

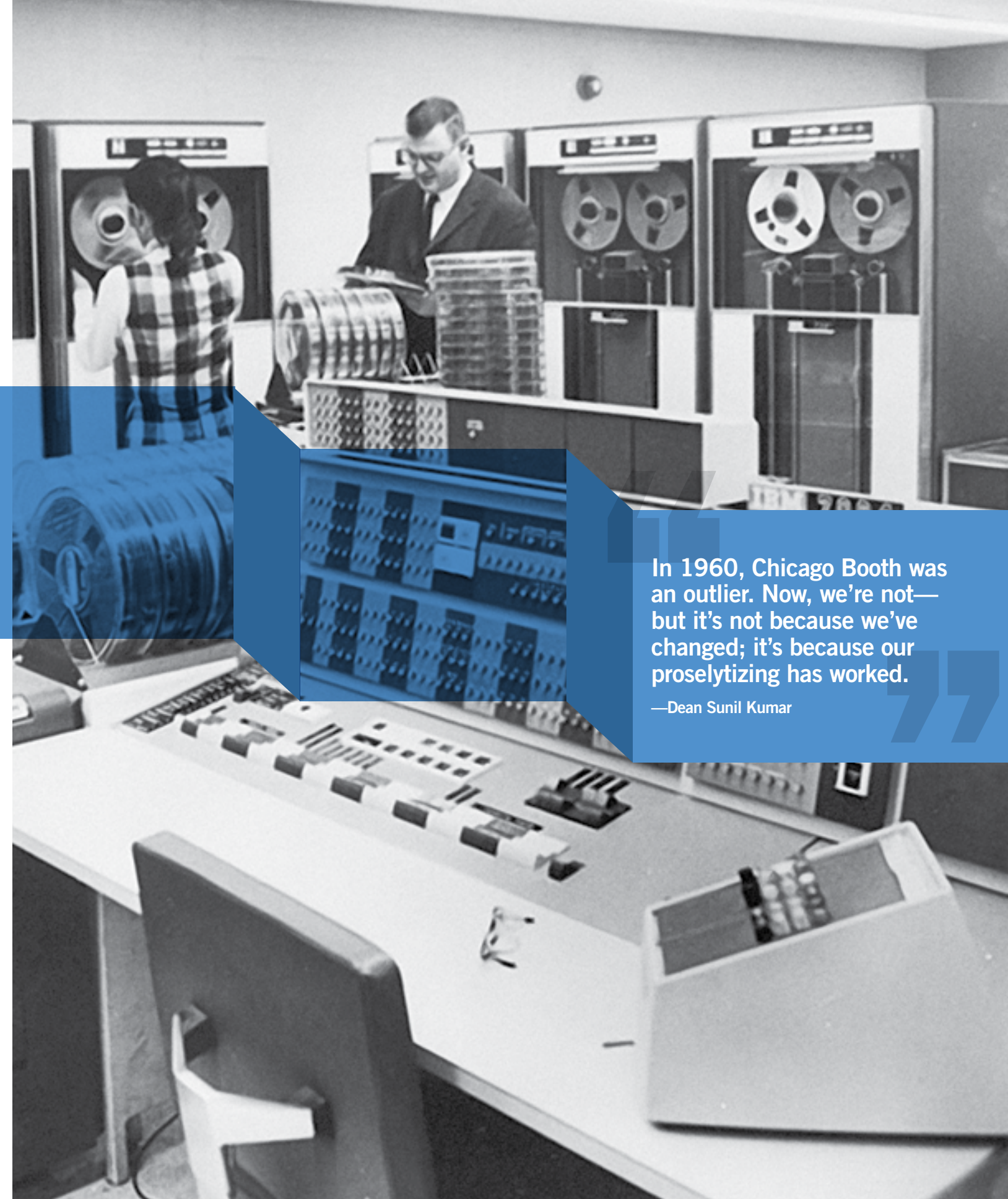
# THE GENERATION OF THE FIRST INDEX FUND

## HOW CHICAGO BOOTH HELPED USHER IN THE ERA OF DATA-DRIVEN INVESTING

BY KATE ANCELL

It's a story that begins in New York in 1963, when an engineer with an MBA started analyzing share price behavior with the help of an IBM mainframe. It culminates in San Francisco, where Wells Fargo introduced the first index fund in 1971. But that might never have happened if the journey hadn't gone through Booth, where the engineer met the "Chicago gang" and formed a collaboration that would forever change the stock market.

**DATA WITH DESTINY:** With the help of an IBM 7090 mainframe like the one at right, Mac McQuown began investigating how to quantify share price behaviors.



In 1960, Chicago Booth was an outlier. Now, we're not—but it's not because we've changed; it's because our proselytizing has worked.

—Dean Sunil Kumar



“In 1960, Chicago Booth was an outlier. Now, we’re not—but it’s not because we’ve changed; it’s because our proselytizing has worked,” said dean **Sunil Kumar** in a recent rumination on Chicago Booth’s place in academia. And he’s right—so many of the concepts, theories, and ideas that the world takes for granted started right here, as a crazy idea in a professor’s (or, often, a student’s) head that the school was brave enough to let grow.

Take index funds, for example. Not a terribly complicated concept to understand, and a term that novice investors today like to toss around to sound knowledgeable, as they learn the industry. At its most basic level, an index fund is—quite simply—a passively managed fund that mimics, follows, or replicates a well-known market index, such as the Standard & Poor’s *S&P 500*. No one selects stocks, there are no security analysts, and there is no portfolio manager. It is the enemy of the investment or hedge fund manager, the scourge of Wall Street, and has been described by Mark Dowie in *San Francisco* magazine as “the best investment advice you’ll never get.” And it exists, in large part, due to Chicago Booth’s willingness to think well, *well* outside the finance box.

It wasn’t all Booth, of course—key players in the creation of the first index fund (which is not what they planned to call it, either) came from all walks of life. There was a mechanical engineer with a bent for portfolio management and an eye on the future of computation; a mathematician-musician from Kentucky; a statistician from Stanford, on loan from IBM; two young graduates with theorems on their minds; a brand-new professor and his mentor, too; and a bank chairman who was ready to go the distance. But, like the center of a beautiful spider web, there was Chicago, spinning and binding all the parts together to make something brand new. And this is the story of how it all happened.

When John Andrew “Mac” McQuown, a mechanical engineer with a degree from Northwestern, graduated from school in 1957, he did two things: He entered the Navy, and he invested in Texas Instruments, because of the company’s expertise in transistors. Even then he was convinced of how important computers and technology would be for the future of business. It didn’t take long for him to be proven right, either. In 1959 he sold his shares, which he had bought only two years earlier for \$1,600, for more than \$120,000.

So it was only natural that, with this interest in the market, upon his discharge from the Navy and graduation from Harvard’s MBA program, he went to work on Wall Street. Which is where he ran into problems.

“There are oodles of things that made no sense to me in Wall Street,” he recalls, sitting in his current offices at Diversified Credit Investments, or DCI, on a leafy, tree-lined street in San Francisco. DCI is an independent asset management firm, and its offices are like something out of *The Social Network*, with white-board walls covered in theorems and data, comfortable sofas, cool tripod lamps, and the almost-audible hum of whirring brains.

“One of the most perplexing things that I have ever encountered—and never sorted out—is the Prudent Man Rule of investing . . . an interpretation of a judicial proceeding going back to early in the 19th century when some fiduciary was charged with malfeasance,” McQuown says. “The conclusion of the case was that investment fiduciaries should behave as prudent men behave—and they defined a prudent man in terms that made no sense at all. Basically, they said: ‘Go find a prudent man and behave like he behaves.’ That rule governed the investment management process of fiduciaries for

“All of a sudden I’m at Chicago and there’s a whole bunch of guys asking all kinds of questions and collecting all kinds of data and actually investigating what’s going on.”

—Mac McQuown

a hell of a long time, and in some sense still applies today. I got some inkling that there were weird things like that, in business school, but I never really became clear about what was going on until I got to Wall Street.”

One thing McQuown does not like is applying received wisdom “just because.” Which is why, when he was working on his MBA, he discovered a professor at MIT “who was interested in testing a particular hypothesis about the behavior of share prices. I made a deal to be a data dog and do some programming in order to follow the professor. It got me interested in the behavior of share prices.”

This interest—and the idea that share prices even *had* “behaviors” that could be quantified—was a new concept, largely

ignored by investors. It stayed with him in New York when he went to work for Smith Barney. While holding down a day job (and simultaneously studying for a PhD in mathematics at NYU), McQuown spent evenings moonlighting for his former professor, finally buying time on the IBM 7090 in the “service center in the basement of the Time-Life Building for \$300 a weekend. The program took so long to run, and produced so many reams of uninterpretable data, that McQuown often crawled into his sleeping bag on the floor and slept while the program was running,” as Peter L. Bernstein describes in *Capital Ideas: The Improbable Origins of Modern Wall Street*.

## MAC AND THE ‘CHICAGO GANG’

Eventually, of course, word of these nocturnal adventures got around, and a colleague, who understood his determination to harness the quantitative power of computers as a device to pick stocks, gave McQuown an entrée to a presentation that **James Lorie, PhD ‘47**, and **Lawrence Fisher, ‘68**, were giving a group of Merrill Lynch executives about their preliminary results on returns for common stocks. (The seed money garnered by this Fisher-Lorie lecture resulted in what would eventually become the groundbreaking Center for Research in Security Prices [CRSP] database.)

McQuown recalls, “There were probably no more than maybe 40 or 50 people in this audience. I went up to Professor Lorie and I asked him a couple questions about the statistical behavior of share prices, and he said, ‘Well, you know, you’re going to have to come to Chicago and meet a couple of my colleagues—if you really want to talk about that subject, you need to meet Gene Fama.’”

Newly minted professor **Eugene Fama, MBA ‘63, PhD ‘64**, now Robert R. McCormick Distinguished Service Professor of Finance, had spent years

### TRACKING THE DEVELOPMENT OF THE INDEX FUND BY KATE ANCELL AND DAN KEDMEY

#### 1963

Harvard MBA and mechanical engineer John “Mac” McQuown (below right) learns of **Lawrence Fisher** and **James Lorie**’s study on reasonable expectations for returns on common stock. McQuown meets Lorie (below left), who introduces him to **Eugene Fama** (above) and “the gang” at Chicago Booth.



#### 1964

William Sharpe paper<sup>1</sup> establishes the capital asset pricing model (CAPM), the mathematical formula showing that a stock’s value is sensitive to risk relative to the market.

McQuown joins Wells Fargo Bank Management Sciences Division, where he studies how computers could be used in trading.

<sup>1</sup> “Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk.”

#### 1964–1971

Wells Fargo brings in leading academic thinkers as advisers or employees, including Booth luminaries **Fischer Black**, **Lorie**, **Merton Miller** (left), and **Myron Scholes** (below).



#### 1965

Paul Samuelson paper<sup>2</sup> shows that stock prices follow a “random walk”: No other estimate is likely to be more accurate than what buyers and sellers agree on in the marketplace in that moment.

Fama study<sup>3</sup> explains that the “random walk” is a product of new information (news) influencing prices. He coins the term “efficient market hypothesis.”

<sup>2</sup> “Proof That Properly Anticipated Prices Fluctuate Randomly.”  
<sup>3</sup> “Random Walks in Stock Market Prices.”  
<sup>4</sup> “The Performance of Mutual Funds in the Period 1945–1965.”

# Feature The First Index Fund

studying the markets and had written his thesis on what he called the efficient market hypothesis. Essentially, this states that at any given time, security prices fully reflect all given information. Put even more simply: You can't know anything more than the market itself knows, which makes trying to beat it impossible. Not only was this idea heresy at the time, it was also revolutionary. Fama's later study "Random Walks in Stock Market Prices," published in the *Financial Analysts Journal* in September/October 1965, cemented his—and Chicago's—reputation as the leader in the field of efficient market theory.

This reputation was reconfirmed when one of his graduate students, **Michael Jensen, MBA '64, PhD '68**, published, in the *Journal of Finance* in the same year, the first study comparing actively managed funds to randomly selected stocks, demonstrating that only 26 out of 115 actively managed funds beat the random stocks. As McQuown puts it now, "Fama and Jensen were fellow members of the self-appointed inquisition into the real behavior and performance of common stock portfolios."

By the time Burton Malkiel's book

*A Random Walk Down Wall Street* came out in 1973, putting the efficient market hypothesis into layman's terms, McQuown and his team had taken this concept and run with it, all the way to the bank.

Meeting Fama and learning what the "Chicago gang" was all about was an offer McQuown—who was sure that traditional Wall Street wisdom was wrong, and wanted to figure out how to make it right—couldn't refuse. Which is how one cold post-Thanksgiving Monday morning, McQuown found himself on campus. "I went to Professor Lorie's office, and we chatted for a few minutes, and he took me in and introduced me to Gene Fama. An hour later he introduced me to **Merton Miller**. So, in the course of that morning, I met the two people who would be ultimately more influential than any other two in terms of getting me started."

McQuown recognized this life-changing moment at the time: "I thought, all of a sudden a door had opened up, on the other side of which was understanding and study that I'd never encountered. I was looking for an understanding in finance that was consistent with the

learning that I had been exposed to in engineering. And it wasn't there. And all of a sudden I'm at Chicago and there's a whole bunch of guys asking all kinds of questions and collecting all kinds of data and actually investigating what's going on. I mean—wow. Right?"

## MANIFEST DESTINY

Although he didn't know it, another wow moment was snapping at his heels. IBM—whose computer McQuown was renting—asked him to speak with a group of executives at their training facility in San Jose, California, on the application of analytics to finance. In that audience was then-president of Wells Fargo, Ransom Cook. Cook, whose successor, Dick Cooley, became equally supportive of McQuown's project, "was very skeptical about what was going on in the Trust Department. They were skeptical about corporate lending. They were skeptical about the economics of branch banking. They wanted it examined—and were willing to put a number of cherished banking/investment beliefs to the analytical blade.

"Ransom had the wisdom of realizing that loans and deposits are quite insufficient products for an expensive bank branching system. He needed a

more diverse product suite. Second, he was very skeptical about brokers and he was also very skeptical about investment performance. He wanted somebody independent, who wasn't afraid to ask tough questions," McQuown explains in hindsight.

"Cook said to himself, 'Do you know what? We're spending cajillions of dollars on computers. It's the fastest-growing expense in the bank, and all we're doing are the same things that we used to be doing with punch cards and people with green eyeshades and armbands. We've got computers full of data, but we're not doing anything with it except mailing out customer statements, and miscellaneous other kinds of things.' He was really committed to making sense out of his computers and making them work for him."

Though McQuown didn't know it, he was about to become the eye of a perfect storm.

After the speech, Cook approached McQuown and, within one day, offered him a job. Understandably, Mac—who had a wife, a career, and a PhD program on the go back East—was "kind of flabbergasted" and asked for time to think about it.

He didn't have long to consider it. About 10 days later, Cook was on the phone again. A few vacation days after that, the two met in California.

"He said, 'I want you to come work here. And money is not going to be a problem,'" says McQuown.

"I said, 'Well, you know, it's going to take a lot more than just me. And it's going to cost something.'

"He said: 'Whatever it costs, it costs. That's fine. We'll just do it.' He didn't bat an eye."

Which is how, going on little more than a handshake and hope, in March of 1964, McQuown arrived in San Francisco as the head of Wells Fargo's Management Sciences Division, tasked with developing the newly coined "Investment Decision Making" project.

## BITS AND BITES

It is difficult to overstate just how "out there" both Cook's offer and thinking were. The idea of trying to use computers—which, until this time, even IBM itself had only used for accounting—to break the investment process into parts and to then evaluate those parts and come up with a reliable model predicting what they would do, was simply unheard of. Further, it seemed that, even if it

could—in theory—be done, no one had the technological resources to do it.

Wayne Wagner, who came from IBM and was McQuown's first hire and eventual lieutenant, puts it this way:

"To this day I marvel that Mac was able to convince the chairman of the bank to fund—and continue to support—this highly speculative venture that was frowned upon by virtually everybody else at the bank."

It is hard to conceive of just how little data and computing resources were available. First, Professor Lorie's CRSP database, which at its inception had charted the rising and falling stock prices of 506 companies from 1925 to the current day, was brand new. (The team at Wells Fargo was its first outside user.) Other than that, analysts had virtually nothing to work with to begin building their database of information. And without a database, they could never hope to create a system to predict market behavior and manage funds on those predictions.

Says Wagner, recalling the cobbled-together early days, "Say we wanted to do a test of security analysts' ability to identify outperforming stocks. There was a weekly, approved list of stocks that could

### 1969

Scholes, Black, and Jensen update the CAPM formula, showing that low-beta stocks are underpriced and high-beta stocks are overpriced. They propose a fund that profits from this inefficiency.

### 1971

**WELLS FARGO BANK ESTABLISHES THE FIRST INDEX FUND: A \$6 MILLION FUND FOR SAMSONITE CORPORATION'S PENSION PROGRAM.**

### 1973

McQuown opens a new fund at Wells Fargo indexed to the S&P 500. At the same time, American National Bank opens a competing S&P 500 index fund.

Burton Malkiel publishes *A Random Walk Down Wall Street*, putting the efficient market hypothesis into layman's terms.

### 1973

Black and Scholes introduce the Black-Scholes model,<sup>5</sup> which is used to calculate the value of an option. Texas Instruments creates calculators with a built-in Black-Scholes formula, which traders use on the floor.

### 1975

Charles Ellis article "The Loser's Game" details how 85 percent of active managers failed to beat the S&P 500 over 10 years.

Deregulation of the stock commission results in lower transaction costs.

Both Wells Fargo and American National Bank have \$70 million to \$80 million under management. New York Telephone (subsidiary of the Bell system) gives \$40 million to American National Bank. Within 15 months, both ANB and Wells Fargo increase their assets by more than \$1 billion each.

$$C = SN(d) - Le^{-rt} N(d - \sigma\sqrt{t})$$

<sup>5</sup>"The Pricing of Options and Corporate Liabilities."



# Feature The First Index Fund

## Fama-Miller Center Launches New Website

The recently opened Fama-Miller Center for Research in Finance at Booth, named for **Eugene Fama** and **Merton Miller**, has launched a new website that highlights current research by its scholars, working papers from Booth faculty, and other information about the facility.

The center is named in honor of Fama, Robert R. McCormick Distinguished Service Professor of Finance, and in memory of Miller, a Nobel laureate who held Fama's current title until his retirement in 1993. He died in 2000.

The center's mission is to maintain and advance the legacy of Fama and Miller by providing the institutional structure and resources required to push forward the boundaries of research in finance. It provides direct funding for Booth faculty research and visiting scholars from other institutions.

**ON THE WEB** Access the website at [research.ChicagoBooth.edu/fama-miller](http://research.ChicagoBooth.edu/fama-miller).

be bought, but nobody thought to save them. Last week's selections? Isn't that as useless as last week's news? Nobody had ever thought to keep them, to make a

database to measure performance—so security analyst performance wasn't measured; nobody had any idea whether they were good, bad, or indifferent. But we found one financial analyst who had thrown the lists into a bottom drawer rather than the wastebasket. A treasure!

"We also needed, every day, what the closing prices were the day before, on all the stocks in the universe. We found this guy in Palo Alto, and this was his system: He went out and he bought a *Wall Street Journal* and a *New York Times*. He gave one to one keypunch operator and the other to another keypunch operator, and they both keyed in all of the prices and then compared them to check for errors. He was able to deliver that 'report' by noon the next day."

Second, Wells Fargo didn't have a single machine capable of running Fortran—the analytic language of the time.

"We were able to buy time on the 7094 II at Standard Oil for \$500 an hour," says Wagner. "We were hiring college graduate programmers for \$475 a month! This was the largest machine in San Francisco. Quite literally, it had far less capacity than today's iPhone, but it was room size."

Third, analytic packages didn't exist. "When I wanted to run a regression analysis, I had to program a step-wise regression."

Finally, there was no university that offered a major in quantitative finance. "Almost all the practitioners had operations research or engineering backgrounds," says Wagner, who graduated from Stanford. "Hell, hardly anyone graduated from college even knowing how to program a computer."

## BUILDING A TEAM

At the time, when big clients—like Wells Fargo—signed up for their services, IBM "gave" systems engineers away to the clients to make them happy (and, often, to explain how to do things). In what would prove to be a fateful move, Wagner was temporarily assigned to Wells Fargo. "Management said, 'They have this crazy guy there, trying to rebuild the entire investment process,'" he says.

Wagner's role was to literally assist McQuown in interviewing people. One of McQuown's "eccentric" hallmarks at the time was his disinterest in hiring typical finance guys to be members of his fledgling team. Instead, he wanted mathematicians, statisticians, and computer science experts.

As Wagner sat in on the meetings, he began to think that, actually, the guy McQuown should be hiring was him.

"The more I listened to what his plans were, and his thinking behind them, the more thrilling it sounded to be a part of. Mac and I shared two very strong beliefs: that the scientific method could be applied to business problems, and a strong libertarian streak. We got along from day one."

There's another reason he was the right man for the job: in another perfect-storm moment, Wagner had recently been assigned—unhappily, on his part—to IBM's San Francisco-based finance division.

"I said, 'I don't want to go there. There's nothing happening.' And [the boss] said, 'No, no, no, we're going to come up with a new program. I want you to take the lead in putting this into usage.' He handed me Markowitz's book. I said, 'Huh. That sounds interesting.'"

So Wagner, using Nobel Prize-winning economist Harry Markowitz's principles, had already begun to try to develop a financial reporting program for IBM. But it was too big to run even on the Standard Oil machine. He recalls, "I had to come down to UCLA, which

[had] the biggest machine on the West Coast, in order to run these programs. So, here I am. I don't understand this; I've had some finance courses, but it wasn't something I really understood. I didn't really know what portfolio managers did, for example. But I had this program, and it required nine-point estimates."

To fill the points, he started asking managers some previously unconsidered questions about potential portfolio performances—questions like: "What do you think it's going to be?" "What's your high and low estimate?" "What if things were not quite as good, or a little bit better?"

"You can imagine what kind of wacky looks I got talking about this stuff. But I got some data and took it down to UCLA. It didn't work. Meanwhile, I was learning theory, and something about quadratic programming, and operating systems portfolio management."

When Wagner realized what McQuown wanted to do, he said, "You know, I've been working with this stuff." Mac was shocked.

"He said, 'I didn't know anybody in the world was.' I said, 'Well, I might be the only one in the world.'"

Needless to say, Wagner was hired. And the years went by, and the team increased from six to 35, and McQuown called in experts to help with the heavy lifting—experts like Bill Sharpe with his CAPM expertise, Harry Markowitz, Lawrence Fisher, Mike Jensen, and Jim Lorie. And still they couldn't make it work. And still the bank funded the team.

McQuown explains, "We did one thing really, really well—we were completely open about what we were doing. We didn't withhold anything: When things got screwed up, we told the boss—'Things are screwed up, and we need to do something different, or quit, or whatever, but there is no reason to do it anymore.' I think that Dick [Cooley] really liked that attitude. It had to do with honesty and integrity."

So when, after three years of going down blind alleys, following false starts, and working about 100 hours a week, McQuown announced that they needed to start over completely, from thought one, Cooley trusted him and his team to carry on.

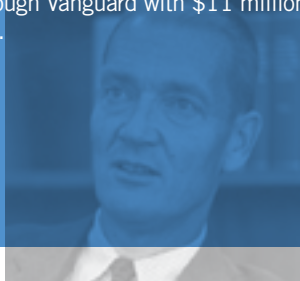
"He said, 'Go do it.' There was no committee. There was no nothing. He just made up his mind," says McQuown. "There was a lot of adaptive behavior and extremely good executiveship from the top of the institution."

So Mac began to cast about for new ideas. And it wasn't long before he found one, which would change everything. Which would, in fact, change the world. ■

**ON THE WEB** To read the entire story, including how Mac McQuown's continuing long-distance ties with the "Chicago gang" resulted in the breakthrough that would prove pivotal in the index fund's creation, visit [ChicagoBooth.edu/indexfund](http://ChicagoBooth.edu/indexfund).

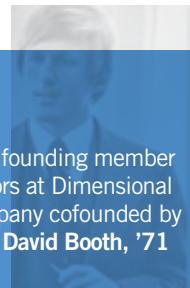
## 1976

Vanguard Group founder John Bogle (below) introduces the first retail investor fund through Vanguard with \$11 million in assets.



## 1981

McQuown becomes a founding member of the board of directors at Dimensional Fund Advisors, a company cofounded by Wells Fargo colleague David Booth, '71 (right).



## 1997

Scholes (below right) is awarded the Nobel Memorial Prize in Economic Sciences for his research on options.

