

FT Magazine **Markets volatility**

## How a volatility virus infected Wall Street

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The collapse of a few small funds in February helped fuel a terrifying stock-market slide. Why?

Robin Wigglesworth APRIL 12, 2018

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Music teacher Chris Pomrink was driving between two lessons outside Philadelphia, when a friend called with some distressing news: “Hey Chris, XIV is in trouble.”

Pomrink, 30, checked his trading account. It was February 2 and XIV — an arcane, fiendishly complex financial security that he had sunk \$2,500 into earlier that week — had indeed taken a beating. The “exchange-traded note”, or ETN, which allowed traders to bet on the US stock market remaining tranquil, had made Pomrink a bundle of money after he stumbled across it on a site for traders back in 2015, so he decided to keep the faith. But worse was to come after the weekend.

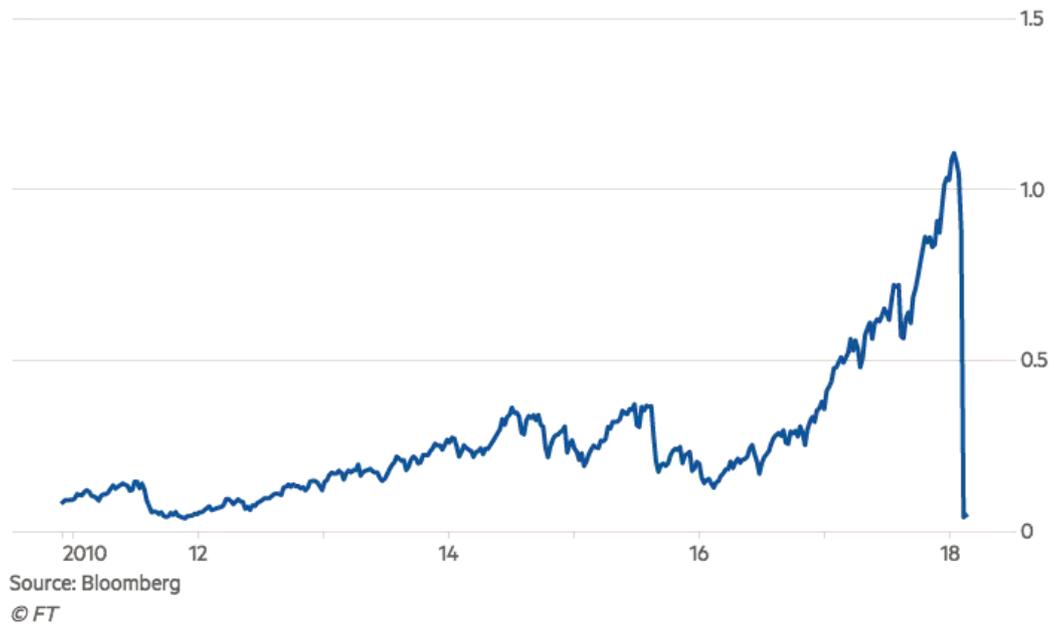
On February 5, the mounting bout of [market volatility](#) suddenly shredded XIV, in a day so torrid that traders have since dubbed it “vol-mageddon”. This can’t be real, Pomrink recalls thinking. By the time he woke up the next morning, the ETN had lost 94 per cent of its value and its manager announced plans to shutter the fund entirely. “I just couldn’t decipher it,” Pomrink says. “It was pretty brutal.”

Ruining the mishap, he enlisted his friend Zubair Latib — a fellow day-trading musician who had cashed out his \$6,000 from XIV just four days before its implosion — and wrote a lament, set to the melody of Tom Petty’s “Free Fallin”.

“It’s a long day, watching a correction, the S&P crashing through the floor. I bought the XIV, ’cause I’ll make my money back. I’m a bad boy, ’cause I bought even more. Now XIV is free falling. Yeah, XIV is free falling,” they sang mournfully on a [video they quickly uploaded to YouTube](#).

## Volatility ETP implodes in February mayhem

XIV inverse-Vix fund drops over 90 per cent in one day



For Pomrink, the blow was survivable, merely wiping out the gains he had made trading XIV in 2017. But for markets, it was more serious. The collapse of XIV and two other similar funds exacerbated the turmoil, turning what could have been a normal, even healthy reversal into a terrifying slide. The US stock market suffered one of the swiftest 10 per cent slumps in history, and global equities lost \$4.2tn that week. In terms of dollars, that is more than the total losses suffered by the Nasdaq index when the dotcom bubble burst.

Volatility is an inevitable part of financial markets. But XIV and a handful of similar funds held only \$3bn ahead of that fateful Monday. Why did the collapse of such small, little-known funds help to fuel the wider carnage?

At its heart, this is an eerily familiar tale of Wall Street innovation, greed and hubris. It is a story of a good idea overdone, of financial engineers creating something new, lucrative and potentially dangerous for hedge funds, insurers, banks and ordinary investors to trade — arguably making the global financial system more fragile in the process.

Over the past six decades, volatility has come to dominate risk-management models across the finance industry. At the same time, a motley crew of academics and investment bankers have turned volatility itself into something that can be sliced and diced, bought and sold, just like any bond, stock or barrel of oil. This has arguably created a potentially dangerous [feedback loop](#), one that makes markets even more prone to booms and busts.



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Eric Lonergan, a fund manager at M&G Investments, compares the use of volatility as a proxy for risk to a “[virus](#)” that has infected the entire finance industry and gradually “corrupted” its behaviour. “It is absolutely everywhere now,” he says. “It makes intelligent people make clearly stupid decisions.”

The tale of how volatility conquered Wall Street features multiple Nobel laureates, a plethora of investment bankers and [Mark Cuban](#), the billionaire owner of the Dallas Mavericks basketball team. But the genesis was arguably the intellectual ferment of the University of Chicago’s famed economics department six decades ago.

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**Growing up in Chicago** in the 1930s and 1940s, [Harry Markowitz](#) enjoyed baseball and football, playing the violin and reading philosophy, especially David Hume and René Descartes. The bookish son of two grocers had little interest in the world of money.

Yet after his undergraduate degree at the University of Chicago, Markowitz decided to stay on and pursue a graduate degree in economics, studying under legends such as Milton Friedman. “Descartes was a big inspiration, so when I went into economics I naturally gradually gravitated towards the economics of uncertainty,” he recalls. “It was a wonderful time.”

In 1950, a chance meeting set Markowitz on the path towards revolutionising how the investment industry functioned. For a long time, fund managers had been judged largely by their performance. People intuitively understood that riskier investments should generate higher returns to compensate for the dangers of losing their money, but there was little rigour to it. Then, while waiting for his university supervisor, Markowitz struck up a conversation with a visiting stockbroker, and realised he could apply some of his economic thinking to markets.

The 25-year-old wrote a groundbreaking paper entitled “[Portfolio Selection](#)”. Published in the *Journal of Finance* in 1952, it argued that returns should be judged against, and optimised for, the amount of risk taken. Since risk can be a vague concept, Markowitz used “variance”, or volatility, as a handy proxy. For example, stocks are more volatile than bonds, so investors should expect better returns to justify the increased risk.



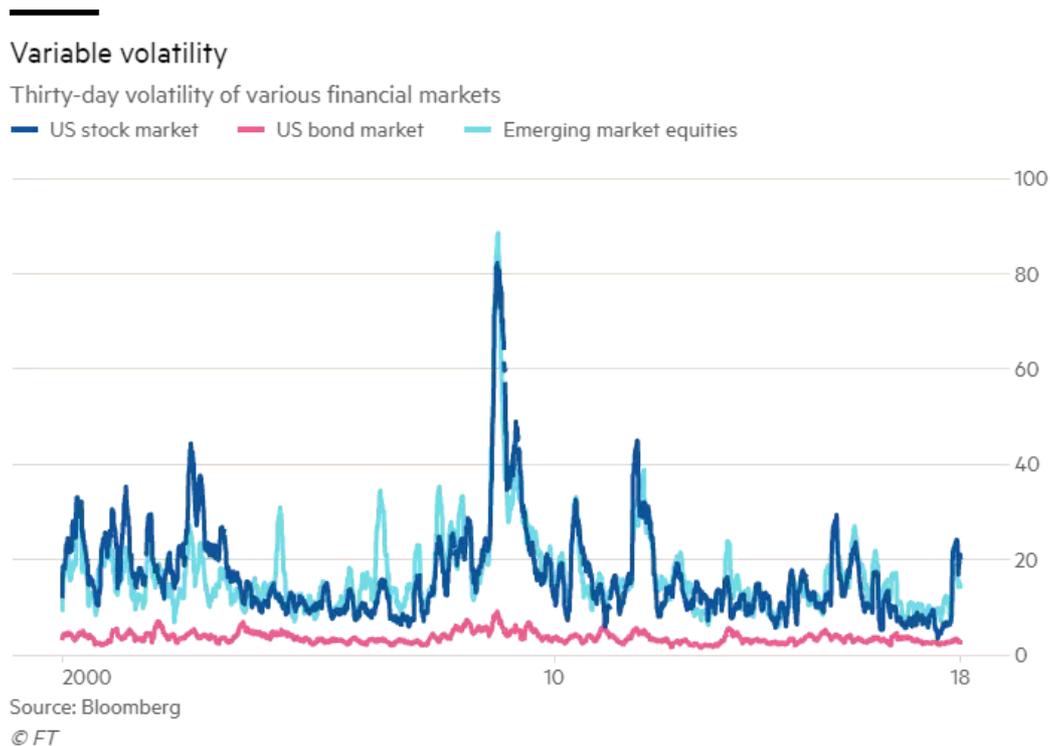
Harry Markowitz, father of modern portfolio theory © Alamy

While Markowitz was not the first to use volatility as a shorthand for risk, he was the first to put it in a rigorous framework, according to Richard Bookstaber, a former risk manager and adviser to the US Treasury who now works for the University of California. “What Markowitz did was to put it in the context of optimising for risk,” he says. “When I went to school in the 1970s, [his work] was ingrained into everything we did. It became self-evident that this was the way to look at the world.”

Together with other insights — such as the importance of diversification, famously the only “free lunch” in markets — this became known as “modern portfolio theory”. Today it underpins much of the modern investing world. It also won Markowitz a Nobel prize in economics in 1990.

“It happened in the twinkle of an eye,” he says. “People ask me if I knew I’d get a Nobel prize. I always say no, but I knew I’d get a PhD.”

It was another Nobel prize-winning economist — and a disciple of Markowitz — who would ultimately inject volatility as a proxy for risk into the bloodstream of the investment industry. [William Sharpe](#) dropped out of Berkeley, where he was planning to study medicine, and pursued a degree in business administration at the University of California Los Angeles. Finding accounting a bore, he decided to major in economics, and was fascinated by Markowitz’s work, eventually pursuing a doctorate in which the older economist served as an informal adviser.



Sharpe later taught at the University of Washington, and it was there, in 1966, that he published a seminal paper entitled “[Mutual Fund Performance](#)”. This introduced a rule that is still measured and cited by virtually every money manager as a yardstick for their skill. What became known as the “Sharpe ratio” was just a simple mathematical measure of what Sharpe called “reward to variability”.

In other words, directly comparing the returns of a fund manager to the volatility of his performance, and subtracting the returns of a risk-free asset such as cash. Its simplicity means that almost every fund manager in the world still includes the Sharpe ratio in their investor prospectus.

Despite the acclaim surrounding this academic work, it took some time before volatility-as-risk started to infect markets. Back in the 1960s and 1970s, accurate financial data were hard to get, and the rudimentary computers that were popping up on Wall Street were inadequate to the task of calculating the volatility of various markets or stocks. But all that began to change in the 1980s.

**Today, Till Guldemann** runs a small, picturesque [vineyard](#) in Saratoga, California, where he grows a mix of Cabernet Sauvignon and Bordeaux grapes. Born in Switzerland, Guldemann dreamt of becoming a neurologist but decided he wouldn't be very good at it and switched to electrical engineering. When he then thought he wouldn't make a very good electrical engineer either, he took an MBA at Harvard and started working at JPMorgan.

There he constructed a computer system to monitor major currency exchange rates minute by minute. This may seem humdrum in a world where a Google search can reveal instantaneous information for most currencies across the world, but at the time it was a huge leap. JPMorgan summoned him to New York and put him in charge of monitoring the bank's exposure to the whims of markets. Fittingly for a vintner, he describes the job in agrarian terms.

“Risk management relied on limits. So you told traders how many pigs or horses they could buy [to control their risk],” he says. “But it was hard to gauge the overall exposure . . . because we had to measure the relationship between pigs and horses. If you had \$100 worth of horses on our books, and \$50 of pigs, then the overall exposure might not be \$150.”

In other words, a bank had to know the “correlation” between bonds and stocks — or pigs and horses. Because bonds typically rally when stocks sell off, \$150 worth of bond and equity exposure in practice tends to add up to less actual market exposure than the sums might imply.

In the wake of the 1987 Black Monday crash, JPMorgan's then chairman Sir Dennis Weatherstone ordered staff to start a daily report that would show how much money the bank could lose on its trading positions on any given day. The “value-at-risk” (or VaR) report that landed on Sir Dennis's desk at 4.15pm every day was designed by Guldemann, who used the historical volatility of markets to calculate the maximum the bank could lose with a high degree of certainty.

Many banks and investment groups developed similar systems, but it was JPMorgan's model — known as [RiskMetrics](#) — that spread across the industry like wildfire in the early 1990s.

**It is absolutely everywhere now. It makes intelligent people make clearly stupid decisions**

**Eric Lonergan, fund manager, M&G Investments**

The dominance of VaR and its dependence on volatility as a proxy for risk came under fire in the wake of the financial crisis, when it became clear that losses could be an order of magnitude larger than models might imply. VaR assumes that market moves are normally distributed along what statisticians call a “bell curve”.

In many cases this is a good approximation.

Markets do move by 1 per cent more often than by 2 per cent. But they also have a nasty habit of sharp, statistically improbable tumbles. “VaR is

always looking in the rear-view mirror,” Bookstaber points out. “If the future looks like the past it will do a decent job, and 98 per cent of the time it works. But we should worry about those 2 per cent.”

The problem is that volatility can nurture “pro-cyclical” behaviour: when it is low, it encourages investors to buy more assets, pushing volatility even lower. But when it rises, risk models start blinking amber and spur investors to shed assets, in turn lifting volatility even more.

Even the father of VaR is unhappy about what he sees as the blind reliance on something only designed to be a guide. Guldemann compares it to the popular wine rankings invented by [Robert Parker](#). Buyers pay more for a wine scored 95 than for one with a measly 93 rating, whatever their taste buds tell them. “It’s ridiculous, but people like its simplicity,” he says. “Once a measure gets standard it becomes gamed.”

Despite its flaws, volatility-based risk management is the scaffolding upon which most of the modern investing industry is built. “Volatility is a good shorthand for risk,” Bookstaber says. “If someone put a gun to my head and forced me to choose just one number, I’d choose volatility.”

The spread of the “volatility virus” might even have been benign but for parallel developments elsewhere in the finance industry. Even as volatility became the dominant way to measure and manage risk, a series of academics and investment bankers started laying the groundwork for trading volatility itself. In the process they changed what was once just an observable phenomenon into something that investors could themselves influence.

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**Derivatives may seem arcane to laypeople**, and have been lambasted as dangerous by critics, but they are older than the stock market itself. Financial historians trace their genesis back to ancient Mesopotamia, when traders would swap contracts for future grain deliveries. One of the first big financial windfalls recorded was that of the Greek philosopher Thales in the sixth century BC, when he cannily bought the right to use [olive presses](#) ahead of a particularly bountiful harvest.

The gross notional amount of derivatives (essentially securities that derive their value from something else) floating around today’s global financial system is more than \$542tn, according to the [Bank for International Settlement](#). These help farmers insure against bad crops, protect creditors from bad loans, insulate companies from currency fluctuations — and allow traders to place wagers on volatility.

### Recommended

In practice, all derivatives involve an implicit bet on volatility. For example, buying a “put option” — the right to sell an asset at a pre-agreed price at some point in the future — is a bit like buying insurance against price declines. Buying a “call option”, which gives the right but not the obligation to buy at a prearranged price, is a way to bet that a

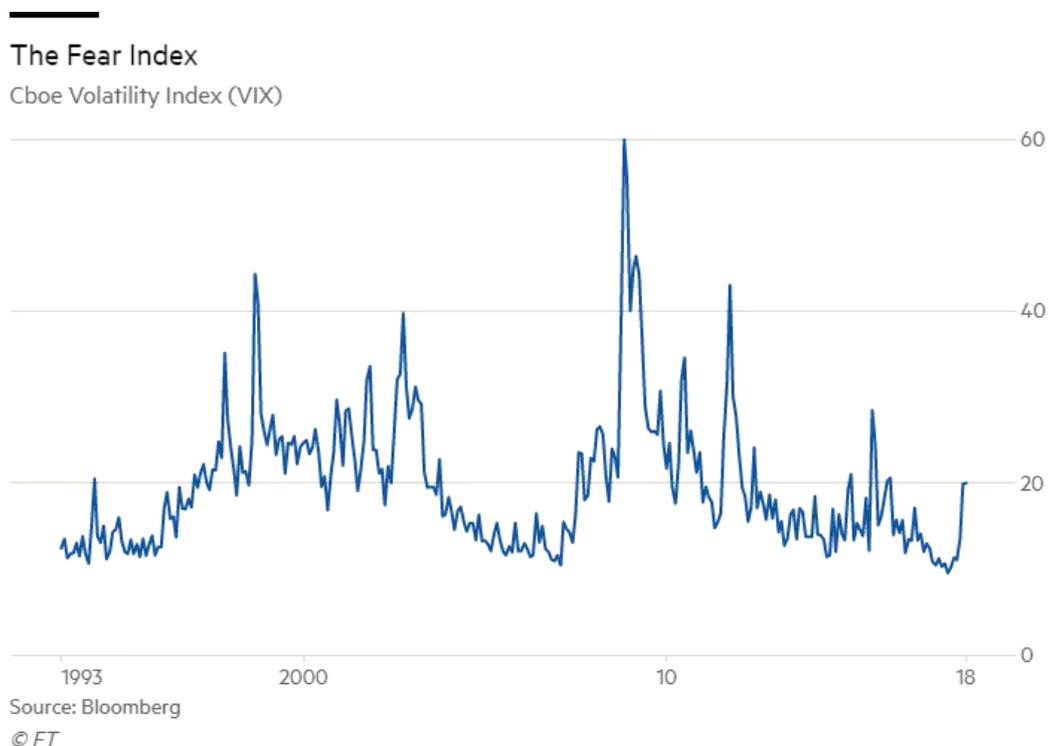
stock will rise. If a trader buys a call and a put together, they can form a “straddle” that functions as a bet on market turbulence itself. If you sell them, you are essentially betting on market tranquillity.

Options owe their popularity to Fischer Black, Robert C. Merton and Myron Scholes, three academics who, in 1973, published a revolutionary model to calculate more efficiently the value of options. The [Black-Scholes model](#) won Merton and Scholes the Nobel prize for economics in 1997 (Black had passed away a few years before).

This wasn't sufficient to turn volatility into something that could be actually traded, but the interest in volatility was on the rise. In the 1980s, Menachem Brenner and Dan Galai published a series of papers that created an actual index of stock-market volatility based on options, which they called “Sigma”. They pitched the idea to various exchanges but at the time no one wanted to turn it into a live volatility benchmark.

The idea languished until 1992, when the Chicago Board Options Exchange (Cboe) hired [Robert Whaley](#), a Bob Dylan-loving financial academic with an Irish pub in his basement, to turn the idea of an options-based volatility index into reality.

Whaley and his family decamped to France for six months to work out the details. By 1993, the [Cboe Volatility Index](#) was born. The gauge was initially supposed to have the stock ticker REW but that was already taken, so Cboe faxed a list of alternatives to the hamlet where Whaley was ensconced. “On the list was ‘VIX’. I circled it and faxed it back,” he says.



Vix aims to measure the expected volatility of the US stock market over the next 30 days, as implied by option prices — in theory measuring the level of investor anxiety. Because it is only a number based on complicated calculations from thousands of underlying derivatives, investors

couldn't buy or sell the Vix itself. Yet where there is a desire — and fees to be made — investment banks invariably find a way.

The first “pure” volatility derivative appears to have been a deal structured by a UBS banker called Michael Weber in 1993. Weber, who now works at JPMorgan and declined to comment for this article, built something that became known as a “[variance swap](#)”, based on the UK stock market's volatility, to protect the Swiss bank's trading book from losses.

Variance swaps quickly started to gain ground on Wall Street, especially in the late 1990s, when markets were roiled by the Asian financial crisis and the collapse of hedge fund LTCM. This stirred interest in the idea of trading volatility itself, but variance swaps remained too arcane for wide usage. That would all change in the noughties.

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**In the summer of 2002**, Mark Cuban faced a quandary. A few years earlier, the entrepreneur had sold [Broadcast.com](#), an internet radio company, to Yahoo for a cool \$5.7bn, netting him \$1.4bn worth of the portal's stock at the time. But then the dotcom bubble unravelled, and Cuban wanted to buy some protection.

His Goldman Sachs broker put him in touch with a colleague on the New York derivatives desk, but the conversation proved frustrating. Devesh Shah, the banker who fielded the call, tried to sell Cuban a variance swap, but the Texas-based billionaire wanted to punt on the hot new “fear index” he had heard so much about. “I kept asking them if there was a way to play volatility, to use the Vix, but there wasn't,” Cuban recalls.

Shah admits he had no clue who Cuban was at the time, but the conversation stayed with him. Soon afterwards he idly mentioned the businessman's desire to punt on the Vix to a colleague, [Sandy Rattray](#), a cerebral Brit who was tickled by the idea. “He thought it would be fun,” Shah says. “So Sandy, being Sandy, wrote a nice Goldman Sachs letter to Cboe saying, ‘We have a nice idea for you.’”



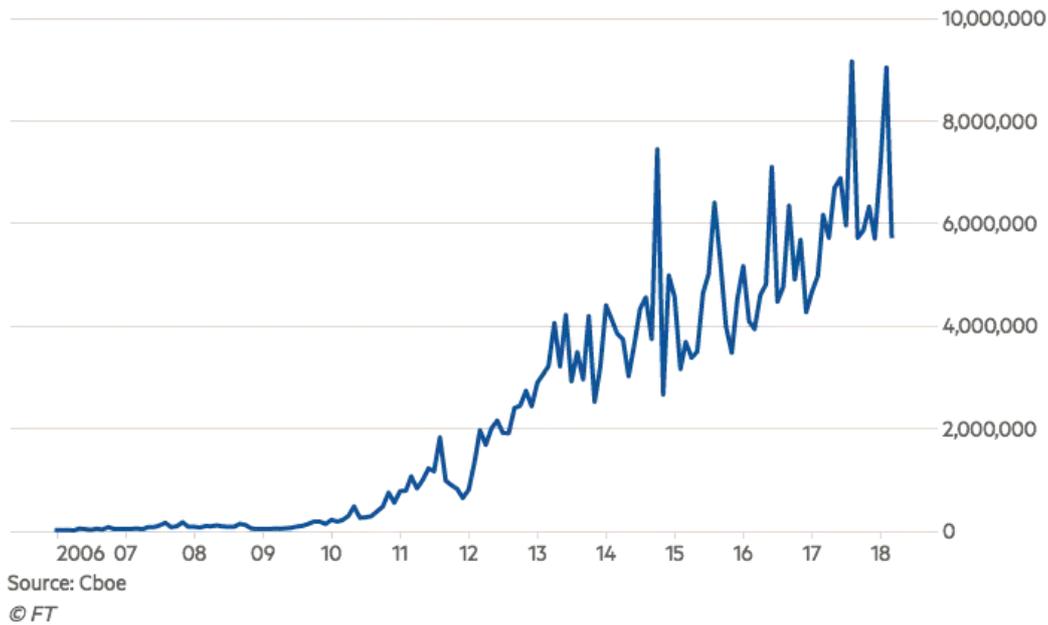
Mark Cuban, the Texas billionaire who saw potential in the 'fear index' © Getty

Intrigued, Cboe hired the investment bank to tweak Vix's methodology to make tradable futures contracts based on its level more feasible. In 2004, it was ready to launch the first Vix futures. Initially, interest was only respectable. In 2006, the number of Vix futures contracts being traded averaged about 1,730 a day. But when the financial crisis erupted, rampant coverage of "Wall Street's fear gauge" turned the Vix into a rock star of the finance industry.

People rushed to buy Vix futures to protect themselves from the spreading disaster, and by 2008 more than 4,300 volatility futures were traded each day. The moniker even inspired *The Fear Index*, a 2011 bestseller by Robert Harris about an artificial-intelligence-powered homicidal hedge fund called [Vixal-4](#). "Everyone knew the Vix, it was like Coca-Cola. But no one could drink it. Then we created Vix futures, and Americans love sugar, so people bought them," Shah jokes.

## The relentless rise of volatility trading

Volume of Vix futures contracts traded per month



More was to come. Financial engineers smelled an opportunity to “democratise” access by constructing exchange-traded products based on the index. In 2009, Barclays built the first volatility-linked ETP using Vix futures, and by 2017 there were more than 40 [Vix-linked ETPs](#) available for ordinary retail investors to trade. Some rise when volatility climbs, and others benefit when it falls. All of them are fuelled by Vix futures, swelling the average daily trading volumes to more than 294,000 contracts last year. But, as February’s turmoil illustrated, there are risks inherent in having a major input into risk-management models that is also a popular trading tool.

**Launched in 2010**, the [Global Volatility Summit](#), an annual fiesta of hedge funds dedicated to trading turmoil, has never been as well attended as it was this year. February’s event came hot on the heels of the market turbulence, and the organisers — Capstone, a hedge fund — had erected a dustbin filled with fake XIV certificates as a humorous prop, with a sign exhorting attendees to “place all XIV shares into the proper container”.

The festival featured a wandering magician, the disgraced cyclist Lance Armstrong and a string of hedge-fund managers spouting the Greek letters that physicists have imported into the derivatives industry: gamma, delta, theta. But the most compelling speaker was a young, intense man called Christopher Cole of Artemis Capital Management.

Cole’s meandering, colourful [letters to investors](#) have gained a cult following in parts of Wall Street, by predicting an inevitable volatility-triggered financial cataclysm, citing Goethe, George Lucas and [Dennis Rodman](#) along the way. After February’s carnage, Cole looked more like an iconoclastic oracle than the wild-eyed madman some had previously thought, earning him an invitation to speak at the industry’s leading bash despite the modest size of his Texas-based hedge fund.



Christopher Cole, Artemis Capital Management © YouTube

The money manager pointed out the worrying implications of just \$3bn of Vix-linked ETNs causing such market mayhem, highlighting how volatility had morphed from a proxy of risk into an input for risk — comparing it to the tail-eating [ouroboros](#) snake of Greek mythology. Warming to his subject, and oblivious to occasional titters in the audience, Cole warned that February’s flash of turbulence was just an appetiser for a “volatility revolution” that “will not be televised”.

He told me later that he believes “volatility is an instrument of truth” but a worrying one. Cole frets that there is now a “dangerous” feedback loop linking volatility, low interest rates and financial engineering, and estimates that there is more than \$2tn in strategies that both exert influence over, and are influenced by, stock market volatility. “This is a very fragile system,” he says. “This has made volatility the only asset class that really matters.”

XIV might have been small but it ended up being the snowball that triggered an avalanche, he argues, as banks and investors wrongfooted by its collapse scrambled to cover their bets, in turn spurring a blizzard of automated selling by the [volatility-targeting funds](#). The mayhem would have been much worse if the global economic backdrop hadn’t been so favourable, encouraging many investors to take advantage of the sell-off to dive back in and break the feedback loop.

Cole points out that the economy will not always look so buoyant, and that the XIV-triggered vol-mageddon was therefore just “an *amuse-bouche*” for what the future might hold.

“I don’t know if I’m crazy, or if the rest of the world is crazy,” he says. “But this is the kind of thing our children might look back and say, how did we not see this coming?”

Whether Cole is a modern-day Cassandra or not, it is striking how many of the people who have played a part in the history of volatility defend their role in its evolution while expressing concerns at the next stage. Volatility is now embedded in risk-management models. Trading

strategies have been built on volatility targets, Vix futures developed and complex financial instruments created that can fuel the very thing they attempt to harness.

“The more you fiddle around with volatility, the more you disturb it,” Guldemann says. Shah reckons that making volatility a tradeable asset was a valuable development, but says the Vix ETNs are “stupid products” and that he would have preferred XIV “was never born”. Cuban admits some pride but mostly bemusement at the small but pivotal part he played in the saga.

## Our children might look back and say, how did we not see this coming?

Christopher Cole

Physicists have long noted that observing some phenomena actually changes their nature. In finance, the equivalent is known as [Goodhart’s law](#), after the British economist Charles Goodhart, who in 1975 argued that once a measure becomes a target, it loses the very properties that made it a good gauge to begin with.

Volatility looks like a textbook example of Goodhart’s law. As more people weave it into their models, they change its nature in subtle but important ways.

The question is whether anything can or even should be done about it. Volatility’s dominant role in the financial system calls to mind Winston Churchill’s adage on democracy: perhaps it is the least bad of all the systems. Whether the volatility-trading industry is big enough to shake the \$80tn global stock market is still up for debate.

Even if people treat what should merely be a framework as a law of finance, Markowitz, the godfather of volatility, is sceptical that anything will ever change. “It has organised so much of our world that there’s simply no way of backing away from it,” he says.

*Illustrations by Shout*

*Robin Wigglesworth is the FT’s US markets editor. Parts of this article first appeared [on FT Alphaville](#)*

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