

INTERVIEWER: Today is April 27, 2011. I'm Barbara Moran, and today we are speaking with Robert Merton at the MIT studio as part of the MIT 150 Infinite History project. Dr. Merton, the distinguished professor of finance at the Sloan School of Management, has spent his career applying high-powered mathematics to the real world. His research focuses on finance theory, including life cycle finance, pricing of options, loan guarantees, and other complex derivative securities. He has co-written or co-edited 10 books, is the author of more than 90 articles, and is a member of the National Academy of Sciences.

Dr. Merton graduated from Columbia University with a degree in engineering mathematics in 1966, earned a Master's degree in applied mathematics from the California Institute of Technology, and a PhD in economics from MIT in 1970. He received the Nobel Prize in Economics in 1997 for a new method to determine the value of derivatives.

Welcome, Professor Merton. Thank you for joining us today.

So I want to start-- when I was reviewing your CV, the first thing that jumped out at me was the fact that you got your PhD here, you had 20 years at MIT, 20 years at Harvard, and then you came back. We got you back. So I was wondering if you could tell me why you came back. Glad you did. Thank you for coming back.

MERTON: It's my pleasure. Well, I guess I could just quip, you know, every 20 years or so, you have to do something radical and move from one end of Cambridge to the other. Well, I've always-- the Institute is a very special place for me. As you say, I got my degree here. This is where I did my best work. I love the students here. I was here, as you mentioned, 20 years.

And then around that time, I took a year, my first year off, to write a book that I'd been wanting to write. And it was a culmination, really, of the work I had done in for the past couple of decades. It was kind of written to put it all together.

And I had a wonderful time writing it. I was so much involved in the Institute that I had to go somewhere. And the Harvard Business School said, well, why don't you come up? We'll give you a nice place. And it'll be quiet. You have nothing you have to do. And this was great, because I could write my book and I wouldn't have to leave. So that's how I got to the other end of town to do it.

And then at that time, I had decided I was going to go another direction of research of large change, in the sense of still within finance, but focusing more on understanding the dynamics of institutional changes and so forth rather than prices and instruments. They were connected, but very different style.

And after I spent this year, I was invited to stay at Harvard. It was very difficult for me, because MIT is a great place, and truth be known, if I had to come back, I would have been very happy, too. But I got to take advantage of the fact that I wasn't really leaving MIT. Because I was actually live only a quarter of a mile from the Institute, and all my friends, colleagues were still here, and I still interacted with them. So I kind of got the free ride in this.

And I think it was a combination maybe of just a change, but also the idea that I was going to be involved more in understanding how institutions work and so forth. And it seemed to me at the time that perhaps the resources available at the Harvard Business School would be more conducive to that.

INTERVIEWER: Hmm. Are there are some differences? What are some differences between the two schools?

MERTON: They're very different, just as East and West Cambridge are very different, happily so. The Institute had always struck me as a place that was, on the surface, a little more relaxed dress and all. Of course, we know, in reality, it was very rigorous, demanding, and so forth. I think you see it in the art and design. It's more modern, it's more eclectic. Certainly engaged in technology, certainly more than Harvard as a whole university.

And while the business school, as a professional school, was focused on practice as well as research, it just is a very different character. The nature of the people, the students. I didn't say better or worse. Different.

INTERVIEWER: Not saying better or worse. Just saying different.

MERTON: No, but different. Also there, even with the students, I continued to have many MIT students whom I served on their thesis committees, and they came over and took classes with me. So in some sense, I never really left the Institute, from a personal point of view.

INTERVIEWER: Yes. So what made you decide to come back here formally?

MERTON: It was somewhat a serendipitous event. I was quite happy at Harvard. And as a university professor, you have a lot of freedom. You can do pretty much what you want. And I was treated very well there.

I happened to have lunch with Andrew Lo, whom I've known for a long time, who was the unit head for the finance group here. And he was telling me about some of the new programs that they were designing, what they were trying to do here at the Institute. And I thought it fascinating. And as he talked to me about it, at some point he said, well, would this ever interest you? And I didn't think about it. I said, hmm. It makes sense. I mean, you know, you don't normally move.

And this was also part of the serendipity-- not a good part of it. But we had this terrible financial crisis that occurred. This occurred really 2007-2009, which we're still feeling the effects of.

And my belief coming out of that was that in my field of finance, where much of this was centered, the financial system, one of the things that we really do need more of is better-trained people. From the most senior people, meaning senior executives, board members, regulatory overseers. They just have to understand much better the technology and how these things work in the modern financial system. And they also need staffs of very well-trained people, in my view. And this is a global issue. It's not for the US and the UK. It applies around the world.

And at this time, it just seemed to me what one could do, is sort of, it's fun to do, exciting to do, and also feel that it's the right thing to be doing to contribute. And it would be to get involved in a program that was designed to turn out a very large number of highly-trained people in this area to meet that need. And the Institute is the perfect place to do it.

Plus, the reality was that from the president on down here, there was a commitment to this new program, which was called the M.Fin program for students. Master's in finance program. This is in addition to our Master's program and our PhD program. But this was really designed to turn out very highly-trained people in finance who would start at the bottom, whether in private sector or in the public sector, but would bring this very, very rich set of tools and knowledge, and then gain experience, and be available first to implement what needs to be done in a well-done fashion, and eventually grow into positions of influence and oversight. And we want to do this for the whole world.

INTERVIEWER: It's very interesting, because a lot of what you were just talking about fits in with these other big picture issues of MIT's role in the world, and the role of engineering in the world, and the role of engineering in finance. And I saw a quote from you somewhere that you said you're an engineer at heart, or an engineer by nature.

And can you just talk a little bit-- it's a sort of an interesting-- I mean, a lot of people, I believe, when they think of engineers, they think of people who build, whatever, bridges and cars and that sort of thing, not people who try to engineer finances. Can you just talk about MIT's role there, and how you fit into that and your way of thinking fit into that?

MERTON: Sure. As you quoted me, I was describing my personal characteristics. For example, I would make a very poor candidate to be a doctor in an emergency room, because all the patients would probably die. Because I would want to do everything precisely, and you can't do that when they're in trauma.

That said, if you go to an emergency room, let the ER doctor treat your trauma. Don't let the ER doctor set your broken leg. If you want to last for 30 or 40 years and work, that's the wrong temperament.

So part of that was to describe by temperament. So therefore, for example, with respect to the crisis, although I've obviously been involved in advice and so forth in that area, actually it's not something that I feel is my relative expertise. That's dealing with crisis, immediate things and fixing stuff. Which is very important. I like to build. So in fact, that's what-- so that was part of it.

Now clearly, that fits very well within the character of the Institute. If you go to the main building, from its very beginnings, of course there was a focus on deep research, generation of knowledge, both in sciences and the surrounds. But always with a focus towards application. That these things could be brought to bear to make the world a better place, to solve real problems that we face. And that's the application here.

And one of my original work I did in helping to contribute to create this, what was really a new field, financial engineering and the whole new way of looking at, this was the perfect place to be for it. I mean, the technology that, now I'm talking about computer technology and so forth, but just the whole mindset.

And is it really is parallel, in fact, much of the mathematics sometimes can look very similar. The same equations that appeared in heat transfer, or mechanical engineering, or the same mathematics used for rocket trajectories, how they go, are also the same kinds of mathematics that we use to design and build and understand the characteristics of the financial system.

INTERVIEWER: It almost seems like it was the only place where it could happen in a way, do you know? I mean, I'm sure it could happen other-- but I mean, it's like a perfect confluence of factors here.

MERTON: It was a perfect confluence. And in the early part of my career, you know, when you're young, you don't know any better. So I grew up here at the Institute, and everything was fantastic. We had a fantastic time -- a student. And then later, joining the faculty, there couldn't be anyplace better. Everything was wonderful. It's only when you grow up and realize what the rest of the world is like do you appreciate how special it really is.

INTERVIEWER: Yes. So I wanted to go back a little bit and talk about your life before you got to MIT. So you had a quite an interesting childhood, I think, as far as your father being this acclaimed sociologist who invented pretty much every sociological term we've ever heard. That's fascinating. And so I'm just wondering. Could you just describe your household growing up? What was it like?

MERTON: Well, my household-- I actually grew up in a town just north of Manhattan called Hastings on the Hudson. It's a relatively small town, and remarkably, today it remains so. It was a solid middle class town. It had some factories. A good part of the graduates of the high school went to work in the factories.

But it also had an interesting sort of bunch of characters that lived there, including the Cubist sculptor, Jacques Lipchitz. And also later on, much later on-- now I'm moving forward to today-- it turned out that I think there's, in one way or another, seven Nobel laureates in the little town.

INTERVIEWER: Huh! No, really?

MERTON: Yes. Over many, many years if you look at the number. But it wasn't one of these university towns or lab towns where you might guess. It's just truly a kind of ordinary town, but with some interesting people. It was close to Manhattan. The school was K - 12 in one location, and it was truly a public school. I got a fabulous education there, thanks to Sputnik and MIT. So there was early connection.

But I think beyond that, I have two sisters. One time I had 25 cats.

INTERVIEWER: I heard about that. Those were grandma's cats? Or were they your cats?

MERTON: Well, I would take credit for some of them.

INTERVIEWER: How does that happen?

MERTON: Well, you have one. And she has five. And then some of them grow up, and pretty soon, you have a lot of them. Anyway, so I guess that's sort of an odd thing.

But in terms of my surroundings, my father was, as you indicated, a really eminent scholar. And he taught me many, many things. I was the black sheep in the sense that my two sisters were the smart ones. And if you had a who was most likely to succeed contest, I would have lost. I did lose.

But other than that, that was fine. He set more by example. Never was one of these people like some of my classmates, whose parents really pushed them, particularly the academics, to go on and on and on. I was never formally pushed about it, but he just did it by example. I just absorbed what standards were, and how you do things by observation, rather than being sat down and told.

And my mother was a big influence on me. At one point, she gave me some advice. I mean, she gave me much advice. But one piece of advice she gave me which has influenced my views of how I do things was she said, first do it their way, and do as good as anybody can do it. Then you've proved you can do it their way. Then you're free to do any way you want.

And she illustrated that to me in the case of art. When I was little, I saw these abstract sculptures that Lipchitz had done. He was a neighbor. And I'd look at them and I'd say, you know, what are these things? You know the traditional sayings.

So rather than tell me, you need to develop a taste to understand this and all, she took me to see many of the busts that he did that were perfect. They were in bronze. But the facial features and everything were like they were alive.

And her point was to say, look. He can do art that is so realistic that the bronze becomes alive, in terms of capturing the person. Having done that, he sort of earns the right to-- that he's doing these abstract things not because that's all he can do, but because that's what he chooses to do.

And while this may seem a very sort of folksy type of thing, it had a very big influence on way I've done things. I always have said, look. I can do it the way it's normally done or traditionally done, and then felt that that gave me the license to then do it my way.

INTERVIEWER: Very interesting. I also understand that baseball and cars had a big influence in your early life. What do you think is the common-- well, I guess baseball, cards, poker. I don't know when poker came in. But what was the common thread between--

MERTON: And the stock market? Well, I suppose we could try to look for something. That'd be natural. I guess I really don't know what the connections were. What they all had in common was passion. And there were certain things I developed a passion for, and I came to appreciate how great that was when you could get it.

And also to recognize that if you have a passion for something, you can really do almost anything. And if you don't, if you're dealing at the highest level of performance in any field, you're probably not going to be able to compete. Because there's always someone faster, smarter, better-looking, richer than you are. But if you have passion about it, just because you love it, you can do more of it, and you can do it well. And at that level, that's the edge.

And so it was just enjoyable, but those were my passions. It was baseball--

INTERVIEWER: So playing or watching--

MERTON: I played--

INTERVIEWER: --collecting stathead?

MERTON: Well, I became a stathead on everything I did, but I don't think that's special. I can still tell you the cubic inches and the different models of every engine and car built in the 1950s or '60s, early '60s. And you're certainly familiar with people with baseball statistics.

But I was preparing myself for coming to Boston. I didn't know it. Because at the time in baseball, there were three teams in New York. The New York Yankees, the New York Giants, and the Brooklyn Dodgers. Which, for a baseball fan, that's just nirvana.

And of course, I was a Brooklyn Dodgers fan. The Yankees were the big success, rich ones. And you didn't do it. And the Giants didn't know where they were. But Brooklyn. And there was this Ebbets Field out in Brooklyn. Just like Fenway Park. Totally kinky, totally crazy. Small. Great fans. And by the way, the Dodgers never won a World Series until 1955. I actually was there to see them win the pennant.

But sort of the history of the Red Sox from 1918 on, I knew that well when I came here. I felt very comfortable. And Fenway Park felt that way. So maybe there's another connection that developed.

And then I wanted to switch to cars--

INTERVIEWER: So baseball was sort of like early, age 10 type thing, and then you switched to cars?

MERTON: Yeah, age 10 to 12. Well, from seven, eight to 12. And I played sports in school. I played football. I ran track. Things like that. But I confess, I didn't have a passion for them. I played them. I don't know why I did.

But then it became cars. And because I was too young, I got to know older people who did have cars, and I helped build them. I learned how to build them. And eventually I built my own. You know, hot rods and things that. Cheap-- no money, lots of labor.

INTERVIEWER: Did you buy a junker and fix it up, or did you--?

MERTON: Yeah. The first car I bought for myself, I was, I guess, 15, was a Cadillac convertible. Fabulous thing with big fins, leather, the whole nine yards. In terrible condition. I bought it for \$75.

INTERVIEWER: Nice.

MERTON: And I rebuilt everything, from the engine, the body, everything. Floorboards. The whole thing. And then sold it, because I couldn't drive it legally. And eventually I built cars. As I said, I used to build them and then race them on tracks.

INTERVIEWER: Yeah. So explain this. So I read about this drag car-- so I don't actually know what a dragster is. Is that like in *Grease*?

MERTON: That's where you go a straight line around the center. It's all about getting on a line and going as fast as you can for 1325 feet. And as fast, as quickly as you can.

INTERVIEWER: Huh. That's an interesting little niche to get into.

MERTON: Well, it fits into-- I didn't have any money, so it was one of these things where labor and going to junk yards and doing a lot of the work was all the fun of it. And then as a teenage, testosterone-type kid, I got a great deal of pleasure out of it when some other male, who had his dad's Corvette, was taking a lady out somewhere, and I had my old '48 Chevy, but the darn thing would run about three times as fast as that Corvette. And I always had in my dream that she would say to him, what's wrong with your Corvette?

INTERVIEWER: Right. See you later!

MERTON: You see the level of this sort of thing. But it was competitive. And I actually thought that I was going to be an auto engineer, and actually all through engineering school, though engineering mathematics was my field, and I did everything because I thought -- but I actually worked for Ford for a couple of summers as an engineer.

INTERVIEWER: Yeah. Why didn't it stick, do you think?

MERTON: I don't know. I mean, it was a lot of fun. I did it. But I liked the mathematics, and so then I decided to get a PhD in applied mathematics.

INTERVIEWER: Well, I wanted to back up a little bit. Because you have this somewhat roundabout path into getting a PhD in economics. Can you just talk about how you got there?

MERTON: Well, going back to one of the things I had a passion for, along with various stages-- baseball, cars. I learned to play poker. I also learned magic. My father was a very good mathematician.

INTERVIEWER: Magician?

MERTON: Magician, yes, thank you. He was not a mathematician. But that didn't stick. But the poker did.

INTERVIEWER: Do you still have a couple tricks you can pull out once in a while?

MERTON: No, no. The rule is, you never do a trick until you perfect it, because then you'd expose it. And I can't say it was because I had small hands. These are real tricks. They're not props. You have to practice them. And I didn't have the temperament or the passion to do it. So that didn't stick.

But in any case, I bought my first share of stock when I was 10.

INTERVIEWER: Right. Now, how do you do that when you're 10?

MERTON: Oh, I got my father to open an account and told him. I just did it for my aunt and for him. They didn't have a lot of money. But I would do all this analysis for them of the companies, and--

INTERVIEWER: How does a 10-- I mean, from the newspapers? Is that what you did?

MERTON: No, I got things like S&P guides, and I--

INTERVIEWER: You're making that up. What 10 year old-- you had a lot of time! Building cars, baseball--

MERTON: I didn't build cars when I was 10. I was a little older. No, well. If you really want to-- when I was younger than that, I used to like to pretend design things. So I used to have all these companies that I made up. One was called the RCM Savings of Dollars and Cents Company, which was, I would collect from the people in the family and around money. You know, like a banker. And then take it down to the-- the S&L had an account. Put in the account and earn interest. And then I would pay them interest-- less-- on it.

So I guess there was some characteristic of that beforehand. I used to take care of my mother's checkbook and make sure it balanced and that sort of thing. I don't know. Who knows what these are.

But in any case, I was very interested in stocks. GM was the first stock I ever bought.

INTERVIEWER: All right. Now, were your sisters during this same stuff, too, or were they just--

MERTON: No. There's no connection.

INTERVIEWER: Or were they just like, what's Bobby up to?

MERTON: Yes, exactly. So I got involved with stocks. And then later on, when I was older, I would go to what they call boardrooms, which were the brokerage houses. And I'd go first with my father, and then later-- and there were these places where people who would go there all day long to trade. You know, civilians, not trade like Wall Street, but civilians. And they would sit there and watch the tape, because that's all there was. There was no electronic--

INTERVIEWER: Oh, it was an actual tape-tape.

MERTON: Well, it wasn't paper tape. It was electronic tape. But that's where you got your information. And they would teach me how to read the tape. I knew all the symbols of all the stocks on the New York and AMEX, American Stock Exchange. And they would show me this, and how this-- see this little tick? Well, that's the specialist stealing from somebody. And then they taught me about a thing, and one fellow taught me about convertible bonds.

So I used to go there. I was kind of their mascot. I traded. I didn't have much money, but I would trade, too. And so I was engaged in all of this.

But they never thought of it as a day job. It was kind of an after hours sort of thing one did. And so in that sense, I was always involved with financial-type things.

INTERVIEWER: If you had to sort of examine, what interested you about it? Was it some sort of a game? Or was it thinking about making money? Or was it just the analytical aspect of it, or what do you think about it?

MERTON: I think it was partly the challenge of understanding it. It was partly non-periodic positive reinforcement. Every once in a while, something did actually go up and you made money, and you know, psychologically, that's very addictive. You know, sort of understanding how it worked. I built some models. I didn't know what I was doing, but I thought I did.

And as a consequence, that did have an effect that carried all the way through to eventually being in the field. But I just didn't know it at the time. It was really-- I don't want to say a hobby. It never occurred to me that would be what I would do during the day, if you know what I mean.

INTERVIEWER: Right, right. Interesting. I mean, it does sound like your parents were quite supportive of all this. That they let you build a car, you know?

MERTON: They let me build a car, make a lot of mess in the garage.

INTERVIEWER: Yeah. They took you to the, what did you call it, the board room, the trading room?

MERTON: My father would take me up to the board rooms, right.

INTERVIEWER: Yeah. So they must have seen, you know. something.

MERTON: I guess so. My father had many interests, but he was a really serious academic. One can say that about a parent. You can't say it about a child. I had nothing to do with my parents, creating them or anything else they achieved. So when I say good things about them, I'm not patting myself on the back the way I might be implicitly if I said that about children that I made. And he was really a very special scholar. And he was a very serious academic.

And he was my best friend for-- we were best friends for the last 40 years of his life. I knew him longer, but when I was younger-- you know, young men and their fathers sometimes aren't always as close. But we were very good friends, and he was a great influence on my life.

INTERVIEWER: Before we move ahead, was having an academic for a parent like that, were you exposed to a lot of big ideas, too, as a kid? Did you understand what your father, as a as a young man, or before college, did you understand what he did?

MERTON: I had a reasonable understanding. I wasn't trained in it, but I absorbed it. Obviously there were many eminent academics that were part of my culture, so I knew a lot about the academic life. He created the field of sociology of science. So I had a lot of understanding about science as a social system, as a rewards system in science, how it works in the sense of functioning. I absorbed some of the concepts. But he didn't spend time training me or anything.

INTERVIEWER: That's very interesting. I mean, I think that's probably just what you're talking about. It's a thing a lot of who went into science lack, that sort of meta-understanding of the system.

MERTON: But he knew about everything. We were surrounded by books. I had thousands of books in my house. I had reference dictionaries and things in all the languages and all that sort of thing. Not that that did me any good, the other languages. But I was surrounded by books, and I'm sure that influenced my life as well. So it was a big influence, that's for sure.

INTERVIEWER: You studied mathematics and engineering. You decided to go into that for undergraduate. Engineering mathematics?

MERTON: Engineering mathematics, which was at that time, a relatively new field. And it gave me the freedom-- I mean, I loved applied mathematics. I took some pure mathematics, of course, but the truth was, I loved applied mathematics. I liked using it. I liked the way the structures worked. I got to take almost every kind of engineering, because the idea was, your tool is that you had to understand the language, not just the mechanical, electrical, civil materials, whatever. And so that gave him a breadth there. Columbia required all of us engineers to do things like contemporary civilization, humanities, English. In fact, my first published paper was in English literature.

INTERVIEWER: Wow. On what?

MERTON: Well, it was on *Gulliver's Travels*, of all things. It's a little strange. I was a sophomore, and I was taking an English course which I had to take, and they made you write every week, and I was terrible. I hated it. I couldn't come up anything. They said, write something creative. And of course, you know, my mind was blank, and the grades were reflective of that.

And then he had us read *Gulliver's Travels*, and we had to do a term paper of some sort. And in looking at one part of that dealing with the island of Laputa, how it worked-- as you know, Swift was a satirist. And he was always making fun of politicians, or Royal Society in particular. The island of Laputa was thought to have been a satirical treatment of the Royal Society of London. And he didn't seem to have much taste for these scientists. They had all their theories, but nothing worked.

And so I read this, and I, just reading his words, saw that-- he described how the island worked. If you actually followed the way he said the island worked, the island would crash. And he didn't need 20th century physics for that. It was-- you could take a pencil and just do the pencil like it was the island, and you'd see it would crash. So I thought that was kind of neat. And that was a different interpretation. I wrote that up for my term paper.

And I turned it in, and I remember, the teacher was an instructor. Because there were so few positions open in English that you didn't even get on tenure track for years. And I remember him coming up to me and saying, I think we have a good paper here. And this is, again, where I had the good fortune to have my father for advice. And I went and said, well, this guy hasn't done anything. Why is it our paper now? And is this is the way you do things? He said, no. You don't have to do that.

So I got my nerve up and told my teachers that it was my paper. I got a very poor grade in the course, but the paper got published in the *Journal of the History of Ideas*, which is a blue ribbon journal. And so in fact, my first published paper was-- I was 19. It was in English literature. So it sort of stands out as a little different from my later work.

INTERVIEWER: Was that your first and last paper in English literature?

MERTON: Yes, it was. You know, it's like forecasting. If you get it right once, you retire, because it doesn't get any better. And I didn't think that was going to happen again.

INTERVIEWER: That's very funny. So you ended up, you went to Caltech, right, for a bit? How did that--?

MERTON: Well, how that worked is I applied to PhD programs in applied math. And I applied to MIT and to Caltech, and I got in both places. Caltech gave me a full fellowship. MIT wanted me to be a TA as well. And I kind of like Southern California, and my brother-in-law had been a professor at Caltech. So I went to Caltech.

And I went out there to do it, and I had had a lot of mathematics as an undergraduate. Because Columbia let me-- I took six, seven courses a term. Not to show up, but they just let me do it. I took all kinds of courses, but lots of mathematics as well, because I just took so many.

So I had a lot of math when I got there, and so I was able to do all of coursework and to my qualifiers the first year. And toward the end of that, it was really in the-- oh, I guess after the first semester going into the second semester, I could see I'd have to start thinking about a thesis topic. I mean, I had to take qualifiers, but you know. And I was looking at the projects, the kinds of things the people were doing. It was kind of water waves in a tank, or plasma physics. And I had no passion for any of that.

And what was I doing? I was getting up every morning-- because it's 6:30 in California when it's 9:30 when the markets open in New York. I was trading for a couple of hours every morning before going to class, and then doing my classwork, working on my research, and then going in the morning, and-- but what really influenced me to think about it, was at this period of time-- this was in 1966, '67-- this was a period in which it was believed that we had solved the macroeconomic problems. I'm smiling because here we are, 40 later in this mess. But there was-- so this is back to the future. I've lived long enough to live through this at least twice.

But at that time, there was a belief that we had solved the big macro problems. Which was, we had policies that we could implement that would protect us against depressions or even big recessions and against inflations and out of control things. So the extremes. We still didn't know how to do what they call fine-tuning, but the big events, we thought we knew.

INTERVIEWER: It's like '67?

MERTON: '66, '67. And this had gone back to Walter Heller under Kennedy, and then Johnson. And I didn't really know. I had never had an economics course, a formal one. And I read about this, but I thought that was fascinating.

And then I read a really bad book on mathematical economics. I didn't know it was a bad book. I got it in the bookstore. And I read it and I said, gee. You know, I think I could do something in this area. If I'd gotten a good book, Ken Arrow or Paul Samuelson, I might have been intimidated. But I got a bad book, so I thought I could do something. Now, this is true. I didn't know.

So I started to begin to think about what I really wanted to do. And it comes back to this issue of passion. Passion was what was getting me up into that board room 6:30 in the morning and I watched. I did everything kind of transaction under the sun. I did convertible bonds, I borrowed money, I did options over the counter. There weren't even markets. I did everything.

INTERVIEWER: Was this something that, like, other guys your age were doing? You're just like the only one?

MERTON: No, I was the only one. I'm the only one I knew of. I'm sure there were other--

INTERVIEWER: Did you tell people what you were doing, or were you kind of secret about it?

MERTON: Well, I didn't advertise it. You know, this is at a time when this was not-- you know, it's like poker, we were talking about? Poker today, you know, with the World Series of Poker and so on on TV, in fact, some guy I used to play with here in Boston won the World Series. So you know, it's a big get TV thing now. So it's an appropriate thing. But poker was always one of those things, you know, if people ask you in good academic circles-- although there are plenty of academics who play, it's much more appropriate to say, I play chess. You don't say, I'm a poker player. You know? And the same thing with the stock market. That even Keynes, when he told the story about how he made all this money for his college, lying in bed in the morning, citing which bonds to be brought before his real work-- the whole idea was, if you did it for good cause, but it should be effortless. Never devote any real energy to something like that.

And there was a very big distinction at that time between business schools, or finance, or things like that, and other parts of economics. It's not that the stock market wasn't studied. But somehow business and other things was not thought of as an academic discipline.

INTERVIEWER: Interesting.

MERTON: You know, it was a very different way than it is now, 40 years later. So in that context, you asked the question, yeah, no, I didn't go out and say, hey, guess what I've been doing, or am doing. It was more secret.

But to get back to the main point-- it was clear, it was revealed that I had a passion about it. I thought about it. I thought about it not because anyone told me to. It was always there in my mind.

And so I had this idea, I said, well, I love mathematics. I've been doing a program. I do all kinds of stuff. Maybe what I ought to do is go into the field of economics, bring all these tools that I had in mathematics, and apply them to solve economic problems. And while I haven't had any economics-- so you can see this is a bit-- maybe a little bit, I hope not arrogant, but rather naive, maybe.

But in any case, I did feel I had a sense for it. I knew I had a passion for at least this part of it. But what inspired me is, if you do a little bit good, if you add a little bit, you can impact millions of people for a long time. And that's kind of cool. And that's what has happened. You had this vision-- at least that was the claim-- they had solved these major macroeconomic problems. And this would matter to millions of people. And I said, wouldn't that be kind of neat? So this is one of those things we all have that starts as a little thought here, and it keeps growing and growing and growing. And eventually I said, this is what I'm going to do.

So then I went to my advisor at Caltech and said, I've decided I'm going to apply to economics programs and change fields. And he told me I was crazy. And then I told my family. And they also thought I was probably a bit crazy. But no one, they weren't going to-- But so I did. So I applied to either eight or nine schools, including Columbia, where I had come from. Everybody but one turned me down. So it was easy decision.

The one that took me in was actually MIT. Probably the best department in the world, or the second best, who cares. And they give me full fellowship. So you apply to eight or nine places. They all said, well, who was this person? Because at that time, it was not a norm for people to switch fields like that, to take mathematics and apply to a graduate program in economics or other things. It just wasn't done. And so I'm sure they looked at me a bit crazy. And it was pure luck, or coincidence, or serendipity, if you like, that I got into MIT. And that was in itself an interesting story.

But I got in. I knew the names, Paul Samuelson and Bob Solow, but not much more, because I hadn't studied it. And since it was the only one anyway, it was a pretty easy decision.

So they let me get a degree at Caltech for my work. I got a Master's degree. And I lifted up, left California, and came back here to Cambridge.

INTERVIEWER: It's interesting because that story isn't totally unusual at MIT. MIT does seem to have this way of, or the ability to take people out of different fields and put them into other fields if they see promise or interest. And I mean, does that-- they're willing to take risks on smart people.

MERTON: Well, I'd like to say it's-- first of all, I'm sure you're correct, because I've known many people here at MIT who have had that experience. But I think in this case, it may have been a little more localized. I didn't know it, but there was a professor in the economics department, Harold Friedman, who was a statistician by training. Had been there forever. Before Paul Samuelson came to MIT, so he predated Paul Samuelson. I don't even think he had a PhD. And he apparently was on the graduate admissions committee.

And so when he saw my application, he recognized, first of all the mathematicians who had written for me. Secondly, because I had gotten into MIT in applied mathematics, what happens then is my previous application got shipped over so he could see what the people at MIT thought. And he said, why don't we take a flyer on this guy? I mean, I found this out, of course, later.

And that's probably the true story. If Harold Freeman hadn't been here, MIT probably-- you know, it's the best department in the world. So why take a flyer on someone when you can get all these great people? I might not have gotten in here either. So if he hadn't been there.

And then Harold, as an aside, deserves, if he hasn't gotten it, a very definite spot here in MIT, especially as it goes to the development of economics and the economics department. Because I found out later that he was instrumental in convincing Paul Samuelson to come. That he took a big part in trying to get Bob Solow to come. And then in my case, I told you already got me in as a graduate student.

But then the second part-- because this is a Harold Friedman story, not about me. When I showed up to register, you know, I was very contrite. Because I said, look, I've had no economics. So I had read what I was supposed to take, and I dutifully had said micro, macro, economic history, and so forth. I wrote it down. Guess who the graduate officer was I met? It was Harold Friedman.

And he looked at this. And I can remember this to this day. He looked at this thing. He has this big shock of white hair. He looked at this, and he looked at me, and he said, if you take these courses, you're going to be so bored by the end of the semester, you'll leave. And I said, well-- he says, why don't you go over and take Paul Samuelson's mathematical economics course? So I say, well, I haven't had any economics. He says, go take it anyway. It was a second year course.

So of course I said yes. I did what I did. And as a result, I went on, I signed up, my first semester here for Paul Samuelson's mathematical economics course. And I ended up running my economics sort of backwards, because I ended up taking the advanced course. And because of my mathematics training, the mathematics was quite comfortable for me. And I learned economics working backward. Along with some intuition, that I said, I think I just had an insight for that.

But I learned it that way. So I learned the advanced course first, and I did it with him. And it was a great experience. I took the other course as well, but I took this one. And at some point, he asked me, would I look at the paper he had written using Hamiltonian optimization equations and so forth. And being a graduate student, I said, of course, you know?

And then I took this thing, and I can tell you. I worked on this paper-- because he'd just handwritten all these equations-- I worked on this paper literally all night. I went over it and over it and over it, correcting as much as I could find, because I didn't want to miss anything. And then I got some sleep.

The next day I came, and I remember, I brought it to him. And I tried as much as I could-- you know, I was this kid-- I said, yes, well, I did go over it a little bit. Like I didn't say I was up all night. Gave it to him. And he came back to me, and he says, how would you like to work for me?

And so out of that course, I did the exam, but I also wrote a paper for the course, which was my first published paper. My term paper got published in economics, so that was nice. And then he hired me, just right there, my first semester. And I basically moved into his office. And I lived in Paul Samuelson's office for the rest of my graduate training.

So how could one have a better education? Being at MIT with all the great economists that were here, and the whole Institute as a frame, I felt very comfortable here. Because it was the Institute, because of the quantitative, the math, everything. You know, the engineering seemed fine to me. But the economics, you know, I lived there.

So when I look at these things--and I guess everyone has this experience. There were these little things that could have gone the other way, and my path would have been totally different. And it would have been some path, so it's not completely random. But none of this is going by the script of how it's all supposed to work.

INTERVIEWER: Yes. What was Samuelson like as a mentor? He seems like a good guy.

MERTON: We get along very well. And to say he was a very smart man is sort of a silly thing to say about him, since he was-- I don't know if you want to use the word "genius" or not. It's an overused word. But he was really--

INTERVIEWER: A giant, in any case.

MERTON: A giant, but we got along very well, and I never felt intimidated by him at all. And what was wonderful-- he was responsible for creating the notion of the sort of open door policy. His office was open. If Samuelson's door was open for students or colleagues, who should have their door closed? So it set a whole cultural thing there.

But I remember. His office-- this was in the '60s-- was in one spot, and Bob Solow's office was sort of next to it, on the side. And there'd be a big line of students to see Solow, and no one to see Samuelson. So I said, fantastic. I just get all this free time with him. And later on, I found out there was a certain intimidation factor, apparently.

But I just had a great time. We talked. And then we found out we had this common interest in the stock market. And he had written a paper on warrant pricing, and I knew all about warrants, because I traded them, and I got into it. And that's when I first found out that what I had been doing all this time, on some level, since I was 10 years old-- all the stuff on the stock market, and warrants, and convertible bonds and everything-- I could actually do that as a day job. It was actually something I could do serious research on. It was a challenging problem, because finance is all about uncertainty. It's all about things over long periods of time, and it's all about optimization. So the kinds of problems you have are dynamic optimization under uncertainty, where you're having to deal with issues that go way, way out into the future.

Intellectually, I loved calculus of variation. I loved all the techniques for that kind of optimization. And so technically, and in terms of just sheer intrinsic excitement, the challenges of the problem were just wonderful in this field.

INTERVIEWER: That must have a great moment when it all clicked, and you're like, whoa!

MERTON: Yeah. And he just took me in, and I understood this stuff. I ended up running a little bit of money with him, for him.

INTERVIEWER: How did you do?

MERTON: I think we did all right. He had better ones that he had. He had students that created great fortunes. But no, it worked fine. The stuff all worked. I just don't want to suggest that we made great fortunes with it or anything, but it was fine.

But I learned a lot. And turned out, being engaged in the markets, even though I really didn't know what I was doing-- I thought I did-- was such a powerful thing for a young person. Because in all of the science I know of, but models, or things you build to try to describe the rule of the world, by their nature have to be abstractions from complex reality. They have to be simplifications.

So the art of the science, in my view, is the abstractions you choose. You have to look at a real world problem, say, how can I build a model of that? Clearly it has to be a simplification where I have the belief, faith, whatever that the answers that model gives for what I'm trying to understand will be useful. And if you think about that, you've got to simplify. So you're getting an answer to something that isn't the actual thing.

So how do you decide what to simplify or abstract? What abstractions allow you to get to the essence, so you have the faith, or faith enough to put it into empirical tests, but the faith that that will capture what you're after?

INTERVIEWER: Parallel to like designing a scientific study or drug test or something.

MERTON: Yes, they're all the same. But this is fundamental in any field to the notion of building models, because you have to simplify. And that's an art. And it maybe informed, but in the end, I view, that's the art of the science.

And knowing, having actually been engaged in these markets for so many years, even as a young person-- so I'm 20 something, 22, 23, whatever-- I had a very good feel about the market. So when I started to make that abstraction, I could draw on that to say, yeah, I can justify this, or I believe this is a good one, in a way that I probably couldn't have done had I had no actual experience.

So that turned out to be very helpful to me. It also turned out to be very good when I started teaching a little later, because many of my students were older than I was. And on top of that, they were professional school students. They were in the Sloan School. And I was having these regular students learn all these mathematical models and everything. And some of them were complicated, and you can imagine someone looking and saying, what does this have to do with the real world? Because again, this is a different time. This is before all of this became mainstream. This was not the norm for how things were done in the field of finance.

And my experience allowed this relative kid, doing the mathematics, to be able to explain to the students what was happening in the real world that was connected to these models. As I said, I'm 25, 26 by that time. And so I got credibility because I could explain it.

And that's something that's held with me through until today. I always like to try to explain stuff-- I'd done all the mathematics, all the things-- to explain to students so they understand the intuition, they see it for themselves. And so that's how these things interacted.

And my whole professional life-- always I've been 100 percent engaged in academia. research, teaching, and so forth. And I've always been very, very engaged, I don't want to say 100 percent, but very, very engaged in practice.

And that's an Institute characteristic, too, which makes it a very comfortable place. And my research has certainly helped the practice, but the practice has also helped my research. Because if I hadn't had those experiences, I wouldn't have the foundation, the knowledge to understand either what makes the problem interesting, or even know the existence of a problem, because it came out of a problem in the real world that I wasn't familiar with. So that's a characteristic throughout my life.

INTERVIEWER: Before we get to the work for which you won the Nobel Prize, I wanted to talk to you a little bit about some of your mentors at MIT. And you talked about Paul Samuelson a bit. But where there any other people who really influenced you as you sort of found your way in the your early days of finance?

MERTON: Well, I would say Paul Samuelson is overwhelmingly the most influential, both as a graduate student, and then we did a lot of research together as well, by far. But Franco Modigliani, among other things, he was the one who came to me and offered me a job. Because MIT had a rule that you can't hire your own right out of school. So the economics department can't hire their own. They can bring someone back who's gone out, but you can't take a grad student and give them a job.

And so when I was looking at jobs, one, I didn't even think about business schools, and two, I didn't even think about MIT, because it wasn't possible. And then after I got all my job offers, Franco-- who's a wonderful character. Very, very gentle and sweet man. And he came to see me, asked me, how would you like to teach here in the Sloan School, in finance? And I looked at him, I said, Franco, I've never taken a course in finance. He says, given your thesis, you'll have no problem. And I said, well, I hadn't thought about it. I mean, the Sloan School and the economics department were physically very close to one another. We were intertwined. But I never even really knew anything about the Sloan School. I think I may have taken a course over there in dynamic programming or something.

So I started interviewing with people. And I said, gee. I'm having a very productive time here at MIT. I was producing a lot of research, a lot of publications, and having a great time. And I said, if I don't have to move, and I can stay here, you know, wouldn't this be great?

And my father thought it was not a good idea. Not staying at MIT, but to go to a business school. You're an economist. You're in an academic department. Business schools are for--

INTERVIEWER: Interesting.

MERTON: Well, that was, as I said, the nature of the time. In fact, for about two or three years after I took the job, when he'd write me a letter at the school, it would be addressed to the department of economics, even though-- it was in the same building, so it got to me. But you know, we all have our quirks.

But so I met some people, and one of the people I met was Myron Scholes, who had been hired a few years before from Chicago. And Myron and I, after I took the job, we got to be good friends. We did many things together.

We didn't do academic research so much together. It's, you know, the Black-Scholes, and there was sort of the two of them and me. But we did commercial things together as well as being friends and so forth.

INTERVIEWER: Can you describe his personality? I understand it's--

MERTON: Well, I don't know how to--

INTERVIEWER: Is he funny?

MERTON: Yeah. He has a good personality. He can, at times, be intense, but then I shouldn't exactly say that that's an unusual characteristic. We get along very well.

He was much more involved in empirical work, although obviously there was conceptual work involved. That was most of his research, was empirical. He's is very organized. He had a hierarchy of research assistants, from senior assistant down. They earned their way up, all the way through. And I can't manage myself, so the idea of managing an RA or something-- I would have them from time to time, but I'd never really use them.

And actually, most of my research-- certainly in the first 10, 15 years, but most of my research was single authored. And that's somewhat unusual in the field. Even more so now. Most of people in finance, you'll see two, three, even sometimes more authors. I don't mean to suggest I'm somehow, I can't get along with anybody, but I've always done most of my own research. I haven't done a lot of joint research.

So interactively, we talked and enjoyed it. But in terms of actually writing pieces together, I did very little of that with anyone. Including Paul, Paul and Myron.

But Myron clearly was influential. We became friends. We grew up in this crazy MIT Sloan finance group. I say crazy because, again, not knowing any better-- there was Stewart Myers, who is still here at the Institute. And he started in 1966, so I guess he's been at the Institute for 45 years. Myron came. There was another fellow, Jerry Pogue, myself. All the senior members-- well, there were two exceptions-- had left or weren't there-- there were no senior members-- except for one fellow who did taxes, but was really off on the side, nice man-- and Franco. But Franco was sort of everywhere. He was in the economics department. He was doing the MIT-FRB model. So he was wonderful and great for research, but he wasn't really running the area.

So my initiation into my first academic job, when I took the job at Sloan, was there were all of us junior guys-- and I was the most junior on the list-- and no one to run the place. Normally, you have this hierarchy of senior faculty and so forth, and they organize and mentor you and everything. And we were sort of like the, I don't know-- it was benign neglect. We were part of a larger group of applied economics, but the senior person for that, an economist, Sidney Alexander, never came into work. And as he would put it, he was involved in the OSS in World War II. And his unit in France, whenever a big decision had to be made or anything, he happened not to be there Nice man, but it was really, truly benign neglect. Nobody told us what.

So we were all junior people. We made the courses the way we wanted them. We did the research that we wanted to do. We had seminars. So from the beginning, we ran the show. And we got lucky that we did a good job of bringing the subject in. We got a lot of students. And so success. You know, the Institute said, fine. Keep going.

And so all these junior people-- we ran the department. We did the whole thing. And it seemed very natural, because we didn't know anything else. So that kind of character was very, very special. We were a tiny group, and even we got a little more organized and grew or so, we were always, by comparison with the other big departments that we competed with, at Chicago, Wharton, and Stanford, so forth, we were like tiny, and they were many, many-- Wharton probably had 30, 35 faculty. We were five, six. But our research made us look like a peacock. Very big, even though there were only really a handful of us. And so we always got ranked right there along with them. And so it was just a delightful experience.

And teaching the students was fantastic. Because I got all these professional school students, but I enforced the MIT and said, you can't get into the Sloan School unless you've at least had the calculus and some probability. And while some of them may not have. I said, that's a deficiency. That's your problem, not mine.

And I pushed it to the limit. And so I taught these Master's students all this advanced stuff that we did our research that haven't even been published. Things like option pricing and the pricing of corporate liabilities. All kinds of things we taught. And I put those in the regular Master's program, not as some special seminar. Mainstream course. Even the first year course became that way.

So I taught them all the mathematics, and I taught them all this stuff. And my colleagues, Stewart and everybody, we all did it together. But I put all this stuff in the stuff I did not because I needed an outlet-- because I really believed they were going to be very practical. And at that time, with professional school students, it was more important they got it than the PhDs. And you say, why? Well, the PhDs are going to spend all their life in research. So if they don't learn something this year, they'll learn it next year. But the professional school students at that time, it was not fashionable or even thought about that you went continuing education. You got your training, your degree. That's it.

So I said, this is interesting stuff. I think it'll be useful for them. And so I taught it all to them. And as they say, maybe it's better to be the lucky than smart. It could have gone the other way. But it turned out, the stuff we taught them turned out to be really useful for them. And so the students were quite happy. And they got a lot happier as the years went on. And some of them have been very generous and very supportive of the Institute. Because they realize that they get the special experience of being taught stuff that hadn't even appeared in the journals as part of their regular courses, and it had a lot of use for them.

So I loved it. The idea that you could teach the stuff you were doing research on to professional students who were actually going to use this stuff. And eventually, this all became very mainstream. And so, you know. what's there not to like?

But the spirit of it is, to who influenced us, it was really the surroundings. You had fabulous people in the economics department, so all of them are influential. I don't have any particular ones because they were a whole group. But what I'm trying to give you a sense for, is that it was a very special epoch of time and space. So the kids were running the show, and all the overseers weren't there. And they did a good job, or good enough that nobody bothered to do it.

INTERVIEWER: Now this is the early '70s you're talking about.

MERTON: Yeah. I started in 1970, and this was really in the early part of the '70s.

INTERVIEWER: I wonder if you could tell me about, sort of at that time, what were some of the big problems that you were working on, and sort of layman's terms. And also how that led to the work that Black and Scholes were doing.

MERTON: Well, the research was as follows. Going back to when I was a graduate student, when I started working with Paul Samuelson, and I found out that I could combine my knowledge of financial markets that I experienced into actual research, and I was fascinated about dealing with uncertainty. How do you decide, in an uncertain world, what are the things to do? I wanted to model that. I didn't know what mathematics to use to do it.

So I went searching. I knew I had a problem, and I went searching for it. And I found that it turned out to be what's called the Ito calculus, which turned out to be just the mathematics I needed to model how portfolios and other things would go through time. Not expectationally, but little sample path by sample path. Every possibility, I modelled all that within mathematics, which was exactly the tool I needed.

INTERVIEWER: I'm sorry, the Ito calculus. And that was used for rocket trajectories, is that where you found it?

MERTON: I didn't find it from rocket -- I did find reference to it in an engineering- I prefer engineering versus pure mathematics books on the subjects. I just like the notation. I like the intuition of it. That's just a matter of taste.

But just by chance, I got a little reference and found it. And it was really a case of, I've got a problem. I need to find a tool to do it. I don't know what it is. And I found it. And once I found it, I said, this is it.

INTERVIEWER: Yes. And this was a big question not just you, but in your field at the time, right? Managing financial services, historically.

MERTON: Oh, yes. There had been an explosion in the field. The field had been not very exciting intellectually until about the 1960s. And then there was some work done at Chicago, Harry Markowitz and then others. And then when I get involved in this, what I was trying to do-- most of the work then was what they call static one period models. They were uncertain but, like, for one period. And what I was interested in was dynamics, you know, how things are through time, with the uncertainty.

So I developed the tools. I found them to try to solve these problems. And then I wanted to be able to solve the so-called lifetime consumption portfolio selection problem under uncertainty. Which, you take a person and you imagine their whole lifetime in front of them, with all the uncertainties out there. How would you optimize for them their life and work that problem back? And then once you've worked that problem back, then you would come up with the demands, why people who want one asset or another, what would affect it, and how behavior would work.

And the next step was to say, okay, but in order for that to work in a system, you have to have an equilibrium where supply equals demand. You don't have to be an economist. Whenever you're asked a question about economics and you're not sure, look at them and say, I think it's a matter of supply and demand, you know? And usually they have to be equal. And you'll be fine, okay?

But when you impose this kind of equilibrium, then it gave you a whole theory of asset pricing. How are prices formed? How do all these, how stock prices, bond prices, all these things.

Then I had this interest, going all the way back to when I was kid sitting in a board room and had to be explained about convertible bonds. Then when I was in California, and even before that, at Columbia, I was trading convertible bonds, warrants, options. All these, what later became called derivatives. They weren't called derivatives. And they were all over the counter and everything. And I was intrigued with it, and Samuelson had been intrigued with it, and written a paper about it.

And so a theme that was going along with this, is I wanted to be able to understand how you would really do it. I'd been trading them, but I didn't really know what I was doing. You know, it's like one of those things where you do something, but you don't really know why. And now I wanted to do it.

So those were the thrust of my research in that area. And it turned out the two came to come to converge. And the reason they converged was that I was working on the option pricing, I was working on the convertible bond pricing, all that sort of thing. And I was also doing this research on how portfolios behave, and optimization.

And then by this time, when I had just met Myron Scholes, and I hadn't really joined-- maybe I had agreed to join, but I was still a student. You know, I hadn't gotten my degree yet. Hadn't finished in one nest to move to the next. We began talking. And of course, it would be natural that would mention that he and this fellow Fischer Black were working on the pricing of options.

And so we talked about the research, and I said, well, how are you doing about it? I've been interested in this. And he said, well, we're doing this kind of dynamic trading to try to hedge the risk of the option with stock. And if we can do that, then we can get this result that the so-called systematic risk is zero. And if that's the case, then in equilibrium, this has to be true. Out of that, we can get a pricing model.

And at first I said, you can't do that, because it's not linear or something. Portfolios are linear. So I was skeptical.

Then I looked at what they did. And what I did, was I reframed what they had been doing in the context of what I'd been doing with portfolio theory. So not in the convertible bond and everything, but in portfolio theory. And I had developed this idea that the abstraction I made was that you could trade continuously. Literally.

Now of course, you can't literally do that. Although today, you're very close. This is a case where practice follows theory. So 40 years later, right now, in high frequency trading, the so-called latency, the length of time is one millisecond. So that's pretty close. One millisecond is pretty short. So you know, theory.

But at the time, that was the abstraction. I justified it because I could explain how that's the way the world kind of works. And I found the right mathematics to capture the key features. And when I did it, I got all kinds of wonderful results that were highly simplified and very rich. So it was one of those good abstractions.

So I had done a lot of work on this. In fact, published two papers on it when I was still a student. But I was developing that.

So when I looked at it, I said, you know, what they're doing, I just don't see it. So I put it in this context. And then when I did it in my context, I said a version of "eureka," but not quite that dramatic. But pretty close. I said, they're right, but for a different reason. That if you look at this in the limit when you go to this continuous trading, not only could you hedge out what they call a systematic risk. There will still be risk, but so-called market risk will be hedged out. And then apply equilibrium on it, I get rid of all the risk.

INTERVIEWER: Yes. Did you think, like, this can't be right? It's too good?

MERTON: No. I knew it was right once I did it. What I didn't think is that the original, what they were doing didn't make sense to me, how they could be getting it. And then when I did this, I said, that's really neat!

So I went back to them and I said to Myron-- because I actually interfaced more with Myron than with Fischer, because he wasn't an academic at that time, even.

INTERVIEWER: Where was he?

MERTON: He had a very interesting life. In fact, there was a biography or so of him. He was Fischer-Black Associates. And there was one associate. And he had four children, and he had been at Arthur D. Little, where he had actually gotten exposed to finance. He was trained in applied mathematics and artificial intelligence at Harvard. He never took any-- and when he was at A.D. Little, Arthur D. Little consulting firm, he met Jack Treynor and he got exposed to some of this, and in his spare time worked on it. And then he left Arthur D. Little to become an independent consultant.

And he had such discipline-- imagine. He's a freelance-- not a freelance, but his own consultant, four kids, four daughters-- and he would always take at least one or two days a week for research. He just wouldn't work. This is a job where you-- if you don't go out hunting, there's nothing on the table.

But he was always that disciplined, and worked on it. And then he had met Myron through another set of things. It's a web of interactions that continues to this day, the people that are involved, that do all of this. So it's a very small world, in that sense.

But in any case, the two of them had gotten working on something else, and then worked on this problem. So when I found this, and I told Myron about it, and I explained it to them, and I thought that was pretty neat. And so we now had two derivations. The way they did it, which was an equilibrium model, and the way I did it, which was what's called the replication model or the no arbitrage model.

And in terms of significance, in terms of the theory, a necessary condition for an equilibrium model to apply-- remember, this is supply versus demand pricing-- is there be no arbitrage opportunities. That is to say, if there are arbitrage opportunities, you can't be in equilibrium. So that's necessary, but not sufficient.

So if you can prove something on the basis of no arbitrage, then it's robust, because it will have to apply in every equilibrium model. Whereas if you prove it as an equilibrium result, it will apply to that model, but need not apply to some other equilibrium model. And so what I was able to do with the technology and that assumption of literally continuous trading was to show you can get closer and closer, -- get it all gone. And that was my contribution.

And that's ultimately why I received the Nobel Prize. It wasn't for these other extensions or other things. I did a lot of extensions. But it was for the fact that I actually found this other way to do it that was much more robust. and? And when Fischer and Myron eventually published their paper, they put both methods in, but they did put a footnote saying that this was from me. So I guess it's good that there was a footnote.

INTERVIEWER: Yes. I'm always just interested in the actual sort of process of science and math, and how it happens. So I don't know if you even remember this, but how long did it take you to do this set of equations? Was it like a year, three days? Do you remember, were you doing it on paper? Was it some sort of--?

MERTON: Well, I had been doing, as I say, a lot of work in this area. And I had been doing this other thing. But when they showed me what their idea was, which they didn't originally, but they did-- it was a weekend? Less than a weekend. All I did was look at it and say, hmm. And then put in there, and made sure it was right. And said, oh, yeah.

And then from that, once that was done, then for me, anyway, I then really understood what was going on. Because the idea originally that they had was you get rid of the risk. So you have option, you have these stock and bonds, you change it, and the net of it is no risk, so therefore, that gave you the condition. I showed there was no risk at all, not just hedging.

But that means, what I'm doing is I found a way to dynamically trade, which is just meaning mixing, as you move through time, keep remixing stocks and bonds in a fashion that if you keep remixing them all the way through, the end result payout on that, no matter what happens, not expectationally, with every possible outcome, will be identical on that as it would be on this security. That's why the difference between them is absolutely, perfectly, you know, in theory, is perfectly zero.

Well, what that became-- that's called a replicating portfolio-- it became a production theory. Because this told me that I could manufacture a derivative that didn't even exist. I didn't need the derivative. I didn't need to do the arbitrage. That technology told me I could write down a dynamic strategy-- just a set of rules that if I follow those rules and don't make any mistakes, the outcome of that would exactly be the payoff to some contract. It could be an option contract, it could be a squiggle, it could be anything.

It was quite apparent to me almost, I don't want to say instantly, but right after that-- that this didn't just apply to options or warrants. It applied to any derivative. Because all we had to do was change the so-called boundary conditions. The only difference between a put and a call, even though look very different, was same equation, just different boundary conditions.

And so what was clear from this, is that you could really manufacture these things. And then once you saw that, it became a theory of production. Because the portfolio value that you got had to be the production cost. You had to put that much money in and then run the process to get that out. So that's your production cost.

The risk at any point time, since these portfolios were identical, whatever the risk of the mix of stock and bonds was at that instant, that had to be the risk of the derivative. So we got simultaneously a theory not only of pricing, or of production cost, but also a theory of risk. And the risk was changing all the time, but we could exactly, in the theory, tell you exactly what the risk was at any point in time. And that was critical. Particularly for applications.

But it wasn't just the pricing, it was the risks. And then once you had that and you see it as a production theory, then the whole world opened up. And once you saw that, you really did know.

And I have working papers that I put out, and Fischer and Myron did too, where it was readily apparent-- and we told this, I mentioned when I first started teaching, I put this in classes for the regular Master's students. I said, you can use this to have a unified theory of pricing the corporate liabilities of a firm. That if you create-- in fact, I still do this in my class to this day. I have the students design an instrument in class called a squiggle. I don't know what it is when we start the class. They design it, and of course, by committee, it looks kind of funny, but that's okay. And then I show them, within the class time, how you could use the tool to figure out what it would cost you to produce the squiggle and what are the risk characteristics of a squiggle? And you can go before a risk committee and say, here's the risk of something that at the beginning of class, we didn't even know what it was.

And this was a caricature of the way the world, and that's how the world was able to operate. We were able to do all these new innovations because we didn't have to wait 10 years of experience to see if it worked. Because as long as the technology that we used to create them had been vetted, then that's good enough to be able to build something new.

So if you like to think of it as a production system, you know, you're going around there, it's like having numerically-controlled machines. So I want to produce something that looks like something, I set this dial here, this dial here, this dial here, it goes through, out comes the custom thing at the end. You change the dials, you change what you have.

So that generalization, that's what I'm saying, was an epiphany. And it was more research to be done for us, for the students, PhD students, than anybody could do.

INTERVIEWER: Did you know-- did you say, this is going to win the Nobel Prize? Did you know at that time?

MERTON: First of all, the Nobel Prize was only created in 1969. In fact, it was the first year when Paul Samuelson won in '70. But actually, going all the way up to the day I did learn the news, I didn't-- you know, people said, did you expect to get it? And the answer is, I have proof that I didn't. At least on the day I got it.

And what's the proof? The proof was that I lived in an apartment down the street here from the institute on the river. And I, at that time, was involved in a company that I had co-founded, it was called LTCM, in Greenwich, Connecticut, and other parts of the world.

And so I was going down to that company, and I was going to take-- everybody knows, today, Nobel Prizes in their field, because it's sent out to you. So I knew it was going to be announced that morning. And everybody knows, because of the time change, you always get an early in the morning phone call.

And I was trying to get the first shuttle out. 6 am. I was all ready to go. And the phone rang, just as I was about to leave for the airport. And you know how the phone is like a baby crying. It interrupts you. It's hard to avoid it. But in that instant, I said, wait a minute. If I stop and answer this, I may miss the plane. If it's important, they'll leave a message. I'll get it when I get to New York. And I said, I'll answer it quickly and just say, hi, I'm running to a plane. Leave me a message or all call you when I get to New York.

So I pick up the phone and I say, hi. And then this deep voice says, Robert Merton? Yes. And he says, my name is Samuelson. I'm the director general of the Nobel Foundation. I have some interesting news for you.

And okay. But the proof that I couldn't believe it was that-- I lived alone. This company, I'm a founder, so if I showed up an hour late, no one's going to fire me. If I thought there was a one in 20 chance, couldn't I kind of lie in for an extra hour in the morning, six o'clock, and see if the phone rings, and if it didn't, I could just go my way, no one would ever know?

So that's my sort of object proof that I didn't think I would get it that day. And part of that was, I heard rumors that our work had been considered. But I also knew enough from my understanding of the science, sociology of science, and all that. I knew a lot about prizes, and in particular, I knew a lot about Nobel Prizes. In fact, my stepmother's thesis was on the Nobel Prize, the scientific elite, and she even did PBS television on it. So I knew an awful lot about the Nobel Prize.

And one of the things about prizes-- and my father had written a paper called "The 41st Chair." You know, if you establish one more seat in the French Academy of 40. What would the person look like in that seat? And of course, he's going to look just like the other 40. Which is a way of saying, whenever you have a prize like that, there are always many more people who are fully qualified. What do I mean by "fully qualified?" If their name is given, people say, that's reasonable, or that's good.

But you give one prize a year for the whole world, you've got to be alive to get it-- you know, there's a lot of qualified people, even if you're in the top. So even if I did know that our work had, there's some sense that they might-- you know, you never know, because they don't tell you. And people were pretty good about not saying anything, in my experience.

But there was some rumor. The *Wall Street Journal* had run one of those things they do once a year. Who's being considered, and we had been done.

So but let's say they are considering our work. The chances you get picked are still pretty small. And furthermore, in economics, because you get started later, the people who get the prize are relatively old. Now, there's somewhat of a tradition that a Nobel Prize is after some early missteps, to have a lot of time go by before the work's done, when you get the prize.

This Peace Prize is completely different. That's done in a completely different way. But the other prizes-- because they want to make sure the work holds up.

So that combination is that economists getting the prize tend to be a lot older. And while I was hardly a kid, by the comparison to those getting the prizes, I was very young. And because you have to be alive, my feeling was that they're not going to give you a Nobel Prize at this age, you know what I mean? And so those were all the reasons I did.

And in fact, just to give you a sense of how skewed this age was, I received the prize in 1997. And the first economist to win the prize who was younger than then I-- not when I won the prize, but at the time-- was in 2007. So I was 10 years older than when I won the prize when the first person younger than me at the time won. So you see what I mean?

So I wasn't thinking this is a likely-- now, Myron said he always thought --

INTERVIEWER: And we hear Myron's by the phone, going--

MERTON: No, he wasn't by the phone, but actually, that's another story. He didn't say he was going to do it, but he always thought we would. I always said, I knew the story of the 41st chair, and there are-- and Paul Samuelson, my dear friend and mentor, has given many a good economics, history of science talk in which he gave out his own list of Nobel Prize winners. He says, these are all people who should have won, who didn't. Not because he was being critical, but rather, he wanted to recognize them.

And so when you realize how unlikely an event is, you value it differently. So that's what it was.

INTERVIEWER: Can you tell me, so after you missed your 6 am shuttle and get off the phone--

MERTON: I sure did.

INTERVIEWER: What happened next?

MERTON: Well, I get off the phone. And it's interesting what they do. After you talk to the director general and they give you the whole thing, they put the head of the selection committee from the Royal Academy on the phone-- a man I had met, I didn't really know him, but I had met him-- to congratulate me. But the real reason they put him on was so that I would be assured that it wasn't a hoax. Because there are some people that think it's funny to call up people and--

INTERVIEWER: Oh, no!

MERTON: Oh, that's happened. So after that happened, I hung up the phone, and I said, wow. And I'm standing there. And next thing I know, the phone rang again. I didn't think. I picked up. It was CBS. I said, I can't talk.

And then the phone just rang, and the mailboxes filled up, and then my concierge called me up and they said, there's 50 reporters down here that want to see you. And I said, I've got to take some time. I just said, let them wait. They're going to have to wait.

So I put on a suit. I was wearing a sport jacket. And so I said, what suit should I wear?

INTERVIEWER: Nobel Prize winners wear suits!

MERTON: Well, you know. Do I have, what's a good thing? And then I started to think about it and I said, I've always said pretty much what I want to say. I just say it. That's one of the things that being an academic, and being a tenured academic-- you're not nasty, you should never be arrogant or nasty, but you can say what you think and never worry about it too much, right? You can't get fired.

And now I said, if I say something really stupid right now, it's going to be all over the planet. It's going to reflect on my institution, my family. So I started to think about that. I called my father, of course, to tell him. And it was one of those silly things where they, of course, were sleeping. And when he picked the phone up, the phone fell on the floor, and he grappled for it, picked it up, but had it upside down. So I'm shouting at him, and he can't hear me. But anyway, he finally got the message. And I let Paul Samuelson know--

INTERVIEWER: What did your father say?

MERTON: Oh, he was-- because you can imagine. I mean, this is a person, as a graduate student, who lived in 17th century England, along with Newton and all the rest. So this had a much even deeper meaning than the obvious. No, he couldn't believe it. He was very happy. So that was great.

So I told family members and some friends, and thought it through, and then eventually I went downstairs. And then the whole, you know, all the reporters, and they take you out, and there's cameras everywhere. And then I went over to Harvard eventually, and there were trucks there, you know, satellite trucks and everything, they did all these interviews.

And they had a press conference, which I was very impressed how they had everything set up for it. I found out later from the person in charge of communications that for a number of years, even though I didn't know about it, they had been doing dry runs every Nobel year so that they had a team. And they were so excited, they finally got the real thing. You know, they'd been training. Each year they'd do it and nothing happened. So it happened.

So that was very well put together. They had a press conference and some celebration. And then we went over there things. It was pretty nice.

INTERVIEWER: It's interesting how you're saying how it made you think about what you say. And there is a sort of thing where Nobel laureates are seen as experts on everything.

MERTON: Oh, that's what Paul Samuelson told me. We had a party. The dean of the business School threw a party. The dean has a house there on the campus, and they have a beautiful garden, and they had a party, and Paul Samuelson and Bob Solow came, and others here from MIT.

And my father-- he had always wanted to do this-- jumped in a taxi, he had to try to make the airport. And he said, I can give you an extra \$20 if you can get me to the airport. My son just won a prize. I've got to get up there for a thing. And this cab driver took this as a quest. You know, I'll get you there!

So he came. He was 87. And he raced up the hill, got in the car-- he was kind of a robust guy. So he came. So we had a nice party there. And it was just very--

INTERVIEWER: But you are saying that there was something Paul Samuelson told you about.

MERTON: Yeah. So Paul Samuelson said to me, he said, I've just got to tell you. Not only do they think you know everything about economics-- and economics is a big field. But they think you know everything about everything. He says, they're going to ask you medical questions. They're going to ask you about everything.

And of course, if you know about the Nobel Prizes, they're for a very specific thing. They aren't a Leonardo da Vinci prize for a Renaissance man or woman. They're for a specific thing. And while there may be that someone who's done something outstanding intellectually of that sort would also perhaps be knowledgeable, but more knowledgeable about other things, there's no reason at all that someone who's very good at this need to really know very much about anything else.

But it doesn't matter. They always ask you. I think Paul was exactly right. They think you know the answer to everything. But that's okay.

INTERVIEWER: Do you think having that sort of pulpit-- I mean, has that made you more cautious about what you say in public, or has it made you freer, in a way?

MERTON: As with many things, it's a bit of both. I feel certain responsibility that-- I mean, the Nobel Prize attracts an enormous attention, not only when it happened, but after a person. And that can be for good or not. You know? If you're a bright light attention-getter, sometimes it gets the wrong kind of attention. But that's reality. You have to accept that.

So I, for example, generally will not speak on economic issues, certainly publicly. Except-- this is my own choice-- on subjects where I feel I know a special lot about it. Do I know more economics than a random person on the street? Sure, but that's not the measure. Do I feel I know more about it than most people think that I'm an expert? I'll talk about that. But you know, people are always asking me, what's going to happen to the Chilean economy? And I said, well, I've been in the country six times. Do you think it's a little bit cheeky to think you know how-- you understand what I'm saying.

So that's been one of the things that I refuse to talk about them in public. I have opinions about everything. That doesn't mean that they need to be expressed.

On the other hand, at some level, sometimes you can say things that make no sense. And people say, oh, it must be so deep I can't understand it.

In fact, there was an impersonator from Australia who does, for his living, impersonations. And he got in touch with me, asked me if he could impersonate me. What am I going to do about it? And he sent me a tape, and he went on at this event, and he was introduced as me, and started talking, and it was filmed. And he was going along-- he's very good. I've seen him in person later. Many years later, in Australia, when I was in Sydney, I saw him.

He's very good. But of course, the whole joke is that he starts to say things that are total nonsense. And here you have a Nobel Prize winner up there, so everybody's calibrated. Then you see the people's faces going-- at first it's, this must be too deep. I'm not understanding it. And then of course, eventually he tells them.

So yes. There's both pluses and minuses, and wonderful pluses. You get attention. I found that I can go almost anywhere in the world and see almost anyone. I can get audience to see almost anyone. Not everyone, but almost everyone. And I've been very, very well-treated as a respected--

So it gives you enormous license, enormous kind of a credibility that is hard to-- there's really nothing quite like it. That's the audience thing.

INTERVIEWER: Was there someone you have in mind that you, like you just said, maybe I could meet with X, and you just called them up. Wow! It worked!

MERTON: Yeah, I think I've had some very good experience. Now, what was a little different, there are some pluses and minuses of our particular Nobel prizes, or in terms of the impact on us. Both Myron and I, because of what we were in, and what we're doing in finance and economics, had been reasonably, compared to a lot of physicists or others who are more involved in their labs and had much more public exposure-- so we were much more used to talking to large groups, being on television, that sort of thing.

And so in some sense, we already had a kind of pulpit for saying things without-- but of course, this enhanced it enormously. But we were, I think, probably a little more comfortable than some of our colleagues from other areas, just because we've been through this kind of thing. And so in that sense, that part was less of a change. I never felt that no one was listening to me, at least on subjects that I had something to say. So this was, in that sense, a bully pulpit for me to do it. And I never wanted to use it for other purposes.

But it certainly changes your life.

INTERVIEWER: Yeah. Did it change your research? I mean, did you find yourself-- you said you're already tenured, so you can kind of go where things lead you.

MERTON: Well, you were tenured long before that.

INTERVIEWER: But I wonder, did it feel like, wow, now I can take some real risks, or something? Do you know what I mean? Or go further out?

MERTON: No, I didn't feel that way. I felt it opened doors for me to do things just more. I mean, I had, as I said access to people.

And then there were also stories-- I mean, I knew this again from my stepmother's work. You know, it's such a wonderful thing to have happen. I mean, other people can't understand, but this is worth much more than any amount of money that could ever be offered. There's no amount of money that I would ever considered have giving it up. And all it is, is a-- well, it's a pretty nice gold medal, and all that sort of thing. But because of your growing up in that world, it's priceless.

So it is a sort of very one of a kind thing. There's just is nothing you would trade it for. But in terms of giving me much greater opportunities for my research, no, not really at all. I could always do everything. I mean, look. I was at MIT. I was at Harvard. I was a university professor, you know, these institutions take very good care of people. They give you all the opportunities in the world. I was blessed with that. So this was just a plus.

But it's pretty nice. But I was going to say, my stepmother says, you know, with all these good things, many Nobel laureates have downsides to it. They found it interfered with their research, because they were always in the press. People were bothering them.

INTERVIEWER: Were they just not used to the attention and the fame and they sort of floundered? Yeah.

MERTON: And I can understand that. And they feel guilty about it, because they say, this is so wonderful. How could I be finding anything wrong with it? And that, I didn't have the experience at all. And it's a very special thing to have that.

INTERVIEWER: Yeah. I'd read somewhere that the work you did for the Nobel Prize has been likened to the discovery of the structure of DNA, in that that both gave birth to new fields. Did you ever feel that way, that it was of the same?

MERTON: I don't like to make that kind of comparison. First of all, DNA is pretty fundamental, to put it mildly. And I don't know whether you need that.

To the extent that there is a comparison, what it did do is open the door up to give you the keys to how you could do all these things, to do these innovations, understand -- it was kind of a unified theory for understanding how all these things-- it gave a prescription on how to do this.

And it turned out, again, partly by luck of the work-- had Myron and Fischer and I done this work in 1960 versus 1970, it would have been fine. It would have probably gotten very little attention. The reason was that 1970, the '70s-- if you think things have been pretty exciting year for the economy in the last three years, which they have been, in a negative way, the 1970s-- just about everything you could imagine economically went bad. We had oil prices go from \$2.50 to \$30 a barrel. We had interest rates, US treasury interest rates, in double digits. We had inflation in double digits. So you started out-- your savings were eroding at a rate of 10 percent a year.

So you had double-digit interest rates, double-digit inflation. You had spikes in oil prices. We didn't know we were going to number the number of oil crisis. Number one, two, three, so on. The stock markets fell, in 1973 to 1974, in that 18 months, it fell by 50 percent in real terms. These were interest rates, inflations that we hadn't seen since the Civil War in modern times.

And on top of that, at the same time we had high inflation, we had high unemployment, so-called stagflation. And this, in fact, was the lesson. You may recall, I told you, I went into economics because I was motivated by the great success of macroeconomics in the 1960s. By the 1970s we found out we didn't know what we thought we knew, and those prescriptions didn't work. It's like some new bug comes that antibiotics don't work on, and they say, what? We thought we had it licked, and we don't.

Bretton Woods. All the currencies were tied together in fixed exchange rates, pretty much. So the pound and the dollar and the Swiss Franc and the French Franc and the Deutsche Mark were all tied together pretty much, in one relation. So all the currencies were linked. That exploded, and we suddenly had all the currencies gone.

So in every domain you looked at, there was uncertainty, risks, events happening that were outside anything that we really experienced in modern times. With that much risk, with all the negatives of that, it created enormous incentives for innovation in risk developing.

And so all these derivative markets that were created, they all had origins right there. I mean, we used to have a derivatives market for a long, long time in commodities like wheat and so forth. But I'm talking about these financial levers. It all happened right then, because the need was so great.

In innovation-- you know, they say in real estate, the three most important things of value are location, location, location. In innovation, in my view, the three most important is need, need, and need. There was a huge need.

So you have all these markets being created. We had the great good fortune to have developed a tool, the universal kind of tool that could be used to solve these problems, to actually implement. And that coincidence led to these ideas that were conceived basically in theory, and then confirmed with empirical work. But being adapted widespread into practice almost overnight. And it wasn't because of intellectual curiosity. It was because of need.

And first of all, that's very exciting. But secondly, that's what made it such a big deal. And what made it, that particular Nobel Prize in economics a big deal, was that a lot of people couldn't understand always with the prizes were for in economics. They either simplified them to the point where they say, you can get a Nobel Prize for that? Like Modigliani and Miller's work. If you take a pizza and you cut it in four big slices versus eight, the size of the pizza doesn't change. And you say, really? So it was either at that end, or some esoteric thing no one understood.

And ours sort of hit the world-- because like the bankers and other people, they understood it. They had equations and mathematics that looked like physics or looked like something. That's why there's so much focus on the formula, even though the formula is not what we got the prize for. The formula was a special case. The prize we got was for the methodology I described, which was this replicating thing.

So everybody was happy with it. The practitioners understood it. It had kind of this cachet. So it got a lot of attention when it did come out. So we were lucky even all those years later. So a lot of this is a coincidence of good fortune of the need was there when we did it.

And then subsequently, the creation of the national mortgage market, that wouldn't have been doable. Or anything's doable if it hadn't been for this. And it's been going on now for 40 years and still going. And although we've had some setbacks, and people talk about it here, it's still used by every-- there's no financial institution in the world, including all the central banks, including our Fed, they can't operate without it.

INTERVIEWER: Yes. No, it's hugely influential.

MERTON: So it's kind of a kick to see the same technology being used in a field that's evolved, four decades later. And I almost look at it, it's not us. I look at it and say, that's pretty neat, and that was kind of fun. So as I say, good luck.

INTERVIEWER: I wanted to talk to you a little bit about your work now and the things you're working on now. But I also wanted to ask you if you could describe how you work. Like a typical day of work. Do you work at home? Do you work at an office? Do you get up at four and work? What do you do?

MERTON: First of all, the one constant I've had throughout my professional life is, I almost never work at home. I mean, I do emails and so forth. I've always had a study. But that started out because when I was a student, I was in East Gate Tower, which was across the parking lot from the Sloan School and the economics department. So as a student, I could just run over there to my office from home. And then when I was on the faculty, I stayed there for a while.

So I started out working always in the office. And then I've done that all my life, and I now live-- 40 odd years, how far have I gotten? A quarter mile down the road. I was in East Gate, next to 52. I'm now at the Esplanade, 1325 or 1500 feet away. So I haven't gotten very far in all these decades.

But so I always work in the office. That's always been my pattern. The hours I work-- I've always work lots of hours, but now, since my children, everybody is all grown up, I live by myself, so I have complete flexibility. I do whatever I do. So I work sometimes weekends, I can work Christmas Eve, or something like that. But then I have lots of fun. I spend a lot of my family. You know, they're grown up and everything.

So part of the work pattern is, there isn't a work pattern, except I work a lot. I like working. I like doing things. I like doing other stuff. So when I'm not playing, pretty much, I'm working.

And so I sometimes get up early. I often work late. But I don't have any fixed pattern. I don't sleep very much. I mean, I sleep what I need to do. But I love doing this stuff.

So I love the freedom of being able to work whenever I feel like it. Which obviously when I was raising children and so forth, we all have those constraints. But you know, that's my style.

INTERVIEWER: So I just wanted to ask you a little bit about some of your-- I know that you have a lot of interest in retirement savings now, and I was wondering if you might just talk a little bit about your--

MERTON: Well, my whole life is, in terms of, I've always been involved in practice. I like to implement the research I do into practice. And that's been my kick. That was what brought me to economics in the first place.

And the one that has intrigued me is for 40 or more years has been life cycle. That's the original thing I talked about. Solving the optimal problem for people's lifetime. And in particular, a part of everyone's life cycle, their life-- whether you live 200 years ago or 200 years from now, whether you live here, in China, Japan, Brazil, Germany, Iceland-- you have to deal with retirement. Retirement is a part of every life cycle, which is the time between the time when you stop working and the time when you leave this earth.

And that's been a part of a bigger set of research for my whole life. But I had lots of good ideas about this, but what's inspired me to spend a lot of work on the last seven or eight, really focusing on it, was circumstances. That this is a huge problem for the world. Some big changes have occurred, leaving voids. Every part of the world.

We have it in the United States. You have some countries that are aging very rapidly. You have China, with a single child per family. That isn't a big base to support retirement. And a growing standard of living.

But even in the Middle East, where you have a very young population-- I mean, some of the Middle Eastern countries, Iran, for example, the population under 25 is, I don't know, 60 percent. It's huge. They still have a problem, too. Because these retirement systems are very long-lived. You think in terms of decades into the future. They take a long time to build up.

Because think about this. You work for certain time, and you don't work for the other. And on average, you've got to earn, during her work life, not only enough for you to live while you're working, but to have enough to pay when you don't. And if you don't, somebody else has to do it. I mean, there's no freebie.

So these build up over a long time. So this is not a problem that you solve in an hour or a week or a month or a year or five years or ten in terms of the time it takes to build them up. So they're long horizon. This is a very challenging problem. And the need is there.

Going back to-- I find it a fascinating challenge. It's a global problem. And as I've done in the past, I've tried to implement in practice what I've developed in my theory and my work. And so I'm so actively involved in implementing the Next Generation Pension Solution, and I've been doing that for about five or six years.

Now, whether I'll be the one that succeeds, I'll find out. I've had some great successes, some pretty spectacular failures, and that's the nature of doing innovation. But if I succeed with this-- it's a challenging, interesting problem. Someone says, what did you do with the last five, ten years of your life? If it works, you say, I did something to help an awful lot of people for a long time. And it was fun, interesting, exciting, and even it can be financially rewarding, and it's a global problem. So why wouldn't you want to do that?

I mean, this is an exciting time for me, and it's stimulating to me to be able to work on this. Where a lot of people would be thinking about retiring at my stage of life, and a lot of people say to me, you won a Nobel Prize, What else is there to do? And I say, that's not the way -- this is just fun. I mean, what would you rather do? This is work.

And so I'm very much engaged in this. And it's a matter of the research, but also the implementation. And I bring it into the classroom. I have a whole course on this now. And we'll see how the students come out on this.

So I feel very blessed. How many people can go on and work this long, and still be able to keep working, and then have such exciting stuff going on that you never want to retire? I mean, I work on retirement, but I never plan to voluntarily retire. Because it's too much fun, and it's exciting. I travel all over the world to these things, meet all kinds of neat people, including you. You know?

INTERVIEWER: Great. Well, that's wonderful. I think that's a good place to end it.