

WANTS

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BY GREGORY ZUCKERMAN AND BRADLEY HOPE

Alexey Poyarkov, a former gold-medal winner of the International Mathematical Olympiad for high-school students, spent most of his early career honing algorithms (?) at technology companies such as Microsoft Corp. , where he helped make the Bing search engine smarter at ferreting out pornography.

Last year, a bidding war for Mr. Poyarkov broke out among hedge-fund heavyweights Renaissance Technologies LLC, Citadel LLC and TGS Management Co. When it was over, he went to work at TGS in Irvine, Calif., and could earn as much as \$700,000 in his first year, say people familiar with the contract.

The Russian-born software engineer, who declined to comment, as did the hedge funds, had almost no financial experience. What TGS wanted was his wizardry at designing algorithms, sets of rules used to power calculations and problem-solving, which in the investment world can quickly parse data and decide what to buy and sell, often with little human involvement.

WSJ PODCAST

• The Quants: Today's Kings of Wall Street?

Up and down Wall Street, algorithmic-driven trading and the quants who use sophisticated statistical models to find attractive trades are taking over the investment world.

On many trading floors, quants are gaining respect, clout and money as investment firms scramble to hire mathematicians and scientists. Traditional trading strategies, such as sifting through balance sheets and talking to companies' customers, are falling down the pecking order.

“A decade ago, the brightest graduates all wanted to be traders at Wall Street investment banks, but now they're climbing over each other to get into quant funds,” says Anthony Lawler, who helps run quantitative investing at GAM Holding AG . The Swiss money manager last year bought British quant firm (?)

Cantab Capital Partners for at least \$217 million to help it expand into computer-powered funds.

Guggenheim Partners LLC built what it calls a “supercomputing cluster” for \$1 million at the Lawrence Berkeley National Laboratory in California to help crunch numbers for Guggenheim’s quant investment funds, says Marcos Lopez de Prado, a Guggenheim senior managing director. Electricity for the computers costs another \$1 million a year.



Algorithmic trading has been around for a long time but was tiny. An article in The Wall Street Journal in 1974 featured quant pioneer Ed Thorp. In 1988, the Journal profiled a little-known Chicago options-trading firm that had a secret computer system. Journal reporter Scott Patterson wrote a best-selling book in 2010 about the rise of quants.

Prognosticators imagined a time when data-driven traders who live by algorithms rather than instincts would become the kings of Wall Street.

That day has arrived. In just one sign of their power, quantitative hedge funds are now responsible for 27% of all U.S. stock trades by

investors, up from 14% in 2013, according to the Tabb Group, a research and consulting firm in New York.

Quants have almost caught up to individual investors, which outnumber quants and collectively have 29% of all stock-trading volume.

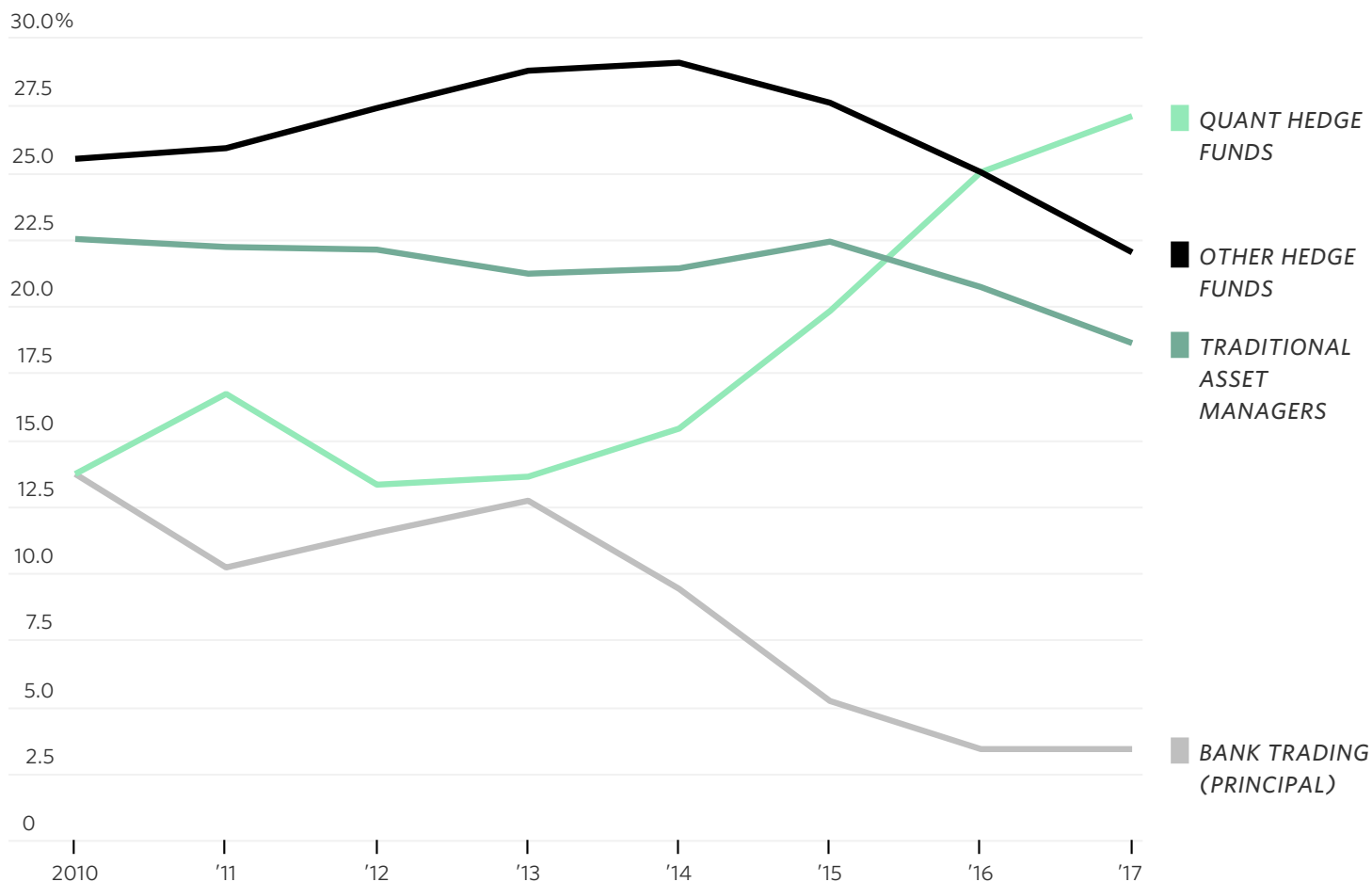
At the end of the first quarter, quant-focused hedge funds held \$932 billion of

Source: IBM

investments, or more than 30% of all hedge-fund assets, estimates HFR Inc. In 2009, quant funds held \$408 billion, or 25% of all hedge-fund assets.

Quants got \$4.6 billion of net new investments in the first quarter, while the overall hedge-fund business saw withdrawals of \$5.5 billion.

SHARE OF STOCK TRADING BY TYPE OF INVESTOR



Source: Tabb Group

THE WALL STREET J

The computers are outperforming humans at picking investments. In the past five years, quant-focused hedge funds gained about 5.1% a year on average. The average hedge fund rose 4.3% a year in the same period.

In the first quarter, quant funds rose about 3%, compared with 2.5% for the

average hedge fund.

Quants have been helped by two transformative forces. Regulatory scrutiny has made it hard for investors to obtain an edge through methods such as prodding company executives for information or tapping expert networks that included employees of public companies.

Even more importantly, investors now have at their fingertips an expanding ocean of data about the global economy and financial data, such as changes in earnings estimates and accounts receivable.

The next frontier: tapping data from drones and other cutting-edge sources to help understand companies and the economy in real time.

Quants are different from high-frequency traders, who tend to focus on very short-term trades that might last just milliseconds. High-frequency traders have been under pressure as market volatility dips and competition grows.

Exchange-traded funds also use algorithms but are geared more to investors who want exposure to certain industries or sectors.

Quantitative-driven trades can last anywhere from a few minutes to a few months. The biggest quant firms, including Renaissance, Two Sigma Investments LLC, D.E. Shaw Group, PDT Partners and TGS, make thousands of trades and manage tens of billions of dollars in investor assets.

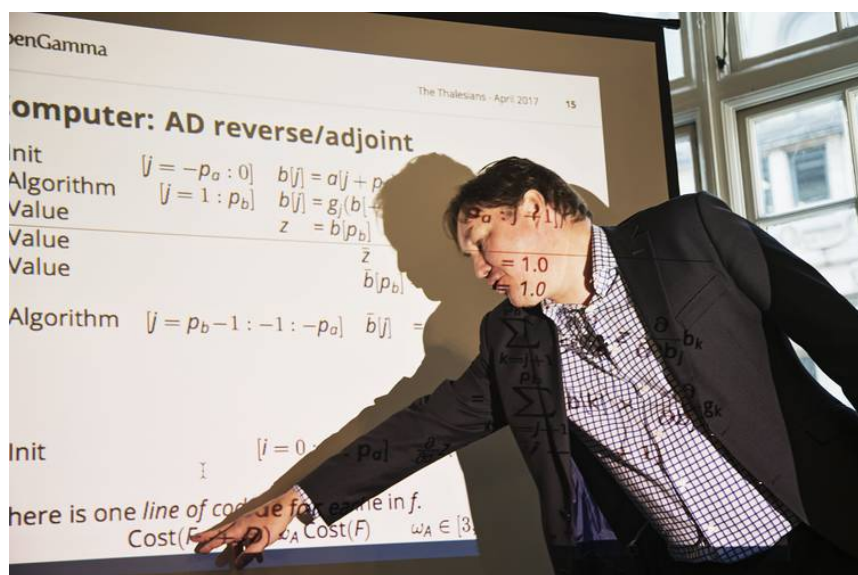
Quants *nearly doubled* their share of stock trades since 2013

2016 **27%**

2013 **14%**

That's more than other hedge funds and investment firms

Source: Tabb Group



Marc Henrard, head of quantitative research at risk-management software developer OpenGamma, gives a presentation in April to the Thalesians, a social group for quants in London. He has a Ph.D. in mathematics.

PHOTO: IMMO KLINK FOR THE WALL STREET JOURNAL

Some analysts worry that firms and investors stampeding into the quant business might be disappointed. The most successful quants have been operating for years. And hiring Ph.D.s doesn't guarantee profits.

More competition could hurt returns and give a false sense of security about the market's stability. In 2007, what became known as the "quant meltdown" was caused largely by the similarity of strategies among quants, who simultaneously rushed to sell, causing losses at other firms and more selling.

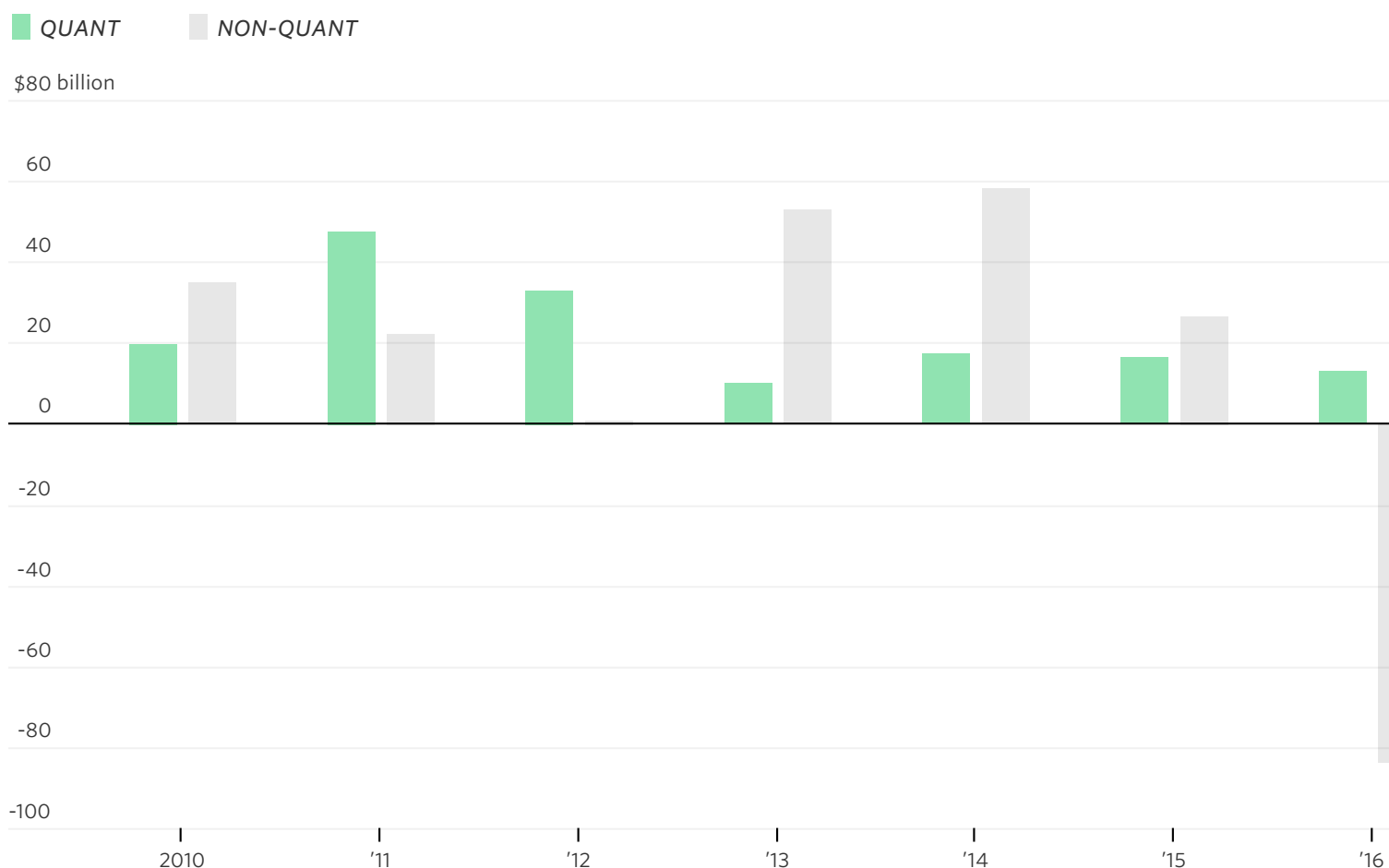
Mathematician William Byers, who wrote the 2010 book "How Mathematicians Think," warns that rendering the world in numbers can give investors a deceptive belief that predictions churned out of computers are more reliable than they truly are. The more investors flock to complicated algorithmic models, the more likely it is some algorithms will be similar to one another, possibly fueling larger market disruptions, some analysts say.

So far, though, nothing has stopped the quant arms race, which is creating new jobs previously unheard of in the finance industry.

Citadel, of Chicago, has a chief scientist to run its analytics and quantitative strategies. Balyasny Asset Management LP hired in August data scientist Gilbert Haddad, formerly of Schlumberger Ltd. and General Electric Co. , to overhaul data and analytics at the New York hedge-fund firm. He studied nanoparticles at the University of Wisconsin and has a Ph.D. in engineering.

“You take tours of offices, and everyone is always pointing out some guy off in a corner, working on his own,” says Alexandru Agachi, chief operating officer at Empiric Capital Ltd., a startup quant hedge fund in London. “They say with

NET FLOW INTO HEDGE FUNDS



Source: HFR

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pride: ‘Over there is our quant. He’s building signals.’ ”

It’s common for hedge funds to retool themselves to fit the latest popular



April's meeting of the Thalesians, named after ancient Greek geometer Thales of Miletus. PHOTO: IMMO KLINK FOR THE WALL STREET JOURNAL

strategy. Many funds dove into mortgages after the financial crisis ebbed. Some turned into “macro” investors in anticipation of global economic shifts.

Hedge-fund billionaire Steven A. Cohen’s investment firm, Point72 Asset Management, with \$12 billion in assets, is shifting about half of its portfolio managers to what it calls a “man plus machine” approach.

Teams that use old-school research methods are working alongside data scientists. Financial analysts are taking evening classes to learn data-science basics. Point72 is plowing tens of millions of dollars into a group that analyzes reams of data, including credit- card receipts and foot traffic captured by apps on smartphones. The results are passed on to traders at the Stamford, Conn., investment firm.



Point72 lost money in most of its traditional trading strategies last year, say people familiar with the results. The firm’s quant investors made about \$500 million.

Matthew Granade, Point72’s chief market-intelligence officer, recently



STEVEN COHEN

The billionaire investor is using a “man plus machine” approach at his \$12 billion family office, Point72 Asset Management.

encouraged London School of Economics students to learn basic programming languages, like R  and Python,  to become more competitive when they graduate. Investors are shifting their preference from “artisan to engineer,” he said.

Billionaire Paul Tudor Jones is one of the best-known investors in history. The former cotton trader anticipated the 1987 stock-market crash and made gigantic profits with quick bursts of trading, averaging annual gains of more than 17% since then. His hedge-fund firm, Tudor Investment Corp., barely made any money in 2014 and 2015, though.

By last year, Mr. Jones was feeling pressure from more successful quant traders, according to people close to the firm. In October, Mr. Jones chose Dario Villani,



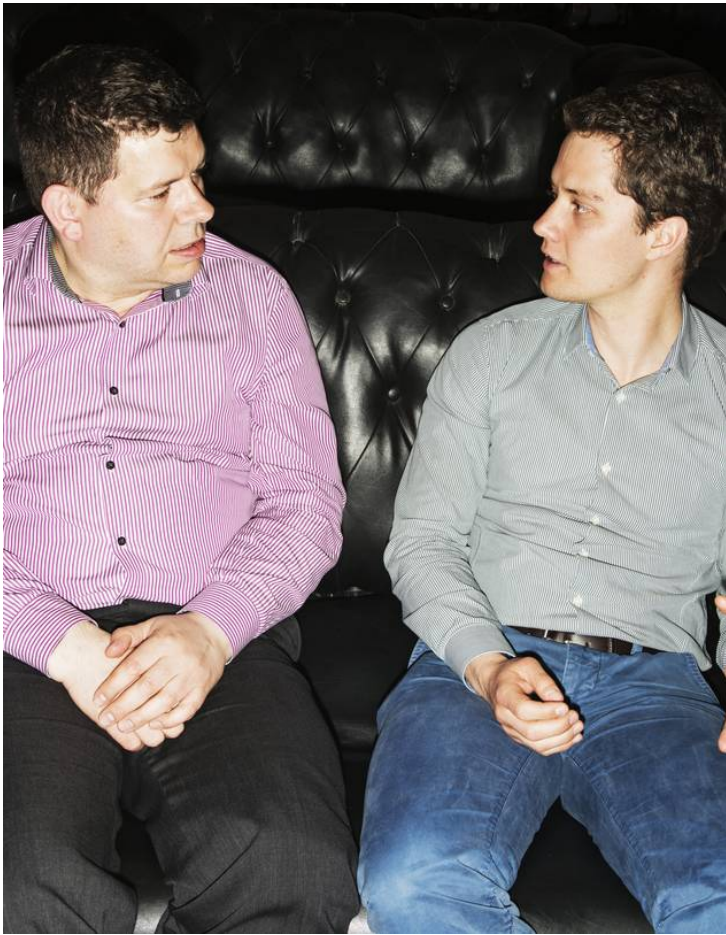
PAUL TUDOR JONES

A legendary trader, Mr. Jones is incorporating quantitative trading methods at his hedge fund, Tudor Investment Corp.

an Italian with a doctorate in theoretical physics who was hired in 2015, to help rejuvenate Tudor.

Hunkered down with a team of quants and other Tudor employees in a small house on an estate in Greenwich, Conn., Mr. Villani began developing computer programs to replicate trading positions of Tudor's portfolio managers using instruments that better allow the firm to increase risk to improve returns without endangering the hedge fund or Tudor, people familiar with the matter say.

Despite the changes, Tudor's two key funds were flat in 2016 as well as so far this year, even as markets have climbed.




Thalesians mingle and swap business cards at last month's meeting in London. *PHOTOS: IMMO KLINK FOR THE WALL STREET JOURNAL*

Humans have long searched relentlessly for ways to gain an information edge. Legend has it that financier Baron Rothschild built a network of field agents and carrier pigeons in 1815 to get a jump on the Battle of Waterloo outcome. Today's quants hope to digest—and act on—economic and corporate information faster than traditional investors.

Hedge funds with quant-focused strategies have been poring over private Chinese and Russian consumer surveys, illicit pharmaceutical sales on the dark web—a network of websites used by hackers and others to anonymously share information—and hotel bookings by U.S. travelers, according to Quandl Inc., a platform for such data.

In the late 1990s, an algorithm might have simply tried to ride the momentum of

a stock's price rise, buying at a certain price level and selling at a predetermined moment. Today's algorithms can make continuous predictions based on analysis of past and present data while hundreds of real-time inputs bombard the computers with various signals.

Some investment firms are pushing into machine learning,  which allows computers to analyze data and come up with their own predictive algorithms. Those machines no longer rely on humans to write the formulas.

Algorithms and quants eventually could sharply reduce the need for large investment staffs. A machine-driven algorithm might help quantitative researchers discover dozens of new algorithms in the time it used to take to create one.

In the battle for talent, quant-focused firms often are reluctant to call themselves hedge funds or even investment firms. Quant firms would rather emphasize their similarities to cutting-edge tech companies in Silicon Valley.

Two Sigma, based in New York, has in-house hacker labs, robotics competitions and game rooms. Empiric calls itself a “technology company operating in financial markets.”

Saeed Amen, a quantitative researcher in London, says his investment strategies were considered “very niche” for most of his 14-year career.

He organized social events for quants, including occasional gatherings of a group called the Thalesians after ancient Greek geometer Thales of Miletus. The beer and conversation sometimes attracted fewer than a dozen people.

Investments held by quant hedge funds **more than doubled** in three years

2016 **\$918B**
2013 **\$408B**

Source: HFR

Mr. Amen’s phone has started ringing with calls from hedge-fund managers in the U.S. and Europe. They don’t all want automated investing algorithms, but they are trying to figure out how to make better predictions, he says.

Much of that push is coming from investors such as Pepperdine University in Malibu, Calif. Last year, the college placed about 10% of its \$750 million portfolio in big quant funds, including those run by Man Group PLC of London and AQR Capital Management LLC, Greenwich, Conn.

Until then, Pepperdine had “essentially zero” quant investments, says Michael Nicks, its director of investments. “The narrative of fundamental investing is much more comfortable to digest,” he says. “Finding a company with good prospects makes sense, since we look for undervalued things in our daily lives, but quant strategies have nothing to do with our lives.”

After “years and years of self-education” and dozens of meetings with quant managers, says Mr. Nicks, Pepperdine decided it was ready to make the leap.

—*Rob Copeland contributed to this article.*

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Design, development, and graphics by: Jessica Ma, Tyler
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