



Renaissance Technologies

Renaissance Technologies LLC, also known as **RenTech**^[4] or **RenTec**,^[5] is an American hedge fund based in East Setauket, New York,^[6] on Long Island, which specializes in systematic trading using quantitative models derived from mathematical and statistical analysis. Their signature Medallion fund is famed for the best record in investing history. Renaissance was founded in 1982 by James Simons, a mathematician who formerly worked as a code breaker during the Cold War.

In 1988, the firm established its most profitable portfolio, the Medallion Fund, which used an improved and expanded form of Leonard Baum's mathematical models, improved by algebraist James Ax, to explore correlations from which it could profit. Elwyn Berlekamp was instrumental in evolving trading to shorter-dated, pure systems driven decision-making.^[7] The hedge fund was named Medallion in honor of the math awards that Simons and Ax had won.^{[8][9]}

Renaissance's flagship Medallion fund, which is run mostly for fund employees,^[10] is famous for the best track record on Wall Street, returning more than 66 percent annualized before fees and 39 percent after fees over a 30-year span from 1988 to 2018.^{[6][11]} Renaissance offers two portfolios to outside investors—Renaissance Institutional Equities Fund (RIEF) and Renaissance Institutional Diversified Alpha (RIDA).^[12]

Because of the success of Renaissance in general and Medallion in particular, Simons has been described as the "best money manager on earth".^[13]

Simons ran Renaissance until his retirement in late 2009.^[14] He continued to play a role at the firm as non-executive chairman, which he stepped down from in 2021,^[15] and remained invested in its funds, particularly the Medallion fund until his death in 2024.^[16] The company is now run by Peter

Renaissance Technologies LLC

 Renaissance	
Formerly	<u>Monometrics</u> (1978–1982)
Company type	<u>Private</u>
Industry	<u>Financial services</u>
Genre	<u>Hedge fund</u>
Founded	1978
Founders	<u>James H. Simons</u> <u>Howard L. Morgan</u> ^[1]
Headquarters	<u>East Setauket, New York, U.S.</u>
Key people	<u>Peter Fitzhugh Brown</u> (CEO) <u>Robert Mercer</u>
Products	<u>Medallion Fund</u> <u>Institutional Equities Fund</u> <u>Institutional Diversified Alpha</u> <u>Institutional Diversified Global Equities</u>
AUM	<u>US\$130 billion</u> (as of April 19, 2021) ^[2]
Number of employees	310 ^[3] (2021)
Website	<u>rentec.com</u> (https://rentec.com/)

Brown (after Robert Mercer resigned). Both of them were computer scientists specializing in computational linguistics who joined Renaissance in 1993 from IBM Research.^{[1][12][17]} The fund has \$165 billion in discretionary assets under management (including leverage) as of April 2021.^[18]

Academia and research

James Simons founded Renaissance Technologies following a decade as the Chair of the Department of Mathematics at Stony Brook University. Simons in 1976 was a recipient of the Oswald Veblen Prize of the American Mathematical Society, which is geometry's highest honor.^[19] He is known in the scientific community for co-developing the Chern–Simons theory, which is used in modern theoretical physics.^[20]

Quantitative trading

The firm uses quantitative trading, where staff tap data in its petabyte-scale data warehouse to assess statistical probabilities for the direction of securities prices in any given market. Staff attribute the breadth of data on events peripheral to financial and economic phenomena that Renaissance takes into account, and the firm's ability to manipulate large amounts of data by deploying scalable technological architectures for computation and execution.^[21]

Renaissance Technologies' hedge fund has employed mathematical models to analyze and execute trades, many of them automated. The firm uses computer-based models to predict price changes in easily traded financial instruments. These models are based on analyzing as much data as can be gathered, then looking for non-random movements to make predictions. Some also attribute the firm's performance to employing financial signal processing techniques such as pattern recognition. The book *The Quants* describes the hiring of speech recognition experts, many from IBM, including the current leaders of the firm.^[22]

"Quants" with non-financial background

Renaissance employs specialists with non-financial backgrounds, including computer scientists, mathematicians, physicists, signal processing experts and statisticians. The firm's latest fund is the Renaissance Institutional Equities Fund (RIEF).^[23] RIEF has historically trailed the firm's better-known Medallion fund, a separate fund that contains only the personal money of the firm's executives.^[24]

Renaissance is a firm run by and for scientists, employing those with non-financial backgrounds for quantitative finance research like mathematicians, statisticians, theoretical and experimental physicists, astronomers, and computer scientists. According to a piece in *The New York Times*, "Wall Street experience is frowned on and a flair for science is prized."^[20] One former employee speculated that the herdlike mentality among business school graduates is to blame for poor investor returns.^[8] Renaissance engages roughly 150 researchers and computer programmers, half of whom have PhDs in

scientific disciplines, at its 50-acre East Setauket campus in Long Island, New York, which is near the State University of New York at Stony Brook.^[25] Mathematician Isadore Singer referred to Renaissance's East Setauket office as the best physics and mathematics department in the world.^[26]

The firm's administrative and back-office functions are handled from its Manhattan office in New York City. The firm is secretive about the workings of its business and very little is known about them.^[27] The firm is known for low personnel turnover^[28] and for requiring its researchers to agree to intellectual property obligations by signing non-compete and non-disclosure agreements.^[29]

Monometrics

In 1978, Simons left academia and started a hedge fund management firm called Monometrics in a Long Island strip mall. The firm primarily traded currencies at the start. It did not occur to Simons at first to apply mathematics to his business, but he gradually realized that it should be possible to make mathematical models of the data he was collecting.^{[30][31][17]}

Monometrics' name was changed to Renaissance Technologies in 1982. Simons started recruiting some of the mathematicians and data-modeling types from his days at the Institute for Defense Analysis (IDA) and Stony Brook University. His first recruit was Leonard Baum, a cryptanalyst from IDA who was also the co-author of the Baum–Welch algorithm. When Baum abandoned the idea of trading with mathematical models and took to fundamental trading, Simons brought in algebraist James Ax from Cornell University. Ax expanded Baum's models for trading currencies to cover any commodity future and subsequently Simons set up Ax with his own trading account, Axcom Ltd., which eventually gave birth to the profitable fund — Medallion. During the 1980s, Ax and his researchers improved on Baum's models and used them to explore correlations from which they could profit.^{[31][30]}

Medallion Fund

"From 2001 through 2013, the fund's worst year was a 21 percent gain, after subtracting fees. Medallion reaped a 98.2 percent gain in 2008, the year the Standard & Poor's 500 Index lost 38.5 percent."

—Rubin and Collins. June 16, 2015. *Bloomberg*

In 1988, Renaissance established its most profitable fund, the Medallion fund (previously the Limroy Colombian fund), which used an expanded form of Leonard Baum's mathematical models improved by algebraist James Ax to explore correlations from which they could profit. Simons and Ax, who were classmates at UC Berkeley, started Medallion, which they named after their awards in mathematics.^{[8][9]} The initial success of the company's models led Simons to base the fund's trades entirely on the models.^{[8][9]}



Medallion outperformed their old pre-2010 401(k) plan and S&P

By April 1989, however, peak-to-trough losses had mounted to about 30%. Ax claimed to have accounted for such a decline in his models and insisted on continuing to trade. Simons wanted to pause and reevaluate; Simons, as majority owner, prevailed, and Ax departed. Simons then asked Berkeley professor Elwyn Berlekamp to run Medallion. A consultant for Axcom whom Simons had first met at the IDA, Berlekamp had acquired most of Ax's stake in Axcom and became its CEO. He worked with Sandor Straus, Jim Simons and another consultant, Henry Laufer, to overhaul Medallion's trading system over the course of six months. In 1990, Berlekamp led Medallion to a 55.9% gain, net of fees, and then returned to his duties as a Berkeley professor after selling out to Simons at six times the price for which he had bought his Axcom interests sixteen months earlier. Straus then took Berlekamp's place, running Medallion's revamped trading system, which returned 39.4% in 1991, 34% in 1992 and 39.1% in 1993, according to Medallion annual reports.^{[8][32]}

The Medallion fund is considered to be one of the most successful hedge funds ever. From 1994 through mid-2014, it averaged a 71.8% annual return, before fees.^[33] The fund has been closed to outside investors since 1993^[34] and is available only to current and past employees and their families. The firm bought out the last investor in the Medallion fund in 2005 and the investor community has not seen its returns since then.^[10] About 100 of Renaissance's some 275 employees are "qualified purchasers", meaning they generally have at least \$5 million in assets to invest. The remaining are "accredited investors", generally worth at least \$1 million.^[33]

"Since 1988, his flagship Medallion fund has generated average annual returns of 66% before charging hefty investor fees—39% after fees—racking up trading gains of more than \$100 billion. No one in the investment world comes close. Warren Buffett, George Soros, Peter Lynch, Steve Cohen, and Ray Dalio all fall short."

—'The Man Who Solved the Market: How Jim Simons Launched the Quant Revolution'
by Gregory Zuckerman 2019

By 2000, the computer-driven Medallion fund had an average annual return of 34% after fees from its 1988 inception.^[35] Simons ran Renaissance until his retirement in late 2009.^[14] Between January 1993 and April 2005, Medallion only had 17 losing months and out of 49 quarters over the same period, Medallion had only three losing quarters. Between 1989-2005 Medallion had only one year showing a loss: 1989.^[36]

During 2020 the Medallion fund surged 76%.^[37]

Medallion as a retirement fund

"[Renaissance] won the [Labor Department]'s permission to put pieces of Medallion inside Roth IRAs. That means no taxes – ever – on the future earnings of a fund that averaged a 71.8 percent annual return, before fees, from 1994 through mid-2014."

—Rubin and Collins. June 16, 2015. *Bloomberg*

Renaissance Technologies terminated its 401(k) retirement plan in 2010 and employees' account balances were put into Individual Retirement Accounts.^[33] Contributions could be made to a standard Individual Retirement Accounts and then converted to a Roth IRA regardless of income.^[38] By 2012, Renaissance was granted a special exemption by the United States Labor Department allowing employees to invest their retirement money in Medallion arguing that Medallion had consistently outperformed their old 401(k) plan. In 2013, Renaissance's IRA plans had 259 participants whose \$86.6 million contribution grew to \$153 million that year without fees or annual taxes.^[33] Renaissance set up a new 401(k) plan, and in November 2014 the Labor Department allowed that plan to be invested in Medallion as well.^[33]

Renaissance Institutional Equities Fund (RIEF)

In 2005, Renaissance Institutional Equities Fund (RIEF) was created.^[23] RIEF has historically trailed the firm's better-known Medallion fund, a separate fund that only contains the personal money of the firm's executives.^[24] In April 2020, Institutional Investor reported that the disparity between Renaissance's Medallion fund and other funds, including RIEF, was approximately 17-19%.^[39] Renaissance also offers two Renaissance Institutional Diversified Alpha (RIDA) to outsiders.^[12] Simons ran Renaissance until his retirement in late 2009.^[14] Renaissance Institutional Equities Fund had difficulty with the higher volatility environment that persisted throughout the end of the summer of 2007. According to an article in *Bloomberg* in August 2007,^[40]

"James Simons's \$29 billion Renaissance Institutional Equities Fund fell 8.7% in August 2007 when his computer models used to buy and sell stocks were overwhelmed by securities' price swings. The two-year-old quantitative, or 'quant', hedge fund now has declined 7.4 percent for the year. Simons said other hedge funds have been forced to sell positions, short-circuiting statistical models based on the relationships among securities."

—Bloomberg 2007

RIEF once again struggled in the high volatility environment of 2020. According to an article in *Bloomberg* in November 2020,^[41]

Renaissance saw a decline of about 20% through October in its long-biased fund, according to a person familiar with the matter. The \$75 billion firm's market-neutral fund dropped about 27% and its global-equities fund lost about 25%... The firm, founded by former codebreaker Jim Simons, told investors that its losses are due to being under-hedged during March's collapse and then over-hedged in the rebound from April through June. That happened because models that had "overcompensated" for the original trouble. "It is not surprising that our funds, which depend on models that are trained on historical data, should perform abnormally (either for the better or for the worse) in a year that is anything but normal by historical standards," Renaissance told clients in a September letter seen by Bloomberg.

—Bloomberg 2020

From December 1, 2020 to February 1, 2021, according to *Bloomberg*, clients (LPs) had withdrawn \$5 billion from the fund.^[42]

On 25 September 2008, Renaissance wrote a comment letter to the Securities and Exchange Commission, discouraging them from implementing a rule change that would have permitted the public to access information regarding institutional investors' short positions, as they can currently do with long positions. The company cited a number of reasons for this, including the fact that "institutional investors may alter their trading activity to avoid public disclosure".^[43]

Governmental affairs

2014 tax avoidance investigation

In July 2014, Renaissance Technologies was included in a larger investigation undertaken by Carl Levin and the Permanent Subcommittee on Investigations on tax evasion by wealthy individuals.^[6] The focus of the tax avoidance investigation was Renaissance's trading strategy — which involved transactions with banks such as Barclays Plc and Deutsche Bank AG — through which profits converted from rapid trading were converted into lower-taxed, long-term capital gains.^[6] The strategy was also questioned by the Internal Revenue Service (IRS).^[6] The higher rates for the five years under investigation would have been 44.4 percent, as compared to 35 percent, whereas the lower rate was 15 percent, as compared to 23.8 percent.^[6]

The IRS contend[ed] that the arrangement Renaissance's Medallion fund had with the banks, in which the fund owned option contracts rather than the underlying financial instruments, is a ruse and that the fund investors owe taxes at the higher rate. Because Medallion could claim that it owned just one asset — the option — and held it for more than a year, investors could declare their gains to be long-term investments.

—Bloomberg 2014

In September 2021, Simons, Mercer, and other Renaissance executives agreed to pay up to \$7 billion in taxes and penalties to settle the dispute with the IRS. The settlement was among the largest in history.^{[44][45]}

Campaign contributions

According to OpenSecrets, Renaissance was the top financial firm contributing to federal campaigns in the 2016 election cycle, donating \$33,108,000 by July.^[46] By comparison, over that same period sixth ranked Soros Fund Management has contributed \$13,238,551.^[46] Renaissance's managers were also active in the 2016 cycle, contributing nearly \$30 million by June, with Mercer ranking as the #1 individual federal donor, largely to Republicans, and Simons ranked #5, largely to Democrats.^[47] They were top donors to the presidential campaigns of Hillary Clinton^[48] and Donald Trump.^[49]

During the 2016 campaign cycle, Simons contributed \$26,277,450, ranking as the 5th largest individual contributor. Simons directed all but \$25,000 of his funds towards liberal candidates. Robert Mercer contributed \$25,059,300, ranking as the 7th largest individual contributor. Robert Mercer directed all funds contributed towards conservative candidates.

Between 1990 and 2016, Renaissance employees have contributed \$59,081,152 to federal campaigns and since 2001 have spent \$3,730,000 on lobbying.^[50]

See also

- High-frequency trading
- Quote stuffing
- Winton Group
- D. E. Shaw & Co.
- PDT Partners
- Two Sigma Investments
- *Flash Boys*
- Dark liquidity
- Algorithmic trading

References

1. Patterson, Scott (16 March 2010). "Pioneering Fund Stages Second Act" (<https://www.wsj.com/articles/SB10001424052748703494404575082000779302566>). Wall Street Journal. Retrieved 1 November 2015.
2. "The largest managers of hedge funds (P&I Sep 2019)" (<https://www.pionline.com/special-report-hedge-funds/largest-managers-hedge-funds>). No. Special Report Hedge Funds. United States: Pensions & Investments. Crain Communications Inc. 16 September 2019. Archived (<https://web.archive.org/web/20200730092657/https://www.pionline.com/special-report-hedge-funds/largest-managers-hedge-funds>) from the original on 30 July 2020. Retrieved 15 October 2019.
3. "Renaissance Technologies LLC – NEW YORK, NY – Avoid Fraud, Get The Facts, And Find The Best" (<https://investingreview.org/firm/renaissance-technologies-llc>). *investingreview.org*. Retrieved 2 May 2023.
4. Weiss, Miles (1 February 2019). "Hedge Fund RenTech Created the Ultimate, Tax-Free IRA Account for Employees" (<https://www.bloomberg.com/news/articles/2019-02-01/rentech-created-the-ultimate-tax-free-ira-account-for-employees>). *Bloomberg*. Archived (<https://web.archive.org/web/20200407025052/https://www.bloomberg.com/news/articles/2019-02-01/rentech-created-the-ultimate-tax-free-ira-account-for-employees>) from the original on 7 April 2020. Retrieved 7 April 2020.
5. "Inside Renaissance Technologies Medallion Fund" (<https://atticapital.com/inside-renaissance-technologies-medallion-fund/>). *Attic Capital*. 23 November 2019. Archived (<https://web.archive.org/web/20200407025055/https://atticapital.com/inside-renaissance-technologies-medallion-fund/>) from the original on 7 April 2020. Retrieved 7 April 2020.

6. Mider, Zachary R.; Rubin, Richard (11 July 2014). "Renaissance Said Probed by Senate Panel on Tax Maneuver" (<https://www.bloomberg.com/news/articles/2014-07-12/renaissance-said-probed-by-senate-panel-on-tax-maneuver>). Bloomberg. Archived (<https://web.archive.org/web/20160105060315/http://www.bloomberg.com/news/articles/2014-07-12/renaissance-said-probed-by-senate-panel-on-tax-maneuver>) from the original on 5 January 2016. Retrieved 26 December 2015.
7. Zuckerman, Gregory (2019). *The Man Who Solved The Market*. Penguin. ISBN 978-0735217980.
8. Teitelbaum, Richard. "Simons at Renaissance Cracks Code, Doubling Assets" (<https://www.bloomberg.com/apps/news?pid=newsarchive&sid=aq33M3X795vQ>). *bloomberg.com*. Archived (<https://web.archive.org/web/20120416225233/https://www.bloomberg.com/apps/news?pid=newsarchive&id=aq33M3X795vQ>) from the original on 16 April 2012. Retrieved 27 November 2007.
9. "The American Mathematical Society and the Mathematical Sciences Research Institute's 2014 AMS Einstein Public Lecture in Mathematics with James H. Simons" (<https://www.youtube.com/watch?v=Tj1NyJHLvWA>). *youtube.com*. San Francisco State University. 30 October 2014. Archived (<https://web.archive.org/web/20160316101720/https://www.youtube.com/watch?v=Tj1NyJHLvWA>) from the original on 16 March 2016. Retrieved 11 November 2015.
10. "Jim Simons Bio, Returns, Net Worth" (<http://www.insidermonkey.com/hedge-fund/renaissance+technologies/5/>). *Insider Monkey*. Archived (<https://web.archive.org/web/20151021031636/http://www.insidermonkey.com/hedge-fund/renaissance+technologies/5/>) from the original on 21 October 2015. Retrieved 31 October 2015.
11. Zuckerman, Gregory (2 November 2019). "The Making of the World's Greatest Investor" (<https://www.wsj.com/articles/the-making-of-the-worlds-greatest-investor-11572667202>). *Wall Street Journal*. ISSN 0099-9660 (<https://www.worldcat.org/issn/0099-9660>). Archived (<https://web.archive.org/web/20191106164135/https://www.wsj.com/articles/the-making-of-the-worlds-greatest-investor-11572667202>) from the original on 6 November 2019. Retrieved 7 November 2019.
12. Herbst-Bayliss, Svea (15 October 2015). "Renaissance Technologies to shut small hedge fund: sources" (<https://www.reuters.com/article/us-hedgefunds-renaissance-idUSKCN0S72SG20151013>). *Reuters*. Archived (<https://web.archive.org/web/20151025221000/http://www.reuters.com/article/2015/10/13/us-hedgefunds-renaissance-idUSKCN0S72SG20151013>) from the original on 25 October 2015. Retrieved 31 October 2015.
13. "Quants: the maths geniuses running Wall Street" (<https://www.telegraph.co.uk/finance/10188335/Quants-the-maths-geniuses-running-Wall-Street.html>). *The Telegraph*. 23 July 2013. Retrieved 2 April 2021.
14. PÉREZ-PEÑA, RICHARD (13 December 2011). "Stony Brook University to Get \$150 Million Gift" (<https://www.nytimes.com/2011/12/14/nyregion/stony-brook-university-given-150-million.html>). *The New York Times*. New York Times. Archived (<https://web.archive.org/web/20170909174341/http://www.nytimes.com/2011/12/14/nyregion/stony-brook-university-given-150-million.html>) from the original on 9 September 2017. Retrieved 28 February 2017.
15. Zuckerman, Gregory (14 January 2021). "WSJ News Exclusive | James Simons Steps Down as Chairman of Renaissance Technologies" (<https://www.wsj.com/articles/james-simons-steps-down-as-chairman-ofrenaissance-technologies-11610637320>). *Wall Street Journal*. ISSN 0099-9660 (<https://www.worldcat.org/issn/0099-9660>). Retrieved 14 January 2021.
16. "Forbes 400" (<https://www.forbes.com/profile/james-simons/>). *Forbes.com*. Archived (<https://web.archive.org/web/20190831224516/https://www.forbes.com/profile/james-simons/>) from the original on 31 August 2019. Retrieved 1 November 2015.

17. Blake, Mariah. "Why Are These Hedge Fund Kingpins Dumping Millions Into the Midterms?" (<http://www.motherjones.com/politics/2014/10/hedge-fund-taxes-superpacs-election-renaissance>). *Mother Jones*. Archived (<https://web.archive.org/web/20141015004129/http://www.motherjones.com/politics/2014/10/hedge-fund-taxes-superpacs-election-renaissance>) from the original on 15 October 2014. Retrieved 14 October 2014.
18. "The Medallion Fund Is Still Outperforming. Other Renaissance Funds Still Aren't" (<https://www.institutionalinvestor.com/article/b1rgwjlfqccst/The-Medallion-Fund-Is-Still-Outperforming-Other-Renaissance-Funds-Still-Aren-t>). *Institutional Investor*. 19 April 2021. Retrieved 19 April 2021.
19. "Oswald Veblen Prize in Geometry" (<http://www.ams.org/profession/prizes-awards/pabrowse?url=veblen-prize>). *Oswald Veblen Prize in Geometry*. American Mathematical Society. Archived (<https://web.archive.org/web/20151222115643/http://www.ams.org/profession/prizes-awards/pabrowse?url=veblen-prize>) from the original on 22 December 2015. Retrieved 11 November 2015.
20. Broad, William (7 July 2014). "Seeker, Doer, Giver, Ponderer" (https://www.nytimes.com/2014/07/08/science/a-billionaire-mathematicians-life-of-ferocious-curiosity.html?_r=0). *The New York Times*. New York Times. Archived (https://web.archive.org/web/20151105140238/http://www.nytimes.com/2014/07/08/science/a-billionaire-mathematicians-life-of-ferocious-curiosity.html?_r=0) from the original on 5 November 2015. Retrieved 1 November 2015.
21. Hope, Bradley (1 April 2015). "How Computers Trawl a Sea of Data for Stock Picks" (<https://www.wsj.com/articles/how-computers-trawl-a-sea-of-data-for-stock-picks-1427941801>). *The Wall Street Journal*. Archived (<https://web.archive.org/web/20151029135833/http://www.wsj.com/articles/how-computers-trawl-a-sea-of-data-for-stock-picks-1427941801>) from the original on 29 October 2015. Retrieved 1 November 2015.
22. Patterson, Scott (2010). *The Quants*. New York: Crown Business. pp. 113–115. ISBN 978-0-307-45337-2.
23. Baker, Nathaniel (24 June 2005). "Renaissance Readies Long-Biased Strat" (<http://www.ialternatives.com/?page=1&SID=520382&ISS=17199>). *Institutional Investor*.
24. Zuckerman, Gregory (1 July 2005). "Renaissance's Man: James Simons Does The Math on Fund" (<https://www.wsj.com/articles/SB112018150042875023>). *The Wall Street Journal*. pp. C1. Archived (<https://web.archive.org/web/20150819124902/http://www.wsj.com/articles/SB112018150042875023>) from the original on 19 August 2015. Retrieved 6 August 2015.
25. "Quantitative Finance: Research & Programming Opportunities" (<https://web.archive.org/web/20160330024333/https://www.rentec.com/Jobs.action?research=true>). *Renaissance Technologies*. Archived from the original (<https://www.rentec.com/Jobs.action?research=true>) on 30 March 2016. Retrieved 31 October 2015.
26. "Mathematics, Common Sense, and Good Luck: My Life and Careers" (<http://video.mit.edu/watch/mathematics-common-sense-and-good-luck-my-life-and-careers-9644/>). *MIT Video*. Massachusetts Institute of Technology. Archived (<https://web.archive.org/web/20151105100210/http://video.mit.edu/watch/mathematics-common-sense-and-good-luck-my-life-and-careers-9644/>) from the original on 5 November 2015. Retrieved 31 October 2015.
27. Comstock, Courtney (25 January 2015). "Jim Simons: My Hedge Fund's Secrets Are Even Bigger Secrets Than The Work I Did For The Government" (<http://www.businessinsider.com/jim-simons-renaissance-mit-speech-video?IR=T>). *Business Insider*. Archived (<https://web.archive.org/web/20150916052912/http://www.businessinsider.com/jim-simons-renaissance-mit-speech-video/?IR=T>) from the original on 16 September 2015. Retrieved 31 October 2015.
28. Lux, Hal (1 November 2000). "The Secret World of Jim Simons" (<http://www.institutionalinvestor.com/article.aspx?articleID=1028172&single=true>). *Institutional Investor Magazine*. Archived (<https://web.archive.org/web/20151222104253/http://www.institutionalinvestor.com/article.aspx?articleID=1028172&single=true>) from the original on 22 December 2015. Retrieved 1 November 2015.

29. Narang, Rishi K. (2013). *Inside the black box a simple guide to quantitative and high frequency trading* (<https://books.google.com/books?id=aYA0LnecyTgC>) (Second ed.). Hoboken, N.J.: Wiley. ISBN 9781118416990.
30. Zuckerman, Gregory (8 November 2019). "How Billionaire Jim Simons Learned To Beat The Market—And Began Wall Street's Quant Revolution" (<https://www.forbes.com/sites/forbesdigitalcovers/2019/11/08/jim-simons-the-man-who-solved-the-market-gregory-zuckerman-book-excerpt/>). *Forbes*. Archived (<https://web.archive.org/web/20210204081039/https://www.forbes.com/sites/forbesdigitalcovers/2019/11/08/jim-simons-the-man-who-solved-the-market-gregory-zuckerman-book-excerpt/?sh=3627ef2613b6>) from the original on 4 February 2021.
31. Teitelbaum, Richard (27 October 2008). "Simons at Renaissance Cracks Code, Doubling Assets" (<https://web.archive.org/web/20071202081120/https://www.bloomberg.com/apps/news?pid=20601213&sid=aq33M3X795vQ&refer=home>). Bloomberg. Archived from the original (<https://www.bloomberg.com/apps/news?pid=20601213&sid=aq33M3X795vQ&refer=home>) on 2 December 2007. Retrieved 2 June 2009.
32. Berlekamp, Elwyn. "Business and Finance Biography" (<https://math.berkeley.edu/~berlek/bus.html>). *Elwyn Berlekamp's Home Page at UC, Berkeley*. Elwyn Berlekamp. Archived (<https://web.archive.org/web/20160305010852/https://math.berkeley.edu/~berlek/bus.html>) from the original on 5 March 2016. Retrieved 11 November 2015.
33. Rubin, Richard (16 June 2015). "How an Exclusive Hedge Fund Turbocharged Its Retirement Plan" (<https://www.bloomberg.com/news/articles/2015-06-16/how-an-exclusive-hedge-fund-turbocharged-retirement-plan>). Bloomberg L.P. Archived (<https://web.archive.org/web/20151101085931/http://www.bloomberg.com/news/articles/2015-06-16/how-an-exclusive-hedge-fund-turbocharged-retirement-plan>) from the original on 1 November 2015. Retrieved 1 November 2015.
34. "Inside a Moneymaking Machine Like No Other" (<https://www.bloomberg.com/news/articles/2016-11-21/how-renaissance-s-medallion-fund-became-finance-s-blackest-box>). *Bloomberg.com*. 21 November 2016. Archived (<https://web.archive.org/web/20170514081528/https://www.bloomberg.com/news/articles/2016-11-21/how-renaissance-s-medallion-fund-became-finance-s-blackest-box>) from the original on 14 May 2017. Retrieved 11 May 2017.
35. Lux, Hal (1 November 2000). "The Secret World of Jim Simons" (https://faculty.fuqua.duke.edu/~charvey/Teaching/BA453_2005/II_On_Jim_.pdf) (PDF). Institutional Investor Magazine. Archived (https://web.archive.org/web/20160304101040/https://faculty.fuqua.duke.edu/~charvey/Teaching/BA453_2005/II_On_Jim_.pdf) (PDF) from the original on 4 March 2016. Retrieved 26 December 2015.
36. Ziemba, Rachel E.S.; Ziemba, William T. (2007). *Scenarios for risk management and global investment strategies* (<https://books.google.com/books?id=FwnGNAEACAAJ>). Chichester, England: John Wiley & Sons. pp. 46, 70, 79, 295–297. ISBN 978-0470319246.
37. "Renaissance's Medallion Fund Surged 76% in 2020. But Funds Open to Outsiders Tanked" (<https://www.institutionalinvestor.com/article/b1q3fndg77d0tg/Renaissance-s-Medallion-Fund-Surged-76-in-2020-But-Funds-Open-to-Outsiders-Tanked>). *Institutional Investor*. 13 January 2021. Retrieved 13 January 2021.
38. Bader, Mary; Schroeder, Steve (2009). "TIPRA and the Roth IRA, New Planning Opportunity for High-Income Taxpayers" (<http://www.nysscpa.org/cpajournal/2007/507/essentials/p48.htm>). *The CPA Journal*. The New York State Society of CPAs. Archived (<https://web.archive.org/web/20120221023647/http://www.nysscpa.org/cpajournal/2007/507/essentials/p48.htm>) from the original on 21 February 2012. Retrieved 31 January 2012.
39. "The Famed Medallion Fund Is Crushing It. Other RenTech Funds, Not So Much" (<https://www.institutionalinvestor.com/article/b1l98yt4p0bvr4/The-Famed-Medallion-Fund-Is-Crushing-It-Other-RenTech-Funds-Not-So-Much>). *Institutional Investor*. 21 April 2020. Retrieved 28 November 2020.

40. Burton, Katherine (10 August 2007). "Renaissance's Stock Hedge Fund Falls 8.7% in August" (<http://www.bloomberg.com/apps/news?pid=newsarchive&sid=atIWKnI7&refer=home>). *Bloomberg News*. Retrieved 1 October 2014.
41. "Renaissance, Two Sigma Drop as Quants Navigate Chaos" (<https://www.bloomberg.com/news/articles/2020-11-17/renaissance-two-sigma-see-losses-as-quant-giants-navigate-chaos>). *Bloomberg.com*. 17 November 2020. Retrieved 28 November 2020.
42. "Renaissance Hit With \$5 Billion in Redemptions Since Dec. 1" (<https://www.bloomberg.com/news/articles/2021-02-07/renaissance-hit-with-5-billion-in-redemptions-since-dec-1>). *Bloomberg.com*. 7 February 2021. Retrieved 7 February 2021.
43. "Comment Letter from Renaissance" (<https://www.sec.gov/comments/s7-24-08/s72408-3.pdf>) (PDF). S.E.C. Archived (<https://web.archive.org/web/20090511005741/http://www.sec.gov/comments/s7-24-08/s72408-3.pdf>) (PDF) from the original on 11 May 2009. Retrieved 2 June 2009.
44. Zuckerman, Gregory; Rubin, Richard (2 September 2021). "James Simons, Robert Mercer, Others at Renaissance to Pay Up to \$7 Billion to Settle Tax Probe" (<https://www.wsj.com/articles/james-simons-robert-mercerothers-at-renaissance-to-pay-7-billion-to-settle-tax-probe-11630617328>). *The Wall Street Journal*. Retrieved 4 September 2021.
45. Goldstein, Matthew; Kelly, Kate (2 September 2021). "Hedge Fund's Insiders Agree to Pay as Much as \$7 Billion to I.R.S." (<https://www.nytimes.com/2021/09/02/business/renaissance-irs-robert-mercerothers-at-renaissance-to-pay-7-billion-to-settle-tax-probe-11630617328>) *The New York Times*. Retrieved 4 September 2021.
46. "Interest Groups: Finance/ Insurance/ Real Estate" (<https://www.opensecrets.org/industries/indust.php?Ind=F>). *OpenSecrets*. Archived (<https://web.archive.org/web/20160510222524/http://www.opensecrets.org/industries/indust.php?Ind=F>) from the original on 10 May 2016. Retrieved 9 June 2016.
47. Bowers, John (7 June 2016). "A hedge fund house divided: Renaissance Technologies" (<https://www.opensecrets.org/news/2016/06/a-hedge-fund-house-divided-renaissance-technologies/>). *OpenSecrets*. Archived (<https://web.archive.org/web/20160609121058/http://www.opensecrets.org/news/2016/06/a-hedge-fund-house-divided-renaissance-technologies/>) from the original on 9 June 2016. Retrieved 9 June 2016.
48. "Top Contributors, federal election data for Hillary Clinton, 2016 cycle" (<https://www.opensecrets.org/pres16/contributors?id=N00000019>). Archived (<https://web.archive.org/web/20180204070338/http://www.opensecrets.org/pres16/contributors?id=N00000019>) from the original on 4 February 2018. Retrieved 3 February 2018.
49. Bowers, John (22 December 2017). "Top Contributors, federal election data for Donald Trump, 2016 cycle" (<https://www.opensecrets.org/pres16/contributors?id=n00023864>). *OpenSecrets*. Archived (<https://web.archive.org/web/20171222051613/https://www.opensecrets.org/pres16/contributors?id=n00023864>) from the original on 22 December 2017. Retrieved 22 December 2017.
50. "Organizations: Renaissance Technologies" (<https://www.opensecrets.org/orgs/summary.php?id=D000022219&cycle=A>). *OpenSecrets*. Archived (<https://web.archive.org/web/20161203022656/http://www.opensecrets.org/orgs/summary.php?id=D000022219&cycle=A>) from the original on 3 December 2016. Retrieved 9 June 2016.