Famed Medallion Fund “Stretches . . . Explanation to the Limit,” Professor Claims

In a paper, UCLA professor Bradford Cornell raises questions about how Renaissance Technologies’ flagship fund could produce 66 percent gross returns since inception. Others—including some who advised him on the paper—are less skeptical.

By Amy Whyte January 26, 2020

When finance professor Bradford Cornell first saw the annual investment returns of Renaissance Technologies’ Medallion fund, he was “dumbfounded.”
“It was like the sun rising in the west,” says Cornell, a professor emeritus at the University of California Los Angeles. “I’ve been a finance professor all my career, I’ve read thousands of papers on investment performance, and I’ve never seen anything like it.”

The secretive fund’s performance figures — revealed publicly in Gregory Zuckerman’s 2019 book on Renaissance Technologies founder James Simons, *The Man Who Solved the Market* — paint a portrait of a wildly successful hedge fund that has not once, in 31 years, delivered a negative gross annual return. Struck by Medallion’s “extraordinary” performance, Cornell set about trying to understand what could possibly explain the fund’s reported annual returns, which averaged 66 percent before fees during the period from 1988 to 2018.

The finance professor’s conclusions were published in a brief paper dated December 2, entitled “Medallion Fund: The Ultimate Counterexample?”

Cornell writes in the paper’s abstract: “The performance of Renaissance Technologies’ Medallion fund provides the ultimate counterexample to the hypothesis of market efficiency. To date, there is no adequate rational market explanation for this performance.”

The paper proceeds to analyze the Medallion fund’s performance from a variety of angles: comparing it to the overall stock market, computing the sheer amount of wealth that such returns could have hypothetically created, and running a regression to determine if the results were driven by risk factors. Cornell also looked for answers in Zuckerman’s book and in the results of two other Renaissance Technologies funds — neither of which has delivered returns anywhere close to those of Medallion, he claims. Last, he sought input from asset management executives and prominent academics, including Research Affiliates founder Rob Arnott and Dartmouth College’s Ken French, who were thanked in the paper for providing “helpful comments,” alongside a half-dozen others. (When contacted for this article, Arnott declined to comment on the record about the Medallion fund.)

Ultimately, Cornell wrote that he could come up with no “convincing” explanation for the Medallion fund’s outsize returns, noting that even if Medallion was simply better at trading than any other fund, “the returns are so large, it stretches that explanation to the limit.”
Cornell’s incredulity is not an unusual reaction to the Medallion fund, which has long baffled industry insiders and observers. The secret to Renaissance Technologies’ performance has been debated in news articles and academic circles and on online message boards — and its success no doubt inspired the launch of other quantitative hedge funds that have tried and failed to replicate Medallion’s returns. (Renaissance Technologies declined to comment for this article.)

According to The Man Who Solved the Market, Medallion’s strategy involves holding thousands of short-term positions, both long and short, at any given time. The fund makes high-frequency trades, but has also held positions for up to one or two weeks, per Zuckerman’s description. Robert Mercer, the former co–chief executive of Renaissance Technologies, allegedly told a friend that Medallion was right 50.75 percent of the time when it came to its millions of trades — adding that “you can make billions that way.”

In simple terms, the Medallion fund reportedly makes money in much the same way that a casino does. The house doesn’t always win — but enough small wins over time can add up to large profits.

“In Medallion’s situation they’re probably not taking larger bets — they’re taking small bets that are all about the same in terms of profitability,” explains Campbell Harvey, a finance professor at Duke University’s Fuqua School of Business. Harvey, one of the professors thanked in the acknowledgements of Cornell’s paper, explains that being right just over half the time could theoretically result in “a lot of money.”

He adds, “If you’re doing potentially hundreds of thousands or millions of trades, even a small amount of profitability per trade turns out to be a big amount.”

By Cornell’s estimation, Medallion’s apparent trading skill would have turned a $100 investment in the fund at the start of 1988 into $398,723,873 by the end of 2018. “In 31 years, Medallion would have turned a $100 investment into a $400 million fortune,” Cornell writes.
By comparison, $100 invested in the stock market at the beginning of 1988 — using the Center for Research in Security Prices’ value-weighted index — would have grown to $1,910 over the same time period, with dividends reinvested. Even if an investor had the ability to perfectly predict stock market returns on a monthly basis — and had invested in Treasury bills during times of stock market underperformance — Cornell asserts that the investor’s $100 starting investment would have grown to only $331,288 over that time frame.

Such a comparison makes Medallion’s returns appear improbably high — but it’s the wrong one to make, according to a hedge fund consultant who reviewed Cornell’s paper.

“What Medallion does (and other high-frequency market maker and trading businesses) is a technology business that requires some, but not a lot of capital,” the consultant said by email. “One where the more you spend on quants and computers and data, the more of an edge you have over rivals.”

The consultant suggests that Medallion’s returns would be better judged in comparison to “pure firms that do this, like Hudson River Trading, and not conventional investment funds.” Hudson River Trading, which describes itself as “first and foremost a math and technology company,” conducts algorithmic trades that as of 2014 accounted for 5 percent of all U.S. stock trading, according to a Wall Street Journal article on the firm. (A spokesperson for Hudson River Trading declined to comment.)

Still, even if other firms have found some success using high-frequency trading strategies, Cornell and others interviewed for this story could not identify any quantitative funds that had achieved returns that were as good, and for as long, as Renaissance Technologies has — and certainly not at the scale of the Medallion fund, which manages $10 billion.

“It appears that they’re just better than the rest of us,” suggests French, a business school professor best known for his work with Eugene Fama on asset pricing and investment factors.
For his part, Harvey believes that Medallion’s outperformance comes down to three factors. For one, the Duke professor suggests, Renaissance Technologies must have built an infrastructure to keep execution costs very low. “I don’t know for sure, but I surmise that the execution ability of this fund must be stellar,” Harvey says.

Cornell makes a similar observation, noting in his paper that “the reported gross returns are after trading costs, [making] Medallion’s performance even more extraordinary.”

Another likely driver of Medallion’s success, according to Harvey, is a high rate of employee retention at Renaissance, allowing the firm to keep its proprietary algorithms and strategies secret.

“Often with hedge funds there’s a lot of turnover, and when there’s turnover ideas get communicated,” Harvey explains. “I think the good ideas that Medallion developed years ago have had very long legs because people stay at the firm. And they have a good reason to stay, because it’s so profitable.” (Renaissance Technologies has also been willing to employ legal remedies to protect its intellectual property.)

Still, though Renaissance appears to have successfully outpaced its competitors for more than three decades, Harvey believes that the Medallion fund’s trade secrets will be found out eventually.

“With the confluence of systematic investment, machine learning, big data, and low-cost execution, it is just a matter of time before people figure out the algorithms that RenTech is using,” he says.

More firms trading in the same way as Medallion would arbitrage away the potential for excess returns — which brings Harvey to the third driver behind Renaissance Technologies’ extended run of outperformance: “They have been extremely disciplined in not taking on too much money.”
The Medallion fund has been closed to external capital since 1993, and analysis of the flagship fund’s annual returns suggests that significant distributions are made each year to keep the fund about the same size. For example, despite the fact that Medallion reported annual net returns above 29 percent every year between 2010 and 2018, the fund's assets under management stayed at about $10 billion throughout that period.

“They are closed, and whatever profit they make, they pay out,” Harvey notes. “With a lot of funds that have a good idea, they take on extra money, and as that money is applied to the same strategies, the profitability goes down.”

The theory that Medallion’s strategy is capacity-constrained could also explain why Renaissance Technologies’ other hedge funds — Renaissance Institutional Equities Fund and Renaissance Institutional Diversified Alpha — don’t follow the same strategy as Medallion, as Zuckerman reports. The two funds, which unlike Medallion have allowed outside investments, have delivered returns that are “relatively mundane and in no way comparable to Medallion,” according to Cornell’s paper. (For example, the Financial Times reported that RIEF and Diversified Alpha were up 8.5 percent and 3.2 percent, respectively, in 2018; Medallion was up 76 percent.)

“The other two funds are doing well, but it’s nothing out of the ordinary,” the UCLA professor clarifies by phone. “They’re like going out into my backyard and seeing a coyote and a raccoon.”

As to the Medallion fund?

“It’s like I saw a T. rex in my backyard,” Cornell says. “I just don’t get it.”

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