CEO of Dimensional, sat down recently with **Robert Merton,** professor at the MIT Sloan School of Management, to discuss Merton's illustrious career as an academic and practitioner and his involvement with Dimensional.

WHAT FOLLOWS ARE EXCERPTS FROM THEIR CONVERSATION.

An Early Love for Finance and Some Good Fortune

David Booth: We often ask ourselves around here, "How have we been able to attract these great academics and keep them around?" It's about the power of ideas and putting those ideas to work to solve real challenges. In recent years, I've sat down with some of the key people in finance who have been involved in our firm to talk about how we got here and the opportunity ahead. And, Bob, you're definitely one of the leading thinkers.

Robert Merton: Thank you, David.

DB: Why don't we get started at the beginning. I know your dad was a well-known academic in his own right. What was it like growing up?

RM: Well, I grew up in a small river town up from New York City. It was a special town, middle-working class. I had the great good fortune in that my parents gave me many things. My father was a very eminent scholar at Columbia and my mother was a very well-educated person who gave me good, wise advice. I had two sisters, 25 cats, you know, the usual normal childhood.

What was maybe a little bit different is that I had a love of financial-type things from an early age. I used to go to brokerage houses as a kid. I didn't have any money, and they thought it was kind of cute that this kid was showing up at the board room to watch the tape. At that time, there were no Quotrons or anything else, just the tape. Some kids learn batting averages. I knew all the ticker symbols. So that's an early connection to where I eventually ended up, which I didn't know I would at the time.

DB: You got your undergraduate degree in engineering mathematics from Columbia in 1966, a masters in applied mathematics from California Institute of Technology the following year, and then all of a sudden you're in the PhD program in economics at MIT? That must have been an incredible experience, not only because you're shifting fields of study to economics, but the people and the time at MIT in the late 1960s must have been just mind-blowing for a young student.

RM: Oh yes, you know, it's always better to be lucky than smart. And no matter what people tell you, in order to have any success you have to have some good luck. And boy did I have it. I showed up at MIT, I didn't know any economics, and the graduate officer looks at me and says, "Go down and take Paul Samuelson's mathematical economics course." I said, "That's a second year course. This is one of the most famous economists of the 20th century. I haven't had a course in economics yet. Don't you think I ought to have a warm-up?" "No, go do it." That was an incredible piece of advice.

So I'm taking Samuelson's course, and he was terrific—I mean he published, I don't know, probably 700 scientific papers and eight books. He had such an incredible mind and was incredibly efficient, but he would write this stuff on little yellow sheets of paper. And one day he came to me, a grad student, and he said, "I've written this on optimal growth theory using Hamiltonian mathematics. Would you mind taking a look at it and checking the math?" So, of course, what am I going to say?

QUOTRON *was the first company to deliver up-to-the-minute stock market data in 1960. Prior to Quotron, brokers and money managers relied on paper ticker tape, which at the time had a delay of 15 to 30 minutes in transmitting rapidly moving market data.*

PAUL SAMUELSON *is considered one of the most influential economists of the 20th century. The author of the all-time best-selling economics textbook,* Economics: An Introductory Analysis, *Samuelson was the first American to be awarded the Nobel Prize in Economic Sciences in 1970. In 1996, he was awarded the National Medal of Science for his fundamental contributions to economic science.*

"ANY SCIENCE, NO MATTER HOW QUANTITATIVE AND MATHEMATICAL, HAS WHAT I CALL THE ART OF THE SCIENCE."

The upshot was he hired me as his research assistant my first semester, and I moved into his outer office. For the next three years, I basically lived there. And in 1970, Samuelson became the first American to become a Nobel laureate in economics. So I had as good an economics education as anyone could dream.

The Art of Science

DB: Let's talk about models. They're inherently, to use your words, "incomplete," and there are people walking around with models that they thought were much more complete than they turned out to be.

RM: Oh, absolutely. You'll often hear people say, during the crisis or something, "There were bad models and good models." And someone will say, "Is yours a good model?" That sounds like a good question, a reasonable question. But, actually, it isn't really well-posed. You need a triplet: a model, the user of the model, and its application. You cannot judge a model in the abstract.

The reason is that every model is an abstraction from complex reality. There is no complete model. In fact, it's Gödel's theorem that says you can't ever do it.

DB: Right, that models are always going to be incomplete.

RM: So, if they're incomplete, that means a couple of things. One, they don't capture everything and, two, that means you have to make judgments. Like any science—physics, chemistry, biology—finance is a science. And all of them, no matter how quantitative they are, how mathematical they are, how much they rely on data and seemingly precise answers, they all have what I call the art of the science. And the art of the science is the abstraction.

When you look at a problem in the real world—not a mathematical equation but the real world—what you're trying to say is, "What model can I create that will give me, if I solve it, insights into the way that part of the world really works?" Not hypothetically, but how it really works. There is no formula for that. That's judgment. That's abstraction.

KURT FRIEDRICH GÖDEL'S INCOMPLETENESS THEOREMS *are two theorems of mathematical logic that demonstrate it is impossible to prove everything using mathematics.*

Using Great Ideas to Help People

DB: One of the great things is when we both ended up expressing so much interest in working more directly together, so you stepped down as an independent director from our board to become a resident scientist for Dimensional. As we go forward, we're really counting on you for the things you really believe in and that you've been expressing over the years: helping people integrate their financial needs over their entire life cycle.

RM: You look at the issues of the world: People want solutions; they want something that works. When you buy a car, it's a finished piece that drives. You don't have to understand how it works; you just have to understand that it does work. They're an integrated solution.

In personal finance—not institutional finance, but personal—we're still at the level where mostly we're giving people parts, the transmissions and bodies and engines, and saying, "Good luck. Either put them together or get someone to assemble it for you." What's really needed are integrated solutions.

DB: I agree, and that's an exciting prospect.

RM: Yes, and this goes all the way through the life cycle, whether it's savings or retirement or education for your children, everything. You shouldn't have to understand how much to invest in international real estate, how much in equity, and so forth. Most people think personal finance, even if they can do it, is like going to the dentist without Novocain. They don't like it.

At a personal level, this is a dream to be working with Dimensional on big problems. What got me into economics in the first place was wanting to make a difference. But the fact that Dimensional is built on financial science, on great ideas, on rigorous analysis, makes it truly special. The principles of finance and the findings of finance work everywhere, across time and space. It doesn't just work in the US and Europe. It can work in Asia, Latin America, anywhere in the world.

DB: That's because it's about providing solutions using the principles of financial science.

RM: And to provide those solutions, you start with an investor who has a challenge or an opportunity. Can we solve that problem, either by meeting the challenge or enabling the opportunity? That's where you start, not with one product or one strategy. This, in itself, is a pretty good thing to be doing. I mean, we're talking hundreds of millions of people. Yes, there are different cultures, there are different rules, but it turns out people are people. The life cycle is the life cycle. You reach a time when you retire and you've got to be looked after some way or another. That's universal. And today, through technology and through the understanding of the science of finance, we are in a position to design something you can adapt to broad audiences.

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DB: You've said it extremely well. I'd only add that, if you look at the alternatives, there aren't many people approaching it this way, expressing these great ideas.

RM: It's not just great ideas that made Dimensional successful. I don't know whether Thomas Edison really said this, but people used to say, "Mr. Edison, how do you get inventions actually done?" And his answer purportedly was, "It's 10% inspiration and 90% perspiration." You can substitute that here: It's 10% a good idea and 90% implementing that idea and making it work. The implementation is really critical. It has to work every day, it has to work for decades, and you just can't make mistakes.

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It's a demanding challenge, but Dimensional has the ability, track record, and principles to keep helping investors.

The Next 35 Years

RM: I have a question for you, David. It's been about 35 years since you created Dimensional, and it certainly has come a long way. What are you going to do with the next 35 years at Dimensional?

DB: We now have the resources, client base, and connections with leading thinkers—like you and Gene Fama and Ken French as well as our own internal Research group—to really make a big change in the world. As technology improves and our ideas get more acceptance, I think we can help more and more people. That's the goal. We've talked about developing good financial solutions over a person's lifetime. It's also about getting these services and ideas into the hands of more people.

If we do that, then when we look back, hopefully we feel like we've accomplished what you set out to do—and we set out to do—in the first place, which is to use these ideas to help people. I think we've shown that we can, and I'm excited about where it goes from here. ■

David Booth, a founder of Dimensional Fund Advisors in 1981, is the firm's Chairman and Co-Chief Executive Officer. In 2012, Booth was awarded the Outstanding Financial Executive Award by the Financial Management Association International for his background and accomplishments in applying financial theory and research to the practical world of asset management, particularly for his pioneering work in indexing and small capitalization investing.

The University of Chicago Booth School of Business was named in Booth's honor, and he serves as a lifetime member of the school's business advisory council. He is also a member of the board of trustees of the University of Chicago and the University of Kansas Endowment Association. Booth received his MBA from the University of Chicago in 1971 and holds an MS and a BA from the University of Kansas.

Robert Merton is the School of Management Distinguished Professor of Finance at the Massachusetts Institute of Technology and University Professor Emeritus at Harvard University. Merton first started working with Dimensional as an independent director of the mutual fund board in 2003. He now serves as Resident Scientist at Dimensional, focusing on life cycle investing and retirement funding solutions.

Merton received the Nobel Prize in Economic Sciences in 1997 for a new method to determine the value of derivatives. His research focuses on finance theory, including life cycle and retirement finance, optimal portfolio selection, capital asset pricing, and pricing of derivative securities. Merton has also been recognized for translating financial science into practice. He received the inaugural Financial Engineer of the Year Award from the International Association for Quantitative Finance (formerly International Association of Financial Engineers), which also elected him a Senior Fellow.