

# Bloomberg Businessweek

May 23, 2022 • EUROPE EDITION

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# *The Afterlife of Lehman Brothers*



*At long last, the bank that  
died at the start of the financial crisis is close  
to reaching its final resting place 32*

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◀ Jackie Dolby, who handles Lehman's taxes, will be one of the last people out the door

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■ COVER TRAIL

How the cover gets made

1

"This week's story is about Lehman Brothers."

"What??"

"Yep, Lehman. *The Lehman.*"

"Did I somehow fall into a hot tub whose console was altered to change the course of history?"

"I'm confused. I mean, you're pretty dry..."

"Have you never seen the classic film *Hot Tub Time Machine*? Basically the best buddy comedy of the past 12 years. That is, assuming we're still in 2022?"

"Ah, yep. Still are."

"OK, and we're doing a *Lehman* cover?"

"Yeah! So, as I was saying, it turns out that the company is still quite valuable."

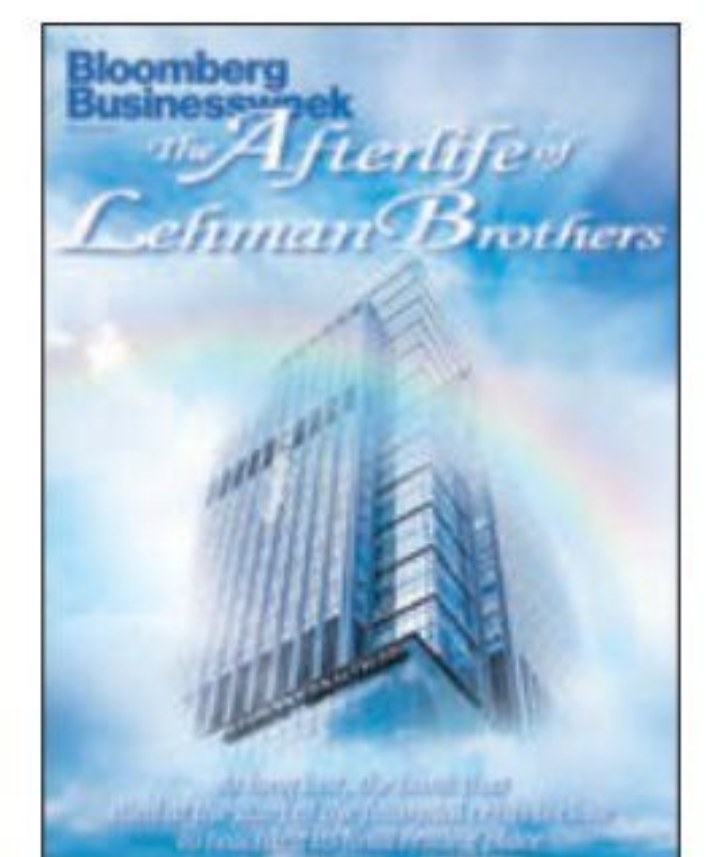
"I thought they *literally* triggered the Great Recession."

"Please don't use 'literally' that way. *Actually*, people have been selling off their assets since then and making a lot of money."

"So...less time travel, more zombie?"

"Try extended afterlife."

"Ah! I've heard great things about purgatory. Speaking of which, have you seen *Groundhog Day*?"



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● Globally, more than 526 million people have been infected by the coronavirus, and about **6.3m** people have died. North Korea has disclosed about 1.5 million suspected Covid-19 infections, which it calls “fever cases.” The reclusive country, where much of the population is malnourished and all are unvaccinated, faces an unprecedented health crisis.

● “White supremacy is a poison. And it’s been allowed to fester and grow right in front of our eyes.”



● President Joe Biden called on Americans to reject the extremist racist ideology that inspired a shooter to murder 10 people on May 14 in a predominantly Black neighborhood in Buffalo. He and Jill Biden visited the scene of the rampage on May 17.

● The Russian invasion of Ukraine is entering its fourth month.

► Russia is getting closer to occupying Mariupol after a protracted siege of the Azovstal steel plant. Hundreds of Ukrainian fighters surrendered and were taken to Russia, their fate unclear.

► Meanwhile, Sweden and Finland’s attempt to join NATO hangs in the balance after alliance member Turkey said it opposed the move, accusing the countries of fostering terrorism.

► The Biden administration will fully block Russian bond payments to US investors after a deadline expires on May 25, which could force Moscow into its first foreign default in a century.

● Walmart and Target cut their profit outlooks on May 18, sending their shares tumbling the most in 35 years. Surging costs for merchandise, storage, and labor are squeezing US retailers, while inflation and higher fuel prices are sapping consumer appetite. Still, April retail data show that Americans are still spending, likely propped up by credit-card borrowing.

● Boris Johnson wants to redo a part of Brexit.



London said on May 17 it would like to override trading arrangements that have created a disruptive customs border between Northern Ireland and the rest of the UK. Reneging on the pact, signed two years ago, is certain to escalate tensions with the EU.

● Online mental-health startup Cerebral replaced its CEO.

The company’s board voted on May 18 to oust Kyle Robertson, who vowed to fight the dismissal. The showdown comes after Cerebral, the subject of a federal investigation into its prescribing practices, announced it would stop dispensing almost all controlled substances. The company has said it intends to cooperate with the probe.

● Élisabeth Borne was named prime minister of France. Previously labor minister under President Emmanuel Macron, she succeeds Jean Castex. Borne will be only the second woman, after Edith Cresson in the 1990s, to hold the post.



● Goldman Sachs is giving employees unlimited annual vacation.

But there’s a catch: The offer only applies to partners and managing directors, two senior ranks notorious for hardly taking any time off at all. Junior bankers, who’d complained about grueling work hours, will be given at least two extra days each year.



● Renault sold its majority stake in Avtovaz to a state-run Russian automobile research institute for the symbolic price of 1 ruble, or **2¢** on May 16. Renault had valued the maker of the bestselling Lada brand at €2.2 billion (\$2.3 billion) at the end of last year.

● Biniam Girmay won the 10th stage of the Giro d’Italia on May 17.



The 22 year-old Eritrean cyclist made history as the first Black African to stand on the podium at the prestigious race. But his joy was short-lived: Girmay had to pull out of the contest after a prosecco cork struck him in the eye during the podium ceremony.

# Short of Baby Formula? Blame Red Tape And Protectionism

To soaring prices, plummeting stocks, and disrupted supply chains, add another worry for US consumers: an alarming shortage of baby formula. Beyond the panic for parents, the crisis is an object lesson in how decades of protectionism can culminate in disaster.

Reports of empty shelves, rationed supplies, and online scams have proliferated in recent weeks. An analysis by Datasembly Inc. found that the out-of-stock rate for infant formula surged to 43% nationwide in May, up from 11% in November. In some cities the rate exceeds 50%. Experts warn it could be months before supplies are back to normal.

Two basic problems underlie the shortage, one new and one years in the making. The first was a contamination scare. In February, Abbott Laboratories—maker of Similac formula—shut a plant in Michigan when federal regulators warned consumers that four infants had been hospitalized after exposure to its products, and two had died. (None of the illnesses has been conclusively linked to the formula.) Abbott issued a voluntary recall. Because the Michigan plant made more than half of the company's US formula—and Abbott produces some 40% of total domestic supply—the shutdown rippled across the market and worsened existing production challenges, such as labor shortages and supply chain disruptions.

Policymakers could hardly be expected to predict such a series of events. But it's fair to question the Food and Drug Administration's response. Its inspectors first detected potential contamination at the plant in September. A whistleblower warned of additional safety lapses in October. Yet the agency waited months to act.

A second, more intractable problem is that decades of bad policy have led to an unduly concentrated market. Excessive tariffs and other trade barriers have all but shut out imported formula. Even if consumers were willing to pay higher prices, the red tape the government imposes on foreign products can be prohibitive. Such measures have effectively blacklisted imports from the European Union.

A program overseen by the US Department of Agriculture worsens this dynamic. The Special Supplemental Nutrition Program for Women, Infants, and Children, known as WIC, provides vouchers to low-income families to help pay for food. By some estimates, it accounts for half of all US formula sales. Over the years, formula producers have offered increasingly steep discounts to win WIC contracts, knowing that this will make retailers more likely to stock their brands and thus boost their market share.

This arrangement discourages competitors from entering the market, inhibits investment, and suppresses the price

increases that would normally encourage production when shortages arise. Such a system seems almost ready-made to exacerbate a supply crisis.

So what now? Abbott and the FDA have entered an agreement to restart production in Michigan, but that will take time. The FDA is working to increase formula imports, the USDA is trying to relax WIC rules to boost supply of eligible products, and companies across the industry are cranking up production. None of those steps will alleviate shortages overnight, but they're all on the right path.

Over the long term, one hopes this crisis will help policymakers accept that protectionism doesn't make the economy stronger or more resilient. Quite the opposite: It diminishes competition, limits choice and capacity, raises prices, and leads to brittle and vulnerable supply chains. Which, as parents are finding out, can buckle just when they're needed most. **B**

*For more commentary, go to [bloomberg.com/opinion](https://www.bloomberg.com/opinion)*

## ■ AGENDA



### ► A Warmer Davos in Colder Times

The World Economic Forum returns to Switzerland from its Covid hiatus, on May 22-26. There are plenty of issues facing the political and financial elite, including the war in Ukraine, rising inflation, and the path to a greener future.

► London's Elizabeth Line opens on May 24 for public rail traffic after 15 years of construction. One of the UK's most ambitious projects, it will serve about 200 million people annually.

► In a sign of defiance against Moscow's aggressive rhetoric, NATO will conduct its Parliamentary Assembly Spring Session on May 27 in Lithuania, on the border with Russia.

► Alibaba reports its fiscal fourth-quarter earnings on May 26. Beijing's sweeping crackdown on the tech sector has forced the country's internet giants to freeze growth plans.

► The Senate Banking Committee holds its annual hearing with the heads of the largest US banks on May 25. Topics include market turmoil and returning to work.

► Twitter holds its annual general meeting on May 25, an event that promises to be tumultuous with Elon Musk's takeover pending. ▷ 16

► Liverpool and Real Madrid face off in the prestigious Champions League final on May 28 in Paris. Madrid has won the trophy 13 times, more than any other soccer team.

REMARKS

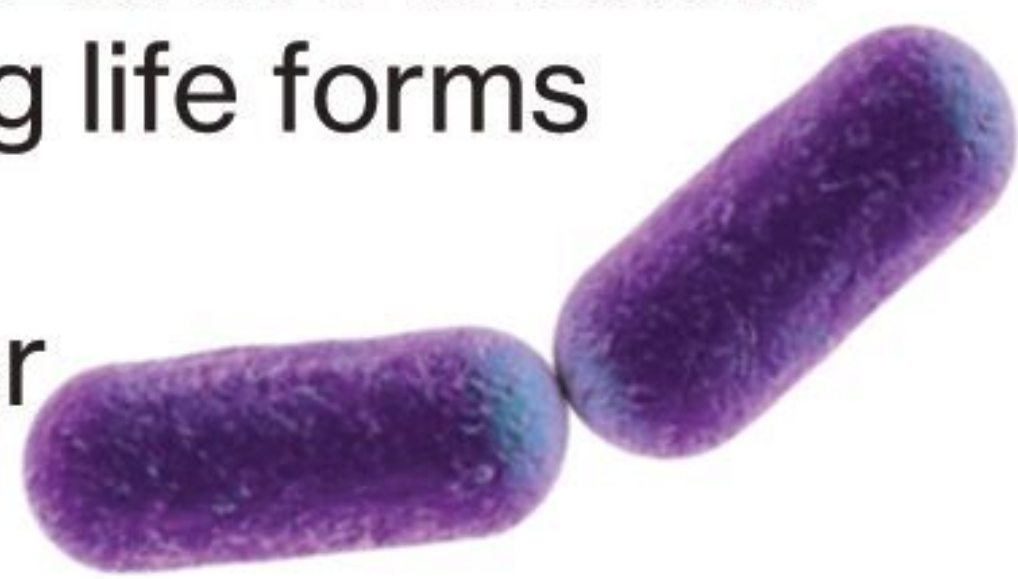
# What The Microbes Are Telling Us





## ● Small things considered: Humanity's future may turn on Earth's unseen majority of mutating life forms

● By Brian Bremner



When a respiratory virus sweeps away almost 15 million lives in two years, as Covid-19 has, according to a May 5 World Health Organization estimate that includes indirect deaths, it's a savage hit to humanity.

A single microbe has destabilized health-care systems, unbalanced economies, and confounded government leaders worldwide. It's a humbling moment for *Homo sapiens*, accustomed as we are to doling out crushing blows to other life forms rather than having them rock our own.

Why have we stumbled so spectacularly? The short answer is that we've rarely been adept at dealing with contagions on a massive scale. If you look at the history of infectious disease outbreaks, across millenniums and technological eras, societies have reacted in similarly self-defeating ways.

We're cognitively wired to react to risks we can see and feel in the here and now—less so with invisible, shape-shifting biological events that happen infrequently. The disease avoidance strategies we've adapted that make sense at an individual level can set off widening gyres of social disorder for a community at large.

Pandemics divide us. We're more likely to look for ways to scapegoat outsiders, and more susceptible to entertain baseless conspiracies to justify our actions or downplay risks. Game theory research shows that the longer a health crisis lasts, the less likely individuals are to make the shared sacrifices needed to ensure public health.

The Plague of Athens in the fifth century B.C., which is believed to have wiped out 25% of the city-state's population, "marked the beginning of a decline to greater lawlessness," the ancient military historian Thucydides wrote in *History of the Peloponnesian War*.

Almost 2,500 years later, a viral adversary unmoored the US, where homicides and hate crimes have soared since. Pandemic and vaccine skepticism posed challenges to public-health officials, even in the face of more than 1 million dead Americans. "We're going through a truly historic pandemic that people feel is not real," Anthony Fauci, America's top infectious diseases authority and director of the National Institute of Allergy and Infectious Diseases (NIAID), said at the end of 2020.

If we're going to successfully handle future viral and bacterial outbreaks, we'll need to head off pathogens quietly circulating in nature or within wildlife and livestock animal carriers well before they escape into human populations. That requires sustained, long-term investment in a biosurveillance system that tracks microbial risks at something approaching the molecular level. We need far better understanding of how

these microscopic creatures behave and the dangers they pose.

Most microbes are harmless or even symbiotically beneficial. Then again, a transmissible, cross-species avian virus could hypothetically kill hundreds of millions of people. When a new pathogen rifles through urban centers, the window to respond is often a matter of weeks. Wait too long and leaders face a Hobbesian choice: You can save lives or your economy. China's Covid lockdowns have sent shock waves through its economy and global supply chains.

Rich-world governments certainly think a lot about pandemic risk. Yet scientific funding skews way more to known diseases and microbes than to future, probabilistic risks. "We are still stuck in a 20th century mode of finding a pathogen, developing a vaccine, and waiting for the next pathogen," says Dennis Carroll, former director of the US Agency for International Development's (USAID) Pandemic Influenza and Other Emerging Threats Unit.

Discerning how microbes swap genes and collaborate in swarming, cross-species networks called microbiomes is where things stand to get especially interesting in the decades ahead. These infinitesimal biological entities have thrived for almost four billion years and survive in extreme environments, from scalding hydrothermal vents in deep ocean trenches to the International Space Station. The potential payoffs from unraveling the genetic secrets of microbes transcend pandemic prevention. Microbial science is central to all the big, civilizational challenges ahead: food security, bio-weapons, ocean health, and climate change, to name a few.

In our oceans, the Arctic, and the Amazon region, microbiomes recycle greenhouse gases such as carbon dioxide, nitrous oxide, and methane. Yet a warming planet may be changing their metabolism and possibly undermining that role. Studies show evidence of increased methane emissions from naturally occurring carbon storage systems called "sinks" in thawing permafrost and dwindling rainforest regions.

Until this century, biologists and geneticists had few investigative tools to explore this strange micro world, so much so that some scientists dubbed microbes and their constituent DNA "dark matter." What's changed is the rapid-fire digitization of biology. Advanced sequencing techniques, combined with high-powered computation, artificial intelligence, and big-data analytics, have opened the way to analyze the key information-carrying molecules in a teeming and diverse population of microbes. At the same time, the pinpoint accuracy of Crispr gene-editing technology, modeled on what we have learned about how bacteria copy and cut the DNA of predatory viruses, has given us the potential to repair genetic disorders, extend lifespans, and boost agricultural output.

This century has seen a giant leap in our ability to read, edit, and redesign the genetic source code of cells and biological systems. Run a random teaspoon of dirt or seawater through a sequencer, and you'll find gigabytes of genetic information, some of which could spawn new food tech applications and biomaterials. Modern humans evolved in a microbially saturated world. There are an estimated 10 nonillion ►



◀ (or 10 followed by 30 zeros) individual viruses, well more than all the stars in the observable universe. There are an estimated 5 million, trillion, trillion bacteria.

Christopher Mason, a geneticist and professor of physiology and biophysics at Weill Cornell Medicine in New York, says that when you sequence part of the human genome, you often find genetic fragments derived from ancient microbial DNA. The ubiquity of microbes inspired Mason to develop molecular maps of them in the world's biggest transportation hubs.

Mason's team spent three years collecting, sequencing, and analyzing microbial swab samples from more than 60 global transit systems, where billions of commuters collide with trillions of microbes. In 2021 his consortium, the Metagenomics and Metadesign of the Subways and Urban Biomes (MetaSUB), reported the discovery of 10,000 previously unidentified bacteria and viruses. "People thought it would be too laborious, or too expensive, to go pathogen hunting," says Mason. "People pay taxes for a military that defends our nation security. Pathogens are in a sense our enemy."

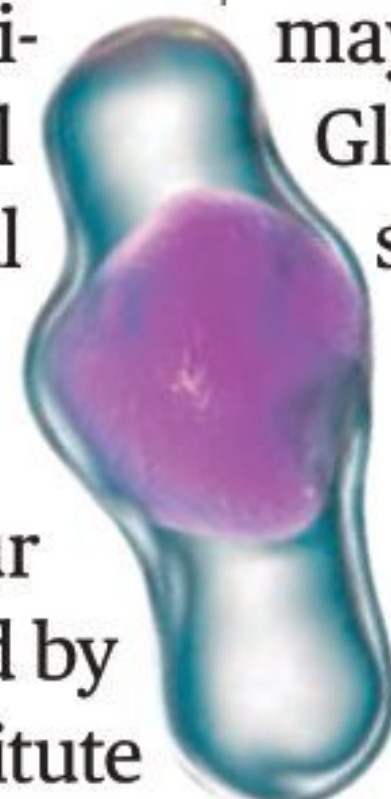
Jonna Mazet, a professor of epidemiology and disease ecology at the University of California at Davis School of Veterinary Medicine, led a group that designed a disease surveillance program called Predict whose diagnostic systems identify new viruses believed to be high-risk for infectious disease flare-ups. In 2018, Predict researchers discovered and genetically sequenced entirely new species of the Ebola viral family called *Bombali ebolavirus* and found the superlethal Marburg virus in bats in Sierra Leone in West Africa.



AI is proving to be a transformative technology in our evolutionary race with the bugs. In early 2020, a team led by synthetic biologist James Collins at the Massachusetts Institute of Technology used AI modeled on the neural networks in our brains to discover a structurally unique antibiotic effective against dangerous strains of the bacterium *Escherichia coli* and drug-resistant tuberculosis. They called it halicin, an homage to HAL 9000, the starship computer in *2001: A Space Odyssey*. "They took 100 million chemical compounds, embedded it into an AI system, and it figured out how the proteins and molecular chemistry would work without them telling it," says Eric Schmidt, a synthetic biology investor and former chief executive officer of Google. "The program literally discovered it."

In another breakthrough, DeepMind Technologies, the London-based AI subsidiary of Google parent Alphabet Inc., deciphered one of biology's most vexing challenges: predicting a protein's 3D shape from its amino acid sequence.

Co-founded by child chess prodigy and neuroscientist Demis Hassabis, DeepMind developed a deep learning program that accurately models the geometry of proteins, the building blocks of life. Understand a protein's shape, and you'll understand a great deal about its function. In mid-2021, DeepMind and the European Molecular Biology Laboratory open-sourced a database of the predicted structures of the 20,000 or so proteins expressed in the human genome and those of 20 model microbes.



Bioengineering is also disrupting animal disease vectors. Last year a British biotech firm spun out from the University of Oxford called Oxitec released genetically modified mosquitoes into the air over the Florida Keys. Oxitec has developed a way to suppress the population of an invasive species of mosquito called *Aedes aegypti*, which transmits Zika and dengue fever and is rapidly spreading worldwide as the climate warms.

It does so by genetically altering male *Aedes*, so that when they mate with females their offspring inherit a gene that overproduces a protein. It's lethal to females, the biters in search of blood for their eggs. Male descendants are unaffected but pass on the life-shortening gene. Population collapses of 90% have ensued in Oxitec trials.

Better intelligence on microbes is also key for vaccine development. The one-year turnaround of Covid messenger RNA (mRNA) and viral vector vaccines by companies such as Pfizer, BioNTech, Moderna, and AstraZeneca was a stunning achievement.

We also caught a break, because we knew a fair bit about coronaviruses from earlier epidemics of severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). Serious blind spots remain. Research by pandemic expert Carroll estimates that there are 631,000 to 827,000 viruses across 25 viral families in mammal and bird hosts that may have the potential to jump species. Carroll chairs the Global Virome Project, an ambitious effort to identify and sequence the planet's major viral threats.

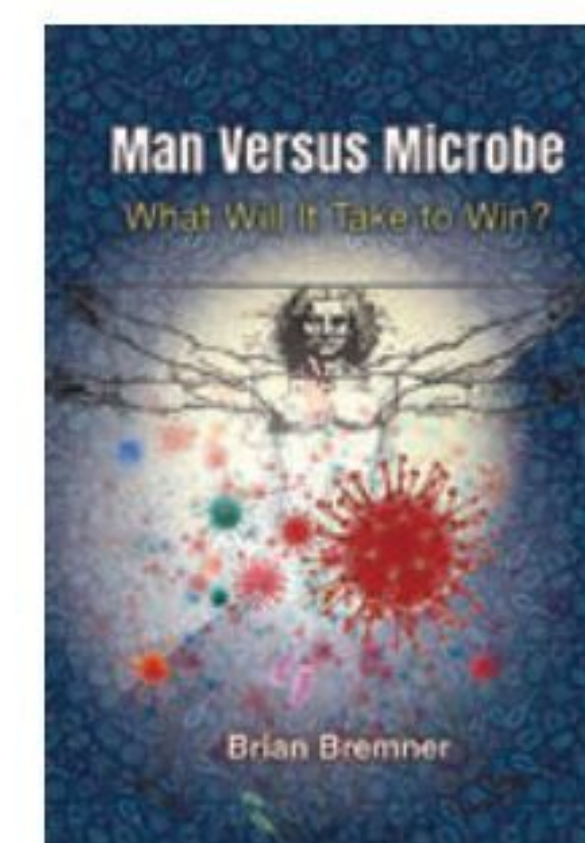
Building an "always-on" early warning system to detect emerging threats and related investments in health-care and drug development could cost as much as \$430 billion over a decade, McKinsey & Co. forecasts. Steep, yes—until you consider the International Monetary Fund forecast that the Covid pandemic will cost the global economy at least \$12.5 trillion in lost growth through 2024.



Whatever choices we make, the microbial world will continue to send us biosignals. SARS, MERS, the run of avian and swine flu, the resurgence of Ebola, Zika, and malaria—they all reflect enhanced disease spillover risks as the expanding food industry and megacities encroach upon natural habitats.

A decades-long barrage of antibiotics, antivirals, antifungals, and antiparasitics into the biosphere has triggered biochemical adaptations that make infections harder to treat. Some "superbug" strains of tuberculosis are now multidrug-resistant. "The cadence of these types of emergencies, not necessarily on the Covid scale, is on the order of every few years," says Kamran Khan, a physician and founder of BlueDot, a Toronto-based data research and digital health firm.

So it might be wise to listen to what the microbes are telling us. Our fates are intertwined, and they're in it for the long haul—even if we're not. **B** Adapted from *Man Versus Microbe*, published by World Scientific Publishing Co. on May 20.



# Am I ready for a constantly changing world?

Does my strategy embrace it?  
And my portfolio reflect it?



**For some of life's questions, you're not alone.  
Together we can find an answer.**

1

BUSINESS

10

# Will American Owners Make Football



## More Like Football?

More than half of England's major soccer clubs will be backed by US money. That has fans worried

Chelsea FC's new owner-in-waiting, Todd Boehly, an American financial and media executive, had to charm sporting and political power brokers earlier this year to triumph in one of the most fiercely contested takeovers in the history of football. Pressure on Chelsea's Russian oligarch owner, billionaire Roman Abramovich, to sell the team to comply with sanctions stemming from the Ukraine invasion suddenly fulfilled the American's yearslong dream to own the club. Now comes the real challenge: winning trophies without breaking the bank.

Boehly's acquisition still must overcome last-minute haggling between Abramovich and the UK government over terms that the sale proceeds go to a charity. If it goes through, when the next English Premier League season begins in August, American money will be backing more than half of the 20 competing teams.

US owners have been divisive figures in the

EPL. They've largely seen their investments grow in the world's richest football division, but they've frustrated hardcore supporters by failing to match the on-field successes of rivals backed by petrodollar billionaires from the East. "American sporting culture is very different to that of the oligarch-sovereign nation culture," says Roger Mitchell, founder of sports consulting firm Albachiara. "In Europe, owners are not expected to make a profit—and criticized if they do. In the US, it's set up for owners to make a return on capital. That's a significant culture clash."

Boehly beat out a host of his countrymen, and a late challenge from one of the UK's richest people, to reach a £4.3 billion (\$5.4 billion) deal for Chelsea, showing just how in demand these trophy sports assets remain.

The American influx into English football began in the early 2000s, when the Glazer family, which also owns the Tampa Bay Buccaneers, took charge

at Manchester United FC. Since then, Yanks have landed in the boardrooms of Arsenal FC, Liverpool FC, Aston Villa FC, and other famous clubs.

High growth potential and lower valuations relative to sports franchises back home have drawn US investors to the EPL. The increasingly global appeal of English football has also opened the door to more lucrative broadcasting and merchandising opportunities.

Before the Covid-19 pandemic, EPL clubs in the 2018-19 season generated more than £5 billion in revenue for the first time, more than double the figure of a decade earlier, according to a report from Deloitte. Media rights accounted for almost 60% of that figure, with an additional 28% coming from merchandise and sponsorship deals, and the rest from gate receipts.

That milestone has helped lift valuations at England's biggest clubs. When the Glazer family took control of Manchester United in 2005, it was reportedly worth about £800 million. Today it has a market value of £1.8 billion. Stanley Kroenke, whose family members own the Los Angeles Rams and the Denver Nuggets among other sports teams, upped his shareholding in Arsenal to more than 62% in 2011, when it reportedly had a value of about £730 million; KPMG Football Benchmark put that figure closer to £1.6 billion before the pandemic.

Despite the healthy increases in revenue, many EPL teams struggle to be profitable because they spend so much on players and coaches to compete for trophies or avoid relegation, the process of being moved down to a lesser league if they finish in the bottom three places in the division.

Fans are more interested in trophies and bragging rights than top and bottom lines. And neither Manchester United nor Arsenal, which used to duke it out for the EPL title every year in the early 2000s, has been delivering enough of either lately. Instead, their followers have had to watch as Chelsea, bankrolled by Abramovich, and Manchester City FC, backed by Sheikh Mansour bin Zayed Al Nahyan, the deputy prime minister of the United Arab Emirates, have enjoyed their best years ever.

Chelsea and Manchester City between them have won seven of the last 10 EPL titles. Over that period, Arsenal fans have seen the club drift further from the top, with Robin van Persie, Alexis Sánchez, and other star players offloaded to rivals. Recent failures to qualify for Europe's elite UEFA Champions League (UCL) have hindered the club's ability to attract talent.

"Since the American owners came in, they've treated it as a business, and whereas we are fans, they look at us as customers," says Turkish, a

presenter on the YouTube fan channel AFTV, who regularly calls on supporters to boycott the Kroenkes by refusing to buy Arsenal merchandise.

At Manchester United, the Glazers faced distrust from the moment they burdened the club with debt as part of their 2005 leveraged buyout, though tensions were mitigated in the early years of their ownership when the team continued to win trophies under the management of Sir Alex Ferguson.

Things changed after the legendary coach retired in 2013. Since then the club has cycled through managers and big-money players to little avail. Headline-grabbing signings such as Paul Pogba, Harry Maguire, and Jadon Sancho have all been disappointments, and the club's famous Old Trafford arena is in need of renovation; many see its decay as a metaphor for the club under the Glazers. "As fans, we expect to be challenging for the title and Champions League as we did for 20 years," says Chris Rumfitt, director at the Manchester United Supporters Trust. "We expect the investment and right decision-making to get to that position."

Both the Glazers and Kroenkes have found themselves the targets of fan protests in and around stadiums. In recent seasons, supporters have decided to vote with their feet, leading to low attendance at some non-EPL games.

But with ticket sales representing a club's smallest revenue source, a bigger concern for owners is the money that broadcasting rights generate, a chunk of which is contingent on qualification for the UCL every year. Arsenal hasn't reached the tournament since 2016, and Manchester United will miss out next season.

Only the top four teams in the EPL get into the tournament, and competition for those slots is expected to increase when the new Saudi Arabian owners of Newcastle United FC begin to exert their financial might. New UEFA rules may offer an extra spot based on the historical performances of EPL clubs in the Champions League.

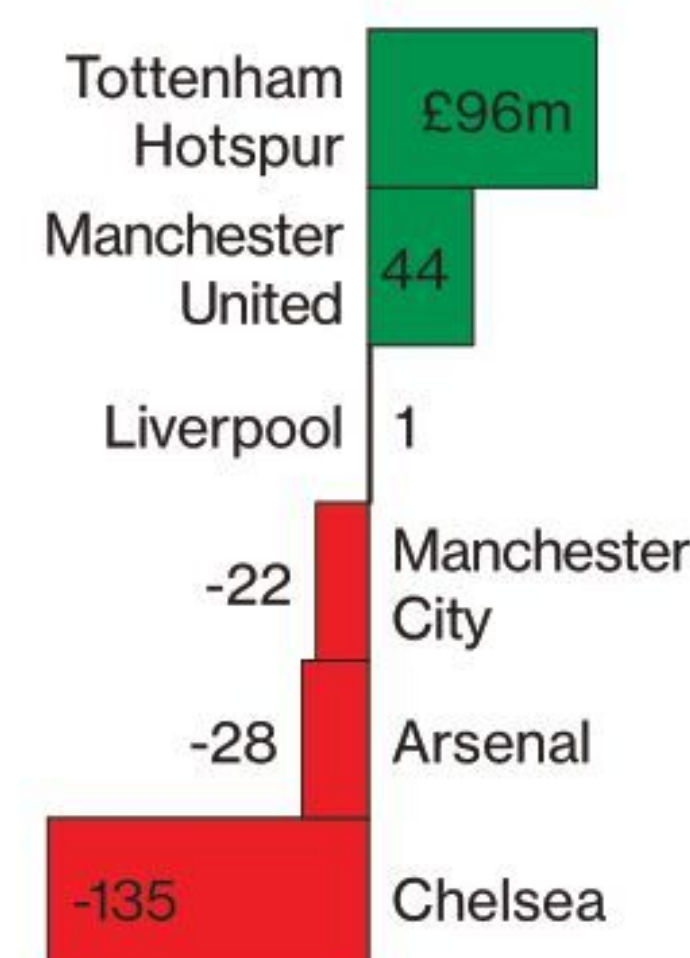
Last year a group of Europe's biggest clubs took what turned out to be a drastic misstep to mitigate the risk of missing out on the UCL. Owners of Arsenal, Liverpool, and Manchester United infuriated fans by helping orchestrate a breakaway Super League that would've guaranteed them places in a new elite competition. All were forced to backtrack and apologize after supporters protested the plans they said would have concentrated power and revenue in elite clubs regardless of their performance.

Although American owners have given no indication of reviving the plan, Mitchell at Albachira says they likely will want to move toward a ►

● Amount American financier Todd Boehly has agreed to pay for the Chelsea FC club

**£4.3B**

▼ Operating profit or loss at "Big Six" Premier League clubs in the 2018-19 season



◀ sporting model they're more comfortable with and that guarantees certainty about the competitions they'll play in. "It would be unwise of owners who were implicated in that [Super League] or other owners to try and make changes which are perceived as nontraditional," says Minal Modha, media analyst at Ampere Analysis.

Representatives for Arsenal, Chelsea, Liverpool, and Manchester United declined to comment.

There have been successes. Liverpool, backed by Boston Red Sox owner Fenway Sports Group Holdings LLC and RedBird Capital Partners, won the EPL for the first time in almost three decades in 2020, having picked up the UCL the year before. With coach Jürgen Klopp, the club has been competing for an unprecedented four titles this season.

Even so, Liverpool's fan base maintains a tense relationship with the owners. The fans' outrage forced U-turns on both the Super League and the club's plans to furlough staff during the pandemic. Peter Hooton, a committee member at the Liverpool supporter group Spirit of Shankly, says that as recently as this season supporters have been chanting, "The Reds [Liverpool] have got no money, but we'll still win the league," from the terraces of the famous Anfield Stadium.

"It's almost like a backhanded compliment," he says. "If we hadn't got Klopp in place, there would have been many more protests."

Arsenal, too, has been showing signs of improvement this season under coach Mikel Arteta. The club spent a lot last summer to bolster the squad with young talent it hopes will lay the groundwork for success in the coming years.

At Chelsea, Boehly will need to deliver on-field success at a cost that ensures he can generate returns expected by his main financial backer, California-based Clearlake Capital. The buyout firm is investing in Chelsea via 15-year long-term funds, Boehly said in a text message.

Still, the investment raises questions about how hands-on Clearlake might be with the West London club as it seeks to maximize gains for its own investors. A representative for Clearlake declined to comment. The investors who put money into Clearlake "will be looking for a return in terms of an exit," says Kieran Maguire, a lecturer in football finance at the University of Liverpool. "I think you'll see a very different style of recruitment at Chelsea, much more analytically based." —*David Hellier and Fared Sahloul*

**THE BOTTOM LINE** Fans of European football—don't call it soccer—are more interested in clubs earning trophies rather than big profits, so they're nervous as US owners buy into the sport.

# Carvana's Big Crash

● The online used-car seller was a big hit during the pandemic. These days, costs are soaring, and it has a Covid hangover

Ernie Garcia III wants to do for used cars what Jeff Bezos did for books, but disrupting the sale of 5,000-pound SUVs is proving far more challenging than peddling paperbacks. Carvana Co., the internet-based used-car dealer Garcia founded in 2012, has become a poster child for pandemic highfliers whose stocks have plunged back to earth. Over the past nine months, Carvana has seen 92% of its market value vanish, taking with it the majority of a fortune amassed by Garcia and his father, a major shareholder. Now the company is pivoting from its growth-at-all-costs strategy toward a more cost-focused approach to restore investor confidence and regain its operational footing.

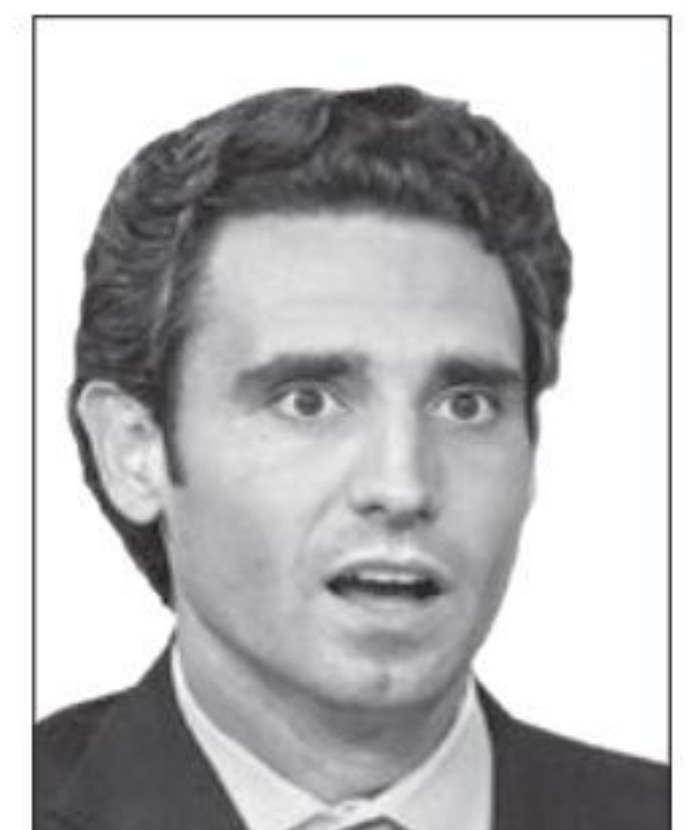
"Markets are reacting right now in a way that seems to be very fearful about the future," says Garcia, who's chief executive officer. "That's the message we are reading and hearing loud and clear."

Garcia has spent the first part of May scrambling to assuage investors. On May 10 he closed a \$2.2 billion deal to buy Adesa, a collection of wholesale auto auction sites that he says will vastly reduce the cost of sprucing up and shipping cars. A few hours later, Garcia announced a plan to eliminate 12% of his workforce and freeze executive salaries until next year. Finally, on May 13, Carvana published a 56-page turnaround plan, which included major cuts to its advertising and capital expenses.

The strategic document appeared to at least chill—if not charm—investors. Carvana shares at the close on May 17 were cruising roughly one-third higher than the lows of a week earlier, the first bit of upward momentum they've seen since they started to swoon in August. Although analysts were generally approving of the company's admission that big operational changes are needed, they're divided over whether Carvana can quickly make good on its more disciplined focus—especially in the two-year time frame it forecasts.

"The reality is, every 5 to 15 years the world changes on you," Garcia says, "and you have to adapt to it."

Carvana investors hadn't seemed too worried about profits until recently. After all, the company's



● Garcia III

low-touch business model seemed perfectly suited to a pandemic. Purchases are made online, and vehicles are either dropped off in a driveway or summoned from a towering glass-paneled “vending machine” like a giant bag of chips.

“It was legitimately disruptive in a way that made the entire industry take notice,” says Bloomberg Intelligence analyst Kevin Tynan.

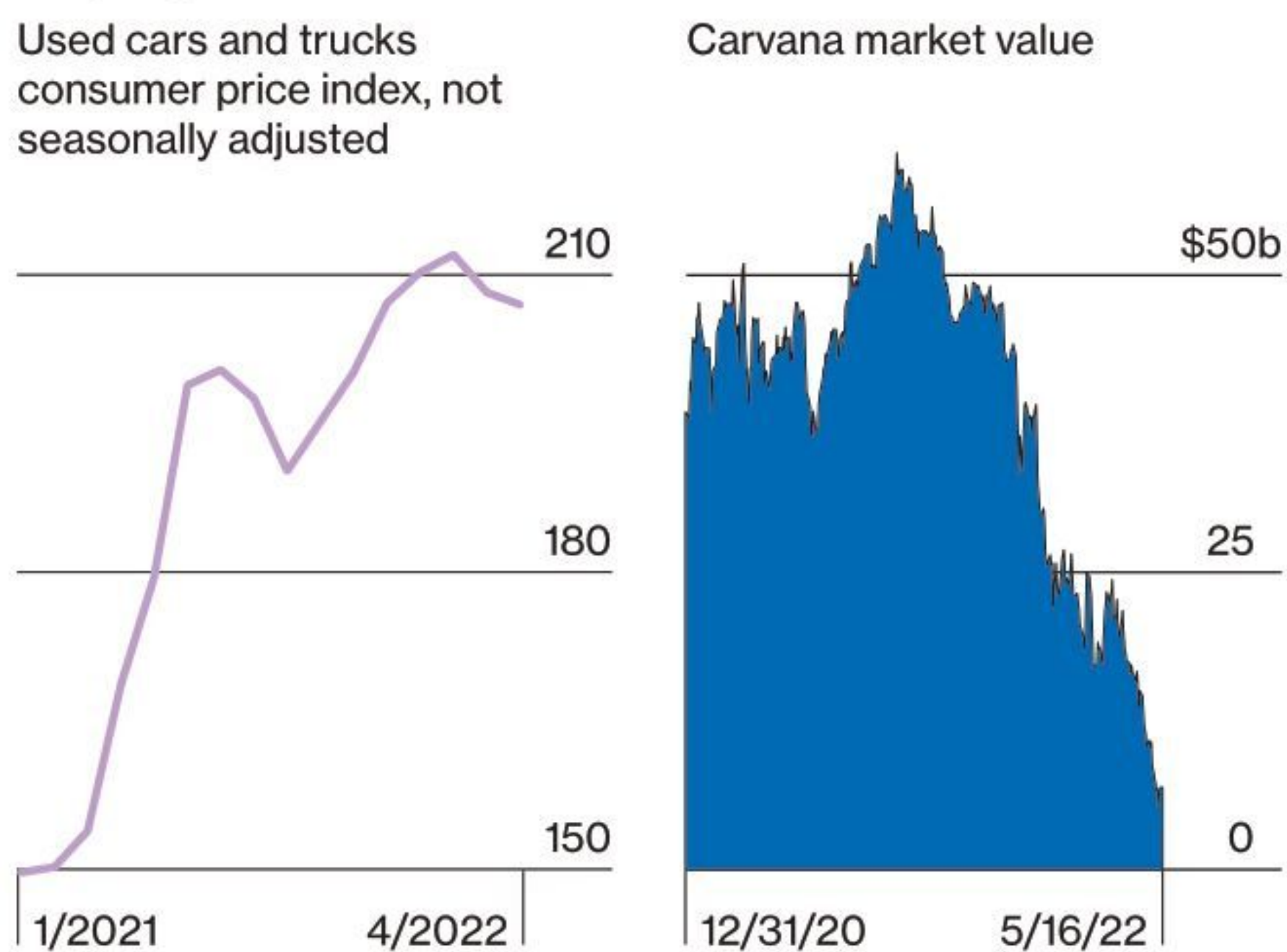
Likewise, Carvana customers at first didn’t seem to care about prices, continuing to buy more cars even as the cost climbed. “The basic business economic principles never really applied,” Tynan says. “It’s almost like ‘fake it until you make it.’ You get rewarded with valuation, and you can kind of grind your way to profitability and hope the bottom doesn’t fall out.” But as general inflation soared and American used-car prices spiked to record highs in January, a lot of would-be buyers finally had the same reaction: No thanks, I’m good.

Carvana sold 105,185 vehicles at retail in the quarter ended March 31, 7% less than in the preceding three months and the first quarterly decline since its founding a decade ago. “All these people have been priced out of the market,” Garcia says. “To me that’s the most fundamental dynamic that I think is happening today.”

As cooling consumer sentiment triggered a drop in demand, Carvana struggled to move and store a glut of vehicles—a logistical challenge in the best of times. Add in some snowstorms and a workforce decimated by Covid-19, and the picture got far worse. At times this year, 30% of Carvana’s operations team was unexpectedly out sick, according to Garcia. Costs stacked up as the company’s skeleton crew hustled to spruce up cars and ship them throughout the country, only to get them in front of shoppers who were already pulling back.

For every vehicle it sold in the first three months

**Paying the Price**



DATA: US BUREAU OF LABOR STATISTICS, COMPILED BY BLOOMBERG



▲ One of the company’s car vending machines in Huntington Beach, Calif.

of the year, Carvana lost \$3,255. In comparison, used-car giant CarMax Inc. made a profit of \$465 a car in the recent quarter. That performance raised a difficult question: If a slick dealership focused on online sales can’t turn a profit during a pandemic, how will it fare in a far less forgiving environment? A lot of investors aren’t sticking around to find out. Carvana has joined Netflix Inc., Peloton Interactive Inc., and other pandemic darlings that are now suffering Covid hangovers. “There’s been this mantra of growth at any cost,” says Wedbush Securities Inc. analyst Seth Basham. “I don’t know if that works anymore these days.”

In its playbook presented to investors on May 13, Carvana promised to rapidly reduce expenses by cutting advertising budgets, further shrinking its workforce via attrition, and scaling back its plans for new warehouses and other major capital projects. The job cuts announced on May 10, it says, will save \$125 million a year.

Garcia is also promising to stock a greater share of more affordable cars and trucks; at the moment, only 3 out of every 100 vehicles listed on its platform are priced under \$15,000. And Carvana plans to start accepting joint applications for financing, a move that could bring more transactions from risky buyers with less-than-stellar credit.

To finance the Adesa acquisition, Carvana sold \$3.3 billion in bonds at a hefty 10.25% yield. Garcia says Adesa’s 56 lots and warehouses will let Carvana prepare and store vehicles closer to its consumers. The company will have a storage facility within 200 miles of 94% of US residents; without Adesa, that number was 56%. That’s critical, according to Garcia, because any shipment less than 200 miles saves an average of \$750 per vehicle. “Most businesses, you’re able to leverage third-party logistics, whether it’s UPS or USPS or FedEx,” he says. “When it comes to cars ... we’ve had to build that.” —*Kyle Stock*

**THE BOTTOM LINE** Carvana saw its stock price plunge 92% over the past nine months as its costs got out of line. The company is now tightening operations in a bid to restore investor confidence.



# This Time Is Different

## ● The slump that startups thought would never happen has arrived

Bilal Zuberi has spent the past few weeks sharing an unsettling message with the founders of companies he's invested in. Startups need to begin slashing costs, which will almost invariably mean job cuts, says the partner at venture capital firm Lux Capital. "The world is falling apart," he says, "and we need to act accordingly."

Unlike the 46-year-old Zuberi, many of the people he's bringing this message to have never gone through a significant contraction in the tech

industry. When he told the chief executive officer of a company with hundreds of employees that it was no longer worth the billion-dollar-plus valuation it held in its most recent fundraising round, Zuberi says, the founder reacted with "confusion, fear, and denial." The CEO had heard other predictions in recent years that dire times were descending, yet things never actually got that bad. Zuberi declined to name the founder or the company, because the conversation was private.

During the astonishing decade-plus bull market fueled by the ascendancy of the tech industry, there have been periodic warnings that the good times were ending. In a widely circulated essay from two years ago, "Coronavirus: The Black Swan of 2020," the venture capital firm Sequoia Capital



# ferent

significant pain at later-stage startups, and it seems likely to trickle down to smaller companies in the coming months.

Investors who've spent their careers dedicated to blitzscale boosterism about the transformative nature of tech haven't lost faith in their ability to reshape every corner of the world's economy. But the financial system gets a say, too. "Companies don't die because the product doesn't work," Zuberi says. "They die because they run out of money." After initial resistance, the founder who'd questioned Zuberi's advice began preparing to cut costs by 20% to 30%, eliminate some jobs, and raise money at a lower valuation than his company's previous value.

Welcome to the downturn of 2022, where the path from tiny startup to multibillion-dollar powerhouse suddenly seems less clear. This quarter the number of tech companies going public is set to be the lowest since 2016, according to researcher CB Insights. Venture-backed companies that have gone public in the last two years have lost about half their value this year, according to researchers at PitchBook Data Inc. Shareholders in high-flying private tech companies such as Stripe Inc. and Instacart Inc. have marked down the value of their holdings, in some cases multiple times.

Globally, fundraising has slowed, with the number of megarounds (\$100 million or more) and the total amount raised declining in the first quarter, the first time that's happened in almost two years. "Investor sentiment in Silicon Valley is the most negative since the dot-com crash" 20 years ago, tweeted PayPal co-founder David Sacks, now a partner at the investment firm Craft Ventures.

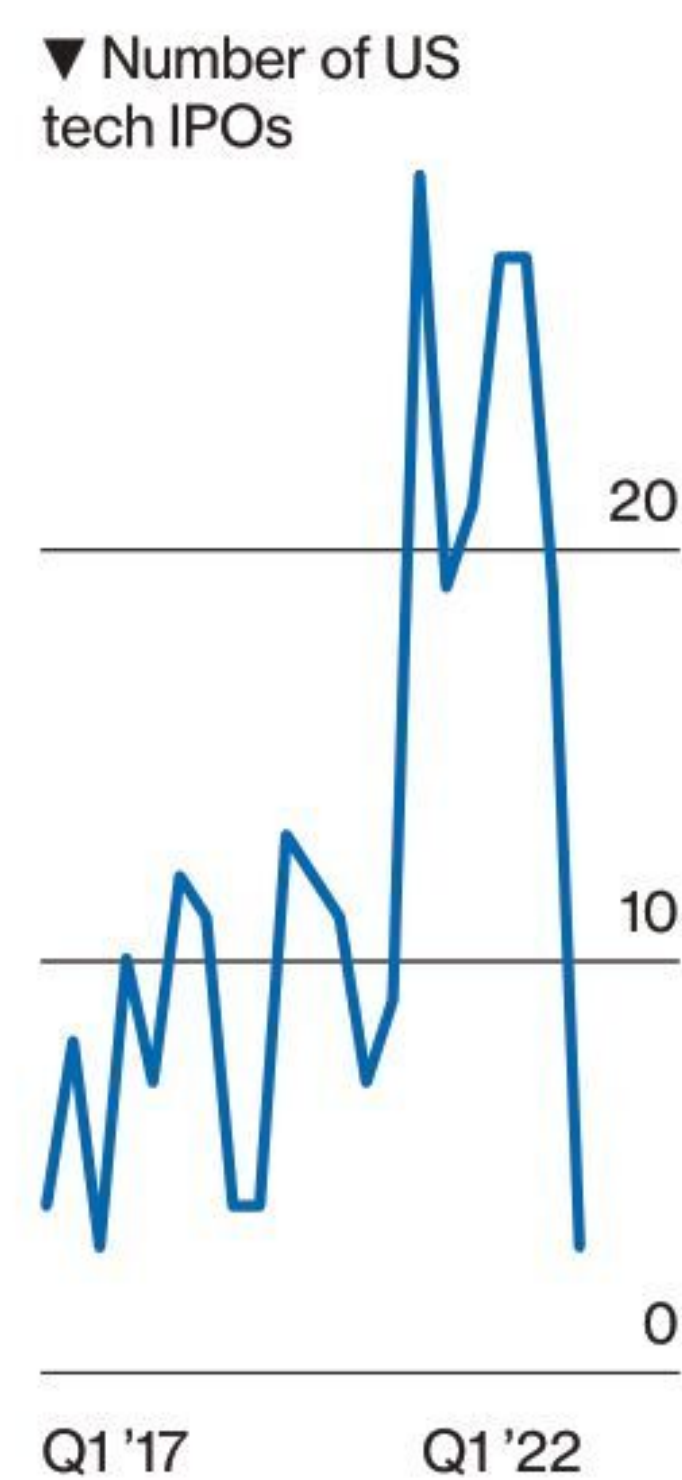
Startups have to learn how to adjust immediately, says Nina Achadjian, a partner at Index Ventures. "Last year no one needed a backup plan," she says. "It was growth at all costs, and capital was easy to come by." Her company is telling founders to shift the focus toward operating sustainably even if that slows growth, to be conservative about hiring, and to make sure they have enough cash to operate for 18 to 24 months.

The market turn is only beginning to take hold. Just 5% of completed investments during the March quarter were down rounds, meaning the company accepted a lower valuation than it had in previous deals, says Kyle Stanford, an analyst at PitchBook. He says that valuations could increase but that what could come first is a rise in "dirty term sheets," referring to deals in which a startup retains its high value while accepting conditions that protect investors at the expense of other shareholders if the situation deteriorates. ►

warned startups to question every aspect of their business, including their staffing levels and whether they'd have sustained access to capital. "Nobody ever regrets making fast and decisive adjustments to changing circumstances," it counseled.

Yet after an initial panic that spring, many tech companies thrived in the pandemic era, when low interest rates, soaring markets, and changing consumer behavior outweighed any disruptions caused by Covid-19. Zuberi says this false alarm made it harder this spring for startup founders to accept the seriousness of the current situation.

But reality is setting in. The stock market drop in early May, combined with the crises of the war in Ukraine, domestic inflation, and a pandemic now well into its third year, has begun to cause





◀ Kneibel at her Michigan home

◀ Venture capitalists, optimistic by nature, are already talking up the silver linings. When big public companies cut back, the first things they stop working on are innovative ideas that take years to pay off, says Vinod Khosla of Khosla Ventures. This response creates opportunity for new founders and early startups, he says, at the same time that market conditions make many startups cheaper to invest in. “Valuations are more reasonable. We can afford to take more risk,” he says.

There’s plenty of money sitting around. Venture capitalists in the US had more than \$230 billion to invest as of mid-May, according to PitchBook. More than 1,000 startups raised funds from seed and angel investors during the March quarter, pushing the total value of early-stage deals to the highest in at least a decade.

“The market is irrelevant for early-stage companies with strong founders and teams,” says Karan Kundra, the founder of a four-person health tech startup in San Francisco. Kundra, 25, says he’s been talking to investors since the beginning of May to raise about \$2 million and has gotten more than a dozen offers.

The changes in the market may eventually work out for investors and founders who can afford to be patient, but that doesn’t mean much to the thousands of tech workers who’ve recently lost their jobs. Venture-backed startups including ghost kitchen operator Reef Technology, grocery delivery company Avo, and artificial intelligence company DataRobot cut more than 7,500 jobs globally from April 1 to May 16, according to employment tracker Layoffs.fyi. Public companies

have also cut jobs, instituted hiring freezes, or both.

Many were stunned by how quickly their seemingly stable employment in a thriving industry evaporated. Michelle Kneibel, a weight-loss coach for the startup Noom, was chatting with her colleagues on Slack one day in late April while they waited to take part in a video meeting. She watched in disbelief as people’s names and posts began to disappear. Minutes later she learned in a private meeting that she’d lost her job. A company spokesperson declined to comment.

Over the course of a few weeks, Noom let 495 employees go. It was a jarring turn for Kneibel, who says she was a top performer in her three years there and always got the maximum annual pay hike. She knew the company had raised \$540 million last year and had recently improved benefits for employees, slashed deductibles on health insurance, and increased parental leave. Late last year, Noom said it would send employees a branded T-shirt and hat to celebrate their accomplishments. “I don’t understand this shift at all,” she says. “I was shocked.”

A few days after losing her job, Kneibel received a package in the mail containing the belated holiday gift from her former employer. The swag came with a note acknowledging the delay but making no mention of the mass firings. Under the current circumstances, the note from the company seemed to carry a different meaning: “It’s finally here.” —Lizette Chapman, with Sarah McBride

THE BOTTOM LINE Venture-backed companies that have gone public in the last two years have lost about half their value so far in 2022, according to researchers at PitchBook Data.

**“Last year no one needed a backup plan”**

## The Twitter Deal’s Big Debt Bill

● If the acquisition goes through, the company will face mounting interest expenses as it tries to grow

Elon Musk has been showing some buyer’s remorse over his deal to buy Twitter, complaining loudly about the number of fake users on the social media platform. He’s even tweeted that he won’t proceed unless Twitter proves bots make up fewer than 5% of its users, setting up a potential

showdown with the company's board, which says it plans to hold him to the merger agreement.

But to sober-minded credit analysts, there's another reason to have second thoughts about such a costly acquisition: a \$13 billion debt load that's looking like it could be a bigger burden by the day for Twitter Inc.

The package, drummed up in a rush and signed by banks before the end of the billionaire's beloved April 20 weed holiday, would give the company an alarmingly small margin for error. Musk would fund his purchase with high-yield bonds and a loan from institutional investors. Research firm CreditSights estimates the new debt will dramatically increase Twitter's annual interest expense to about \$900 million; Bloomberg Intelligence's estimate is \$750 million to \$1 billion. The company's interest costs were only \$53.5 million during the past 12 months.

With numbers like those, Twitter looks poised to burn through cash, boosting the pressure on Musk to transform the company by finding new sources of revenue and slashing costs. That's the case even with Wall Street analysts estimating record earnings in 2022. But those forecasts could be too rosy if predictions for a US recession come true—Musk himself said on May 16 that one is already likely under way. Most of Twitter's sales come from advertising. In an economic slowdown, "the first things that companies pull in terms of marketing budgets is advertising spending," says Bloomberg Intelligence analyst Robert Schiffman.

"This is just a bad capital structure to put on a business like Twitter that has never proven to be highly profitable," says John McClain, portfolio manager at Brandywine Global Investment Management. "It's been a public company for quite some time, and they never have seemed to really figure out how to attractively monetize the consumer."

Debt is only one of three components of Musk's financing. He's found 19 other investors to join him in an equity commitment totaling

\$27.25 billion. And he's taken out a \$6.25 billion margin loan against his Tesla shares, though he's trying to replace that by bringing in preferred equity investors, which could include Apollo Global Management Inc. and Sixth Street.

As is typical in a leveraged buyout, the company being acquired will be responsible for repaying the new debt. Musk and his fellow equity investors can lose only the cash they put into the deal. "Leverage is really high and free cash flow is going to be negative out of the gate, so that certainly adds an element of risk to the deal," says Jordan Chalfin, a senior analyst at CreditSights.

Meanwhile, selling corporate debt has gotten more difficult in recent weeks. Rising rates have hit junk bonds the hardest, and the average yield, a proxy for the cost of borrowing, has increased by more

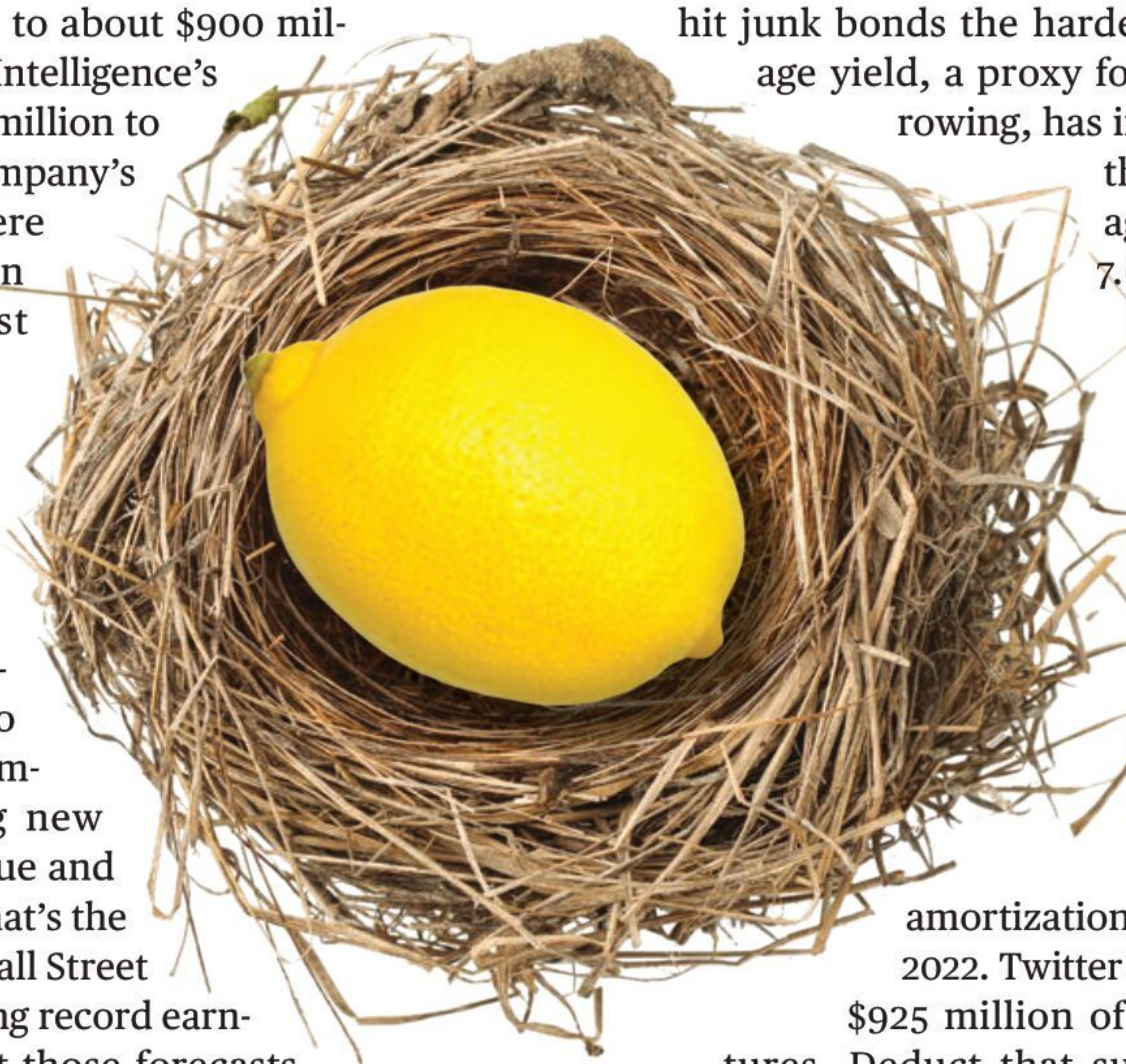
than a full percentage point, to about 7.6%, since banks agreed to the Twitter deal. The institutional market for so-called leveraged loans has cooled, too.

Analysts see Twitter posting record earnings before interest, taxes, depreciation, and amortization of \$1.67 billion in 2022. Twitter has forecast about \$925 million of capital expenditures. Deduct that sum and Twitter's newly increased interest expense from its Ebitda, and the company would be sending cash out the door faster than it comes in.

If Musk is able to boost Twitter's financial performance, the debt load would become more manageable over time, potentially enabling the company to hit neutral cash flow in 2023 and positive cash flow in 2024, according to Chalfin. Twitter also has about \$6.3 billion in cash and short-term investments that could allow it to burn cash for a few years, Bloomberg Intelligence's Schiffman says.

But, to put it in terms Musk, an avid gamer, might use, playing with that much debt means running Twitter on hard mode. —Paula Seligson

▼ Twitter's interest expense



**THE BOTTOM LINE** Twitter is trying to wring higher profits from its user base as it faces the risk of recession. After Elon Musk's debt-fueled acquisition it would have less room for error.

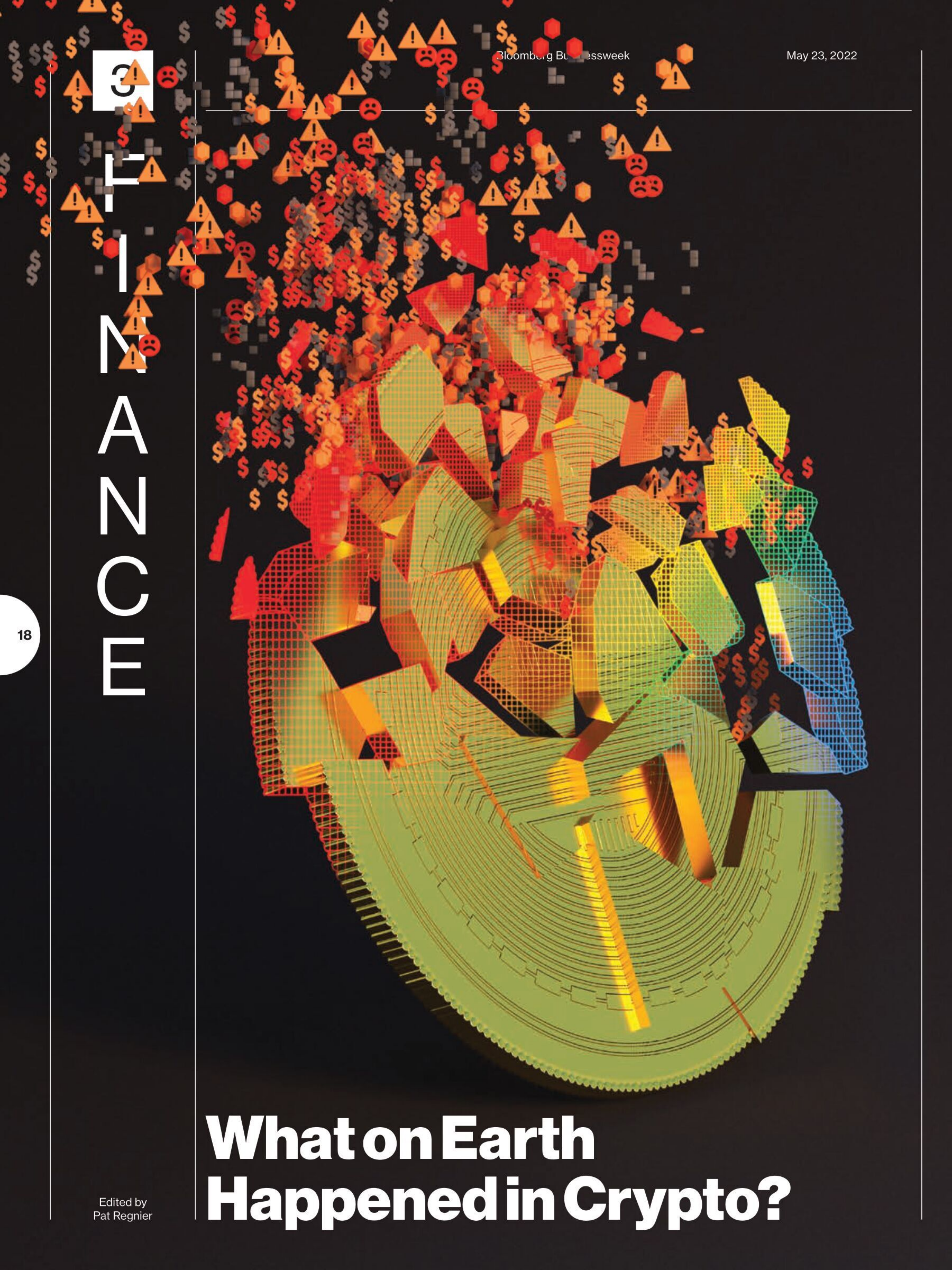


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# What on Earth Happened in Crypto?

Edited by  
Pat Regnier



## ● The unraveling of the TerraUSD and Luna coins reveals a risky, fragile market

Last fall, on the advice of a friend, Odoxa Iyamuosa invested his life savings of \$4,000 in a cryptocurrency called Luna. The 28-year-old, who lives in Abuja, Nigeria, researched the coin himself online, and what he found seemed promising. Luna's price was soaring, thanks to the success of another coin with which it was deeply intertwined, TerraUSD. Some of the crypto industry's biggest names had already invested, including Galaxy Digital Holdings Ltd., the high-frequency-trading firm Jump Trading, and venture investment arms of the exchanges Coinbase Global Inc. and Binance.

For Iyamuosa, it seemed like his best hope to get out of Abuja, where he says many jobs pay just \$2 a day, or less. He'd scraped together a little money selling knockoff Nike and Adidas sneakers to local buyers he found on Instagram. He wanted to increase his savings to \$16,000 and enroll in a data-analytics program at a college in Toronto so he could get a job at a big American company, like Netflix or Google. And for a few months, it looked like his plan was working. The value of his Luna coins doubled. "I sent money to my mom and my siblings," he says. "I was able to eat properly."

Then this month Luna and TerraUSD collapsed. TerraUSD was a so-called stablecoin, which means it was supposed to keep a constant value of \$1. But it dropped below \$1 and kept falling, and Luna tokens, once worth more than \$100, crashed to below a penny, all but erasing a combined market value that had topped \$60 billion. Iyamuosa says his coins are now worth a total of just 3¢. "I didn't even know what to do—I felt like just dying," he says. Iyamuosa says he decided against suicide, because it would devastate his mother.

For the past two years soaring prices for Bitcoin, Dogecoin, and other cryptocurrencies have been stoking a powerful fear of missing out on a chance to make an overnight fortune. And promoters of what's called DeFi, or decentralized finance, where users can deposit, borrow, and lend coins, were promising super-high yields without super-high risks, as if the traditional rules of finance no longer applied. One reason for TerraUSD's popularity was that holders were offered yields of 20%. The crypto industry more broadly encouraged the sense of FOMO with its marketing, painting investing in crypto as a way to seize control of your future. "If you want to make history, you gotta call your own

shots," LeBron James said in one of several Super Bowl ads for crypto exchanges.

Now social media is filled with stories from investors like Iyamuosa, who say they've lost their life savings on Luna. A list of suicide hotlines is pinned at the top of the Reddit forum devoted to the tokens. The two coins' collapse fed a digital-asset rout, helping wipe out more than \$300 billion from the combined value of all cryptocurrencies in the week ended May 13. Bitcoin, which traded for more than \$60,000 as recently as October, now goes for half that. For the moment, at least, the entire crypto edifice looks shakier.

Not long ago, Luna and TerraUSD's backers were talking as if they had reinvented finance. The tokens' creator, Do Kwon, a 30-year-old South Korean who studied computer science at Stanford, said he wasn't making just another form of digital cash—it was going to be a new financial system, one outside government control that was cheaper and faster to use and paid higher interest rates to savers. "Creating a decentralized form of money on which you can build an entirely new type of permissionless financial ecosystem is the holy grail of cryptocurrency, and that's exactly what Terra does," Kwon said in a promotional web video.

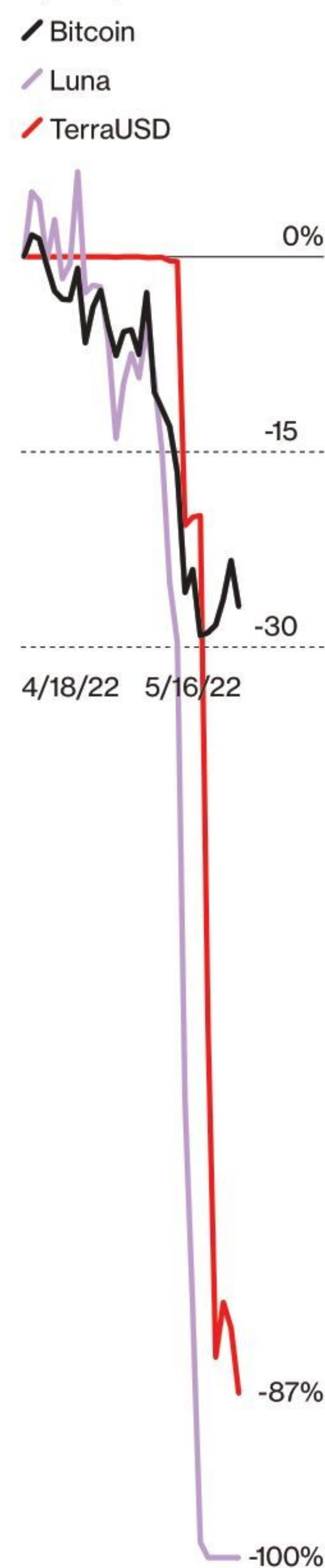
The system around the coins was complex. Start with the stablecoin. These coins have become an important part of the crypto world as a stand-in for traditional cash. Since they're designed to have a constant value, they're easier to use to pay for things in the real world. (Bitcoin and other coins like it jump and plunge in price so much that the seller of a BMW might only end up with a Honda's worth of tokens by the time the deal gets done.) Kwon envisioned Terra stablecoins being used for instant payments and transfers around the globe, undercutting Visa, Mastercard, and Western Union.

The concept wasn't new. But unlike other stablecoins, TerraUSD didn't even claim to be backed by dollars or other assets held in a bank account. Instead, it was supposed to be worth \$1, because it could be redeemed for \$1 worth of Kwon's other token, Luna. If Luna was worth \$10, you could redeem one TerraUSD stablecoin for 1/10th of a new Luna, which you could sell on an exchange for \$1. If Luna was worth 10¢, you'd get 10 Lunas.

Luna itself was supposed to climb in value as the network grew more popular, because its holders accrued usage fees. It was essentially a mullet network: in the front, a boring, businesslike stablecoin, and in the back, the Luna get-rich-quick party.

TerraUSD launched in 2020, but it gained little traction until March 2021 when Kwon introduced a third part of the network: Anchor, a quasi-bank ►

▼ Change in value since April 18, 2022



**"It felt to me like watching my own house burn down"**

◀ for crypto where users could deposit their Terra stablecoins and earn 20% interest. (As is typical in crypto, Kwon says his company, Singapore-based Terraform Labs, wrote the software, but all three legs of the system are “decentralized,” controlled by their users.)

Perhaps this raises an eyebrow? Indeed, some people in the crypto world argued it was unsustainable. After all, 20% is higher than Bernie Madoff’s made-up returns at his hedge fund. But Kwon pitched it as a safe alternative to banks such as Wells Fargo & Co., even saying that one day other fintech companies like Venmo might deposit user funds there. “What’s beautiful and decentralized about this system is that it requires no central intervention,” Kwon said in January on a podcast. “It’s just sort of beautifully combined together using a set of game theoretic incentives.”

In 2021, Luna’s price increased 100-fold, and nearly \$10 billion worth of TerraUSD stablecoins were created. On Twitter, Kwon, whose avatar was an Iron Man-ish armored hero, said Terra was unstoppable and trolled anyone who questioned his ideas. “This community bought Luna, so they definitely are not poor as your broke ass,” Kwon tweeted at one critic in March. Fans took to calling themselves Lunatics. “I’m officially a Lunatic!!!” Galaxy Digital founder Mike Novogratz tweeted in January, after tattooing his left shoulder with the word “Luna” next to a wolf howling at the moon. “My tattoo will be a constant reminder that venture investing requires humility,” the billionaire said in a letter posted online on May 18. (Company filings indicate that selling Luna tokens contributed to \$1 billion in realized gains last year for Galaxy.)

But TerraUSD had a flaw, one it shared with money-market funds or banks before the invention of deposit insurance. If users lost confidence in the system, they could rush to sell or redeem their coins, and others might follow, fearing they wouldn’t get their \$1 per token back if they waited too long. In theory, the network could always issue more Luna tokens to those who wanted out. But that was a risk, too. The more tokens issued, the further the price of Luna would drop, which in turn would mean the network would have to issue even more, exacerbating the decline. On Wall Street, that’s called a “death spiral.”

“The idea was: ‘We’ll just print more Luna out of thin air to back the price of the stablecoin,’ and that doesn’t really work,” says Steven McClurg, chief investment officer at Brentwood, Tenn.-based Valkyrie Investments. “You can’t just create more money out of thin air.”

The crisis started on May 7. Luna had already

been drifting down as part of a general slump in asset prices. After a trader made a large swap of TerraUSD for rival stablecoins, its price dropped to 99¢, prompting speculation the dollar peg was at risk. Kwon had amassed a few billion dollars worth of Bitcoin as a reserve to back TerraUSD in case of emergency, and on Twitter he projected confidence about its stability. “Those of you waiting for the earth to become unstable—I’m afraid you will be waiting until the age of men expires,” Kwon wrote on May 8. But the next day, the Terra redemptions continued, forcing Luna to issue more tokens.

Luna fell by more than half, to less than \$30, then lost another two-thirds in value the next day. Kwon exhorted followers to hold on. “Getting close ... stay strong, lunatics,” he tweeted. But there was no stopping the death spiral. By the morning of May 13, 6.5 trillion Lunas were in circulation, and the price had dropped to \$0.00001834. TerraUSD’s price dropped below 20¢, because even if it could be redeemed for an immense pile of Luna tokens hypothetically worth \$1, there was no one to buy them.

Iyamuosa, the Nigerian investor, says he’s spent the days since the crash in disbelief. Down to his last \$20, he’s still on Twitter and the chat app Discord, hunting for a crypto project that will make his money back. His dream of moving to Canada to study seems out of reach. “There’s literally nothing else for me again,” he says. “I don’t know, man. Honestly, there’s no job, there’s no nothing.”

Other investors also say they were prepared for ups and downs, but never imagined such a rapid collapse. Senior Bernier, 24, a flooring contractor in Montreal, says he lost about \$250,000. “Do Kwon is a guy I’ve always believed in,” he says.

“It felt to me like I was watching my own house burn down or something,” one investor said on an audio support group on Twitter Spaces. “You’re not an idiot, you’re not unloveable,” the host said. “Please don’t make any rash decisions guys.”

Kwon didn’t respond to messages seeking comment. “I am heartbroken about the pain my invention has brought on all of you,” he tweeted on May 13. He said he has a plan for reviving his financial system, this time without a stablecoin.

The crypto market appears to have stabilized. Tether, the most popular stablecoin, which says it’s fully backed by sound investments, dropped below \$1 before recovering. But Terra’s collapse has amplified calls for rules for stablecoins in the US, UK, and South Korea. Authorities in South Korea revived a financial-fraud investigation unit to look into the Terra collapse, according to news reports there. Regulators say a collapse like this



▲ Novogratz tweeted his Luna tattoo before the crash

could pose risks to the broader financial system if crypto and the complex DeFi ecosystem continue to grow. “A lot of people thought that a stablecoin was just going to be as good as a dollar,” said Rohit Chopra, director of the US Consumer Financial Protection Bureau, in a Bloomberg Television interview on May 16. “But they’re learning that it’s not.”  
—*Zeke Faux and Muyao Shen*

**THE BOTTOM LINE** The Luna cryptocurrency and the Terra stablecoin were supposed to be a new alternative to banks. They delivered a new kind of bank run.

## Keeping an Eye On Bankers’ Chats

... Wait, what 🤪?!

● Top professionals on Wall Street are being asked to let lawyers see what’s on their phones

The US Securities and Exchange Commission is forcing Wall Street banks to embark on a systematic search through more than 100 personal mobile phones carried by top traders and dealmakers. It’s the largest-ever probe into clandestine messaging on platforms such as WhatsApp.

The watchdog has been sending firms lists of key positions—including heads of investment banking teams or trading desks—that are subject to the review, according to people with direct knowledge of the requests. Personnel in those roles are being ordered to hand over their phones so the devices can be examined by outside lawyers. The aim is to gauge how pervasively bankers use unauthorized messaging platforms to chat with each other or clients. Banks including Goldman Sachs Group, Morgan Stanley, Citigroup, HSBC Holdings, and Credit Suisse Group have said they’re fielding US inquiries into messaging apps, though it isn’t clear whether all are now accessing employees’ phones.

The requests to examine devices are so sensitive—potentially rooting through years of office banter and even personal texts—that banks are arranging for outside attorneys to help conduct the reviews, acting as intermediaries and preserving some semblance of privacy, the people

familiar with the matter say. The lawyers are being asked to look for business-related messages, with a definition that may offer the industry’s denizens a bit of comfort: Venting to a co-worker about a terrible boss probably won’t be deemed business-related. And the boss won’t find out. Plus, regulators generally aren’t seeking message content at this stage, but rather information on who used illicit messaging channels and how often.

Wall Street has been on edge about phone data since word emerged about a year ago that JPMorgan Chase & Co. was examining some employees’ use of external apps. That review culminated with the ouster of a few employees and \$200 million in regulatory fines as JPMorgan admitted failing to keep records of business-related messages on personal devices. The SEC sees such monitoring by banks as essential to rooting out wrongdoing. “In the past we’ve seen violations in the financial markets that were committed using unofficial communications channels,” SEC Chair Gary Gensler said at the time.

Spokespeople for the banks and the SEC declined to comment. Under industry rules, securities firms are required to set up surveillance systems and archive written communications. Yet workers across the industry embraced messaging apps in their personal lives, and many began using them to chat with each other, potentially splicing jokes, gripes, gossip, and tales of weekend adventures with messages about trades and deals. The texting became all the more common when the pandemic forced legions to work from home, out of bosses’ sight.

JPMorgan’s settlement with the SEC in December didn’t allege that anything fraudulent or untoward was found in recovered texts. But the bank did admit, among other things, that one manager texted with more than 100 colleagues and dozens of outsiders, including clients, racking up more than 2,400 messages over the course of a year. Another manager set up a WhatsApp group chat and invited 19 other members of the desk to join, where they discussed markets, business, and client meetings.

US officials are trying to stamp out clandestine messaging as they’ve been ramping up probes into suspected market abuses. They’re scrutinizing, for example, whether bankers tipped off market participants to large stock transactions, known as block trades. They’ve also opened inquiries into the activities of short sellers and are searching for signs of insider trading ahead of mergers announced by blank-check companies. —*Matt Robinson, Hannah Levitt, and Jenny Surane*

**THE BOTTOM LINE** Like everyone else, bankers are using chat tools such as WhatsApp in their personal lives. But conversations may also bleed into talk of trading and deals.

● Fine paid by JPMorgan in 2021 for record-keeping failures

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# The UK Pays a Price for Short-Term Thinking

● The focus has long been on cutting costs rather than investing for the future

In a world reeling from soaring inflation and weak growth, the UK holds a special place. It's on track to be the advanced nations' stagflation capital. Prices are expected to rise 13.1% over this year and next, the most in the Group of Seven, and the UK will drop to the bottom of the pack for growth in 2023, according to the International Monetary Fund. The National Institute of Economic & Social Research reckons the country will be in recession before next year.

It's a curious form of exceptionalism but one that's become all too familiar. Whenever a squall in the global economy lands on the shores of the UK, it has a tendency to turn into a tempest. The collapse in 2020 after Covid-19 struck was the deepest of the G-7. Fourteen years after the 2008 financial crisis, the government still owns 48% of NatWest Group Plc, the rebranded Royal Bank of Scotland. The US, where it all started, moved on long ago.

When trouble strikes, the UK ends up sprawled on the canvas because, more than others, its economy lacks resilience. It's a lesson in the dangers of just-in-time hyperefficiency, a culture focused more on cutting costs than on investing for the future. Never has that been more apparent than now. The UK's inflation shock will be nastier than in the US and Europe, says Alfred Kammer, the IMF's European director, because it combines "the worst of the two worlds"—America's labor shortages

and Europe's energy crisis. Both can be traced to structural capacity shortages.

Almost half of the UK's gas is domestic, sourced from the North Sea, but there's no storage. Rough, the last major facility, was closed in 2017 because it had become "uneconomic," according to its owner. This, combined with a laissez-faire approach to energy security that's put almost half the country's nuclear power capacity on track to be decommissioned by 2024—two years before any replacement comes onstream—has left the UK exposed to the whims of the spot price in energy markets. High fuel prices are punishing households and spurring the cost-of-living crisis.

It's not hard to see what the alternative might've been. In the past few weeks the UK has imported so much liquefied natural gas (LNG) that it has more than it can use. The UK's gas price is now a third lower than continental Europe's. Were Rough still open, the energy shock would be less severe. The crisis is partially self-inflicted.

A similar story can be told about the tight labor market. Michael Saunders, a member of the Bank of England's rate-setting Monetary Policy Committee, on May 9 said it was "possible that Brexit has steepened the wage and price curves" by reducing labor supply and curtailing some imports.

The labor market is now so tight that, for the first time ever, there are more job vacancies than there are unemployed. Since the start of the pandemic, the workforce has shrunk by 440,000. Almost half the decline can be accounted for by a drop in EU workers. Former Monetary Policy Committee member Adam Posen told members of Parliament on May 11, "A substantial majority of the inflation differential for the UK over the euro area is due to Brexit." Leaving the European Union, Britain exposed its over-reliance on cheap migrant labor.

The Covid recession in 2020 also showed the danger of short-sightedness. The government's lockdown policy was meant to prevent the National Health Service from being overwhelmed. Years of underspending, relative to gross domestic product per capita, had stretched the NHS to its limits. With little give in the system, lockdowns had to be extended to prevent even more deaths.

Undercapacity was to blame again with ►



◀ regard to the stockpile of personal protective equipment, much of which had degraded before Covid. In the global scramble for supplies, the UK overpaid to such an extent that it wrote off £4.7 billion (\$5.9 billion) in “inflated prices” and a half-billion pounds in unusable gear, the Department of Health and Social Care later said.

Turn the clock back further, and the same lack of resilience was true of UK banks. In 2008 they were running on fumes. RBS’s equity capital was so thin that losses of only £1.97 on every £100 of loans were enough to bankrupt the lender, the UK financial regulator later calculated. Banks around the world were undercapitalized, but the UK’s biggest was the worst.

UK business in general embodies this trimmed-to-the-bone approach, choosing to cut costs rather than invest in growth. Businesses invest only 10% of GDP in the UK, vs. 14% in the Organization for Economic Cooperation and Development, and spend a third less training staff. One European industrialist put it this way: When the Germans see a shiny new machine, they want it; when the Brits see it, they ask how much it costs.

The government set the tone in the 1980s when it sold off the family silver to pay its bills. Companies were privatized and social housing sold sometimes “below their retention value,” Richard

Hughes, now chairman of the government’s fiscal watchdog, the Office for Budget Responsibility, wrote in 2019.

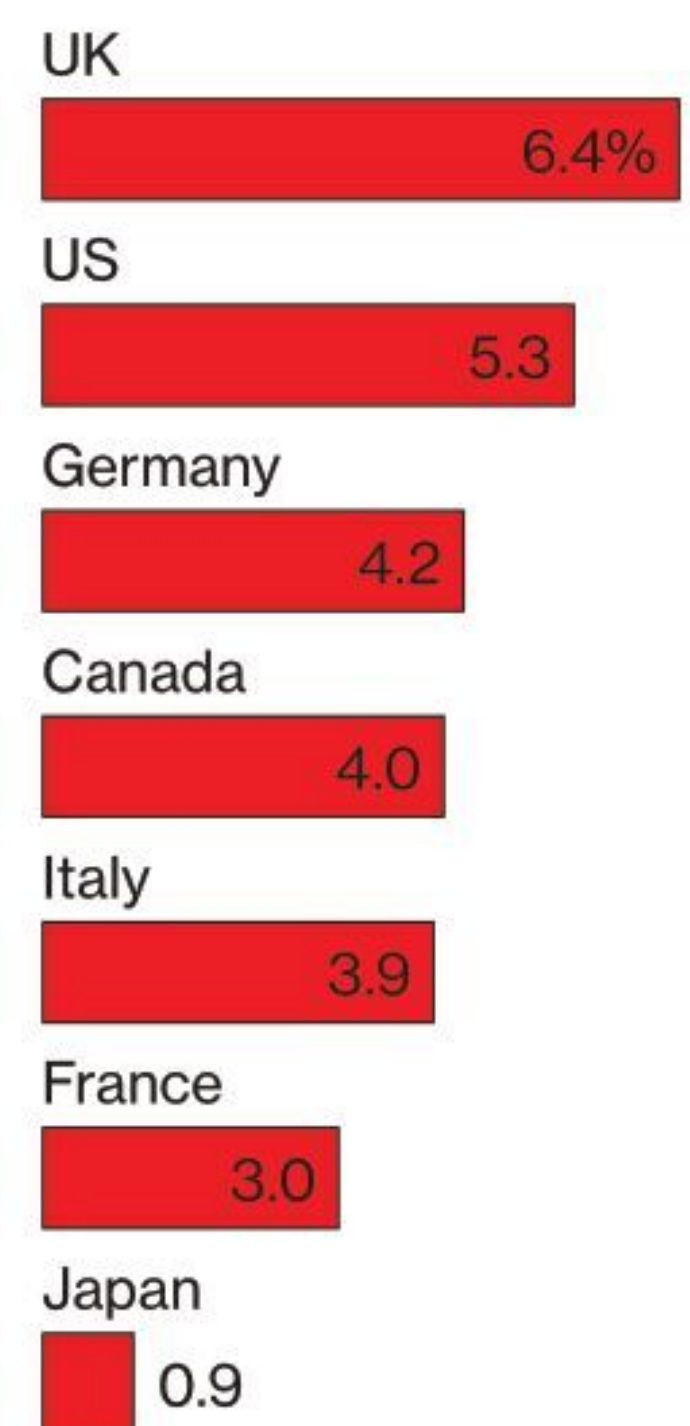
Such short-termism has left public-sector net worth, a measure of long-term fiscal sustainability, deeply negative. The value of the UK’s liabilities is about £2.2 trillion greater than the value of its assets. With the exception of Italy, no other G-7 government owes that much more than it owns.

Along the way, the UK has learned how to make markets work for it. Like the US, it teamed up with the private sector to focus capitalism’s animal spirits on the task of delivering a Covid vaccine. The UK’s success and speed of rollout lay behind the fastest economic rebound of the G-7 in 2021. The recent success the UK has had importing LNG is another example. Andrew Bailey, the BOE governor, even drew parallels between the surge in gas imports and the vaccine task force, calling on May 5 for an equivalent laserlike “focus on the resilience of energy supply.”

When conditions are perfect, the open-market economic efficiency of the UK is a virtue, delivering growth that tends to outpace that of its European peers. But during shocks such as these, the UK pays a price. —*Philip Aldrick*

THE BOTTOM LINE The UK is poised to become the exemplar of stagflation thanks in part to a cost-cutting mentality that’s dominated economic decision-making.

▼ IMF’s projected CPI inflation, 2022-23 two-year average



## Nigerian Projects Stall as Chinese Loans Dry Up

● President Buhari’s legacy could be marred by Beijing’s waning appetite for costly public works abroad

Nigeria’s outgoing president promised to leave a legacy fashioned from concrete, stone, and steel. Instead, billions in stalled financing from China is forcing him to temper his aspirations to seed the country with ambitious public works.

Muhammadu Buhari, a former military ruler, was elected to lead Africa’s most populous nation in 2015 on pledges to tackle a deadly Islamist insurgency, clamp down on corruption, and build critical infrastructure. With only a year left in office, it appears he put too much faith in the appetite of Chinese lenders to fund the roads, railways, and power plants that could transform Nigeria. “It is obvious that things are below expectations,” says Ovigwe Eguegu, a Nigerian policy analyst at Development Reimagined, a Beijing-based consulting firm. “It would greatly help the ruling party’s

chances in the polls next year if they deliver on these major infrastructure projects.”

Although Buhari has scored significant victories, more than \$25 billion worth of projects that were meant to be completed before his departure are either far behind schedule or yet to start.

Africa’s largest economy, where about 40% of its 200 million people live in poverty, is crying out for investment in infrastructure to spur growth and diversify beyond oil production. The government generates barely enough revenue to service the nation’s debt, trapping it in an endless cycle of borrowing. Like many developing countries, it’s turned to loans from Chinese state-owned banks to finance major public works.

“Buhari got into power and looked at his options at how to provide infrastructure to Nigeria,” says

Abdul-Gafar Tobi Oshodi, a political science lecturer at Lagos State University. “China is known for that. China is the leading state financier in Africa, not only in Nigeria.”

Project-specific lending to Nigeria from the Export-Import Bank of China totals \$3.6 billion, according to data published in December by the nation’s Debt Management Office. The loans enabled Buhari to complete two rail lines that cover almost 350 kilometers (217 miles)—one started from scratch linking the commercial hub of Lagos with the city of Ibadan and another begun by his predecessor connecting the capital, Abuja, to the northern city of Kaduna. Funding from the same lender is paying for the upgrade of a 220km highway and a 700-megawatt power plant.

Although these are notable achievements in a country where previous leaders have spent billions of dollars on projects that remained unfinished for decades or swiftly fell into disrepair, they fall short of the ambitions outlined by the president and his allies when they swept aside the political party that had governed Nigeria since the restoration of democracy in 1999. One conspicuous failure is the 740 miles of rail track that will travel northward from Ibadan to the trading center of Kano. Buhari has frequently extolled the benefits of this line, estimated to cost \$5.3 billion, which he says will streamline and turbocharge commerce between Lagos’s seaports and Nigeria’s second-largest city.

Ahead of the president’s reelection in 2019, the ruling All Progressives Congress party told Nigerians that Buhari’s second term would bring the construction of two additional rail projects priced at \$14 billion and a giant 3,000MW hydroelectric plant that’s been on the drawing board for 50 years. Since then, the state-owned energy company has begun work on a \$2.6 billion gas pipeline meant to increase domestic consumption of the country’s abundant reserves and reinvigorate power-deprived industries.

At various times, Buhari or his officials have announced the government had obtained or would shortly secure loans from China to pay for the bulk of these developments. Yet the funds haven’t materialized, so projects are being kept on life support with government money or are on pause until financing can be resolved. Rotimi Amaechi, Nigeria’s transport minister at the time, voiced his frustration in February, telling reporters, “We were waiting on the Chinese to give us the loans we applied for, and till today they’ve not replied.”

Unfortunately for Buhari, China’s enthusiasm for underwriting these capital-intensive endeavors appears to be waning. When President Xi Jinping addressed the eighth triennial Forum on



China-Africa Cooperation in October, his financial pledge to the world’s least industrialized continent fell for the first time in more than a decade, decreasing a third from the \$60 billion committed at the same event in 2018.

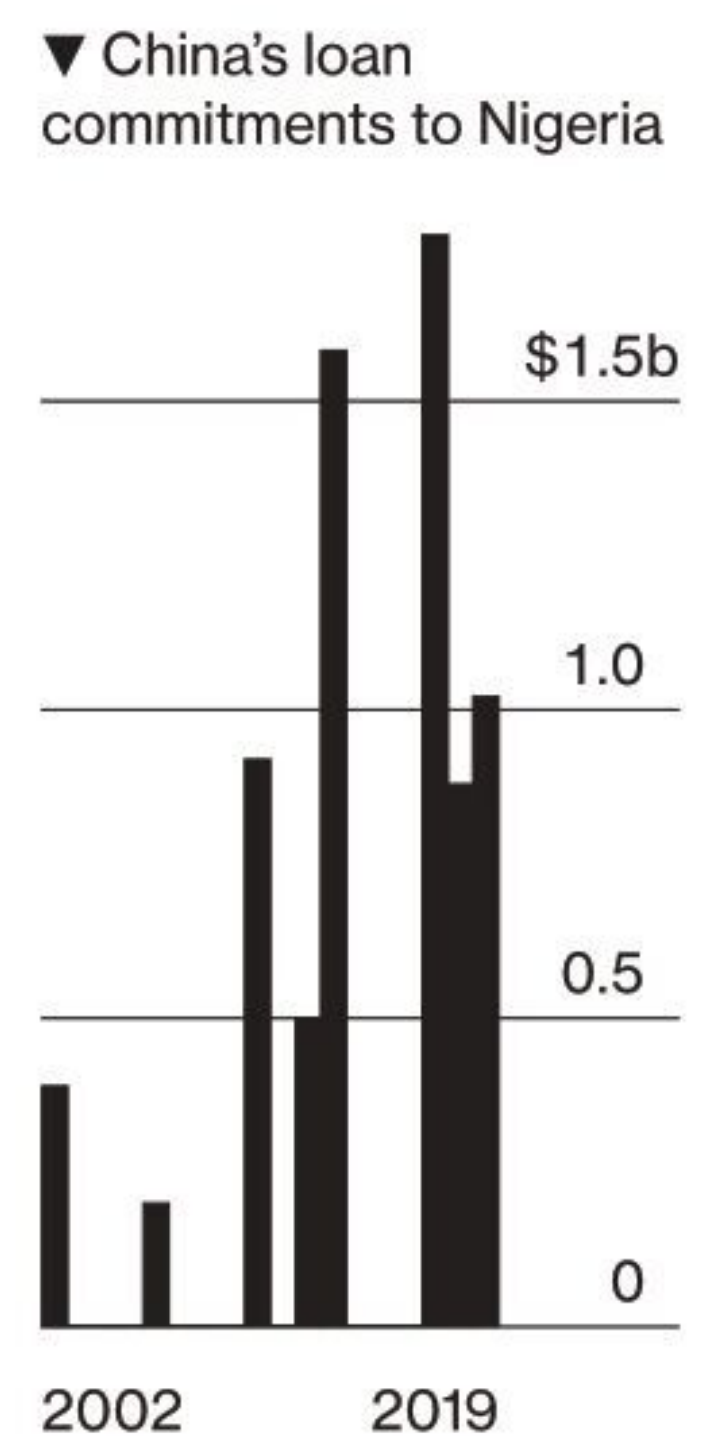
Xi’s government “is facing tight budget limits domestically and needs to balance different priorities overseas,” says Ye Yu, associate research fellow at the Shanghai Institutes for International Studies. In Africa, “the focus has shifted to vaccines and multilateral aid” channeled via organizations such as the International Monetary Fund and the World Bank, she says. Also, concern about the capacity of some African nations to repay their debts is “discouraging Chinese financial institutions’ lending in lower-income countries,” Ye says.

The armed groups that are active across much of Nigeria are also deterring potential financiers. So-called bandits blew up a section of the Abuja-Kaduna line and then opened fire on a passenger train in late March, killing nine and kidnapping dozens more. The abductees are still missing, and service on the line has yet to resume.

A China-backed project that appears to be progressing more seamlessly is one in which the Nigerian government has taken a back seat, participating as a minority shareholder in the development: a much-needed new deepwater port outside Lagos designed to decongest two existing facilities in the city. A \$629 million loan from state-owned China Development Bank and \$221 million in equity funding from majority shareholder China Harbour Engineering Co. are financing most of the \$1 billion project, which is expected to start operations in the first quarter of 2023.

With a presidential vote looming early next year, Chinese lenders may choose to sit on the sidelines until there’s a successor to Buhari. “The fact that China has been reluctant now places it in a powerful position to renegotiate and reengage” once the dust settles after the election, Oshodi says. —William Clowes, with Lucille Liu

▲ Work in progress on a segment of the Lagos-Ibadan rail line in 2019



THE BOTTOM LINE Nigeria’s outgoing president is struggling to line up financing for a long list of ambitious projects that were supposed to help cement his party’s hold on power.

There's more to a consumer price index than meets the eye. The US series, for instance, has grown to include 243 item categories over its 101-year history. We asked reporters all over the world to tell us which subindexes they've been tracking most closely.

*Figures are annual percent change for the most recent month available as of midnight ET, May 17*

● UGANDA

## Laundry soap

▲87.2%

My interest in the “furnishings, household equipment, and routine household maintenance” CPI component was piqued after Ugandan Finance Minister Matia Kasaija in March voiced concern about a spike in prices for laundry bar soap. Behind the jump: a surge in the price of palm oil, stemming from intermittent export bans from Indonesia and the interruption of sunflower oil exports from Ukraine. —*Monique Vanek*

● GERMANY

## Beer

▲2.9%

Christoph Mai, who leads the consumer prices division of Germany's Federal Statistical Office, said images of breweries pouring beer down the drain during the 2020 lockdowns almost brought tears to his eyes. The subindex has lagged overall inflation this year, but producers have been warning price hikes are on the way. —*Carolynn Look*

● US

## Household furnishings

▲10.6%

“Couchmageddon” is what happens when millions of housebound Americans fall out of love with their sofas, order new ones, and then whine about supply chain logjams. Two years into the pandemic, prices for household furnishings show little sign of easing. —*Molly Smith*

● JAPAN

## Cellphone service

▼52.7%

Mobile phone carriers cut fees by more than half last year in response to government pressure, which pushed down the overall CPI readings. The impact of those reductions will start dropping out of calculations in April, a key reason, along with soaring energy prices, why some economists see inflation finally hitting the Bank of Japan's 2% target—a first in seven years. —*Toru Fujioka*

● BRAZIL

## Diesel

▲53.6%

Brazilian truckers staged paralyzing protests in 2018 in response to fuel price increases. President Jair Bolsonaro, who is up for reelection in October, has been publicly berating Petrobras, the state-run oil company, accusing it of fattening its profits, in the hopes that this will help cement the loyalty of a key constituency. —*Andrew Rosati*

● EGYPT

## Tomatoes

▲88%

The price of this dietary staple has always been volatile—Cairo's street vendors cry “Tomatoes are crazy” to tempt people to buy quickly before prices climb. —*Mirette Magdy*

● SOUTH AFRICA

## Frozen chicken

▲21.8%

The price of a frozen bone-in chicken, one of the most affordable sources of protein in South Africa, has spiked largely because of steep hikes in import tariffs and antidumping levies of as much as 265%. With Russia's invasion of Ukraine pushing up the cost of feed and transport, a group representing importers and exporters warns that consumers are “facing a chicken price tsunami,” and it's calling on the government to intervene. —*Prinesha Naidoo*



# in Many Flavors

● US  
**Prepared salad**  
**▲9.3%**

I've been tracking the prepared salad component of the CPI since January of last year to gauge the tempo of return to office. The index has been ticking up since June 2021 and jumped more than 1 percentage point in April from the previous month. Living in New York, I'm used to doling out \$11 on Sweetgreen or the like, but seeing a bowl approach \$15—and that's sans avocado—may be more than I can stomach. —*Molly Smith*

● MEXICO  
**Tortillas**  
**▲17.5%**

The perennial of Mexico's lunch table and foundation of the street corner taco has surged in the past year on the back of rising corn prices. It's one of 24 staples covered in an anti-inflation plan Mexico's government unveiled last month that eschews strict price controls in favor of cooperation with corporations to hold down prices. —*Maya Averbuch*

● CHINA  
**Pork**  
**▼33.3%**

Pork is estimated to be the biggest component of the CPI in China, which is both the world's biggest producer and consumer of the meat. Pork prices have been falling at double-digit rates in each month of 2022, partly because of oversupply. Farmers had been fattening their hogs to almost twice their normal weight in anticipation of a price upswing. Instead, the supersize swine contributed to a rout. —*Lin Zhu*

● AUSTRALIA  
**Domestic holiday travel**  
**▲4.5%**

Australia's Covid-zero stance early in the pandemic forced many families to cancel vacations. Now, as curbs relax and omicron concerns fade, Aussies are hitting the road. Demand for hotel rooms, space at caravan parks, and domestic flights has been increasing, pushing up the subindex. —*Swati Pandey*

● US  
**College tuition**  
**▲2.1%**

For most of the past four decades, college tuition and fees have been rising at a much faster pace than the overall CPI, but the pandemic flipped that around. As the parent of two teenagers, this should be a relief, yet I suspect it's more likely a blip than a trend. —*Cristina Lindblad*



● US  
**Women's clothing**  
**▲5.3%**

Prices for women's clothing, which has a bigger weighting in the CPI than men's, plunged early in the pandemic, with lockdowns reducing the need for dressy, on-trend clothes. The category got a bit of a boost from women switching to the work-from-home uniform of yoga pants and comfy tops. Starting in September of last year, the index ticked up for five months straight as Americans who packed on pandemic pounds replaced clothing that no longer fit and updated their wardrobes as part of the return to office. Since hitting its pre-Covid level in February, the CPI component has trended down, a sign that consumer spending is starting to rotate from goods to services. —*Katia Dmitrieva*

● INDONESIA  
**Red chilis**  
**▲28%**

The blistering price increase for this key ingredient in sambal, a spicy red paste that's an omnipresent condiment, was cited as a reason inflation hit a two-year high in March. —*Grace Sihombing*

● SOUTH KOREA  
**Kimchi**  
**▲10.6%**

The price of the fermented cabbage side dish soared to an all-time high in March, prompting the cabinet of newly elected President Yoon Suk Yeol to convene a meeting of food distributors and crop traders to explore ways to cool the prices of this and other Korean staples. —*Sam Kim*

● UK  
**Sausage rolls**  
**▲4.5%**

I've come to see the savory pastry as a leading indicator of the UK's cost-of-living crisis. Greggs Plc, a giant bakery chain, raised prices for its sausage rolls in December 2020, then again in January 2022 as expenses for labor and ingredients climbed. In March it warned that another increase may be coming, dealing a blow to workers hoping to grab a cheap treat as they file back into the office. A decade ago, Chancellor George Osborne's infamous pasty tax stirred a nationwide uproar. Is a sausage roll rebellion next? —*David Goodman*

# RETHINKING FAIR PAY



● Companies are overhauling compensation amid an uptick in relocations

The pandemic untethered millions of people from their big-city offices, allowing them to move to smaller communities where they could work from home. But the mass migration has become a nightmare for companies, which are struggling to find equitable ways to compensate employees who have the upper hand as remote-friendly roles proliferate in a tight labor market. “It’s one of the hardest business problems to solve right now,” says Daniel Yanisse, co-founder and chief executive officer of Checkr Inc., a provider of background checks for hiring based in the Bay Area. About 40% of Checkr’s

staff live 50 miles or more from one of its six offices. “We’ve fully embraced remote work, but how do you adapt to all these locations?”

Traditionally, big companies based pay on a set of common guidelines including the cost of hiring skilled labor in a particular region. They then lowered salaries as much as 25% for workers who relocated from, say, San Francisco to Boise, Idaho. That made sense until March 2020, when coronavirus-fearing employees fled hither and yon and came to enjoy their remote-work lifestyle.

Since 2020, about 2.4% of Americans, or 4.9 million people, say they’ve moved because of remote work, according to surveys from freelance marketplace Upwork. Its recent polling shows the migration is poised to continue: Almost 1 in 10 Americans plan to move to work remotely. Since January 2020 in the US, monthly remote job postings have tripled, according to Tecna, a tech industry trade group association, and they’ve more than quintupled for tech roles such as software developers.

Now workers are pushing back on automatic pay reductions based on their location, arguing that areas previously considered far-flung are becoming more expensive. With talent scarce and staff quitting at a record clip, companies have had to revamp and consolidate pay tiers. Some are doing away with them entirely; others are freezing or slow-walking salary hikes for workers who’ve moved to more affordable areas.

Whatever strategy organizations employ, questions abound, including tax considerations and deeper concerns about what fair pay actually means. “Nobody was prepared for the turn this took,” says Alicia Scott-Wears, director of compensation content strategy for WorldatWork, a nonprofit that provides education and certification for human resources and compensation professionals.

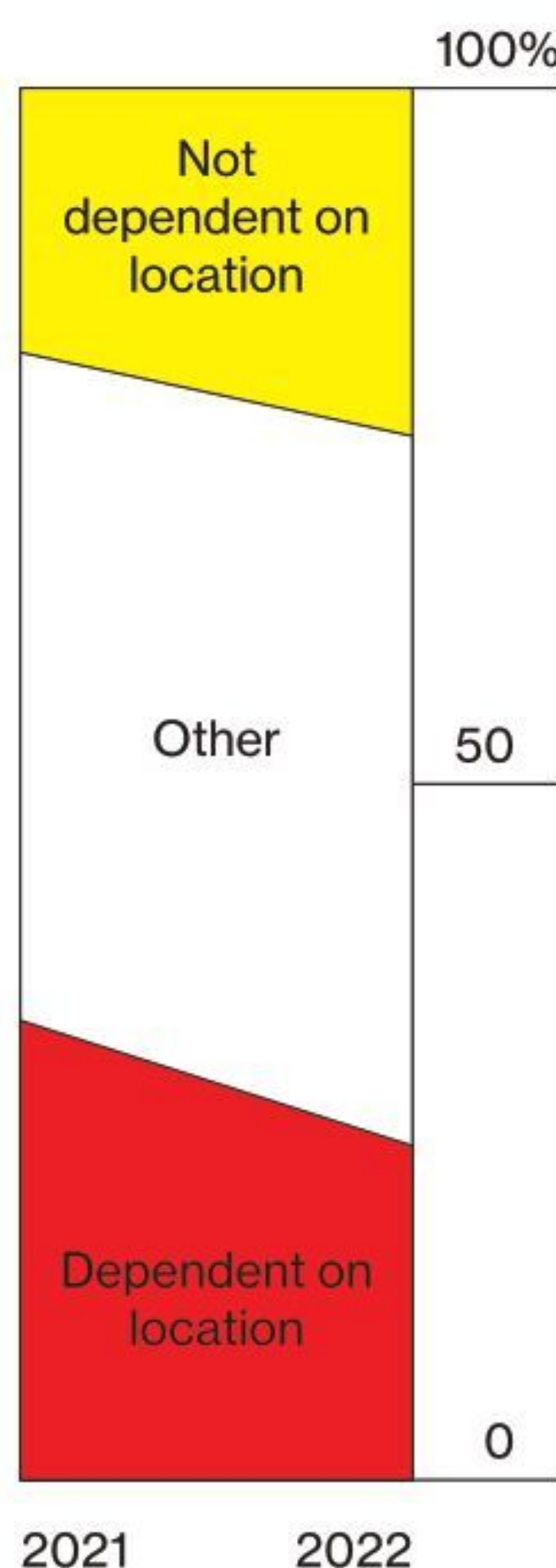
Simply adding more pay tiers creates administrative headaches, not to mention risks causing defections, as many workers simply won’t accept pay reductions anymore. So one approach is to consolidate a slew of location-based tiers into three broad categories of pay. That breakdown makes it easier for administrators to manage, but some specialists—such as coders—command premium pay no matter

where they live. Tech-focused companies engaged in battles for talent are shifting policies on the fly. Okta Inc., a cloud software company, moved from four pay tiers to two in November. Airbnb Inc. has eliminated location-based compensation adjustments for US workers. Sourcegraph, which helps developers search and fix code, has taken that approach even further, pledging to pay the same base salary for the same role globally. Although that certainly inflates compensation costs—and could put workers at the mercy of volatile foreign currencies—CEO and co-founder Quinn Slack says it’s worth it to get the best people.

Doing away with location-based pay adjustments really only works for companies with a work-from-anywhere policy, says David Buckmaster, who’s designed compensation programs for big employers including Nike Inc. If some employees are still tied to an office in an expensive city such as New York, they’ll resent colleagues who can make New York salaries while living in lower-cost Orlando, says Buckmaster, who now works at mobile game developer Wildlife Studios.

For companies with employees spread all over the map, simply figuring out where everyone is at any given moment can be a hassle. Human resources managers need to navigate the web of tax laws and other regulations in every location with remote staff. But the share of HR professionals who felt very confident they knew where the majority of their employees were working declined from 60% in 2021 to 46% this year, according to Topia, which helps companies manage distributed workforces. “There’s a whole series of dominoes that need to

▼ Base pay, share of US companies surveyed



be considered when people move freely and work,” says Suzanne Odom, a principal and compensation expert at employment law firm Jackson Lewis.

These challenges have created business opportunities. Startups such as Deel have emerged to manage payrolls for remote workforces. Radford, a product of Aon Corp.’s human-capital business, compiles salary information from 5,500 companies into a global compensation database that businesses use as a guide. It’s now introducing new “location analytics” tools to help companies decide what to pay distributed workers. About 25% of companies no longer differentiate pay by geographic area, up from 19% last year, according to WorldatWork. But that practice won’t become commonplace, says Radford associate partner Olivier Maudiere. Instead, companies will create several broad-based pay zones, find ways to align a relocated worker’s pay with local norms over time, or handle things on a case-by-case basis, he says.

“There’s no objective answer to how to structure remote worker pay, because there’s no answer to how to structure pay in general,” says Jake Rosenfeld, a sociology professor at Washington University in St. Louis whose research focuses on pay variations. For workers, it’s important that employers are transparent with how they’re designing compensation. “If you can explain why you’re doing what you’re doing, that will engender goodwill.” —*Matthew Boyle and Olivia Rockeman, with Reade Pickert*

**THE BOTTOM LINE** The prevalence of remote work combined with a competitive labor market has companies weighing how much location should factor into an employee’s pay.

# ASTRONOMICAL HARASSMENT

● A long-term survey of women in astronomy reveals a sordid culture of discrimination and inequality in academia

Two decades ago, Rachel Ivie attended a conference for women in astronomy in Pasadena, Calif. During a panel on gender demographics, she presented a series of charts depicting the dismal truth: Only 14% of astronomy faculty

were female—a little more than half the rate for science and engineering overall. After the panel, several participants approached her to discuss why those numbers were so low when 60% of young astronomers at the time were

women. “The question was, what’s going to happen to this big group?” says Ivie, a senior research fellow at the American Institute of Physics (AIP). “Why do women drop out?”

That question continued to nag Ivie, and a few years later she started a long-term study of gender roles in the field, sponsored by the American Astronomical Society (AAS) and the AIP. She and her team have followed 1,300 graduate students since 2007, checking in again in 2013 and 2016, with further rounds possible. Some respondents now work outside academia, so the study sheds light on women’s experience beyond the confines of university astronomy or physics departments. ►

◀ The initial idea was to investigate the myriad reasons women might ditch science careers. But when the data came back, Ivie and her collaborators were riveted by the responses to a question about sexual harassment and discrimination. “We felt that it was important to report on the nuance about where harassment happens, who’s doing it, and what power structure is being reinforced,” she says.

The report details a litany of inappropriate interactions. Most surprising is that harassment isn’t simply predation by a powerful man, à la Hollywood producer Harvey Weinstein. It happens in job interviews, seminars, coffee breaks, and more, with students, collaborators, visitors, superiors, advisers, and peers all identified as perpetrators. Harassment lurks in long-term work relationships and brief interactions, in situations in which there are witnesses, and one-on-one in a woman’s own office or an isolated conference room. One female astronomer was told her promiscuity was to blame when she contracted mononucleosis. A male professor insinuated—apparently thinking he was making a joke—that a female astronomer was sleeping with a female colleague who was crashing at her apartment. Another professor, who was married, sought to run away with

an uninterested female astronomer.

Many women reported getting little or no support from men: Some male advisers took only the men they counseled out for coffee, and male peers avoided collaborating with women. “They literally ignored what I said,” one respondent wrote of a working group with five men. “I had to speak very loudly and repeat several times.” The trouble doesn’t ease as women age, and it gets particularly acute as they become mothers, with frequent comments about body, weight, and child care. And the instigators weren’t always men. “False rumors about my sex life,” one respondent wrote, “were intentionally spread around the department by a woman staff member.”

The study identifies four broad categories of harassment: biased assumptions (“When are you leaving to have kids?”); verbal put-downs (jokes, undermining remarks, critiques); unwanted sexual attention (lurid comments, threats, stalking, assault); and inequitable treatment (less support, little recognition, limited opportunity). Some respondents lodged formal complaints, but many adopted a strategy of resigned avoidance: leaving events, not staying late, changing careers. One woman reported that she “started

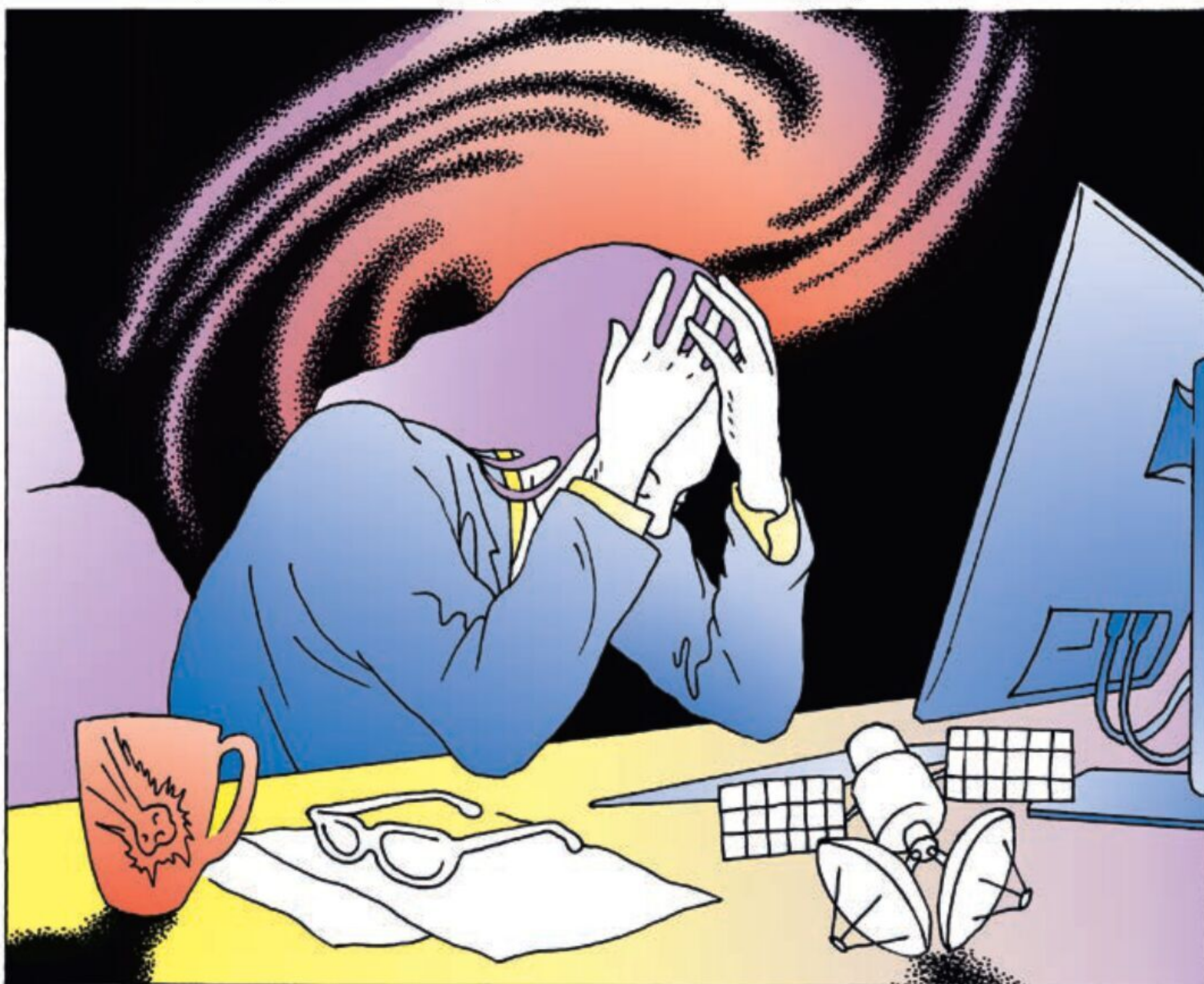
dressing down, wearing loose T-shirts, on days when I knew I would see this particular faculty member.” That’s not an atypical response, says Tracey Levy, co-founder of harassment-prevention company Impact Workforce Training. “Most women cannot push these events to the side,” she says. “They often shift their career in a different direction or step out entirely.”

Ivie was surprised that incidents frequently diverged from the boss-harassing-underling scenario. Low-ranking co-workers often lob put-downs or inappropriate comments at a high-ranking woman—perhaps simply to show they can do so with impunity. “This behavior can reverse power differentials,” Ivie says. “That’s something corporations really need to be aware of.”

Although the study focuses on astronomy, the field isn’t a particular hellscape for women, insists Paula Szkody, president of the AAS. About a quarter of teaching positions today are held by women vs. two-fifths for all science, health, and engineering faculty. “The report makes it sound like astronomy is the worst of the sciences, but actually I think we’re the best in terms of addressing the problem,” Szkody says, pointing to a 2017 revision of the group’s ethics and anti-harassment policy.

Kia Roberts, who oversaw probes of misconduct in the NFL and now runs Triangle Investigations, which looks into corporate harassment and discrimination cases, says the study is indicative of the scale of the problem almost everywhere. And, she says, the AAS deserves praise for airing its dirty laundry. While some organizations run periodic mood checks or culture surveys, they’re typically geared toward answering a business question such as why talented employees depart, and the results are rarely publicized. “If you don’t know how misconduct is really taking place in your organization,” she says, “you can’t come up with muscular, detailed corrective actions for addressing it.”  
—Arianne Cohen

THE BOTTOM LINE A study of why women leave astronomy—only 14% of faculty were female at the time—uncovered rampant harassment.





# WALK THERAPY

● Your commute stays with you even after you leave the car

For 14 years, Kerry Mellin commuted 40 miles to her job as a motion picture costumer at Nickelodeon Studios in Burbank, Calif. The trip from her home in Simi Valley took her east via Route 118, then south onto Interstate 5. Three turns later, she was there. On a good day, the drive took 75 minutes. “On bad traffic days, it was easily two hours,” she says. “The road rage was real. I felt trapped in my lane, and my sciatica was killing me.”

No productivity guru preaches the benefits of morning anger and back pain. But exactly how an odyssey such as Mellin’s affects the workday hasn’t been fully understood. New research from Dartmouth helps quantify the cost of commuting on performance. “Your commute predicts your day,” says Andrew Campbell, lead researcher of the study and a professor of computer science.

Before the pandemic, 275 information workers (45% of them were employed by tech companies) across the US were outfitted with fitness tracking devices; subjects were monitored around the clock for a year. Most of them, 94%, commuted by car, with trips averaging 40 to 60 minutes. The sensors tracked details such as heart rate and sleep, as well as environmental information like weather.

The data showed that a rough morning commute acts as a first falling domino, with ill effects felt down the line. “Commuting, especially if it’s not well-planned and predictable, raises stress levels,” says co-author Pino Audia, a professor of management and organizations at Dartmouth’s Tuck School of Business. Stress, of course, has repercussions on mood and whether you’ll still be inclined to say hello to a co-worker you’ve already passed in the hall four times in a day.

The researchers found that commutes involving more physical activity, such as walking or bicycling, correlated with less stress and better performance at work. Performance was gauged by tracking dozens of behaviors both productive (helping co-workers, volunteering for assignments, skipping breaks to finish work) and counterproductive (leaving early, excessive breaks, working slowly). Participants self-reported, and 110 of the 275 were considered



“Commuting, especially if it’s not well-planned and predictable, raises stress levels”

“low performers.” (There was no conclusion for why the correlation exists; the researchers’ focus was simply on measuring it.)

Another finding: No matter how a worker commuted, those who left their homes or offices at the same times each morning and afternoon and took the same route performed better than commuters who alternated departures and varied their routes. This dovetails with the Dartmouth team’s previous findings that higher performers have more consistent daily routines.

The researchers suggest that, if financially possible, people consider living close to the office or cutting down on a commute by working from home or from a satellite office. Living near the office “can be fun and exciting in your 20s and 30s, but as you get into your 40s or 50s, you think, ‘This is not the type of fun and setting I want anymore,’” says Chris Heller, chief real estate officer of OJO Labs, an online platform for buying and selling homes based in Austin. “Typically companies have their offices in business districts or downtown where it’s just more expensive to live.” If moving closer to work is too expensive, he says, try looking for a home on a public-transit line that’s a straight shot to the office, as opposed to one that requires you to, say, drive to a train station first. Transferring, as any subway rider knows, can be a major pain point.

Audia encourages commuters to analyze their patterns and think about how to be more consistent—which, of course, is easier said than done for busy workers juggling caretaking roles and the existential dread of having to, you know, go do the thing you’re paid to do. “Predictability probably has an impact on your perception of control and sense of what’s going to happen that day,” he says. A lot of research shows that the more control a worker has, the happier that worker will be.

Finding herself often annoyed and flustered, Mellin says she was ultimately “compelled to find an alternative” job to avoid her 40-mile adventures. She started a line of reusable grips called EazyHold for children and those with disabilities and ditched the commute. “I turned that road rage into a big-time motivator,” she says. —*Arianne Cohen*

THE BOTTOM LINE Researchers at Dartmouth found that people who biked or took a stroll to the office performed better at work than people who drove.

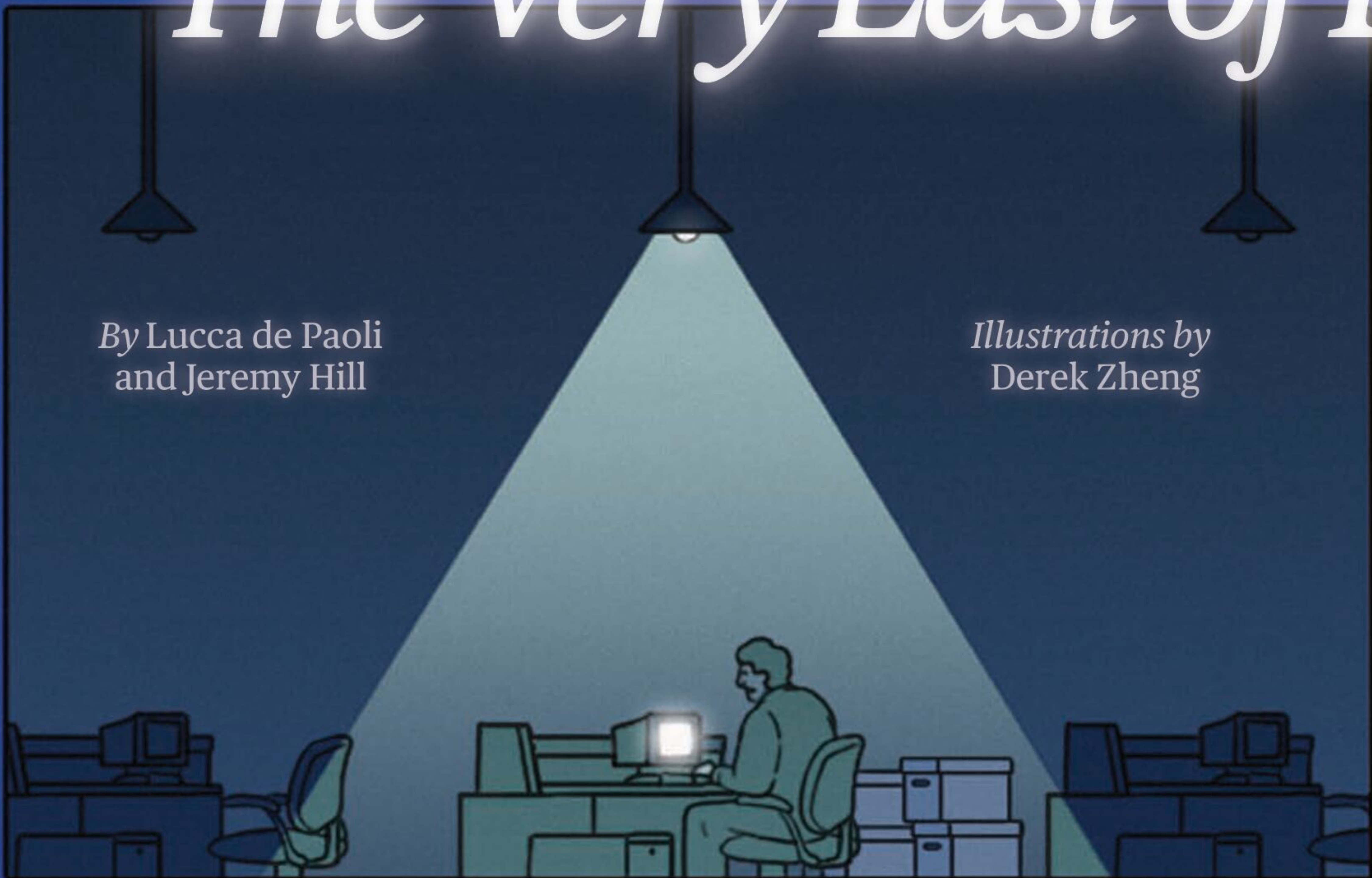


# *The Very Last of I*

32

*By Lucca de Paoli  
and Jeremy Hill*

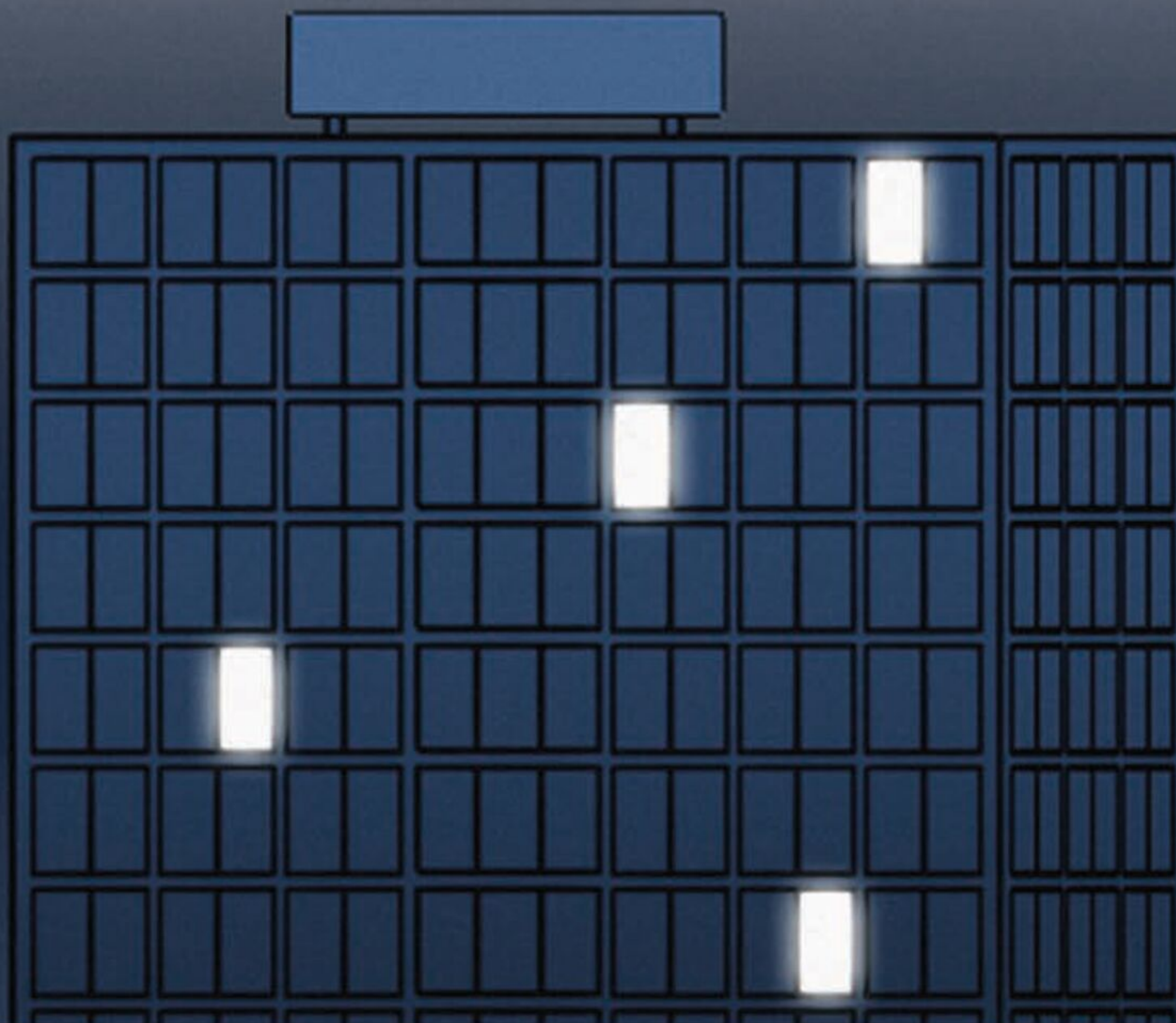
*Illustrations by  
Derek Zheng*



The bank whose collapse marked the beginning of the 2008 financial crisis is only mostly dead. Meet the people attending to its final remains



# Lehman Brothers



**D**ARYL RATTIGAN ARRIVED AT LEHMAN BROTHERS 18 years ago for a three-month assignment from his law firm. Eventually the bank gave him a full-time job at its real estate finance arm in London.

Then the bank suddenly collapsed.

And he's still there, almost 14 years later.

It turns out that when global financial institutions die, it can take a while. These deaths require caretakers. The spirit of a bank, even in life, is debt, and debts don't settle easily into a grave. Most of the assets banks own are the debts of others: the mortgages, commercial loans, and IOUs payable to the bank. On the other side, of course, banks owe money—to their bond- and noteholders, counterparties in financial trades, and a long list of other creditors. Banks such as Lehman topple over when they suddenly can't wring enough cash from their assets to meet their liabilities.

But even after the funeral, all the debts on both sides of the ledger are still there, and professionals are needed to sort out who has to pay up and who should be paid—professionals such as Rattigan, who's spent years working to eke out value from property assets the bank held when it went under. On the morning of Sept. 15, 2008, in the hours after his employer filed for bankruptcy, Rattigan had no idea if he still had a job. He came into the office in London's Canary Wharf, unsure of whether the doors would even be unlocked, to at least get his Rolodex. "In the back of your mind, you are also aware that there's sometimes scope for people to be retained and help" with the cleanup, Rattigan says. "But if I was going to be retained, I had to get back in there and get my face shown."

He got his wish. PricewaterhouseCoopers accountants, who'd been brought in to pick up the pieces of Lehman's UK arm, needed to tap people who knew where the documents were, where the value was, and how best to maintain it. Years after almost all of Lehman's 5,000-strong London workforce has moved on—the line in their résumés becoming a talking point at job interviews—Rattigan is still making a living from the bank whose fall ushered in the greatest financial crisis since the Great Depression.

Like many people these past couple of years, Rattigan has spent long periods working from home. He had to push aside the clutter in his spare room and stick in a small desk to continue his work throughout the pandemic. For a while before the lockdowns, he used a serviced office space in Mayfair. It's a posh neighborhood, "not somewhere you automatically assume a bust bank would go," he says. But he says the accommodation was "far from luxurious." In any case, he's outlasted even that lease.

The scant corporeal remnants of Lehman—a few office spaces, some legal addresses—are scattered around the globe. There's a holding company in New York that's different from the European one Rattigan works for. The husk of that operation sits on the eighth floor of an elegant old building that once housed the uptown branch of the Bowery Savings Bank, before it became a fancy Cipriani catering hall. Lehman shares a floor with a health education

Old Lehman swag on eBay



Rattigan



company and a software startup.

Two court cases, one in London and the other in New York, are probably the last substantial issues that need to be resolved. They could linger for several more years, depending on appeals. But before the last contract is signed and the last key to a rented office is turned in, somebody might want to foot the bill for a goodbye cake and prosecco for Rattigan and others in a loose network of lawyers, accountants, consultants, and money managers. They've performed one of the weirdest jobs in finance: laying Lehman Brothers, finally, to rest.

**T**HE STORY OF LEHMAN IS A TRAGEDY FOR THE homeowners caught up in the risky mortgages the bank bet on and for the millions who lost jobs and economic opportunities in the grinding crisis that followed. But for a select group of people, the saga became the defining, even positive, turn in their careers.

There's the federal judge who oversaw the collapse, for example. James Peck was a relative rookie on the bankruptcy bench when Lehman went under. Deep into the wee hours a few nights later, in front of an overflowing courtroom, he approved the hasty sale of the bank's brokerage unit to Barclays Plc for \$1.75 billion. That deal ensured the orderly transfer of hundreds of thousands of customer accounts, saved about 10,000 jobs on Wall Street, and possibly prevented the global financial system from spiraling further out of control. Peck, now 76, has since traveled the globe speaking about the case.

"I probably think about it a little bit every day," he says. He's now head of cross-border restructuring at the giant Morrison Foerster law firm, which charmingly goes by the nickname MoFo. He does a lot of mediation work, and a party to one of those workouts gave him a silver, Lehman-branded baby rattle. "I learned a tremendous amount and met wonderfully interesting people all over the planet," Peck says, "many of whom are still my friends."

For others, the winding down of Lehman wasn't merely an intellectual adventure; it was lucrative, too. There were investors who ran not away from, but toward, the record-breaking dumpster fire of debt. They bought heavily discounted Lehman bonds and notes—and ground out the analysis to ensure that in the end they'd get paid back at a profit. Scott Hartman was one of those. He joined Värde

Partners of Minneapolis as a senior analyst a couple of weeks before Lehman went bust and spent much of the next five years working on the case. He's a partner now.

"Lehman is the largest bankruptcy filing ever. Because of that, it offered the biggest investment opportunity of nearly any company we could look at," he says. A specialist in so-called distressed investments, Värde was interested in Lehman from the moment it all fell apart. "It's a long time working on one thing," Hartman says. "There's probably some element of fatigue, but I'll look back on this fondly."

And then there are the lawyers. So many lawyers. Holders of Lehman debts don't just wait around to get paid; they often have to fight for their claims in court. At the start of a trial last year, Lord Justice Kim Lewison of the UK's Court of Appeal remarked that he'd expected, after years of Lehman cases being heard at almost every level of the legal system, that all the questions around insolvency would have already been answered. "My Lord," replied Mark Phillips, a lawyer who's worked on bust companies for more than three decades. "If every question on insolvency had been answered, it would be a very sorry day."

**L**EHMAN'S LONG DEATH, WHICH IS NOW ON ITS fourth US presidential administration, began the moment its lawyers filed a petition for Chapter 11 protection. Chapter 11 is designed to give a business that can't pay its debts breathing room to figure out what to do next. Sometimes the process is straightforward. When, say, a chain of clothing stores goes under, the work to be done is clear: Tally the value of inventory, sell it off, and then give that money to whomever the retailer is indebted to. Maybe the whole business can be sold in one shot, making things even easier.

When a global bank fails, the process gets gnarly in a hurry. Instead of shirts and shoes, the assets to be tallied are abstractions. What's a crummy mortgage worth during a housing crisis? Very little. But how little, specifically? And won't that be offset by the insurance purchased on the mortgage? Well, not exactly *that* mortgage, of course, because these insurance contracts are bets on a basket of mortgages designed to mirror the ones the bank owns. What can Lehman get for those?

What made Lehman especially odd was its pile of good assets. It had plenty of terrible stuff but wasn't alone in that. Almost every major investment bank at the time had a high-risk model such as Lehman's. (And many survived only after a huge intervention by the government.) In the 2,000-page court-commissioned



report on its demise, Examiner Anton Valukas pinned the failure not only on junky loans, but also on the loss of faith from Lehman's business partners, including other lenders. The bank had relied too heavily on their confidence, like a poker pro getting staked by other gamblers. When it disappeared, it was all over for Lehman as a going enterprise. But that didn't make all its assets worthless.

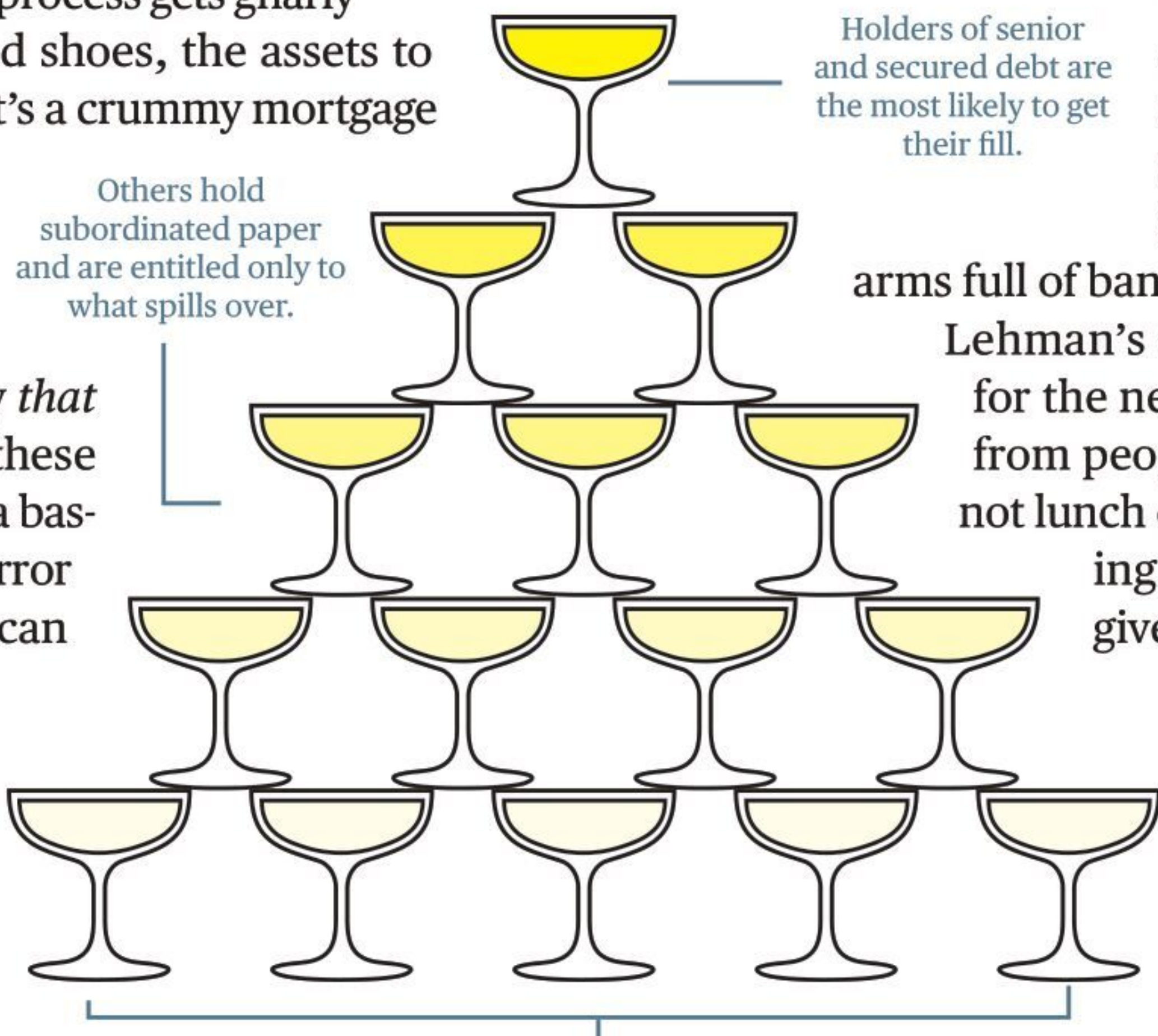
Likewise, there were countless knotty questions about who gets the money recovered from those assets. Say there were Lehman investors demanding repayment, but their debts were pegged to the bank's Netherlands unit. Did the parent company have to cover the debts of the Netherlands unit? Even though the bank was deceased, the stakes of decisions such as these could be enormous for its living caretakers. If PricewaterhouseCoopers paid out, say, \$100 million to the wrong bondholder, and the court decided that some other creditor deserved the money first, the cost was on administrators' heads.

Lehman owed \$613 billion when it went under. That's a lot of angry, anxious creditors. There were also its customers. In addition to lending and borrowing, banks and brokerages hold on to a lot of other people's stuff, such as their stocks and bonds in different companies, so another complex job was to pick through those and get them into safe hands at other firms. One member of the team of lawyers and accountants assigned to the cleanup remembers a client approaching him in Lehman's London office tower right after the collapse. This client had somehow evaded security, demanding to know where his bonds were, brandishing his certificate as proof of what he owned.

About that same time, on the seventh floor, there was a run on the on-site snack shop. Staffers were panic-buying fruit and chocolate bars, afraid the payment cards they'd loaded with cash would become worthless. Some returned to their desk with arms full of bananas. It was a microcosm of what Lehman's administrators would be doing for the next 14 years: answering questions from people who had claims on Lehman—not lunch cards, but bonds—and then deciding how many bananas they could give them.

**How a Waterfall Works**

When creditors are repaid, cash pours down like bubbly on stacked glasses.



Others hold subordinated paper and are entitled only to what spills over.

Holders of senior and secured debt are the most likely to get their fill.

At the bottom of a credit structure, some investors may get nothing.

**T**HERE ARE PEOPLE WHO get into running troubled businesses on purpose. "Professional services" companies such as Alvarez & Marsal, based in New York, sometimes act a bit like temp agencies, providing C-suite executives and expertise to companies that have gone bankrupt or are trying to turn themselves around. ►

RATTIGAN: PHOTOGRAPH BY CARLOTTA CARDANA FOR BLOOMBERG BUSINESSWEEK. OBJECTS: EBAY



(\$62 million) in the heat of the crisis for more than three times that amount.

Many hedge funds made a similar bet. In a major bankruptcy, a company’s original bond- and note-holders often try to cut their losses quickly. The typical mutual fund manager isn’t in the business of hiring restructuring advisers and wading through the bankruptcy court morass and then, years later, getting some of the fund’s money back. Those investors do exactly the thing Ehrmann says he was avoiding: They sell their bonds—that is, their claims on the money Lehman owed

◀ The day after Lehman failed, A&M’s Daniel Ehrmann was working as the interim chief financial officer of Spiegel Brands, an ailing purveyor of women’s clothing that was still fighting a losing battle against the emergence of online competitors. Bryan Marsal, co-founder of A&M, called him in the middle of a meeting: Get to Lehman’s New York office by 2 p.m.

Ehrmann then spent six years helping untangle Lehman’s wreckage from New York. He became co-head of derivatives and head of international at Lehman Brothers Holdings Inc. “When I lie on my deathbed, I definitely will think about Lehman,” Ehrmann says. “Not only, I hope—but it was six fascinating years of my life, right?” The new, post-bankruptcy US arm of Lehman—essentially a portfolio manager and sales lot for used financial assets—would have a few hundred employees for a while. There are only 20 left in the US now.

Ehrmann and his counterparts in Europe and Asia faced a conundrum. They could sell all the stuff that Lehman owned quickly, but that would likely mean accepting deep-discount prices, leaving a small pot of money to distribute to creditors. That’s another way a bank failure is different from a normal bankruptcy. Physical assets can go bad quickly. Bananas rot; dresses and suits go out of fashion. Financial assets caught up in a panic may actually improve with time, as those handling the wind-down sort through the mess and scrape out value.

“What the US proceeding did on Day 1 was say, ‘We’re going to preserve the assets. We’re not going to fire-sale these assets today,’” Ehrmann says. “If we fire-sale them, we’re going to get cents on the dollar.” Instead they decided to wait for the crisis to end and work on the assets, even if the process took years. The strategy worked. In the UK, for example, Rattigan says he eventually managed to sell a clutch of commercial real estate loans valued at £50 million



them—to someone else at a cheap price. In short, they take their lumps and move on. The buyers are usually specialized distressed-asset investors such as Värde who are willing to wait and to haggle.

Värde, which means “value” in Swedish, manages more than \$13 billion and is typical of the type of investor that looks for these deals. Some call distressed-asset funds vultures. Hartman, the money manager, bristles at the idea that he’s in any way feasting on a carcass. “I personally have never understood the vulture reference,” he says. “No one is forced to sell or buy anything. That is their choice.” (Ehrmann, for his part, in 2015 joined King Street, a hedge fund that was a big player in Lehman’s discounted debt.)

Whatever they’re called, after years of analysis, court fights, and late nights, the funds that bought Lehman securities have done well. “For distressed investors, this is what you live for,” Hartman says. For example, one group of investors, including the hedge funds Paulson & Co. and Fir Tree Partners, bought loads of Lehman debt for about 20¢ on the dollar, according to court records. At that price, a \$10 million bet on the debts eventually paid out more than \$20 million, based on distribution data filed with the bankruptcy court, with much of the recovery coming



Dolby

in the first few years. It's hard to get a complete picture of how much has been recouped across the divided Lehman empire, but one important slice of the parent company's creditors has recovered close to half of what was owed, for a total of almost \$40 billion, and twice what was originally forecast. A UK judge in 2019 noted some European debt holders had ultimately earned interest of 8% a year over a decade.

Other creditors may fare even better. One of the most stark examples is the so-called Ecaps trade. The Ecaps were notes Lehman issued that paid investors an attractive yield but came with a catch: They were very low down on what's known in the bankruptcy trade as the "waterfall." When a company can't pay its bills, who gets what is determined by how high they're positioned as money flows downward. Imagine a pyramid of Champagne glasses, with a waiter pouring from a bottle at the top. The senior creditors, who own the glasses at the peak, get their cash first, and then excess spills to glasses beneath them, layer by layer. If there's a lot of cash gushing down, everyone gets some. But if it's a trickle, holders of those Ecaps and other notes might get nothing.

One of the main differences between Lehman's UK arm and most other insolvencies is that Rattigan and his colleagues wrung out much more money than expected. That outcome made the fights among creditors about where they stood in a waterfall all the more important and fiercely contested. It isn't unusual for trials to decide who should be paid and in what order in big insolvencies, but with Lehman there were three waterfall cases in the UK alone. Many of the most experienced and expensive lawyers in London have represented hedge funds, Lehman's US holding company, and even the government tax authorities, all arguing they were entitled to the last remnants of Lehman's wealth.

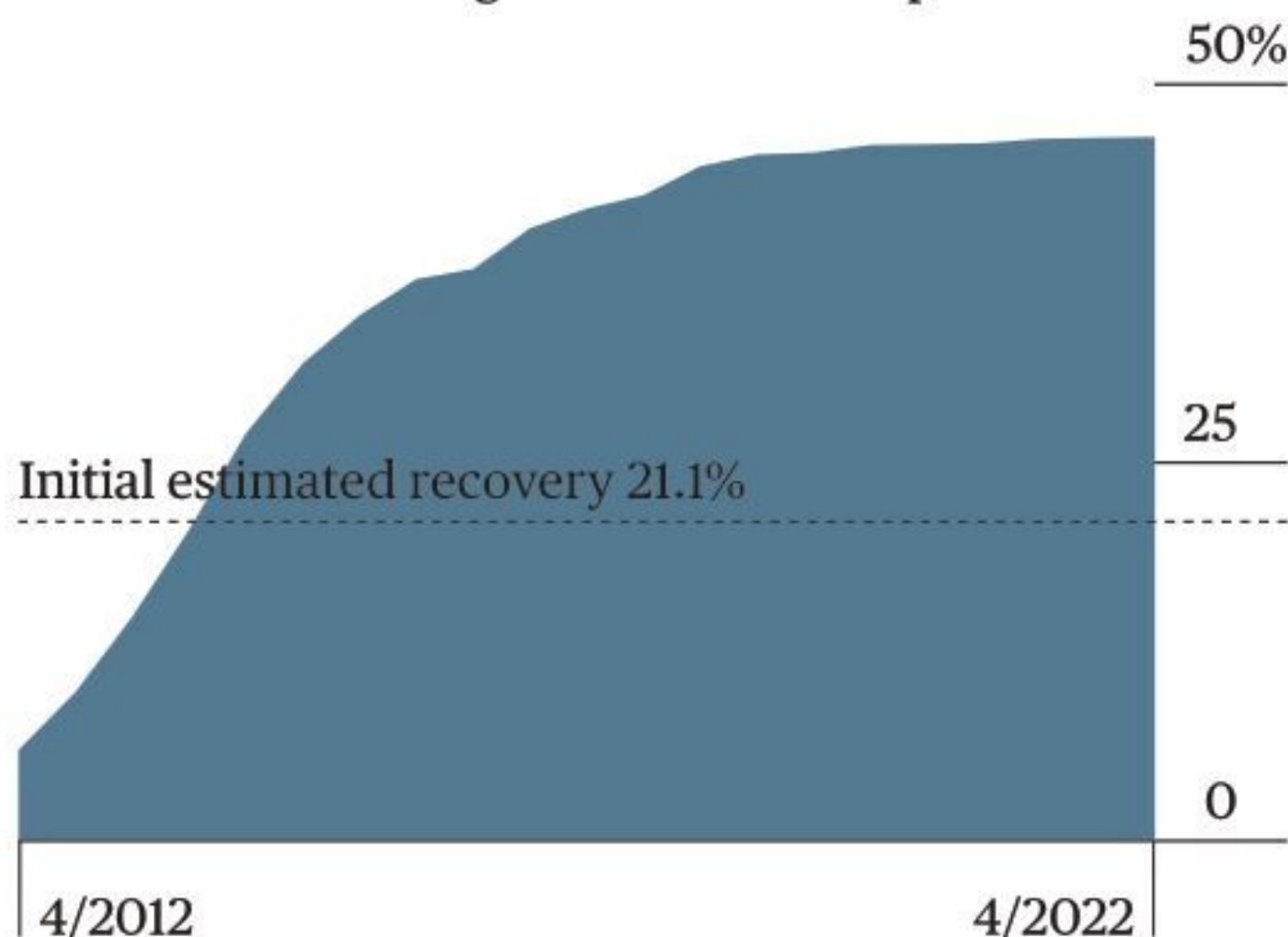
A UK Court of Appeal judge ruled that the Ecaps bucket deserved to go higher up the waterfall. In the years after Lehman's collapse, some Ecaps notes were considered so valueless that they were given away, according to trading certificates seen by Bloomberg. Now it's possible that if things go well for holders—and that's a big if—the notes could be paid in full. For the few who bought early and sat tight, a free scrap of paper might yield millions of dollars.

Even in the sometimes extremely lucrative business of buying bruised debts, the Ecaps trade is considered remarkable. Robert Southey, a broker who's traded Lehman's debts, estimates that some traders could have gotten 40 times their money back. "It's super unusual that something that's considered zero within the whole structure recovers anything," he says. That's bondspeak for "wow."

Other oddities emerged from various nooks and

*Better Than You'd Have Thought*

Share of outstanding Lehman debts repaid



DATA: BLOOMBERG ANALYSIS OF DISTRIBUTION NOTICES. VALUES SHOW CUMULATIVE RECOVERY FOR SENIOR UNSECURED CREDITORS OF LBHI



insurance against default on bundles of subprime mortgage bonds. Put simply, Lehman is trying to cash in on the very securities that helped fuel its demise. Lehman contends that its creditors are owed about \$500 million; Assured says that according to its math, Lehman actually owes it money as a "termination" fee.

There are easier, if more modest, ways to scrape up money from Lehman's death. An active market exists for old Lehman merchandise, such as branded duffel bags, polo shirts, and even pens. A retired handyman from New York bought a "truckload" of Lehman leftovers—some were still in transit from China—for \$5,000 in the wake of the collapse. He's been hawking them on EBay ever since, sparking bidding wars over branded hip bags. "I bought it all on a hunch thinking people would want a piece of history," said the seller, who identified himself in an email as Ric Cam. "Let's say I made my investment back."

**A**FTER DEATH, THE OTHER INEVITABILITY IS TAXES, and some of the last people out the door will very probably be those handling Lehman's tax affairs. Jackie Dolby joined the bank in London in 1989, balancing her job with studying for her accountancy exams at night school. By the time the firm collapsed, she had become head of European corporate tax and planning. Few know the plumbing of Lehman's European outpost as well as Dolby: She was a witness in one of the Ecaps cases, having worked on the minutiae of Lehman's UK debt. For the administrator at PwC, her knowledge is like gold dust. She works two days a week, sometimes more, mostly from her home on England's east coast. After the insolvency, when banking became a dirty word in the popular imagination, she was a little embarrassed to say she worked at Lehman.

Now Dolby feels a certain pride that she stuck around this long. Even after all the money is paid out from Lehman's UK entity, she will still have to do its taxes in the year after, a final benediction to close out affairs with the ultimate financial authorities. "When we went into insolvency," Dolby says, "the PwC people said, 'You will be there to turn the lights off.'" **B**

DOLBY: PHOTOGRAPH BY CARLOTTA CARDANA FOR BLOOMBERG BUSINESSWEEK. OBJECTS: EBAY

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Christopher Beam

**O**n Oct. 14, in a house near Leeds, England, Laurence Day was sitting down to a dinner of fish and chips on his couch when his phone buzzed. The text was from a colleague who worked with him on Indexed Finance, a cryptocurrency platform that creates tokens representing baskets of other tokens—like an index fund, but on the blockchain. The colleague had sent over a screenshot showing a recent trade, followed by a question mark. “If you didn’t know what you were looking at, you might say, ‘Nice-looking trade,’” Day says. But he knew enough to be alarmed: A user had bought up certain tokens at drastically deflated values, which shouldn’t have been possible. Something was very wrong.

Day jumped up, spilling his food on the floor, and ran into his bedroom to call Dillon Kellar, a co-founder of Indexed. Kellar was sitting in his mom’s living room six time zones away near Austin, disassembling a DVD player so he could salvage one of its lasers. He picked up the phone to hear a breathless Day explaining that the platform had been attacked. “All I said was, ‘What?’” Kellar recalls.

They pulled out their laptops and dug into the platform’s code, with the help of a handful of acquaintances and Day’s cat, Finney (named after Bitcoin pioneer Hal Finney), who perched on his shoulder in support. Indexed was built on the Ethereum blockchain, a public ledger where transaction details are stored, which meant there was a record of the attack. It would take weeks to figure out precisely what had happened, but it appeared that the platform had been fooled into severely undervaluing tokens that belonged to its users and selling them to the attacker at an extreme discount. Altogether, the person or people responsible had made off with \$16 million worth of assets.

Kellar and Day stanching the bleeding and repaired the code enough to prevent further attacks, then turned to face the public-relations nightmare. On the platform’s Discord and Telegram channels, token-holders traded theories and recriminations, in some cases blaming the team and demanding compensation. Kellar apologized on Twitter to Indexed’s hundreds of users and took responsibility for the vulnerability he’d failed to detect. “I f---ed up,” he wrote.

The question now was who’d launched the attack and whether they’d return the funds. Most crypto exploits are assumed to be inside jobs until proven otherwise. “The default is going to be, ‘Who did this, and why is it the devs?’” Day says.

As he tried to sleep the morning after the attack, Day realized he hadn’t heard from one particular collaborator. Weeks earlier, a coder going by the username “UmbralUpsilon”—anonymity is standard in crypto communities—had reached out to Day and Kellar on Discord, offering to create a bot that would make their platform more efficient. They agreed and sent over an initial fee. “We were hoping he might be a regular contributor,” Kellar says.

Given the extent of their chats, Day would have expected UmbralUpsilon to offer help or sympathy in the wake of the attack. Instead, nothing. Day pulled up their chat log and found that only his half of the conversation remained;

UmbralUpsilon had deleted his messages and changed his username. “That got me out of bed like a shot,” Day says.

He shared his suspicions with the team, who over the next few days combed the attacker’s digital trail. They discovered that the Ethereum wallet used to transfer tokens during the attack was connected to another wallet used to collect winnings in a recent hacking contest by a participant who sometimes identified himself as UmbralUpsilon. Pulling up the participant’s registration, they saw that it linked to a profile on the collaborative coding platform GitHub.

The GitHub profile had been created by someone whose email address began with “amedjedo” and was associated with a domain owned by a public school board in Ontario. Day and his colleagues also found a Wikipedia contributor with a username similar to the one on GitHub. The Wikipedia editor had once altered the page for a popular Canadian quiz competition for high school students, adding a name under “Alumni”: “Andean Medjedovic, notable mathematician.” Google filled in the rest. Medjedovic had until recently been a master’s student at the University of Waterloo in Ontario, specializing in mathematics. His résumé said he had an interest in cryptocurrency.

The team breathed a sigh of relief. Once cyberattackers have been identified, they often return funds in exchange for a face-saving bounty and credit for being a “white hat” hacker. Day had already contacted UmbralUpsilon to offer a 10% reward for the tokens’ safe return, striking a note of grudging praise—“well played,” he wrote—but hadn’t heard back. So Kellar tried a different tactic, messaging Medjedovic and addressing him as “Andean.” This time Medjedovic reacted, taunting Indexed users publicly on Twitter: “You were out-traded. There is nothing you can do about that.... Such is crypto.” When a team member emailed him independently, saying that if he returned the tokens they’d pay him \$50,000, Medjedovic responded with a link to an Ethereum address. “Send the money over,” he wrote. They didn’t take the bait from their tormentor—who they’d learned, to their astonishment, was only 18 years old.

Finally Kellar texted Medjedovic to make one last plea before, he said, they would be forced to bring in lawyers and police. “I implore you to give up now and make this easy on yourself,” he wrote. The teenager responded with “Xdxdxd,” an emoticon that evokes dying of laughter, and added, “Best of luck.”

**W**hen Kellar and his co-founders created Indexed, they imagined it as a step forward for DeFi, or decentralized finance, a blockchain-based movement that purports to offer a more automated, less intermediated version of borrowing and lending, asset trading, and portfolio management. Some proponents take a utilitarian view of DeFi, considering it an improved version of traditional finance, with its fee-taking middlemen and sluggish human decision-making. Others are more libertarian, seeing DeFi as an escape from the existing system, a way of circumventing the rules and restrictions imposed by governments or corporations. Then there are the skeptics, who think it’s all a grift.



Kellar, who describes himself as “very progressive,” fits squarely into the utilitarian camp. At age 23, after dropping out of the University of Texas at Dallas when computer science classes weren’t teaching him anything new, he started Indexed to solve a problem: What if you wanted to trade crypto but didn’t want the daily hassle of managing a portfolio?

In traditional finance, investors who want a wide, balanced array of stocks can purchase shares of index funds, outsourcing the day-to-day job of buying and selling the stocks to a portfolio manager. Kellar went about creating a similar arrangement on the blockchain, but with an algorithm driving the trading. Whereas an index fund manager would maintain a portfolio containing the underlying assets of an index share, the Indexed algorithm maintained a “pool” of underlying tokens for each index token. Users could swap one or all of the underlying assets into the pool in exchange for an index token—a process called “minting.” They could likewise “burn” an index token by trading it back into the pool in exchange for one or all of the underlying assets. Or, as with an exchange-traded fund, users could simply buy or sell index tokens on decentralized exchanges such as Uniswap.

Index funds take various forms, each with a different investment strategy. Some, such as the S&P500, are market-capitalization-weighted: If the value of one of its stocks goes up, the proportional value of that stock within the portfolio rises accordingly. Others seek to maintain a fixed balance of stocks. For example, if you wanted Microsoft shares to consistently make up 20% of your portfolio, and the value of the stock went up, the portfolio manager would sell shares of Microsoft to maintain its 20% weight.

Kellar and his team modeled Indexed on that type of fund, using a mechanism called an “automated market-maker” to maintain the balance of underlying assets, as many DeFi platforms do. Unlike a traditional market-maker, the AMM wouldn’t buy and sell assets itself; instead it would help the pool reach its desired asset balance by adjusting the “pool price” of component tokens to give traders an incentive to buy them from the pool or sell them into it. When the pool needed more of a particular token, its price within it would rise; when the pool needed less, the price would decline. This model assumed users would interact rationally with the protocol, buying low and selling high.

By eliminating human managers, Indexed could forgo management fees like the 0.95% its bigger rival, Index Coop, charged for simply holding its most popular index token. (Indexed would charge a fee for burning tokens and swapping assets within a pool, but those only applied to a small fraction of users.) It also saved on costs by limiting the number of interactions between the platform and outside entities. For example, when Indexed needed to calculate the total value held within a pool, instead of checking token prices on an exchange such as Uniswap, it sometimes extrapolated from the value and weight of the largest token within the pool, called the “benchmark” token. This

way, it reduced the fees it paid for transactions on the Ethereum blockchain. Kellar saw full passivity as a “natural extension of the way index funds already operate.”

But passivity also created risk. If there was a problem with the code, someone could exploit it directly, without needing to bypass any human safeguards. And limiting blockchain interactions to cut costs entailed a trade-off: When a smart contract—a script that executes automatically when certain criteria are met—has fewer steps, it can leave more room for security vulnerabilities. The list of exploited crypto platforms is long and grows by the week: Poly Network, Wormhole, Cream Finance, Rari Capital, and many more. “There’s a common saying in DeFi that there are two types of protocols,” Day says. “Those that have been hacked and those that are going to be hacked.”

Kellar was aware of one possible pathway for attacks: the mechanism Indexed used to introduce a token to a pool. When such a “reindexing” occurs—after, say, one token has



## The Attack on DEFI5: 1 Program, 7 Key Steps

◀ overtaken another in market value to qualify for inclusion in a blue-chip fund—the pool sets the new token’s initial price using a complex equation. One variable of that equation is the value of the benchmark token; if you could somehow futz with the pool’s pricing of that token, you could theoretically compel the pool to misprice its other tokens.

“I spent at least two weeks looking into this,” Kellar says. But he couldn’t find any errors, nor could two security researchers he paid to examine the code. So, he says, “I decided this is not an attack vector.” Still, Indexed posted a warning on its website: “We are confident in the security of our contracts... [but] we can not be absolutely certain that no mistakes were overlooked.”

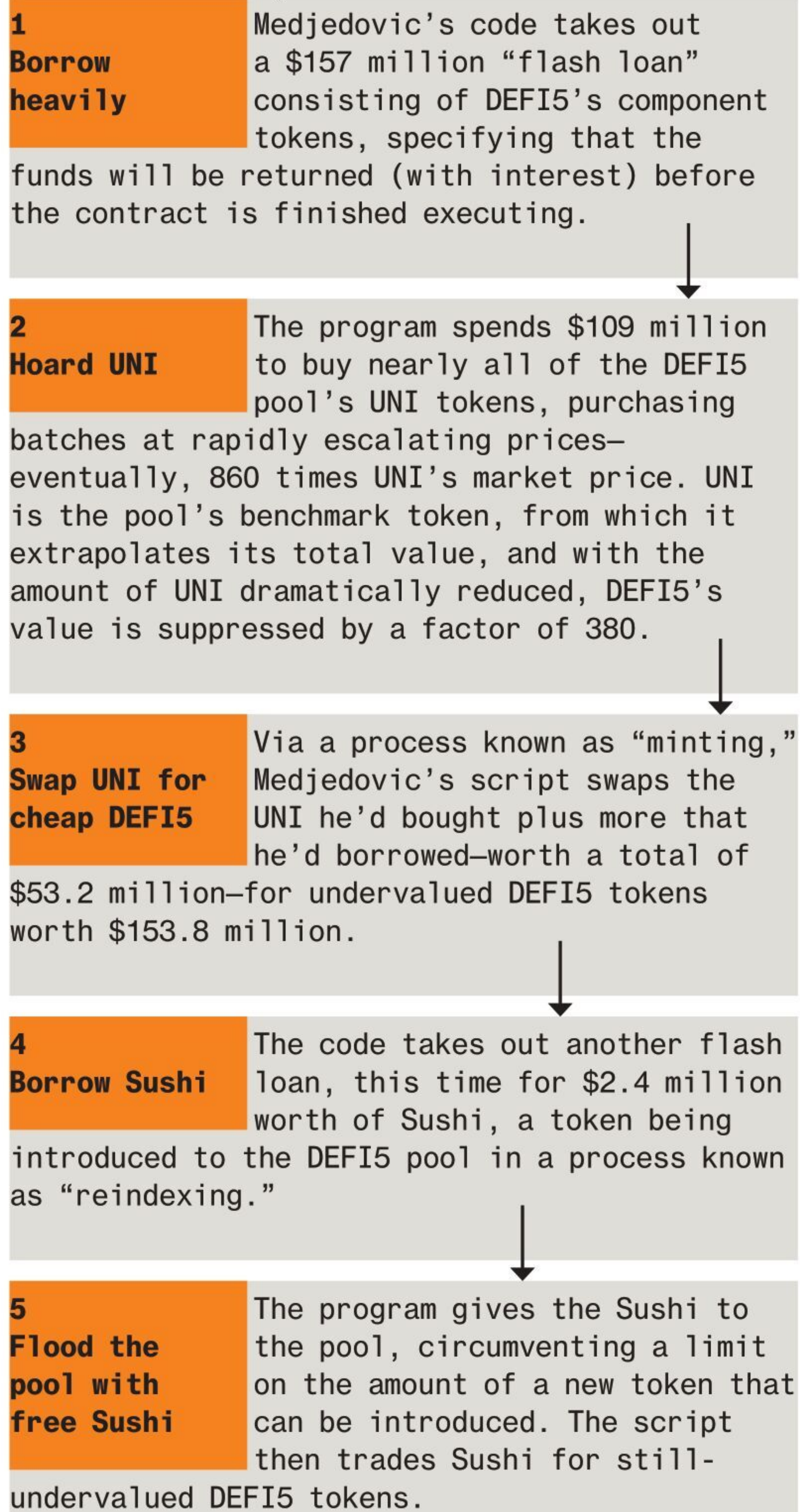
The platform made its debut in December 2020, initially offering two index tokens: CC10, representing 10 of the top Ethereum-based tokens by market capitalization, and DEFI5, representing five top DeFi tokens. The project soon garnered a small but devoted following, including Day. He had a Ph.D. in theoretical computer science and a master’s in financial engineering, for which he’d written a thesis on stock-market index portfolio optimization. Indexed aligned with his interests and his relatively low appetite for risk. “I’m fundamentally, when it comes to investing outside crypto, quite boring,” he says.

Day and Kellar got along well. They shared an absurdist, extremely online sense of humor, and as a finance expert with a writerly bent and a creative coder, respectively, they had complementary skills. “I’m very much the wordcel to Dillon’s shape rotator,” says Day, who’s 33. He quit his job at an oil and gas company and joined Indexed full-time in April 2021.

Propelled by a surge in crypto interest that year, Indexed took off, soon becoming the second-biggest Ethereum-based index protocol by value, after Index Coop. They scaled up their ambitions, rolling out index tokens and planning an upgrade that would allow the assets in the pools to earn interest. The DeFi platform Balancer, on which Indexed had modeled its code, was impressed enough that it gave Indexed a grant—a vote of confidence in its future.

**W**hen Indexed went live, Medjedovic, who goes by Andy, had just started working on his master’s degree. He was on his way to finishing it in a year. He tended to do things quickly. He’d taken 10th grade math in elementary school, graduated from high school at 14, and cruised through his bachelor’s in three years at Waterloo, one of Canada’s top schools for math and computer science and the alma mater of Ethereum co-founder Vitalik Buterin. By fall 2021, Medjedovic had presented his master’s thesis on random matrix theory and was planning to apply to Ph.D. programs. “I can’t think of any other student in my time here who has gotten that degree that early,” says David Jao, a professor of mathematics at Waterloo.

As advanced as Medjedovic was academically, his social maturity lagged. One former classmate, who requested anonymity to speak candidly about sensitive matters, recalls him being “self-confident to the point of arrogance” and



openly condescending to students he deemed less intelligent. “Whenever he did or said something, he believed it was infallible, the absolute truth,” the classmate says. Medjedovic apparently flirted with extremist ideas: The classmate says he heard him speak favorably about White supremacy and eugenics. (Medjedovic didn’t respond to requests for comment about this before publication.)

Still, Medjedovic made friends, connecting with them through activities such as chess and the video game *League of Legends*. He also enjoyed reading fiction, particularly sci-fi. His profile on one social network included a quote from Kurt Vonnegut’s *Cat’s Cradle* about the futility of humanity’s quest for knowledge: “Tiger got to hunt, bird got to fly; Man got to sit

“There’s a common saying in DeFi

and wonder ‘why, why, why?’ Tiger got to sleep, bird got to land; Man got to tell himself he understand.”

Medjedovic was also becoming a proficient coder, regularly participating in an online hacking competition called Code4rena, or C4, in which developers compete for prize money put up by companies to find security flaws in their systems. He managed to win rewards in two C4 competitions. “He seemed pretty friendly and cool,” says Adam Avenir, who helps run C4 and corresponded with Medjedovic before and after the Indexed attack. “Like a young, earnest kid.”

that there are two types of protocols:

Those that have been hacked

Medjedovic took an interest in DeFi, particularly the mechanics of AMMs. “Whenever I would hear of a new type of DeFi product I would take a close look at how it operates and throw some money into it if I came up with a good idea,” he said in an email. (Medjedovic declined requests for a phone interview but agreed to answer questions over email.) He estimated he spent hundreds of hours “playing around with the math behind them, experimenting with the profitability of different strategies.” He then wrote bots that would execute arbitrage trades on those platforms, turning a small profit and helping the pools run more efficiently.

After reading about Indexed on a forum, he pored over its smart contract and noticed a “mispricing opportunity” in the code—the instrument Kellar had worried might let users distort the pool’s internal price calculations when new tokens were being introduced. He also saw it was possible to circumvent a safeguard limiting the size of certain trades within the pool. “At first, I didn’t believe it,” he said. He ran the calculations a few times, and, “on paper, it worked.” He spent the next month writing a script to exploit the vulnerability.

He also reached out to the Indexed team on Discord as UmbralUpsilon, asking basic questions about asset mix and pricing and offering to write an arbitrage bot for the platform. In retrospect, Day says, “I suspect he might have been angling to see if I could open up a crack for him to get into.” Kellar and Day say the information they shared wasn’t instrumental in the attack.

Finally, in mid-October, Medjedovic was ready to deploy the code. And just as important, two of the biggest Indexed pools were ripe for “reindexing.” All they needed was a user to introduce a minimal amount of the new token—in both cases, Sushi, the token corresponding to the DeFi exchange SushiSwap.

Exploiting the vulnerability required hundreds of commands, which court documents later took dozens of pages to explain. But the process contained a few key steps. For his attack on the pool of tokens that made up the DEFI5 index (and later, on the CC10 pool), Medjedovic wrote a program that took out a “flash loan”—a mechanism in crypto trading that gives users access to funds as long as they’re returned within the same set of pre-programmed transactions—worth \$157 million. His script then used a large chunk of the borrowed funds to buy up nearly all of the pool’s UNI, the token corresponding to the DeFi exchange Uniswap. The sudden undersupply of UNI caused its price within the pool to skyrocket, as the algorithm sought to incentivize traders to stop swapping UNI out and start swapping it back in to restore its original balance. The more UNI Medjedovic bought, the more the price increased, eventually reaching 860 times its external market price. In total, he spent \$109 million worth of tokens to buy up UNI that was really worth only \$5.2 million.

and those that are going to be hacked.”

It would have been a crazy trade on its face, except that UNI played a unique role in the DEFI5 pool. It was the benchmark token—the one from which the pool extrapolated its total value. With the amount of UNI in the pool dramatically reduced, the pool was now estimating its own value to be 380 times smaller than it really was. As a result, the amount of the newly introduced token, Sushi, that would have been required to mint DEFI5 tokens plummeted. If he’d wanted, Medjedovic could now have traded \$3,200 worth of Sushi for DEFI5 tokens worth \$1,172,000. And had he simply done that, Indexed would have been fine. The protocol places limits on the amount of a new token that users can swap into the pool, so he would have been able to extract only about 1.5% of the pool’s value—which, given transaction fees, wouldn’t have been profitable for him.

Instead, Medjedovic’s script took out another flash loan consisting of \$2.4 million worth of Sushi tokens. And rather than swapping them into the pool, it *gifted* them to it—a seemingly irrational move that Indexed’s algorithm wasn’t designed to handle. The “donation” overwhelmed the pool and circumvented its usual trade limit for new tokens. This allowed Medjedovic’s program to freely trade overvalued Sushi for undervalued DEFI5 tokens, then cash those out for the pool’s underlying assets, pay back the loans, and keep the rest, now worth \$11.9 million. The attack on the CC10 pool brought the total haul to \$16 million.

**6 Cash out** The script “burns” the DEFI5 tokens, trading them for its component tokens, which now include Sushi. Through a repeated process of minting and burning that takes advantage of the DEFI5’s low valuation, the code then ultimately exchanges \$4 million worth of Sushi tokens for \$21 million worth of other tokens.

**7 Pay back the loans, keep the rest** The almost \$160 million in flash loans is repaid. The remaining tokens, worth \$11.9 million at the time, are stored in an Ethereum wallet.

◀ Medjedovic, in his emails, recalled being surprised the exploit succeeded. “I only had a few tries to get it right,” he wrote, before he would run out of funds to pay for blockchain transaction fees.

“It was definitely very impressive,” Kellar says. “But it was a poor use of his talent.”

If Medjedovic ever considered returning the tokens, it wasn’t for long. After the Indexed team identified him, he posted a defiant poem on Twitter: “A single frog hops in the pool, does something cool;/ To boil him, they try. ‘Don’t arb that,’ and they start to cry./ But the frog is not dismayed, for he has god on his side.” Commenters egged him on. One posted crown emojis. Another wrote, “I love this guy.”

Some called out his use of racist language and tropes: The Ethereum address Medjedovic used for the attack included the number “1488”—shorthand for a neo-Nazi slogan—and he’d written the N-word into the code itself, 16 times. A Twitter user called him the “Dylan [sic] Roof of Balancer Pools,” a reference to the mass shooter who killed nine Black people at a church in Charleston, S.C., in 2015. Medjedovic liked the tweet.

**T**he weeks after the attack were hell for Kellar and Day. They rushed between rebuilding the protocol, fielding blowback online, and devising a compensation plan for their token-holders. In a cruel turn, Day’s cat, Finney, was hit by a car and died.

On Dec. 9, nearly two months after the attack, Kellar and Day filed a lawsuit against Medjedovic in Ontario, arguing that his actions amounted to fraud and that he should be forced to return the tokens to their original owners. It turned out they weren’t the first to do so. An anonymous Delaware-registered company called Cicada 137 LLC had already sued Medjedovic, but the case had been sealed, and Kellar and Day didn’t learn about it until they filed their own motion. According to the complaint, Cicada 137 represents the largest holder of tokens lost in the exploit, which were worth about \$9 million at the time of the attack. (Benjamin Bathgate, a lawyer for Cicada 137, declined to identify his client or clients.)

By the time Kellar and Day went to court, Cicada had already obtained an order freezing the disputed tokens. The court couldn’t actually control Medjedovic’s wallets, but he’d now be breaking the law if he moved them. Cicada also got an order for a search of Medjedovic’s parents’ house, where he’d been living. But when the search was executed on Dec. 6, he’d already left, taking his computer equipment with him. His parents and younger brother said they didn’t know where he was.

In their complaint, lawyers for Kellar and Day argued that two particular steps of the attack violated statutes against market manipulation and computer hacking. One was swapping almost all the UNI tokens out of the DEFI5 pool, the otherwise irrational trade that distorted the pricing such that Medjedovic could buy tokens out from under Indexed users, who were forced by the algorithm to sell. “The only purpose of that trade was to mislead token holders to part with tokens on terms they never would have agreed to,” says Stephen Aylward, a lawyer

representing Kellar and Day. “We say that’s a form of market manipulation.” The same argument applied to Medjedovic’s interaction with the CC10 pool.

The second illegal transaction, they argued, was when Medjedovic overwhelmed the pool with free Sushi, thereby tricking the algorithm into letting him bypass the size limit on certain trades. Aylward calls this “an intentional act by Andean to disable a security measure, like disabling the security system at a bank.” He argues that this falls under Canada’s “extremely broad” legal definition of a hack, which can be interpreted as “subverting the intended purpose of a computer system.”

Medjedovic hasn’t officially responded to either suit; he told me he doesn’t even have a lawyer in Ontario. But in our email exchanges, he argued that he’d executed a perfectly legal series of trades. Nothing he did “involves getting access to a system I was not allowed access into,” he said. “I did not steal anyone’s private keys. I interacted with the smart contract according to its very own publicly available rules. The people who lost internet tokens in this trade were other people seeking to use the smart contract to their own advantage and taking on risky trading positions that they, apparently, did not fully understand.” Medjedovic added that he’d taken on “substantial risk” in pursuing this strategy. If he’d failed he would have lost “a pretty large chunk of my portfolio.” (The 3 ETH he stood to lose in fees was worth about \$11,000 at the time.)

The case raises several tricky questions about how people should be allowed to interact with code on the blockchain. For instance, the plaintiffs allege that Medjedovic made a “false representation” by manipulating the value of the tokens in the pools. But did Medjedovic do this, or did the algorithm? Barry Sookman, a lawyer in Toronto specializing in information technology, says it’s a distinction without a difference: “Individuals are responsible for the activities of technologies they control.”

And if Medjedovic was engaged in deception, who was being deceived? That’s one basis on which Andrew Lin, a Dallas-based lawyer who advises Medjedovic but isn’t formally involved in the Ontario cases, rejects the false representation argument. “It’s unclear who he made a misrepresentation to,” Lin says. “He set forth lines of code. The code itself is neither true nor false.”

It’s impossible to predict how a judge would rule without knowing all the facts that might emerge during discovery, says Andrea Matwyshyn, a professor of law and engineering at Pennsylvania State University who studies cybersecurity. But the case is hardly clear-cut, especially considering Medjedovic’s argument that he took on risk. “People on Wall Street often make a lot of money very quickly when they see a gap and do strategic research,” Matwyshyn says. “I can imagine a world where a judge weighs various factors, after examining the technical and financial specifics of a scenario like this, and reaches the conclusion that there were variables that make this conduct more akin to a highly speculative trading scenario.”

Adding to the uncertainty is the legal and regulatory gray area in which DeFi operates. Anyone with the technical know-how can create an investment vehicle, put it online, and expose users to possible exploits. US Securities and Exchange

# that litigation

Commission Chair Gary Gensler has indicated he plans to rein in crypto trading platforms, and

Dan Berkovitz, a former commissioner at the Commodities Futures Trading Commission and now general counsel at the SEC, has called DeFi a “Hobbesian marketplace” with products that violate statutes on commodities trading. In March, the White House issued an executive order calling for regulations that would, among other goals, “reduce the risks that digital assets could pose to consumers, investors, and business protections.”

Proposed regulations might not have prevented the attack on Indexed, but they could help reduce risk and inform traders about potential hazards, says Ryan Clements, a law professor at the University of Calgary. “Code audits” by accredited parties, for example, could be required prior to launch, as well as real-name registration. However, Clements says, enforcement would be a challenge. Governments can’t “block” decentralized platforms the way they can websites, since they operate on globally distributed blockchains. And even if they could, copycat platforms might appear.

DeFi purists would prefer to keep governments away from their platforms. Chris Blec, who runs the watchdog site DeFi Watch, tweeted that the attack on Indexed was “an embarrassment for DeFi” and criticized the team for turning to a centralized institution like the courts for help. Kellar says he doesn’t see an alternative—it’s not like DeFi has its own justice system. And anyway, he believes DeFi should operate within the existing legal framework. “I think it should be decentralized in terms of governance and the management of projects,” he says. “But you need a central authority to enforce basic rules.”

**A** week after Kellar and Day filed their suit, Medjedovic appeared at a virtual hearing held over Zoom. His camera was off, and he barely spoke. The judge ordered him to either transfer the disputed assets to a neutral third party or to appear in court in person the following week. When the deadline arrived, Medjedovic still hadn’t transferred the tokens, and he failed to show up. The judge issued a warrant for his arrest.

The case is now in limbo until authorities can locate Medjedovic or he decides to appear. In a noncrypto case, if the plaintiffs obtained a default judgment, the court could simply order his bank to freeze his account or turn over his assets. But because of the nature of crypto wallets, which can be accessed only with a private key, authorities can’t get the tokens without Medjedovic. When I asked him if he’d spent any of the profits, he said, “I don’t believe in spending money.” Someone did recently move almost \$400,000 worth of tokens from a wallet used in the Indexed attack to what appears to be a cryptocurrency mixing service, which makes tokens untraceable, suggesting that Medjedovic might be accessing some of the funds.

is not like a fine wine

Almost everyone I spoke with wants him to surface, if not so they can get their money back, then so a court can address the thorny legal questions involved. Bathgate, the lawyer for Cicada 137, says there’s “good reason to believe” Medjedovic has fled the country. Law enforcement organizations in Ontario say they’re not actively pursuing him, and the Royal Canadian Mounted Police and FBI declined to comment. But

hiding out won’t make his legal troubles go away. “I can assure Andean Medjedovic that litigation is not like a fine wine that improves with age,” wrote Judge Frederick Myers, who’s hearing the case.

Medjedovic doesn’t seem interested in public sympathy, to put it

mildly. In his emails to me, he alternated between straightforward answers and apparent trolling. When I asked if he had anyone giving him advice, he went with the latter: “I’ve been exchanging DMs with my mentor, Peter Thiel, through all of this.... He was the one egging me on to do it!” (A representative for Thiel declined to comment.) Other answers included references to “ancestor simulations,” families with “diamonds they have stored extraterrestrially,” and a United Nations program “to sneak down other people’s chimneys and leave copies of Thucydides under their pillows.” The question of whether he means what he says is, per the tenets of internet s---posting, almost quaint.

As for his future, Medjedovic was insouciant: “I’m not concerned about ‘getting a job.’ Waging in the cage is not my idea of a good life.” He didn’t rule out the possibility of creating his own products: “If I ever get an idea for a necessary and useful technology I will, of course, build it. So far I haven’t had any divine inspiration on that front.”

In the meantime, the Indexed team pushes on. It launched an index token in January, but the platform’s total value has dropped even further since then, in step with the entire DeFi space, and the planned upgrade has been put on hold. “Neither of us really has the same drive to work on the project after all that’s happened,” Kellar says. Day adds that “most people recognize that Indexed isn’t coming back in force.”

On the bright side, Day has a new cat, Katniss. And as painful as the attack and its aftermath have been, it has brought attention: Kellar and Day are both fielding job offers in DeFi. Day is also applying to law schools. “There’s not many people who can bridge that divide between technical and legal frameworks,” he says. “I figured I’ll do it myself.”

In February, with Medjedovic still hiding out, Kellar and Day flew out to the ETHDenver convention, attending parties and panels and meeting fellow developers. But they spent most of their time talking to each other. It was their first-ever IRL hang, and they had much to discuss. Day commemorated the moment with a selfie of the two of them, Day grinning and Kellar looking bemused, and tweeted it with a caption: “Shape rotator squad roll out.” **B**

that improves with age”

**BUILD**

**BACKS**



# BETTER

**In a scoliosis market where treatments have changed little since the 1970s, even new brace technology shows how far we still have to go**

**By Amanda Kolson Hurley**

**AT THE END OF MY SON'S ANNUAL CHECKUP LAST YEAR,** the pediatrician called me back into the exam room, where my 15-year-old had his shirt off and his back to me. He'd asked my son to bend toward the floor, his spine standing out in a knobby ridge. "See that?" the doctor asked. I did: My son's back was askew, the ribs slightly higher on the right side than on the left. I didn't have to ask what it meant. I remember taking—and failing—the same test myself, decades ago.

Scoliosis, a curvature of the spine in a C or S shape, runs in my family. The condition affects 2% to 3% of the population around the world. Usually appearing around puberty, it's much more likely to become severe for girls than for boys. (In this article, I use the term scoliosis as shorthand for adolescent idiopathic scoliosis, or AIS, by far the most common form of the condition.) Doctors don't know exactly what causes AIS. There's often a genetic component, but how it gets passed down is unpredictable. It can skip generations, and it might affect one child in a family but none of her siblings.

Tens of thousands of children and teenagers will be diagnosed with scoliosis this year in the US alone. When the curvature is mild, in most cases it won't worsen significantly and no treatment is required, only observation. If it's more pronounced, doctors usually prescribe a back brace to stop the curve from progressing. Severe scoliosis left untreated leads to an off-kilter spine and ribs that squeeze the lungs, often resulting in chronic pain and restricted breathing. When a back brace doesn't work, the next step is surgery.

I had spinal fusion surgery for my scoliosis at the age of 15. It was a complex procedure that carried risks of nerve damage and, the worst-case scenario, paralysis. Over eight hours, doctors placed two titanium rods alongside my spine to hold it straight, attaching the rods with hooks. Then they used pieces of bone from my pelvis to graft nine vertebrae so they would fuse together permanently. I was in the hospital for a week, flat on the couch for six more.

Before that, I'd worn a brace 23 hours a day for more than two years. I hid it, or tried to, under baggy sweaters and hippie dresses. Strapped into a bolt-upright position, I couldn't bend over to pick up a pencil, let alone scoop a soccer ball off the ground during PE. A plastic shell that extended from my hips to my armpits, the brace was uncomfortable to sleep in and chafed my skin even through a T-shirt. It became unbearably hot and itchy in the summer. I still associate the sound of ripping Velcro with the relief I felt unstrapping the brace after school, when I could air out my undershirt for a few precious minutes before the brace had to go back on.

So that day at the pediatrician's, I was distraught that my son might have to go through what

I did. But that was 30 years ago, I reminded myself. Medicine has come a long way. If people can straighten their teeth with plastic trays instead of metal braces, or rock-climb with prosthetic limbs, surely there must be better back braces for kids with crooked spines by now. There had to be an Invisalign for scoliosis. I just had to find it.

**EMMIE SWEENEY IS A SEVENTH GRADER IN CARTHAGE, Mo.,** who plays volleyball and basketball and is learning to scuba dive. She also has early-onset scoliosis, diagnosed when she was 7 years old. Now, at 13, she's got the seven back braces she's worn over the years stacked on the shelf in her closet.

When she was younger and her family went on outings, Emmie says, "I would always have to take it off because I would just, like, overheat really badly." One brace gave her a pins-and-needles feeling in her hips and sometimes left bruises. Emmie's mother, Catherine Sweeney, says hard-shell scoliosis braces also irritated her daughter's sensitive skin and were so constricting that she couldn't eat a large meal. For years, she says, she struggled to get Emmie to keep her brace on. It "became a huge, huge source of resentment and relational issues" in the household, Catherine says.

Scoliosis surgery has advanced over the past couple of decades, and innovative approaches have emerged. Instead of fusing the spine, doctors can now tether it, inserting a flexible cable along the bone to guide its growth and preserve more mobility. But with bracing—orthotics—it's a different story, says Stuart Weinstein, a surgeon and professor of orthopedics and pediatrics at the University of Iowa. "The surgical changes are leaps and bounds ahead of changes in orthotics," says Weinstein, one of the foremost scoliosis experts in the world.

A few scoliosis patients in the US are still prescribed the same make of brace I wore, the off-the-shelf Boston brace, manufactured by Boston Orthotics & Prosthetics and first released in 1974. It comes in a range of sizes and is then tailored to the patient, augmented with padding to push the spine into a straighter position. Newer brace models, including from Boston O&P, are custom-crafted and have "push" forces designed into the plastic, so they are thinner. They also do more to correct the front-to-back rotation of the spine that occurs with scoliosis, not just the side-to-side bending. Increasingly, scoliosis-specific exercises are prescribed in combination with bracing, because there's some evidence they make bracing more effective.

It would be wrong to say there haven't been real improvements in brace treatment. Yet the experience isn't much better than before, as a few minutes on any scoliosis forum online will reveal. Even doctors don't sugarcoat it. In 2017 a doctor



A corset brace from the early 1900s



Today, each Whisper brace can be custom-designed



Mign Design uses 3D printing to make its brace sleek

in Colorado got fitted for his own brace and wore it for a week to better understand what his young patients with scoliosis went through. He told a local TV station that he felt “like a tube of toothpaste that has the last little bit of toothpaste in it, and someone’s trying to squeeze it out of me.”

There are a few reasons bracing has been slow to evolve. Scoliosis isn’t life-threatening, except in very rare cases, and doctors say it’s usually painless (something several current and former patients I spoke to disputed). Pushing scoliosis treatment forward doesn’t seem like a high priority for a health-care system grappling with other, more critical problems.

Medical devices for children, ranging from cranial helmets for infants to tiny stents to treat heart defects, represent only a sliver of the \$500 billion global industry, and it’s the adult market that’s growing fast as the population ages. “I think, in general, pediatric devices are a little bit of an underserved market,” says A. Noelle Larson, a pediatric orthopedist at the Mayo Clinic in Rochester, Minn.

Almost all the doctors in the US who specialize in scoliosis are orthopedic surgeons. That likely biases them on the whole toward surgical approaches, and they don’t make or fit the braces they prescribe—they refer patients to an orthotist for that. An orthotist might treat dozens of arm and ankle fractures for every case of scoliosis they encounter. Some orthotists specialize in scoliosis, and doctors and parents say their know-how can make all the difference to a child with a brace. But they don’t necessarily have the time or resources to conduct extensive R&D.

Just a decade ago, many doctors were ready to give up on bracing. They saw how much kids hated it and weren’t sure it made much of a difference. “People started to pooh-pooh bracing for a while,” says Joshua Pahys, an orthopedic surgeon at Shriners Children’s Philadelphia hospital who was treated for scoliosis himself as a child. “Thank God Stu Weinstein came along.” In 2013 the *New England Journal of Medicine* published a landmark study on bracing funded by the National Institutes of Health. Weinstein was the lead author. The study tracked 242 patients, braced and unbraced, and found that bracing had a 72% success rate at avoiding surgery. The findings were so conclusive that Weinstein and his co-investigators stopped the trial early. Now the medical world knew: Bracing works.

The study also confirmed what many doctors had long suspected: that patient compliance with bracing instructions was iffy. Heat sensors showed many patients in the braced group wore the devices for less time, sometimes much less, than the 18 hours they were told to. That clearly reduced the “dose response” to the brace.

A more patient-friendly brace could boost use and potentially avoid thousands of surgeries a year. Even with recent advances, scoliosis surgery is still a major operation. It’s also costly—in the US the bill can top \$150,000. According to data from 2009, in the 10-17 age group more money was spent on scoliosis fusions in the US than on any other type of surgery except for appendectomies.

It could also ease the emotional burden on kids. There’s

## “I think in general, pediatric devices are a little bit of an underserved market”

research linking scoliosis to psychological and social problems. The early teen years are a time of acute sensitivity about body image and belonging; a less visible brace with more freedom of movement could make brace wearers feel less ostracized. If someone developed a brace that’s both medically effective and more acceptable to young people, Weinstein says, “that would be a real contribution to scoliosis treatment.”

**WHEN JAMIE HAGGARD MEETS ME FOR COFFEE** IN between appointments with potential investors, I wonder if he’s forgotten to bring the brace he showed off to me on Zoom. No, he assures me, he’s got it. He unzips his bag and sets it on the table between us. I’m struck by how retro it looks—more like a construction toy than the latest medical engineering.

The Whisper brace is a stack of white plastic hoops, each assembled from small snap-together components. These are clasped around the torso using black fabric straps with buckles. Metal actuators between the hoops hold them apart and parallel; these alternate with flat metal springs. It is, to put it mildly, unassuming. If “WHISPER” weren’t professionally printed on the straps, it might be an especially accomplished high school science project.

But the Erector Set appearance underscores what Haggard says is a key attribute of the design: its modularity. “We can custom-design it for each kid based on these standard parts. And then, as they grow, it just gets a little bit bigger,” he says. By contrast, a child might outgrow a conventional scoliosis brace after a year and need a brand new one.

A former sales executive in the spinal implant industry, Haggard, 49, is the co-founder and chief executive officer of a Fort Collins, Colo., startup called Green Sun Medical. Green Sun has spent the past six years developing the Whisper brace, which it bills on its website as “a revolution in bracing technology.” Wearing the open-frame Whisper, kids can reach down to touch their toes, Green Sun says, and there’s less surface area to chafe or pinch their skin. Air can circulate around the hoops and springs.

The Whisper is so new that only about 40 patients have worn it for any length of time. One of them is Emmie Sweeny. She and her mom signed up in August 2020 for Green Sun’s clinical trial through Shriners Children’s St. Louis hospital. More than a year later, Emmie describes it as “1,000 times better” than her previous braces.

“It was so much more comfortable for her,” Catherine says. “She could tie her shoes. She could be bloated. And she could get her brace off by herself.” Emmie has worn the Whisper exclusively for well over a year, and so far, her mother says, it’s keeping her S-curve in check.

David Skaggs, the director of pediatric orthopedics at Cedars-Sinai Medical Center in Los Angeles, has treated a ►

◀ handful of patients (not including Emmie) with the Whisper as part of the clinical trial. He says they prefer it to a rigid brace.

“These hard braces have probably been around for 100 years,” he says. “What thing in medicine can you think of that hasn’t advanced in 100 years?” Of the Whisper, he says, “I feel more optimistic about this than any conservative treatment of scoliosis that I’ve come across. I want to be very clear, though,” adds Skaggs, who’s an unpaid adviser to Green Sun and has invested about \$100,000 in the company. “We have no idea if the brace works or not.”

**GREEN SUN’S CO-FOUNDER AND CHIEF TECHNOLOGY** officer, Matt Thompson, 49, is the lead designer of the Whisper brace. Before starting the company with Haggard, Thompson worked on medical devices such as the Digit Widget, which treats flexion contractures of the finger. The Digit Widget gradually extends the bent finger while still allowing the patient to move it, a principle that Thompson carried over to the Whisper.

It took hundreds of design revisions before the team could give the Whisper an open structure, Thompson says. Early prototypes had hoops, as the current brace does, but they were sewn into a neoprene vest with springs sticking out of it. “These poor kids looked like TV antennas,” Thompson recalls of the children who agreed to try it on.

Belying its name, the Whisper is actually a bit heavier than a standard brace, at more than 4 pounds. But Thompson and Haggard say for most patients, flexibility and breathability trump the extra weight.

With a \$1.2 million grant from the National Science Foundation, Green Sun has started developing an in-brace sensor system. The sensors will track not only wear time, feeding that data into an app, but also how much force the brace is applying. Haggard compares it to a tire pressure gauge: If the PSI goes too low, you know the tire needs more air.

As your tissues adjust to force, Thompson says, the correction from that force drops off. The challenge is to “keep that force higher for longer, so you can stay in that sweet spot and keep getting that correction.”

Green Sun, which has six full-time employees, has started selling the Whisper in Colorado and California for \$12,000. It’s a high price point; braces generally range from about \$2,000 to \$10,000. For now, families who buy it can file a claim with their insurance and see what happens. Most US insurers cover scoliosis braces, but not every kind of brace, especially if it’s experimental, and not always the full cost.

Getting buy-in from doctors will be crucial to making the Whisper a viable

product. When I asked scoliosis specialists what they’d need to start prescribing it, they cited two things: evidence of how straight the brace can hold the spine and a high-quality clinical study showing effectiveness at warding off surgery. Haggard says the Whisper’s in-brace correction matches that of rigid braces so far. (Skaggs says in the small sample he’s seen, it may be slightly lower at the initial X-ray.) But it’s still a long road ahead for mass commercialization. Recruitment for the trial slowed because of the pandemic, and obtaining peer-reviewed evidence that the Whisper works—or doesn’t—will take another year at least.

Some doctors might not wait that long to give the Whisper a try. “I’m happy to prescribe it right now,” Larson tells me over Zoom. “I think the ideal candidate would potentially be someone that had tried this”—she picks up a rigid brace—“and was not able to do it.”

Then there are the patients to win over. Here, the Whisper’s science-fair aesthetics could pose a problem. Luke Stikeleather, an orthotist in Virginia who connected Green Sun with patients earlier in the Whisper’s development, says some thought the brace was cool, but others “struggled with its appearance.” Old-school, rigid braces are smooth, while the Whisper has, in Emmie’s words, “lots of bumps.” Along with the clinical trial, Haggard’s new priority: making the design sleeker.

**THE WHISPER ISN’T THE FIRST BRACE TO RAISE HOPES** about a potential breakthrough. Take the SpineCor, introduced in the 1990s. Formed of crisscrossing elasticated straps, the SpineCor seemed like the brace everyone had been waiting for: lightweight, breathable, flexible, and almost invisible under clothing. An early study found that it was effective at halting curve progression, and doctors started prescribing it. But later studies failed to replicate that result, and doctors have mostly abandoned it.

Designing a brace that nails the trifecta—effective, moderately comfortable, and attractive—is incredibly tough. “I don’t know, if we knew five or six years ago what we know now, if we would have jumped in,” Haggard says.

Almost 500 years after the first known scoliosis brace was designed in France, the biomechanics still aren’t well understood, Weinstein says. If a child puts her brace on correctly in the morning and then sits down at her school desk, which pushes the brace up half an inch, what effect does that have on the forces exerted? “There are a lot of unknowns about bracing. That’s what the bracing community really needs to figure out,” he says.

It’s possible that bracing is one of the rare categories in which there’s a limit to innovation. Braces may always



Emmie Sweeny wearing her Whisper brace



A collection of Emmie's former braces, worn between the ages of 8 and 12

have to be a bit cumbersome, says Baron Lonner, chief of minimally invasive scoliosis surgery at Mount Sinai Hospital in New York, because of the necessity of providing sufficient pressure on spinal curves. He's a fan of another recent entrant in the field, a brace made by a Charlotte startup called Mign Design. Mign's rigid brace is a spin on the perennial Boston brace, according to Lonner. It's not a novel concept, like the Whisper, but the low-profile latticework design looks better than any other brace on the market. Mign uses an all-digital process instead of working from a physical mold, which CEO Lisa Tweardy says opens up the possibility of "mass customization at scale."

Mign engineers create custom brace designs by correcting body scans in their software and feeding these to 3D printers that fabricate polymer shells and pads. Lonner and his orthotist, Liz Rauch, have worked with Mign on hundreds of braces, he says, and have seen "excellent results." The company also partners with orthopedic clinics in Charlotte and Atlanta. When Mign bills a brace to a clinic, it charges between \$800 and \$1,650, Tweardy says, depending on the specific device. Clinics then bill patients or their insurance for the brace and additional services. Priced affordably, 3D-printed braces could become an accessible option for scoliosis patients with limited means, including those living outside rich countries.

Both entrepreneurs, Tweardy and Haggard, say that for their businesses to grow, they'll need to branch out from AIS treatment. Mign has made postoperative braces and is working on hand and wrist applications, while Green Sun is

**Greater acceptance of non-normative bodies would make the choices around both bracing and surgery less fraught**

testing the Whisper on adults experiencing pain from scoliosis. That group, plus adults with kyphosis (a frontward-curving spine), makes up a big potential market in an aging population.

Instead of brace innovation, perhaps the real advance will come from genetics and artificial intelligence. Carol Wise, an expert in the genetics of scoliosis, says researchers have closed in on about 10 genes that play a part in the condition, some of them regulating the development of cartilage. In theory, it should be feasible before long to develop a polygenic risk score, says Wise, who's director of basic

research at the Texas Scottish Rite Hospital for Children and a professor at the University of Texas Southwestern Medical Center. Such a test could help sort the kids with curves that are likely to get worse from those with curves that aren't, leading to better-targeted, more individualized treatment. Researchers are also looking at biochemical pathways in spinal tissues and how doctors could intervene with drugs or even nutritional therapy, though this is more speculative.

Meanwhile, patients themselves are trying to change how overwhelmingly male orthopedists treat a condition that mostly affects young women. A national patient-run support group called Curvy Girls is petitioning organizations in the field to stop referring to scoliosis as a "deformity." They're reacting to stigmatizing experiences like one recounted by college student Gianna Calligy, who had a male doctor ask her in front of a room of male residents: "I don't know any 16-year-old girl who would want to be deformed. Do you?" Greater acceptance of non-normative bodies would make the choices around both bracing and surgery less fraught.

It looks like my son, fortunately, won't have to make any hard decisions. His curvature has been holding steady at 22 degrees. That's above the threshold for bracing in some cases, but at 16, he's almost done growing. Instead of a brace, the orthopedist's advice is to watch and wait.

He's relieved, and so am I.

But kids like Emmie still have to do the best they can with limited options. She feels like part of her childhood was taken away, "because I had to readjust so many times to so many different braces." She says she wasn't as outgoing after she started wearing a brace, and teachers treated her as fragile. She worries about passing scoliosis on to her own children.

The Whisper has been "unbelievably amazing" for her daughter's quality of life, says Catherine. Even so, she adds, "It's one of those things where I'm thinking, 'How is it possible that we still don't have something that's even better?'" **B**



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Petting a gray whale calf in Mexico's San Ignacio Lagoon

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Illustrations by Bráulio Amado

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# MAKING CONTACT

TOUCH

**Getting close enough to touch an animal usually isn't a great idea. But in a quiet lagoon on Mexico's Baja Peninsula, the whales are happy to oblige**  
*By Sara Clemence*

It's a windy day in Laguna San Ignacio, and the waves seem to come from all directions—even directly beneath our open 18-foot fiberglass boat. Peaks rise up, slap against one another, roll us around, recede. My children gleefully ride the bucking bow, though we haven't come to this remote part of Baja California for a joyride.

I scan the ruffled waters for a heart-shaped spray of water, the reason we're here: the signature blow of a gray whale.

There. In the distance, a dark shape emerges from the lagoon, then slips back below the surface. The whale's exhalation hangs briefly in the air.

"Help me splash!" our guide says, leaning over the gunwale. I stick my arm elbow-deep into the lagoon. This, apparently, is how you invite an animal the size of your living room to hang.

Two hulking shapes, a mother and her weeks-old calf, answer our aqueous call. The parent remains aloof. But the "little" one pokes its 5-foot-long, Muppet-like snout out of the water next to our bare-bones outboard fishing boat, or panga. The calf has a narrow face; its skin already has the pockmarks of a pickle, pale scratches, and patches of barnacles. It surfaces again and submerges. Then it's right under me; I see its double blowhole pulse open and feel the vapor of its breath on my face.

The whale lolls onto its side like a 2-ton puppy, its mouth open in a smile-shaped gap. With the same impulse behind scratching a dog's belly—but a little more hesitation—I reach out and gently stroke its beak. It feels electric. Also, a bit like petting a hard-boiled egg.

Generally speaking, I react to stories such as these with a mix of awe, distaste, and concern. Among the harms that

can come from handling wildlife are injury (to either party) or illness (ditto). Animals can become deeply stressed by, or lethally habituated to, humans. Around the world, animals are mistreated or exploited by people who are desperate to make a buck: Tigers are drugged; elephants, kept in chains.

And yet I've brought my family to San Ignacio, one of the few places where humans can caress a whale. Each year, grays travel thousands of miles to arrive here from their feeding grounds in the Arctic seas. In four relatively warm and sheltered lagoons on Baja's Pacific coast, they mate, give birth, and prepare their calves for the long swim home.

While here, some of them seek out—or at least are willing to engage in—interactions with tourists, who are allowed in limited numbers. (Only 16 small pangas like ours are permitted into an approved viewing zone at any one time.) Depending on their luck and timing, visitors can see whales courting; shake hands with a leathery fin; feel the bristled, sediment-filtering baleen inside the whales' mouths; or even plant a kiss on a cold, salty cheek.

Fascination with whales, the world's largest creatures, is nothing new: Ancient Greeks, Romans, and Etruscans all depicted frightening whalelike beasts in their art.

Of course, they eventually became prey, hunted for their meat, oil, bones, and baleen. Whalers historically called grays "devil fish" because they can turn aggressive when threatened or, say, when their calves are harpooned. In such cases, the

animals ram their head into boats and wield their tail as 10-ton clubs. Which is why, even as the gray whale inspired modern whale watching—the first commercial operation started in San Diego in 1955—and governments put protec-

tions for the creature in place, the fishermen who lived and worked in San Ignacio remained afraid of it.

Then one day—somewhere around 1970; the history is fuzzy—Francisco "Pachico" Mayoral was fishing for grouper in the lagoon when a gray whale approached his panga. Petrified, he watched it engage in playful antics around him. Eventually he felt brave enough to put out a hand, then to stroke the animal like a pet. Mayoral reported to the village that they might have been wrong about that devil fish thing all along, and a cottage tourism industry soon bloomed.

Laguna San Ignacio isn't easy to reach. My family of four drove from our home in San Diego to the Mexican border,

***Depending on luck and timing, visitors can shake hands with a leathery fin or even plant a kiss on a cold, salty cheek***



crossed on foot to the Tijuana airport, flew to Cabo San Lucas, and took a charter flight two hours back north to San Ignacio. Most of what we saw of Baja along the way was sparsely populated and starkly beautiful: rocky mountains, barely there fishing hamlets, white salt flats, and empty desert roads.

For reasons I can't quite explain, I did almost no research before I booked our trip. I didn't even know about the touching or the cuddling, only that we would be staying in a camp along the shore of a whale refuge that's part of the 6 million-acre El Vizcaíno Biosphere Reserve.

Our three-day tour with Baja Expeditions included overnights in relatively luxe accommodations—safari tents with private composting toilets—and two or three boat excursions a day. Although the ecosystem is interesting, with mangroves, sand dunes, and sea turtles, people come for the mammoth cetaceans.

Upon arrival, we cross paths with a departing group. "I kissed a whale!" one woman exclaims.

Somehow, that doesn't strike me as inappropriate until later, when I am stroking the thick, rubbery skin of an animal that can weigh up to 90,000 pounds. With a pang of guilt, I remember that most important tenet of responsible wildlife tourism: Don't touch the animals.

Do I stop? No—though I have complicated feelings and many questions. Even my 7-year-old daughter seems to grasp

the complexity of what we're doing. She wonders why the calves think they can trust us, these strangers; she concludes they must know how to distinguish the harmless humans, otherwise their mothers wouldn't permit the interaction.

My daughter nicknames the calf from our first encounter, with his signature crust of barnacles, Roller, because he rotates slowly next to the boat. We see him a few times, and he seems to like being petted and splashed.

At one point, I will admit, my lips come very close to his craggy face, but then he exhales hard right into mine. I take it as commentary and don't try again.

Touching these whales feels intimate and connective. Our two species occupy entirely different worlds; we are meeting at their boundary for—what, exactly? A mutual inspection, perhaps. We can't share food or communicate with sound, but we can understand a little bit about each other through feel—and eye contact.

More than once, after nosing around our boat, a young gray turns on its flank so one dark, baseball-size eye is looking up at us. I wonder: Does it perceive a single, hard-sided animal with many short tentacles? Or does it see...me?

The longer we linger, the more I want to simply observe. Touching, the unspoken goal of every outing, can start to feel like entertainment. I want to learn how the whales interact with their environment and one another, not only us. ►



San Ignacio Luxury  
Camp by Baja  
Expeditions

◀ Studies have shown that whale watching can change whales' swimming habits, increase their stress, and result in propeller strikes. Some scientists think that motors may drown out their ability to communicate underwater. The long-term effects are unclear.

Steven Swartz has been studying gray whales in San Ignacio since the 1970s. He tells me that because the interactions happen on the animals' own terms and the rules here are strict, he sees no real cause for concern. We're not feeding them, and there's no known disease transmission between grays and humans.

Whales in general are very tactile, Swartz says: "They love to rub and touch. That's how they communicate." Drone footage shows that gray calves are constantly bumping into,

sliding against, and rolling on their mothers, both for safety and to signal they're ready to nurse.

We spend our next-to-last boat trip near the mouth of San Ignacio, where a sandbar sheltering the lagoon from the ocean generates a wall of waves. We spot and splash-call a mother and calf, whose skin is less blemished than most. The *pangueros* call it Mariposa–Butterfly—for a delicate white splotch on its tail. The baby surfaces again and again next to us; as I hang over the side to stroke her, I see the mother abiding nearby. I'm splashing when I feel her snout press up into my hand.

It's the only time a mother has approached. Wiser and presumably more cautious than her child, she still decides to trust us. For a second I think: "She believes I am one of the good ones." **B**

SIGHT

# Guiding Lights

56



Stars above the Four Seasons Lanai

**Ditch the GPS on your screen and learn to navigate your way by looking up and out**  
By Jen Murphy

"What can you read in the stars?" asks my host, Hawaiian navigator Kala Baybayan Tanaka. She's sitting next to me and aiming her laser pointer above the lawn of the Four Seasons Resort Maui at Wailea, where she teaches guests to use the sky as a compass.

The night looks like a shimmering black sequin dress. I marvel not only at the number of stars but at the idea that

each one could effectively double as a road sign on a highway that spans across the ocean. I shake my head; I can't read much of anything in them.

My friends are constantly amazed at my miserable sense of direction. Whether on the New York City subway or a marked hiking trail in my part-time home of Maui, I'm notorious for getting turned around. I blame technology: Years of letting Siri tell me to turn right or left has dulled my powers of observation. But since 2020, when I got into outrigger canoe paddling, Hawaii's official team sport, I've become more attentive and in tune with nature's directions.

For decades the activity has been a staple offered at resorts across the Hawaiian Islands. It's so common it had a starring role in the hit HBO series *The White Lotus*. And as the state's tourism industry has begun to emphasize Native Hawaiian culture, more hotels, such as Ka'anapali Beach Hotel in Maui and the Four Seasons, are focusing on the traditional purpose of the sport: the almost forgotten Polynesian art of voyaging, or wayfinding. So, too, am I.



Outrigger canoeing at  
Waikiki Beach

My first lesson in spotting Mother Nature's directional cues happens not in open water but on the lawn here, at the hotel where *The White Lotus* was filmed. Tanaka is not quite 40, but her soft voice carries the wisdom of someone older. Part historian, part celestial interpreter, she recounts how 1,500 years ago Polynesians used those twinkling specks to navigate their massive, double-hulled sailing canoes throughout the South Pacific.

Although Western rule and contemporary influence brought the tradition to the brink of extinction in the 1950s, Tanaka is among those perpetuating it for a new generation. Her father, master navigator Kalepa Baybayan, was part of the historic *Hokule'a* paddling crew that in 1976 retraced an epic Polynesian seafaring route—roughly 2,200 nautical miles—from Maui to Tahiti completely unaided by modern

navigational tools. It was the first time it had been done since the rule of Hawaii's King Kamehameha the Great in the 18th century. Tanaka, too, has made the trip herself using only stars, wind, and sea to show the way on the *Hokule'a's* sister vessel, the 72-foot-long *Hikianalia*. When she's not on the water, she teaches the art to others

***“The ocean swells, the birds,  
the fish—they're all out there  
telling you where you are”***

looking to complete transoceanic crossings at Maui's Voyaging Society.

I come to my first lesson with Tanaka knowing only my basic constellations—Orion's Belt, the Big Dipper—but when I gaze directly upward in search of those shapes, she corrects me. The most important stars for navigation are the

ones low in the sky. “Following where a star rises and sets allows us to use the horizon to orient us,” she says.

As the Earth rotates, every star rises over the eastern horizon and sets in the west, following a predictable trajectory, Tanaka continues. “Commit the stars to memory and their bearings as they rise and sink, and you have a 360-degree compass.”

The longer I stare, the more distinct each light becomes, taking on its own unique glow. Some beam a greenish white, others a reddish flame. Tanaka points her laser to a gleaming orange orb named Arcturus, a red giant estimated to be 7 billion years old. The brightest star in the northern sky, it always lies off the Big Dipper's handle, she says. At its highest point, or zenith, it sits directly above the Hawaiian Islands, making it a beacon for voyagers traveling from Tahiti. ►

◀ The next day, right before dawn, we set out in a two-person outrigger canoe. My hawk eyes point straight to the horizon's edge, seeking setting stars. But that's no good, Tanaka seems to indicate with a smirk. The sky today is masked with clouds. Under these circumstances we must read the water, wind, and wildlife instead.

This is when I learn that waves are like the individual ripples of fingerprints, uniquely encoded with information about the land masses nearby. Every island group in the Pacific, it turns out, has its own refractive pattern, sent out to sea when the ocean's swells hit the islands and bounce back. The more swells you can detect at once, the wider and more accurate the map

you can form in your mind. Tanaka can perceive as many as three at one time. Her father can sense eight by closely paying attention to how his canoe subtly rolls or corkscrews according to forces from each octant on the compass (north, northeast, etc.). Even if he can't lay eyes on an island ahead, he can feel it. And when the wind is accelerating, he sees it in the froth on top of the waves.

I concentrate on the rise and fall of the ocean when our stern lifts out of the water, pitching the canoe forward; it's a clue that we're heading into a north swell. Other moments—a pretty red sky at sunrise, a halo around the moon—all hold significance. The former indicates humidity in the air; the latter foreshadows a storm. A sighting of *manu-o-ku*,

or white tern, is a telltale sign that land is nearby. “The ocean swells, the birds, the fish—they're all out there telling you where you are,” Tanaka says.

It's one thing to know what to look for but another to piece it all together when out in elements that are always changing. It will take years, perhaps a lifetime, before I can navigate by nature's compass. But a few weeks later, the night before setting out to paddle with a friend, I note the halo around the moon. The next morning, I observe the brownish clouds in the sky—a mark of strong winds. And halfway into our outing, the foaming whitecaps on the horizon tell me it's time to turn around. My friend considers it a failed adventure. But in my eyes it's a success. **B**

## SOUND

LISTEN  
FIRST, THEN  
LOOK

People often think birders initially locate their subjects with their eyes. That's news to the ears  
By Jennifer Flowers

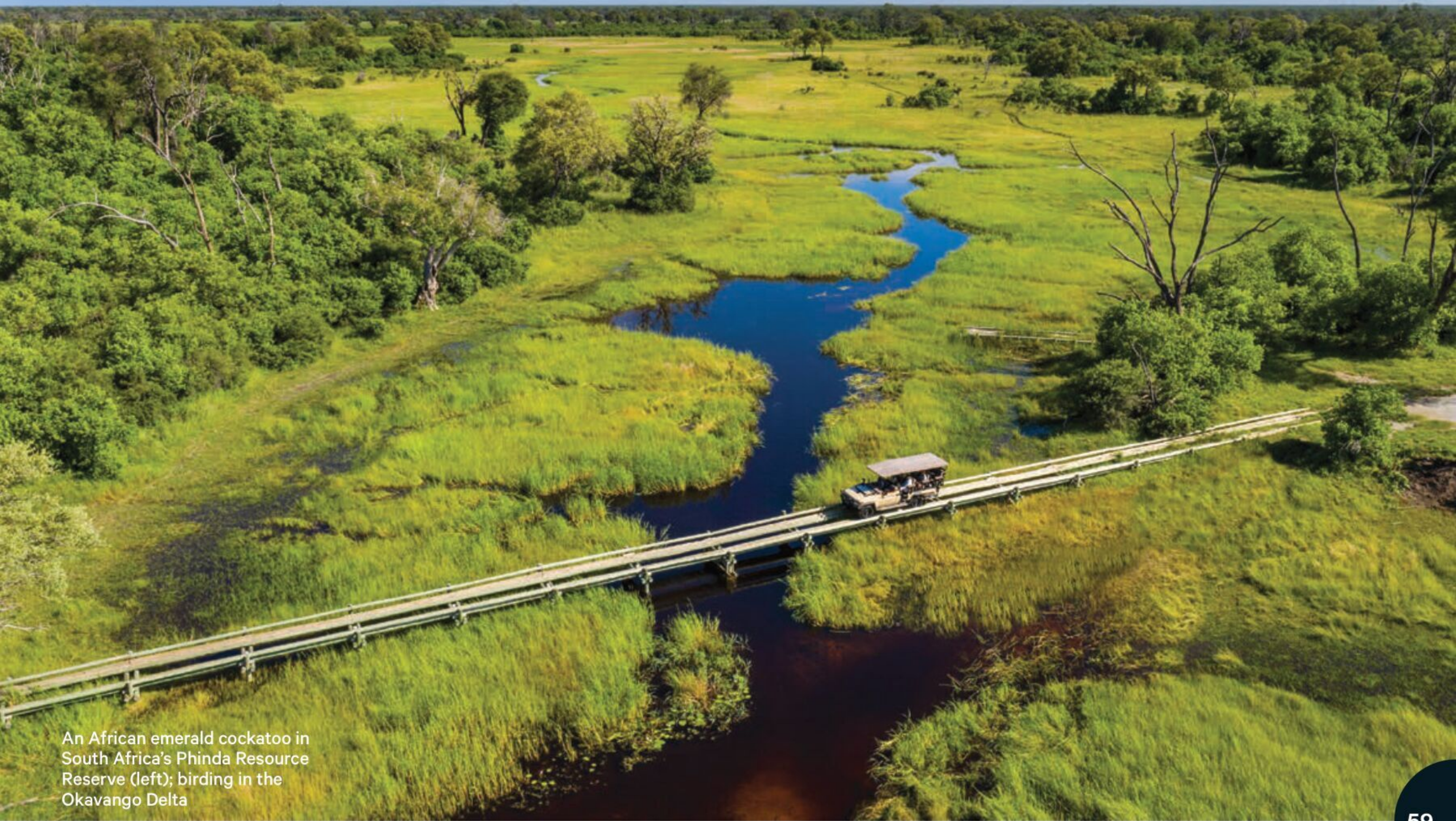
My foray into amateur birding started with a pop song. It was 2017, and I woke up to a catchy avian rhythm outside my tent in a remote corner of Botswana's Okavango Delta, not long after flying in from New York. Maybe it was the jet lag, but to me, the beat had an uncanny resemblance to *Mellow Yellow*, the hit '60s song by the Scottish musician Donovan. From that point, I was on a mission to name that bird.

Luckily, I soon met two huge bird nerds: Peter Allison and Ralph Bousfield, well-regarded private safari guides with outfitter Natural Selection tasked with leading our group on a tour around the country. As we bumped along together in a car on a dirt path through the salt-encrusted Makgadikgadi pans, I hummed the Donovan beat to the duo in the hope of finding an answer. It's common for birders to attach mnemonic devices to what they hear, but my interpretation was, well,



unique, and it stumped them. But a couple of days later, as we were tracking elephants in a mopane forest in the Okavango, it came to Allison: “It's the red-eyed dove!”

I waited for him to tell me about a bird so beautiful that it would be the envy of ornithophiles the world over. Alas, I was mistaken. He called it “relatively drab” and said it had “no remarkable sexual habits or feeding proclivities.” In other words, I'd been romanticizing the Toyota Corolla



An African emerald cockatoo in South Africa's Phinda Resource Reserve (left); birding in the Okavango Delta

of birds. One birding website I found unceremoniously described it as “a largish, stocky pigeon.” But, as a consolation for the poor red-eyed dove, Allison noted: “It drops a beat like no other bird.”

Before my encounter with the red-eyed dove, I preferred tracking terrestrial mammals: elephants, cheetah, the elusive pangolin. Birds felt like an afterthought, charming distractions to pass the time while I waited for a sleepy pride of lions to start hunting. I didn't realize that by ignoring them, I was missing out on some of the greatest dramas in nature.

An outsider could be forgiven for thinking that the point of birding is *seeing* the birds, with their spectacular feats of flight and dazzling plumage. But birds show themselves for only a few moments if we're lucky. Vocalizations can carry for miles, acting as a play-by-play of life in the wild.

Watch enough BBC Earth, and you'll know that birdsongs aren't just pretty. They can indicate that birds are looking for a mate or asserting their territory or—when they sound like staccato blips of Morse code—warning of a predator nearby. Naturalist guides often use the latter as an audible clue that leads to other exciting wildlife. In East Asia the Japanese tit has a specialized “jar-jar” call that indicates the presence of snakes; in South Africa the Wahlberg's eagle gets especially shrill when it sees leopards. A red-billed oxpecker, which hitches a ride on the back of the black rhino, warns with a scratchy, low-pitched alarm for the greatest approaching threat of all: *Homo sapiens*.

Birds are even capable of developing regional dialects

passed through generations, and certain species have been known to abruptly end seasonal mating calls early, months in advance, if they sense that a hurricane is coming.

They can speak to us, too: On a trip to Rwanda in 2019, naturalists Mark and Christine Read told me how the dulcet, two-note call of the African honeyguide will lure humans toward honeycombs to get them to break them open. The cunning birds then scavenge the leftovers.

I've carried these lessons home to Seattle. I don't have naturalist guides for roommates, so on walks through my neighborhood, I use an app from the Cornell Lab of Ornithology called Merlin Bird ID—it's like Shazam for birders—to help pinpoint what I'm hearing. Those three high-pitched wind-ups followed by a bunch of satisfying staccato notes? It's the

Bewick's wren. The two-noted heckle that I could swear inspired Nelson, the school bully on *The Simpsons*? That's the black-capped chickadee.

When my app picked up a purple finch for the first time—a harbinger of spring in this corner of the country—I didn't get to see its raspberry-stained plumage, but I delighted in the sweet, warbling crescendo. Now I'm eagerly anticipating the day I catch the bright, flutelike song of a Swainson's thrush, which, mind-blowing to me, migrates all the way up to Seattle's forests from Central and South America in late May to breed.

Everywhere birds fly, you can listen—which is why it's become an easy hobby for many in recent years. In 2020 the Cornell Lab of Ornithology reported a record-breaking ►

***“The birds have always been there, singing and calling, even when we don't acknowledge it”***

◀ 2.1 million observations during its annual Global Big Day of birding, which enlists ordinary citizens to gather data and raise conservation funds—the number bested the previous high by 30%. Itineraries such as AndBeyond’s Beyond Average Birding safaris in Ecuador, South Africa, and Sri Lanka are popping up by the dozens.

As for me? I’ve spent an afternoon in South Africa following the clinking crystal sounds of the pink-throated twinspot through a dense forest and hours more listening to a rainforest sing in Costa Rica. But nowhere have I felt the profound impact of birdsong as much as I did in Colombia, which, according to Audubon, contains almost 2,000 bird species—more than any other country in the world. In Medellín, which people usually visit to dance to the soul-stirring beats of salsa and cumbia, I instead beelined to a lecture by biologist Diego Calderón-Franco, who runs the tourism outfit Colombia Birding and is best known for using the pursuit as a conduit for peace.

In 2004, while studying birds in a remote eastern part of the country, Calderón was kidnapped by the Revolutionary Armed Forces of Colombia for three months. A dozen years later, encouraged by the 2016 peace agreement that ended a half-century conflict, he returned to reconcile with his captors at Tierra Grata, the site of his kidnapping and a former military camp that’s been transformed into a town. Since then, on repeat visits, he’s guided about a dozen demilitarized fighters toward a career in birding.

Calderón estimates that there are roughly 60 former guerrilla fighters who are now training or working in his field across Colombia, capable of escorting travelers like me through the country’s diverse landscapes in pursuit of the multi-colored tanager and the Andean condor. I met one of them at the lecture, the young Marcos Guevara, who spoke eloquently about the reconciliatory power and economic impact of birding on his broader community. “Once you get to know your own territory and realize there’s a rich and bio-diverse forest to protect, you won’t work in war,” he told me. “There are other beautiful things that fill your heart.”

Many of the reformed militants Calderón works with feel freer to move around their own land having shed affiliations with an army—and to see it unclouded from politics. “The birds have always been there, singing and calling, even when we don’t acknowledge it,” he said. “They are part of our story as a civilization, and now in Colombia they are the bridge that will connect us. Not just with nature, but with each other.” **B**



SCENT

MORNING



Seafood for sale at Tsukiji's former inner market

# ATC

During a visit to the old Tsukiji Market in Tokyo, the author at last learns to heed her nose  
*By Colleen Kinder*

I'm really just following orders when I get up at 4 a.m. with a plan to arrive at Tsukiji Market before daybreak in Tokyo. It's January 2015, and everything I've read assures me that early risers have the best chance to witness the bustle of this "Wall Street of fish," a place where some 480 varieties of sea creature go up for sale daily—including fatty, melt-in-your-mouth bluefin tuna that can net as much as \$200 per pound. But nowhere is there a warning for my nostrils. ▶

◀ The fat flakes of falling snow that morning only enunciate the cold stench of raw fish slabs as I patter into the sprawling, warehouselike complex. It's a wet smell, an air-bound saltiness—not a whiff of fresh ocean but of the dregs of past catches, hauled and dripped over concrete floors, mixed in with boot mud. Too early, everything in me wants to say back to that blunt, salty aroma, which conjures in my mind's eye the guts of herring, the slime of scallops and groupers, a severed head of salmon. Way too early.

That's when I see a sign proclaiming that, actually, I'm too late: "TUNA AUCTION CLOSED." Crestfallen, I remind myself that Tsukiji is more than tuna. Within its tangle of delicacies—sea urchins and conger eel, fine cookware and rare specimens of dried seaweed—I can surely persist and chance upon the market's essence at random.

Which is why I join a long line snaking from one of the outer market's tight aisles, without the faintest idea what it's for. It all happened so fast, as soon as I'd spotted a pack of Japanese strangers. If this many locals had risen this brutally early to stand on a line, my foggy, by-now 5 a.m. brain reasons, the thing they're awaiting must be outstanding. Divine. The true gem of Tsukiji that guidebooks have yet to locate and flag for outsiders.

The queue doesn't budge for an hour. Or a second hour, during which the chill in my bare hands turns to sting and the thick, fishy darkness gives way to sunrise. Every few minutes, I remind myself why I am still here—an iron-clad conviction that the finest enchantments in our travels are the things we stumble upon. Meanwhile, every few minutes a fishmonger forklifts past my trembling legs and shoulders, infusing the air with piquant memories of the very last thing my body desires: fish.

Normally I'd be the first person to sign up for a taste of cod sperm (shirako) or roll up my sleeves for some grilled sea snails (sazae). But the night before, I'd feasted with abandon in Tokyo, sampling every last sushi snack, ramen option, and bakery treat in my

path. Today my torso feels as dense as a punching bag, reckoning still with a smorgasbord of yesterday's indulgences. With a gut this full of sodium, the only thing I can fathom eating for breakfast is a plain old banana.

"What are we waiting for?" I finally squeak at the fashionably dressed trio of women in front of me. They look at me quizzically, then devastate me with the answer: "Sushi."

A normal person would give up here, go check out the nearby knife stores (now open) or maybe the shrine at Tsukiji where fishermen seek blessings. Not stubborn me. I cling to the hope of some kind of "breakfast sushi," dreaming up a fusion buffet in which cinnamon bun supplants salmon, minced grapes do the work of pickled

***A fishmonger forklifts past my trembling legs and shoulders, infusing the air with piquant memories of the very last thing my body desires: Fish***

ginger, and Cheerios shavings stand in for sesame seeds. Western breakfast, that is, masquerading as raw fish.

Finally the line curls around a corner, and I catch sight of what lies ahead. It's a chef's counter called Sushi Dai, with no more than 12 seats inside. The five-star reviews festooning its windows make clear that I've hardly uncovered some local secret. And worse, I now know this tiny eatery's omakase menu—translation: trust the chef—doesn't in fact contain bananas.

I eye a Japanese woman seated close to the entry as a chef places a single, bright-pink piece of sashimi before her; it's one of that day's best nine cuts of fish, according to the chef I'm supposed to trust. A wave of nausea takes hold of me when she swallows it whole, as if she'd eaten a slug plucked from the underside of a rock.

And that's when I finally say enough. Done with my own stubborn will and ready at last to heed my senses, I flee. By the time I spot a glowing coffee cup icon over a pair of sliding glass doors a

few aisles over, my cold-clenched leg muscles are trotting. I yank open the doors, and warmth blows over me like a wind.

Every smell that graces my nose on the other side of that diner's entrance feels holy: lightly burned crumbs on an old silver griddle, spatula encrusted with egg, light steam rising from a newly brewed pot of coffee. Were I not so eager to slide onto a stool at the counter, I might slump to the ground in gratitude and kiss it with half-blued lips.

Instead, two ladies prepping lunch behind the counter look up, bemused, as I unravel my scarf and practically bellow at what I spot behind the diner's counter: "Bananas!"

Has anyone on this Earth enjoyed the creamy blandness of banana more than I did at Tsukiji? I doubt it. In my generic diner mug is the glowing miracle of this day—stove-warmed milk that feels like a tiny campfire. I raise it to my face, and my nostrils relish the familiarity of dairy that's just shy of boiling, sweetened by fire.

"This wardrobe is for Japan in spring!" one of the diner cooks laughs as she comes over to peel off my flimsy sweatshirt, placing a small pouch underneath it. It looks like a jumbo-size tea bag or maybe the world's smallest beanbag, lined with adhesive strips. Only when I feel the first rush of warmth through my skin do I understand that the mystery pouch is in fact a hand warmer. All day long it will accompany me like a tiny heater on my back. First, though, here with the women, I feel a familiar pinch in the bridge of my nose. That, for me, is where tears start—not in the eyes but high in the nasal passages.

I could've gotten to this place hours ago simply by listening to my nose, obeying the primal instinct that the first heady whiff of cod or shrimp goop shot through my senses. No matter. My internal civil war taught me the sweet release of letting an agenda—one that was never mine to begin with—at last go. There are moments to trust the chef and moments also to trust your own body. **B**



TASTE

# CRAVING HOME

**The fastest way to find your chosen family in a new city is to go out and eat**  
**By Howard Chua-Eoan**

Home is a conundrum. It's where you start and where you want to end up. You run away from it, yet you miss it. It's sweet. And also not. There's no place like it. And I've learned this: Home is a movable feast.

I was one of those mythical New Yorkers whose oven doubled as a shoe closet. The city was my kitchen. I ate out practically every day, from morning pour-over coffees off Amsterdam Avenue to midnight slices at Joe's Pizza on Carmine Street. Then, four years ago, work sent me to London. I was excited but also terrified. I'd called New York home for almost 40 years. Would I adjust to London? Where would I eat? Would I have to cook? The prospect was stomach-turning.

I asked for help from Fabián von Hauske Valtierra and Jeremiah Stone, the chef duo of Wildair and Contra, my favorite haunts on the Lower East Side. "We'll email James!" they said.



Flor's "Eat your greens" pizza

"We'll tell him to take care of you." James is James Lowe, the chef of Lyle's in Shoreditch, one of the best restaurants in London and a tough reservation to nab even on a slow weeknight. Could I just walk into Lyle's and say Fabián and Jeremiah sent me?

The front desk was intimidating, but James had indeed received the email; I was in. I took a photograph of my first dish there: a beautiful bowl of gorgeous green, fresh English peas with lovage and fresh cheese. I'd never had lovage until then. I've loved lovage ever since.

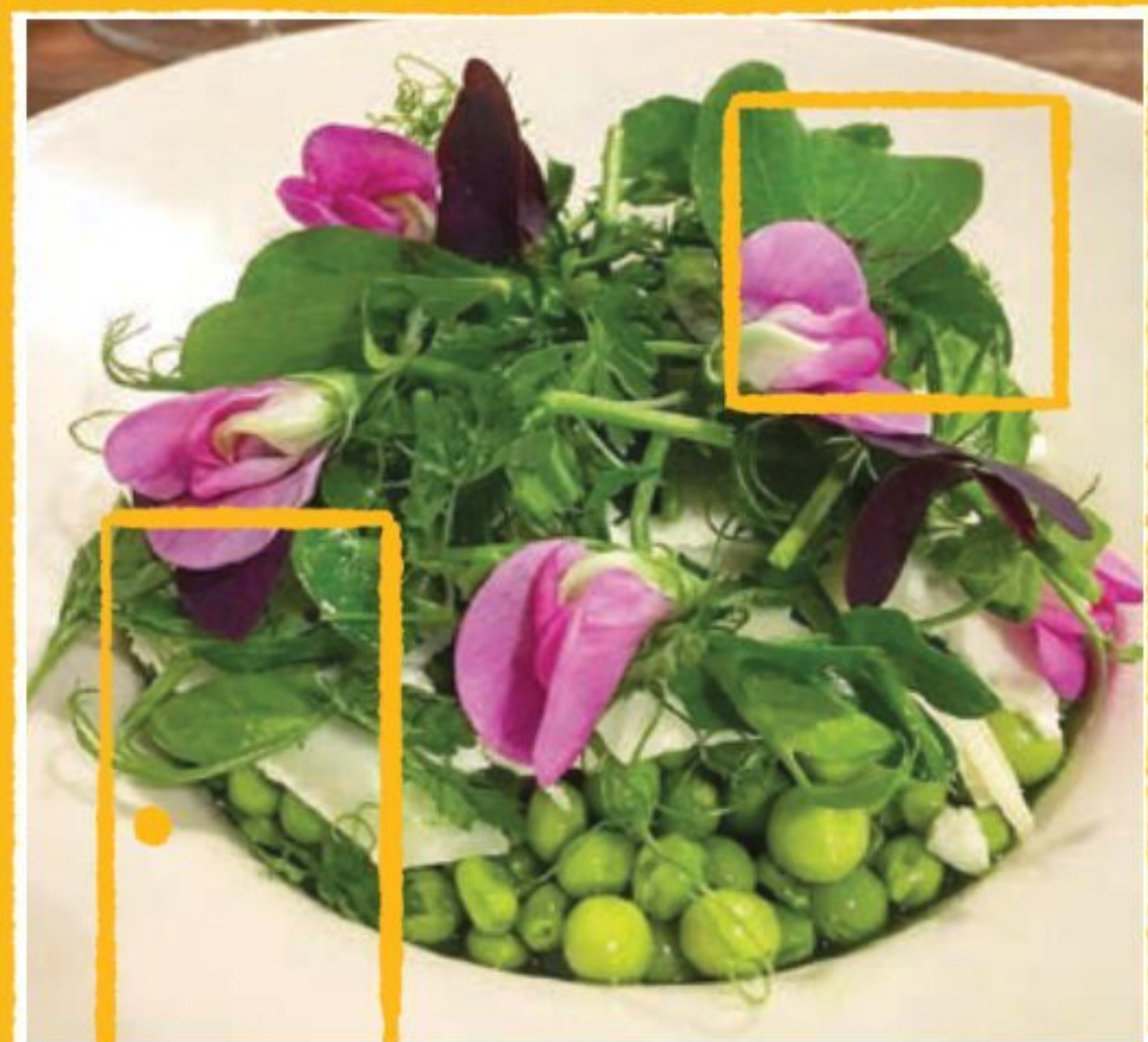
And I loved Lyle's—not only for the food. It filled my need for a sense of home. New York is tough, but London isn't easy, either. I felt alone at first. I thought I'd made a terrible mistake. But whenever the city became too foreign, which was about once a week, I headed for Lyle's. Soon it became the proverbial place where everybody knew my name. There is no price I can put on how it helped me survive those first months.

Lyle's also sent me forth into the rest of the city. At the bartender's suggestion, I crossed Tower Bridge into Bermondsey to sit at 40 Maltby Street, a wine bar where ordinary-sounding fare—chicken liver on toast, tomato fritters, baked lamb shoulder—is extraordinarily prepared. A friend I made there led me to Quality Wines on Farringdon Road, where, again, apparent simplicity (sardines atop warm chickpeas with lemon and olive oil) camouflaged immense richness and flavor. When Fabián came to visit, he took me to Bright in Hackney, where I quickly became a habitué. The network added place after place to my daily rotation, and soon I had dining rooms across London.

Repetition makes the heart grow fonder. But so does adversity. When London locked down in March 2020, I had to learn to cook. My food was terrible, and restaurant friends saved me

again. Chase Lovecky, the chef at Two Lights, dropped off dumplings. James's new restaurant, Flor, run by Pam Yung, pivoted to takeaway pizzas—and I'd walk the 4-mile round trip again and again to pick up her magical pies. Their plump crusts were topped with ingredients as diverse as nduja, mozzarella, girolles, and zucchini, with green garlic mayo on the side or extra Cantabrian anchovies. Sorry, Joe's. Both Two Lights and Flor fell victim to the pandemic. It still breaks my heart they're gone.

But I rejoice that so many of my favorites survived. If it weren't for



Peas, lovage, and feta at Lyle's

them, I wouldn't have been able to stick it out in London. I've tasted both joy and bitterness with them. They're home to me.

A few weeks ago, I took a colleague from New York to Lyle's for dinner. A server came up to us and said to my friend, "You know who you're with, right? This is our most important VIP." I won't sugarcoat it: I teared up.

I have a gruff New York version of that, too. A decade ago, I was at Blue Hill in Manhattan when the chef and co-owner of another beloved restaurant walked in together. They sat diagonally across from me, and, immediately, one of them spotted me. "Howard, you slut!" she exclaimed. "You're seeing another restaurant." And then we all laughed. **B**

# Restaurants Learn to Live With Fewer Workers

By Justin Fox

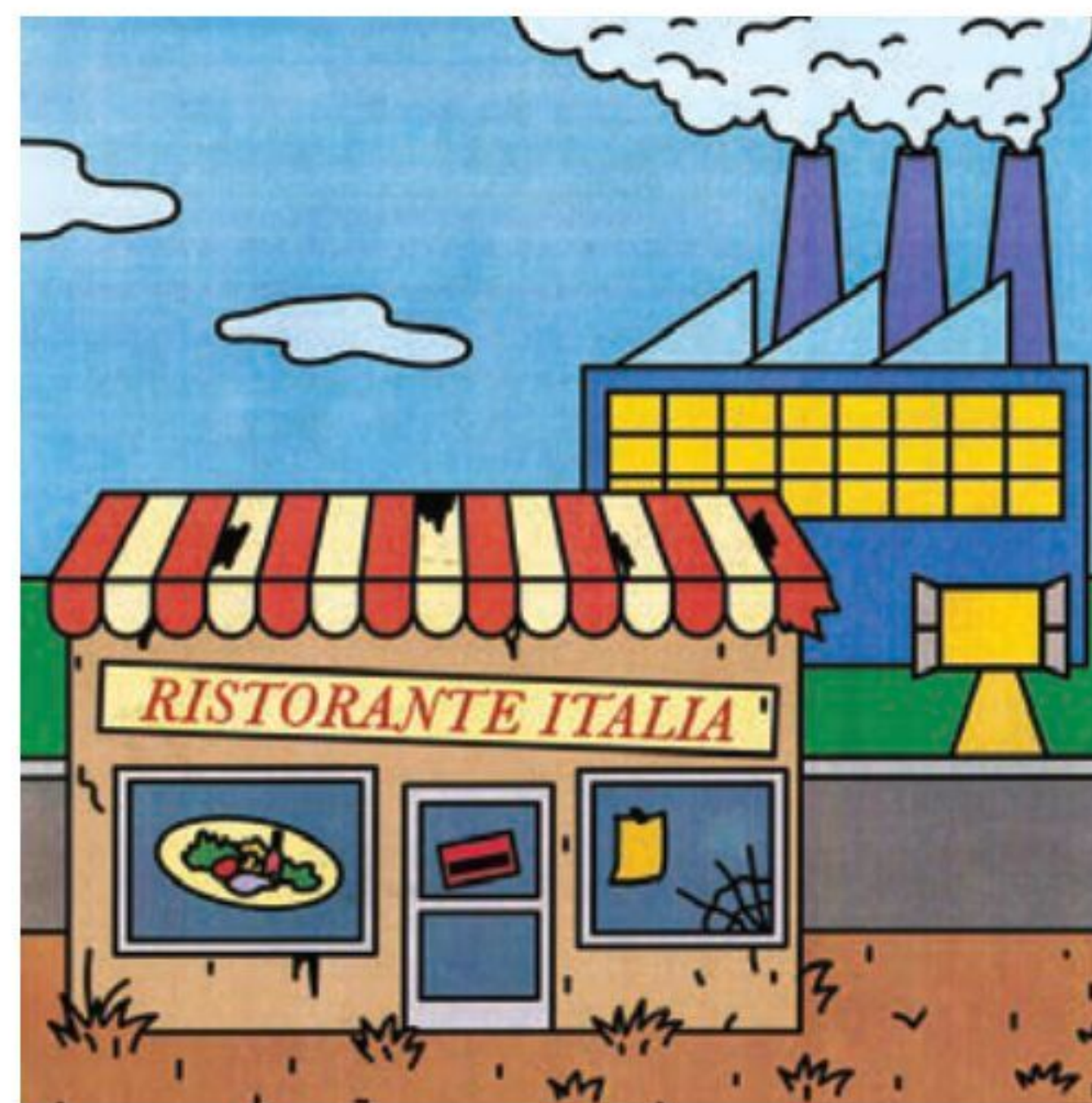
In 2017 food services and drinking places—government statistics lingo for restaurants and bars—were on the verge of overtaking manufacturers as an employer of Americans. In 1965 employment in manufacturing had been nine times that of food services, according to the US Bureau of Labor Statistics, so the looming switch felt like a landmark in the not entirely salutary transformation of the country’s economy in the previous half-century. As the *Atlantic* summed up in a headline, “Restaurants Are the New Factories.”

A manufacturing mini-resurgence in 2018 put off that day of reckoning, but by February 2020 the restaurant-factory gap was down to about 424,400 jobs and seemed sure to disappear during the next recession, given that downturns tend to hit manufacturing much harder than food services.

The Covid-19 slump was different, though, with restaurants and other in-person service providers bearing the brunt. Even now, with consumer spending on food services above where it was before the pandemic, the sector employs 6.4% fewer people. Its employment gap with manufacturing, 1.2 million jobs, actually widened a little in April.

With another, more conventional recession possibly in the offing, food services employment may still catch up. But perhaps not. Long accustomed to abundant cheap labor, restaurants were already adjusting to tighter labor markets before the pandemic and seem to have accelerated their transformation since. Automation is on the rise, as are new, less labor-intensive business models such as takeout-only “ghost kitchens.” Unionization in the industry is on the rise, too, albeit from a very low level.

Restaurants, in other words, are becoming a bit more like factories. **B** —*Fox is a columnist for Bloomberg Opinion*



● **LOW PAY**  
Average weekly pay at restaurants and bars was \$463.34 in April, compared with \$1,248.21 for manufacturing jobs.

● **VALUE GAP**  
Food services and drinking places contributed about

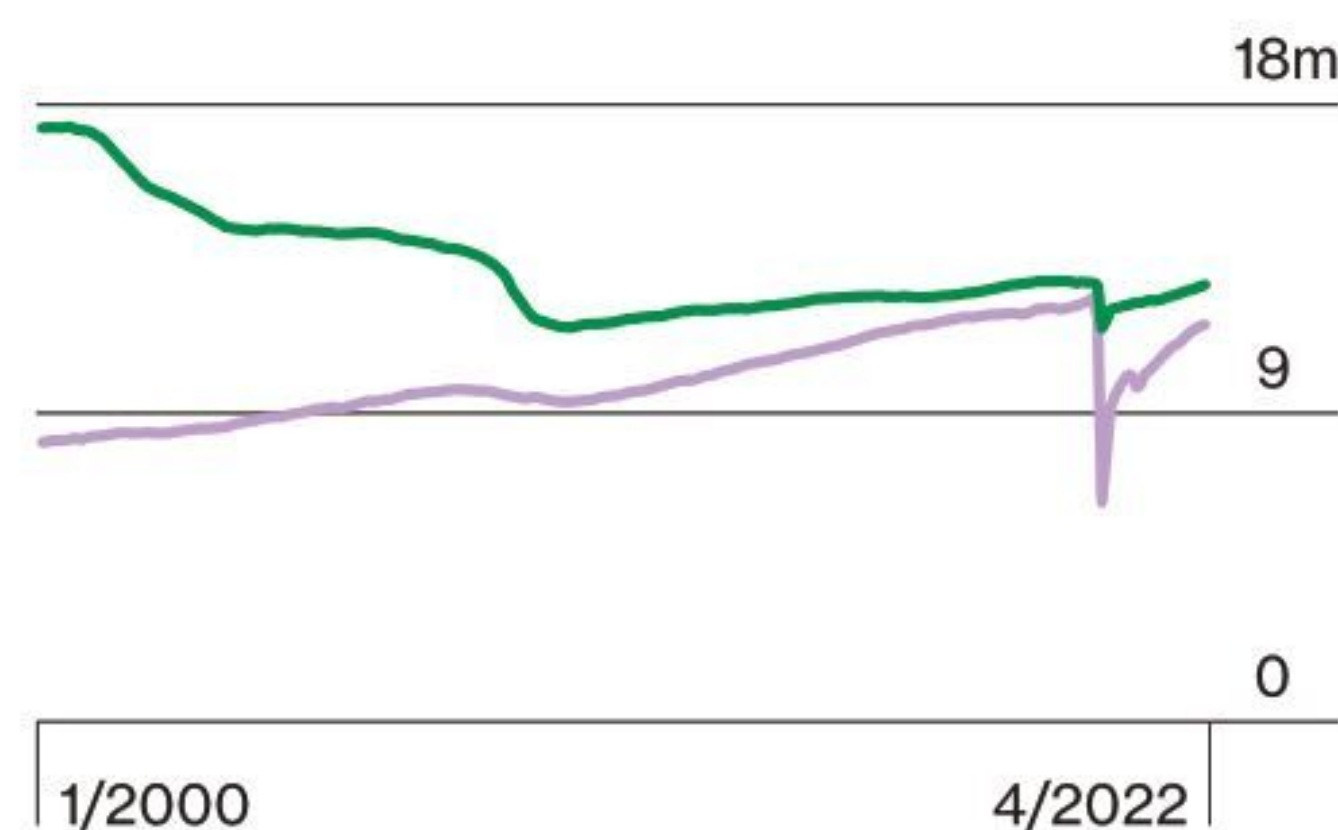
**2.1%**

of US GDP in 2021; manufacturing generated 11.1%.

● **EATING OUT AGAIN**  
Adjusted for inflation, consumer spending on food services was 4% higher in March than it was in February 2020, before the pandemic, according to the US Bureau of Economic Analysis.

● **US payroll employment, seasonally adjusted**

✓ Manufacturing  
✎ Food services and drinking places



● **DISUNION**  
Unions represented only 1.6% of employees at restaurants and bars in 2021, the lowest share of any industry. But that was up from 1.5% in 2020—even as the overall private-sector unionization rate declined from 7.2% to 7%.





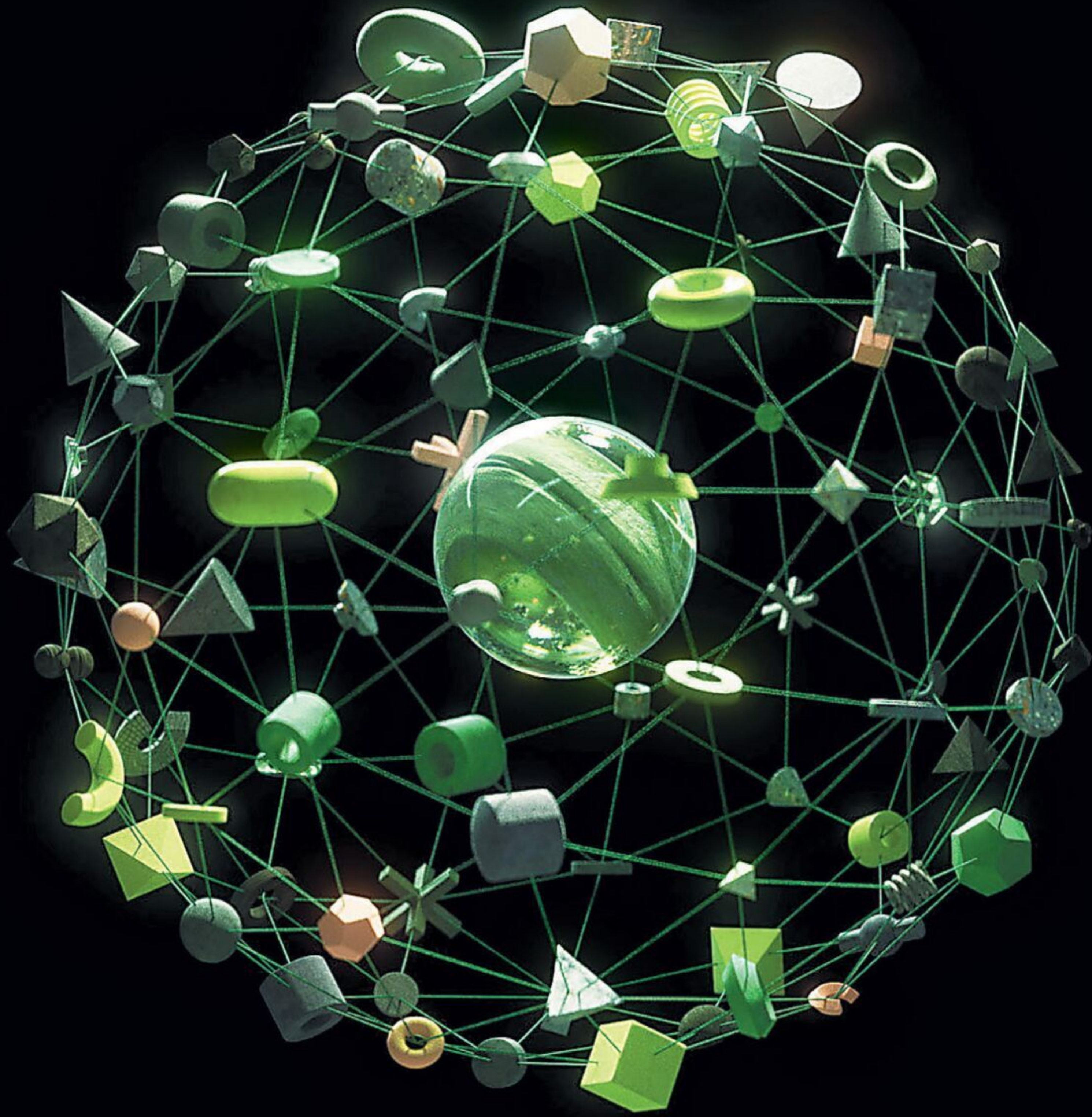
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