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Or are you?
An investing dilemma

p12

Retail Revolution

The trends and breakthroughs that will redefine tomorrow's shopping experience

Much of the publicity surrounding the online retail revolution paints a digital-first future with e-commerce at the fore, yet makes little mention about other important areas of progress that form a much larger picture of an industry undergoing change.

Why the Store Still Matters

Consider the brick-and-mortar store: Contrary to what many would think, in-store receipts accounted for close to 90 percent of total retail sales in the U.S. in 2016.

A research report compiled by Frost and Sullivan highlights two findings that help explain why physical retailing is far from dead. First, people tend to be more trusting of physical merchants, relative to e-commerce sites. Second, the ability to "handle" and "evaluate" a product with immediacy often "trumps a lower price" found online.

Brick-and-Mortar Sales Still Way Ahead of E-Commerce

U.S. Retail Sales (excluding Autos and Food) vs. eCommerce Sales ($ billion)

Source: U.S. Census Bureau, Bloomberg Intelligence

Trust in Shopping Experience

(Use of personal data)

Source: Stratecast

Against this backdrop, the debate for today's retailers, therefore, should no longer be about whether brick-and-mortar stores should be shuttered, but instead about how technological advancements can best leverage a store's real estate to enhance the shopping experience and build customer loyalty.

NEC Corporation, a leader in information and network technologies, is utilizing its core competencies in data analytics and artificial intelligence to help tomorrow's retailers stay ahead of the curve. Here are five breakthroughs poised to redefine the customer journey of the future:

Learn more: > www.bloomberg.com/ad/nec/retail

Trending: Artificial Intelligence in Retail

Elsewhere, machine-learning techniques, fueled by data, are advancing by the day and being tested in various applications across the retail sector to improve existing operational models.

Chatbots lie at the intersection where progress in artificial intelligence (AI) meets the realm of customer service. Already, these virtual assistants possess the required intelligence to help store employees act professionally and promptly—even if they are trainees—by providing insights to deal with any situation.

20.2%

Internet of Things Spending Growth In-Store Contextual Marketing 2017–2021

Source: IDC

AI could also hold the key to optimizing inventory so retailers avoid "overstock" or "understock" scenarios. NEC is capable of providing an optimal predictive formula at any scenario, which projects demand for items sold at stores.

If there's one takeaway to be had in retail in recent years, it's that the customer experience matters more than ever in this digital age. In the quest to compete with e-commerce sites, the prospect of delivering added value to shoppers should be good enough a reason for brick-and-mortar stores to integrate smarter technologies into their day-to-day operations. Knowledge is power, and analyzed data creates knowledge.

1 A Warm Welcome

Breakthrough #1: Smooth Entry

App, chip and swipe card readers used to retrieve a customer's profile will soon be a thing of the past. The technology to recognize customers by face and pull their purchase history simultaneously already exists, and can be deployed at a store's entrance to help shop associates know their customers before serving them.

Did You Know?

NEC's facial recognition technology is ranked No.1

by the U.S. National Institute of Standards and Technology (NIST) in accuracy and search speed.

2 Gauge Interest

Breakthrough #2: Facial and Video Analytics

Advancements in facial analytics now make it possible to gauge a customer's interest—or lack thereof—via gaze and expression, and to identify items customers were interested in but didn't purchase. By combining these insights with video analytics that track customer movements, retailers can pinpoint the best in-store locations to market different products.

3 Promotions With Appeal

Breakthrough #3: Optimum Promotional Services

Promotions may compel customers to buy, but whether they actually make the purchase depends on how well the items on sale cater to individual wants or needs. Facial recognition systems offer the ability to target discounts down to the individual, empowering retailers with a potent tool for upselling.

4 Auto "Add to Cart"

Breakthrough #4: Seamless Shopping

Sometimes, it can be hard to keep track of what's in a shopping cart, especially during frenzied events like Black Friday. With the aid of object recognition technology, the total sum is computed automatically each time an item is added or removed, which can be monitored via the shopper's smartphone.

5 Bypass the Register

Breakthrough #5: Automated Payment at Exit

Long queues at the cash register pose a threat to retailers in competitive markets, as they wear down patience and dent the overall shopping experience, which ultimately affects customer loyalty. To eliminate queuing, NEC has designed a face-authenticating solution that instantly executes payment when a preregistered customer leaves the store.

\Orchestrating a brighter world

NEC

▲ Juha Jarvinen, in Jurva, Finland, gets cash from the government—no questions asked—to indulge his whims

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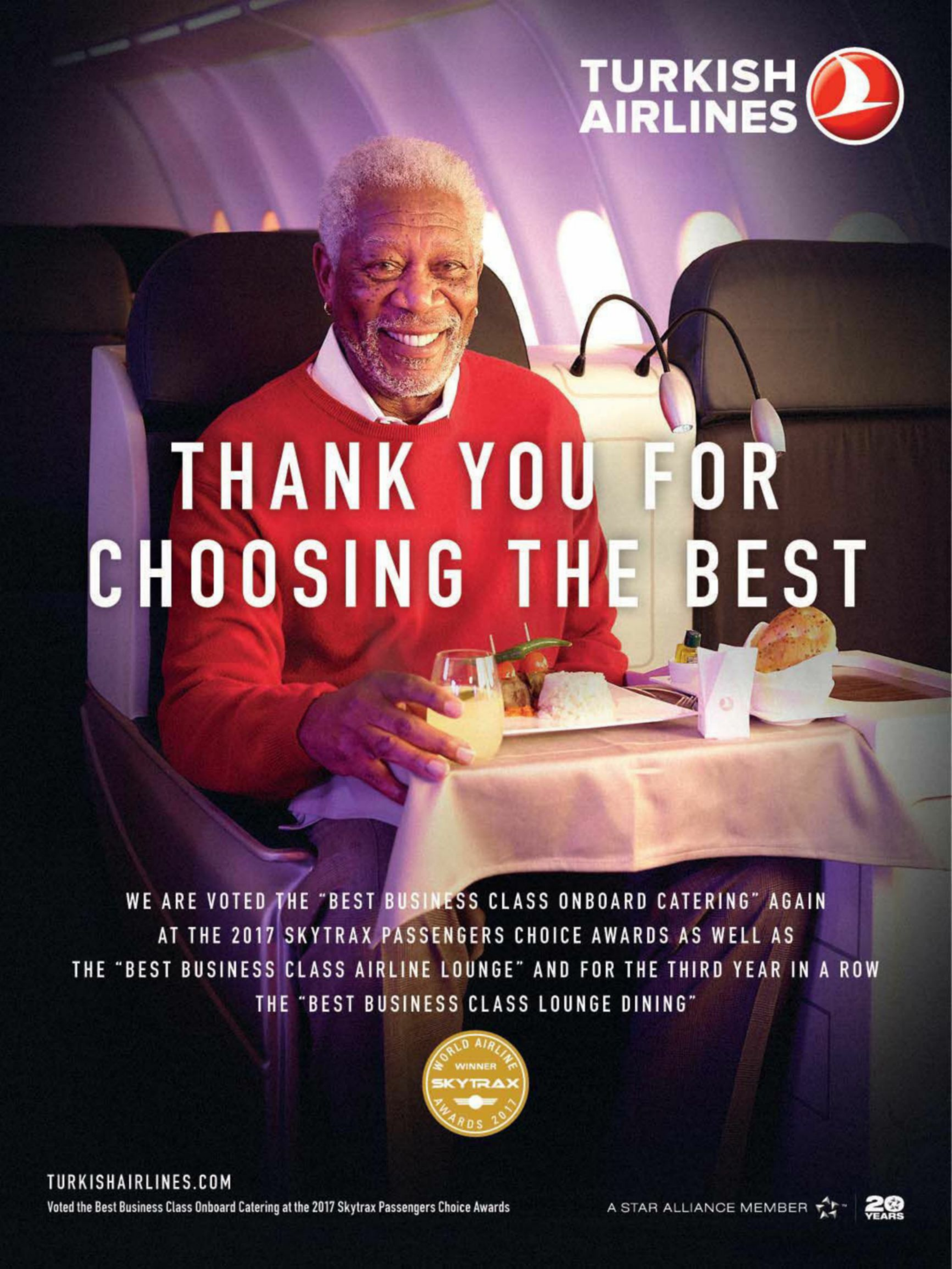
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Striving for Quality

As China's economy shifts gears, more value is being placed on quality of development than on rapid growth By Deng Yaqing

Two months after the conclusion of China's twice-a-decade national Party congress, in October 2017, the nation convened its most important annual economic meeting from December 18–20, and announced that the world's second-largest economy is entering a new phase of development, shifting its focus from high-speed growth to high-quality development.

Attended by President Xi Jinping, the General Secretary of the Central Committee of the Communist Party of China (CPC), the annual Central Economic Work Conference reviewed the nation's economic performance over the past five years, outlined current economic realities and made plans for 2018, which marks the 40th anniversary of China's reform and opening-up policy.

By declaring that the country's economy will be characterized by innovative manufacturing, a more open and green economy, a secure financial system, affordable housing and improved standards of living for the people, the conference mapped out a blueprint for China's development over the next 30 years and beyond.

Development philosophy

Over the past five years, Xi Jinping Thought on Socialist Economy with Chinese Characteristics for a New Era has taken shape, primarily based on the new development philosophy put forward by Xi in 2015 that features innovative, coordinated, green, open and shared development.

A statement released by the conference described this thought as the theoretical crystallization of the past five years of practice in pushing forward China's economic development, the spiritual wealth of the CPC and the country.

"Xi's concepts provide solutions for the deep-seated structural problems that China is facing and will face in the future over the course of economic and social development," said Wu Qi, a senior research fellow with Pangoal Institution, a Chinese public policy research body.

More specifically, Xi's thought provides answers on which actions to take, encompassing the continuation of supply-side structural reform and the pursuit of high-quality development, while clarifying how to achieve these goals through measures such as deepening the reform of economic institutions and administrative management systems, and expanding market access, said Wu.

A shift in focus

At present, as well as in the period to come, high-quality development is the fundamental factor that will determine China's future economic path, along with government policy and macroeconomic regulation, said the statement.

"When a person grows from a child into an adult, the standards used to assess his or her personal development are adjusted, adding indicators such as knowledge and work experience to the list including weight, height and health. In the same way, when a country reaches a certain development level, the mechanisms dominating its future growth should also be changed," said Jia Jinjing, Director of the Macro Research Department at Chongyang Institute for Financial Studies, Renmin University of China, in an interview with *Beijing Review*.

At the micro level, it means that people will be able to access higher-quality products and services, Xu Hongcai, Deputy Chief Economist of the China Center for International Economic Exchanges, told *Beijing Review*.

"People are no longer satisfied with just having the basics of food and clothing; they have higher requirements for the products and services they are exposed to in daily life. Given this, supply-side structural reform is inevitable," said Xu.

Xu added that inclusive growth and green development are the predominant features on the macro level of the shifting economy; the gap between the rich and poor has been widening, and the campaign to reduce poverty and improve the living standards of the low-income population is still an uphill struggle. In addition, China used to favor a development strategy of "getting rich first, cleaning up the environment later," which doesn't reflect the people's aspiration for a better life in the new era of sustainability.

The flipside of this shift in focus is that the traditional industries that have sustained China's economic miracle are slowing down, and new growth generators must now be discovered and nurtured, Sun Jie, a research fellow with the Institute of World Economics and Politics, under the Chinese Academy of Social Sciences, told *Beijing Review*.

Sun pointed to the extraordinary growth recently registered in e-commerce and advanced manufacturing, as well as the progress made in the reduction of excess capacity in traditional industries like mining, iron and steel. "Once structural optimization is accomplished, long-term growth will be in the cards," said Sun.

Jia echoes Sun's perspective on the changing engines of China's economy, and believes that new economic models and technological innovation will breed more growth. "For one thing, urbanization incubates new economic models, such as mobile payment systems and the sharing economy, which has significantly contributed to the momentum of China's growth in recent years. Additionally, technological innovation is becoming increasingly predominant in economic development, with its contribution to the economy standing at 56.2 percent in 2016 and expected to exceed 60 percent in 2020," said Jia.

Challenges ahead

The conference also saw China's central authorities outline the so-called "three tough battles"—three challenges of critical importance that must be addressed while striving to achieve high-quality development, namely the defusing of major risks, targeted poverty alleviation and tackling pollution. To guard against internal risks, China's rapidly expanding financial industry is being placed under greater

Technicians work at the plant of a nuclear power equipment manufacturer in Xuanhua, in north China's Hebei Province, on May 2, 2017

regulatory scrutiny as authorities step up efforts to curb widespread malfeasance in the sector.

"It's difficult to prevent and control financial risks. On the one hand, compared with the real economy, the financial industry is immaterial and intangible, while forces of leverage endow it with amplifying effects. On the other hand, as the lifeblood of the economy, it has a bearing on almost every link and aspect of economic work, and the eruption of financial risks may affect the entire economic situation," said Zhu Ning, Deputy Director of Shanghai Advanced Institute of Finance, Shanghai Jiao Tong University, in an interview with *Beijing Review*.

As to how to effectively control financial risks and curb related illegal activities, Zhu noted that a consciousness of risk should be nurtured in the market. "Chinese investors or companies tend to believe they don't have to bear losses because the government will pay for the failure of a project, which has led them to add leverage or speculate," said Zhu.

"Investors need to know they have to pay for taking risks, but the formation of such a consciousness will take a long time," added Zhu.

The conference statement also said that prudent monetary policy should remain neutral; the floodgates of monetary supply should be controlled; and credit and social financing should see reasonable growth.

"During the period of extensive economic expansion, simple expanded production and market expansion were thirsty for money, and gushing investment into plants and equipment could drive growth. But China has bidden farewell to this way of working, and now what matters most to a country that is pursuing high-quality growth is technology and talent, rather than monetary supply," said Sun.

As for the other two battles, Chinese policy makers have pledged to maintain the quality of poverty reduction efforts, and to focus on helping special groups in eradicating abject poverty. Efforts are also underway to significantly reduce pollutant emissions and to limit the environmental impact of further economic development.

Opening wider

In its role as a pivotal and stabilizing force within the global economy, China will push forward comprehensive opening-up, so as to pursue mutual benefits with the rest of the world, the statement said.

"Objectively speaking, China is the world's largest manufacturer and consumer market. Given its extensive connections with the rest of the world, it should play a leading role in promoting global growth, which will in turn drive the country to intensify its opening-up strategy, initiating another age of globalization," said Jia.

Since China has established itself as a frontrunner in certain industries, it now needs to mold global value chains and incorporate Chinese standards into the global market. To realize these goals, it's imperative for the country to open wider to the outside world and admit more players into its market system, said Jia.

According to the statement, China will increase imports and cut import tariffs on some products to promote balanced trade, while free-trade-zone pilot areas will be expanded, and effective guidance and support will be given to outbound direct investment. The country will also push for nationwide implementation of a pre-establishment national treatment system, as well as a negative list that determines where foreign participation is prohibited or limited.

"As a leader and promoter of globalization, China has stuck to an open attitude toward both foreign investors who seek opportunities here and Chinese enterprises that hope to go abroad," said Zhu. "However, it is a long and continuous process. Over the course of the coming years, China must factor risk control and the demands of its partner nations into its own opening-up arrangements." ■

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Asia

● China ordered local governments to crack down on bitcoin miners, urging them to make an "orderly exit" from the cryptocurrency craze.

● Iranian security forces arrested almost 4,000 protesters and blocked access to social networks, as demonstrations over the country's economy and human rights record reached a head. At least 21 people have been killed in clashes with police.

● "It wouldn't be an exaggeration to say that inter-Korean relations have been frozen more than the natural weather."

North Korean negotiator Ri Son Gwon opened talks with South Korean officials with a joke about the freezing temperatures outside. In the course of the daylong meeting, North Korea said it would send a delegation to the Olympics in Pyeongchang, and the two nations issued a joint statement promising further high-level communications.

● A heat wave in Australia pushed temperatures in Sydney up to 117F on Jan. 7, the highest recorded since 1939.

● Senior officials in Beijing suggested China should slow or halt its decades-long campaign of buying U.S. Treasuries, spooking the bond market. Analysts say the shift could be a warning shot against U.S. diplomats' tough talk on trade.

Americas

● Steve Bannon resigned as executive chairman of Breitbart News.

Abandoned by allies, including former patron and Trump backer Rebekah Mercer, the onetime White House chief strategist has been under siege from the far right since his disparaging remarks about the Trump family appeared in excerpts from the book *Fire and Fury* by Michael Wolff.

● GoPro said it would lay off 1 in 5 workers and stop production on its fledgling drone as the company struggles to compete with smartphone makers—and its own older products.

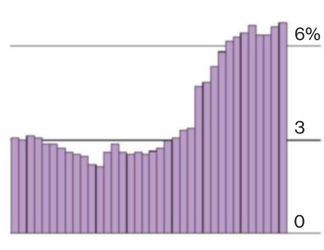
● A U.S. district judge ruled on Jan. 9 that Deferred Action for Childhood Arrivals (DACA) must stay in place, pending the result of a suit challenging the president's decision to end the program. Earlier that day, Trump appeared to endorse a path to citizenship in a bipartisan meeting with legislators.

● The Trump administration withdrew immigration protections from about 200,000 Salvadorans.

The move is part of a larger review of the Temporary Protected Status program, which has already resulted in the planned expulsion of migrants from Haiti, Nicaragua, and Sudan.

● Inflation in Mexico hit a 17-year high in December, with consumer prices up almost 7 percent from the year-earlier period.

Mexico consumer price index, year-over-year change



● Microsoft announced that software updates to protect against the security vulnerabilities known as Meltdown and Spectre, present in all Intel processors, will significantly slow operating speeds. Apple has said that, while its products are also affected, the fixes won't affect users.

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Europe

● Switzerland's central bank posted a record

$55b

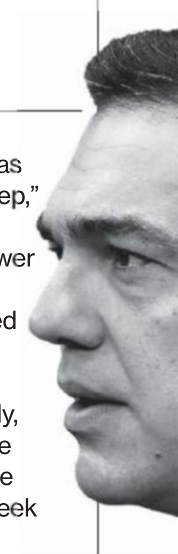
in profit last year. Most of its assets are in foreign currencies, which rose in value vs. the Swiss franc.

● German auto supplier Continental is exploring a breakup of its $60 billion empire.

● Aston Martin hopes to raise as much as

$6.8b

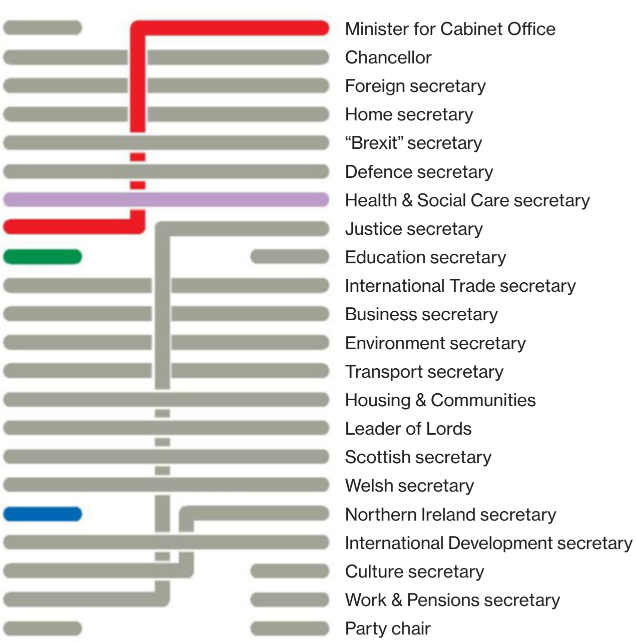
in an IPO, according to people familiar with the matter. The sports car maker, which sold more than 5,000 vehicles last year for the first time since 2008, will base its value in part on that of its rival Ferrari.



● In what prime minister Alexis Tsipras called an "historic step," Greece's parliament voted to limit the power of Sharia, or Islamic law, which has applied to Muslim citizens in matters of marriage, divorce, child custody, and inheritance since the partitioning of the Ottoman Empire. Greek Muslims can now choose to seek justice in secular courts.

● U.K. Northern Ireland Secretary James Brokenshire resigned for health reasons on Jan. 8, the beginning of what turned into an awkward reorganizing of Prime Minister Theresa May's cabinet. Health Secretary Jeremy Hunt resisted moving to Business and was eventually allowed to keep his post, while Education Secretary Justine Greening quit after refusing to take over Work and Pensions. Justice Secretary David Lidington was elevated to Cabinet Office minister, replacing Damien Green, who left in December after a pornography scandal.

May's Cabinet Reshuffle



Africa

● Two giant diamonds, each bigger than 100 carats, were discovered by Gem Diamonds in its Lesotho mine on Jan. 8. The find pushed the company's stock price up 8 percent.

● In a move widely seen as an attempt to quell calls for his resignation,

South African President Jacob Zuma agreed to a probe of his government's dealings with the powerful Gupta family.

● Parts of the Sahara in Algeria were buried in as much as 15 inches of snow.

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● The market's momentum is tempting. But it's not all about the economy—and that's scary

● By Michael P. Regan

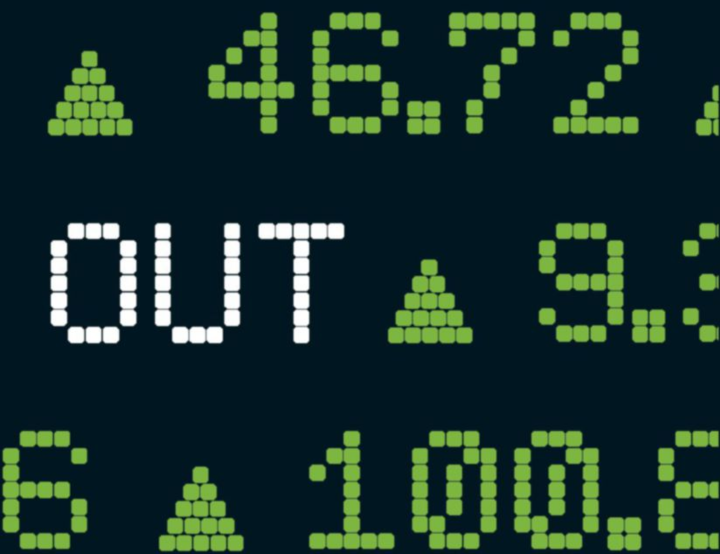
Make no mistake, fear is running amok on Wall Street these days—fear of missing out.

As the S&P 500 got off to its best start to a year since 1999 and the Dow Jones industrial average topped 25,000, it's clear that fear of missing out—FOMO—has jumped to the top of the fear charts with a bullet. It's risen above worries about North Korea's "Rocket Man" and the unpredictable U.S. president who revels in provoking him. It's blown past lingering concerns about the European Union coming apart at the seams. It's even eclipsing the most popular talking point of fear merchants everywhere: marketwide valuations that in many cases are approaching the highest they've ever been.

Is this such a bad thing? Maybe yes, probably no. Unlike other FOMO-driven rallies of the distant and not-so-distant past—from Dutch tulip bulbs in the 1600s to dot-com stocks at the turn of the last century to the Great Bitcoin Craze of 2017—there's little debate that there will be something legitimate to miss out on in the stock market in the near term, rather than the hazy distant future.

Forget about the economy. The massive tax cuts President Trump signed into law on Dec. 22 will probably boost gross domestic product growth by a few tenths of a percentage point, but that's not what investors are excited about. As economists gently inch up GDP estimates, equities strategists may find themselves stepping over one another to jack up their forecasts of different parameters: the benefits to corporate profits, the subsequent cash returns to shareholders, a return of confidence and greed to the collective investor psyche—and good ol' FOMO. The wholesale dismantling of Obama-era regulations adds a hard-to-quantify, but real, fuel to the fire.

The average estimate of strategists surveyed by Bloomberg on Jan. 8 is for the S&P to end just below 2,900 by next New Year's Eve. If the rally continues at anywhere near the breakneck pace with which it started the year—up almost 3 percent in the first four sessions of 2018—it will hit that yearend forecast before Groundhog Day. Some



MELT-UP?

measures of upward momentum in the market are at the highest in half a century or more, and often the strong momentum generates more strong momentum.

When price gains get downright ridiculous, it's referred to on Wall Street as a "melt-up," perhaps because these self-perpetuating rallies tend to be followed by meltdowns. This is the uncomfortable prospect that many investors are contemplating. For those of us old enough to remember the dot-com boom and bust, it's tempting to assume the market will never become that irrationally exuberant again. Of course, many current market participants were in grammar school then. Old-timers need to consider that the market's collective memory may be shorter than their own.

Jeremy Grantham, co-founder and chief investment strategist of asset manager GMO LLC in Boston, who's been following markets for five decades, is an old-fashioned value investor who finds himself in the "interesting position" of looking beyond valuation metrics, instead studying previous melt-ups to try to figure out how long the current party will last. The takeaway, by his analysis, is that the S&P 500 would need to surge as high as 3,700, or 34 percent, in 18 months to qualify as even the tamest "classic bubble event" in history.

Grantham defines a bubble as having "excellent fundamentals, euphorically extrapolated." His description is sounding more familiar every day. Earnings growth for S&P 500 companies is forecast to accelerate to almost 15 percent in 2018, according to estimates compiled by Bloomberg. Economic indicators are strong and beating estimates; the average GDP forecast for 2018 has risen to 2.6 percent, from 2.1 percent on Election Day 2016. Credit markets are healthy. Business, consumer, and investor confidence is off the charts.

Yet most of the measures investors use to evaluate stocks are dizzying. The S&P 500 trades at 2.3 times its companies' sales, a hair below its dot-com peak. Price-earnings ratios are also sky-high: Goldman Sachs Group Inc. estimates the median stock in the index has been more richly valued for only about 1 percent of the benchmark gauge's history. What's known as the cyclically adjusted p-e (CAPE) ratio, at more than 33, is above its level before the crash of 1929—indeed, it's higher than at any moment in history, excluding the dot-com debacle.

Some of these valuations can be explained away, for those willing to try. The CAPE ratio, often called the Shiller p-e after Yale economist Robert Shiller, uses 10 years of earnings in its calculations. Considering the decimation of profits during the financial crisis, the calendar alone will pull that valuation metric lower as the catastrophic years of 2008 and 2009 drop out of the math. Another standard, known as the PEG ratio, used by investors such as Fidelity Magellan Fund legend Peter Lynch, divides p-e ratios by expected profit growth. The current PEG of 1.4 is above average but well below a record of more than 1.7 in early 2016.

"Yes, markets are arguably expensive by history, but this environment of accelerating not only earnings but also economic strength is what's catching the market's attention right now," John Augustine, chief investment officer for Huntington Private Bank in Columbus, Ohio, recently told Bloomberg.

It's hard to know to what degree stock prices already reflect the benefits investors expect from tax reform. Goldman Sachs's basket of companies with high tax rates has outperformed low-tax stocks by almost 10 percentage points since the middle of October. But taxes are complicated, and there could well be more positive than negative surprises as the details are sorted out. Consider the $37 billion boost to book value that Barclays Plc analysts estimate Warren Buffett's Berkshire Hathaway Inc. will enjoy because of reduced tax liability on its appreciated investments.

Yes, 2018 will probably see more complaints that tax reform didn't benefit the little guy as much as it could have. Yes, there will be complaints about how much of the ▶

◀ windfall is spent on share buybacks, dividend increases, and mergers and acquisitions. Yes, there will be complaints about the eventual consequences of a swelling federal budget deficit and the massive, business-friendly deregulation under way. These are worthy, important topics for society to debate. The stock market, though, is all id and no superego, and most CEOs will continue to abide by its demands to reward shareholders first and foremost.

Stocks are always risky, and euphoric rallies like this may be the riskiest. How long FOMO reigns at the top of the fear charts is anyone's guess. Tax cuts may overheat the economy, finally lighting the inflationary fuse and pushing interest rates higher quickly enough to induce a recession. There's also a "live by America First, die by America First" concern that's worth considering if Trump's protectionist trade policies provoke retaliatory responses from trading partners.

Two recent reports out of China highlight this risk. What may sound like a minor tweak in the way Beijing fixes its exchange rate created big ripples in the currency markets—and stocks don't often react well to big ripples in other markets. Many traders took the exchange rate tweak as a signal that the People's Bank of China wasn't pleased that the yuan had strengthened 7 percent against the dollar since the election of Trump, whose platform included harsh rhetoric about China keeping its currency weak. The following day, on Jan. 10, Bloomberg reported that senior officials in Beijing were recommending the nation slow or halt purchases of U.S. Treasuries, sending 10-year yields to their highest level since March and causing a rare weak open in the stock market.

In the near term, there's a risk that the coming earnings season will result in corporate outlooks that aren't quite as euphoric as the share-price gains that preceded them. And we'll probably spend another year worrying if we're one tweet away from nuclear war, or one Robert Mueller indictment or midterm election away from impeachment proceedings that will paralyze Washington.

For now, FOMO is the biggest fear investors need to grapple with. That could change quickly, and anyone with the gumption to think they can time the market will need to be on alert. Fear, like love, has inspired much great work—and a lot of mediocre results—from poets and investors alike. For investors, the best advice about today's market comes from the 19th century poet Ralph Waldo Emerson: "In skating over thin ice our safety is in our speed." *—With Lu Wang*

■ VIEW

To read Leonid Bershidsky on calling Britain's Brexit bluff and Jonathan Bernstein on the Democrats' election strategy, go to Bloombergview.com

Britain's Unavoidable Health-Care Choice

● Low taxes or free, high-quality medical services: The country has to pick one

Can a relatively low-tax country run a high-quality, taxpayer-funded health service that's free to all? A look at Britain's National Health Service suggests the answer is no.

The NHS is good at some things but bad, bordering on disastrous, at others. Its great virtue is truly universal coverage, no questions asked—and by international standards, the system is also cheap to run. As a result, though, it's perpetually short of money, and the service is erratic. Today the NHS is yet again dealing with a financial crisis and a surge of complaints about standards.

Prime Minister Theresa May has had to apologize to patients for a winter breakdown that's seen operations postponed and emergency room waiting times rise well over the promised four-hour maximum. That comes a year after the British Red Cross said the NHS was on the verge of a "humanitarian crisis."

The health service's problems—too many patients and not enough staff—aren't seasonal. Britain's population is growing and getting older, and as medicine advances, treatments become more sophisticated and expensive.

Many years of meager funding are taking their toll. The U.K. has fewer doctors, CT scanners, and MRI units per capita than most European Union countries, and it ranks toward the bottom of the league on infant mortality. Other universal-coverage systems score better on avoidable deaths, cancer survival, innovation, consistency of service, and other measures. Long waiting times for some non-urgent treatments are leading more patients, many suffering from chronic pain, to tap savings or borrow for private treatment.

Granted, more money by itself won't cure the system. One former head of the Treasury called the NHS a "bottomless pit." Even so, bearing in mind how little the NHS costs, more money is surely part of the answer, as long as it's combined with efforts to run the system more efficiently. For instance, social care for the elderly and other groups hasn't kept pace with what's required, placing an added burden on more costly medical professionals. Fixing that kind of misallocation would improve the system's value for money spent.

The public's devotion to the NHS's underlying principle is undiminished: The British see health care as a right. Increasingly, though, they're also demanding higher standards of care, and those come at a price. Taxpayers must either dig deeper to maintain the current service—deeper still to improve it—or accept that the NHS will continue to disappoint.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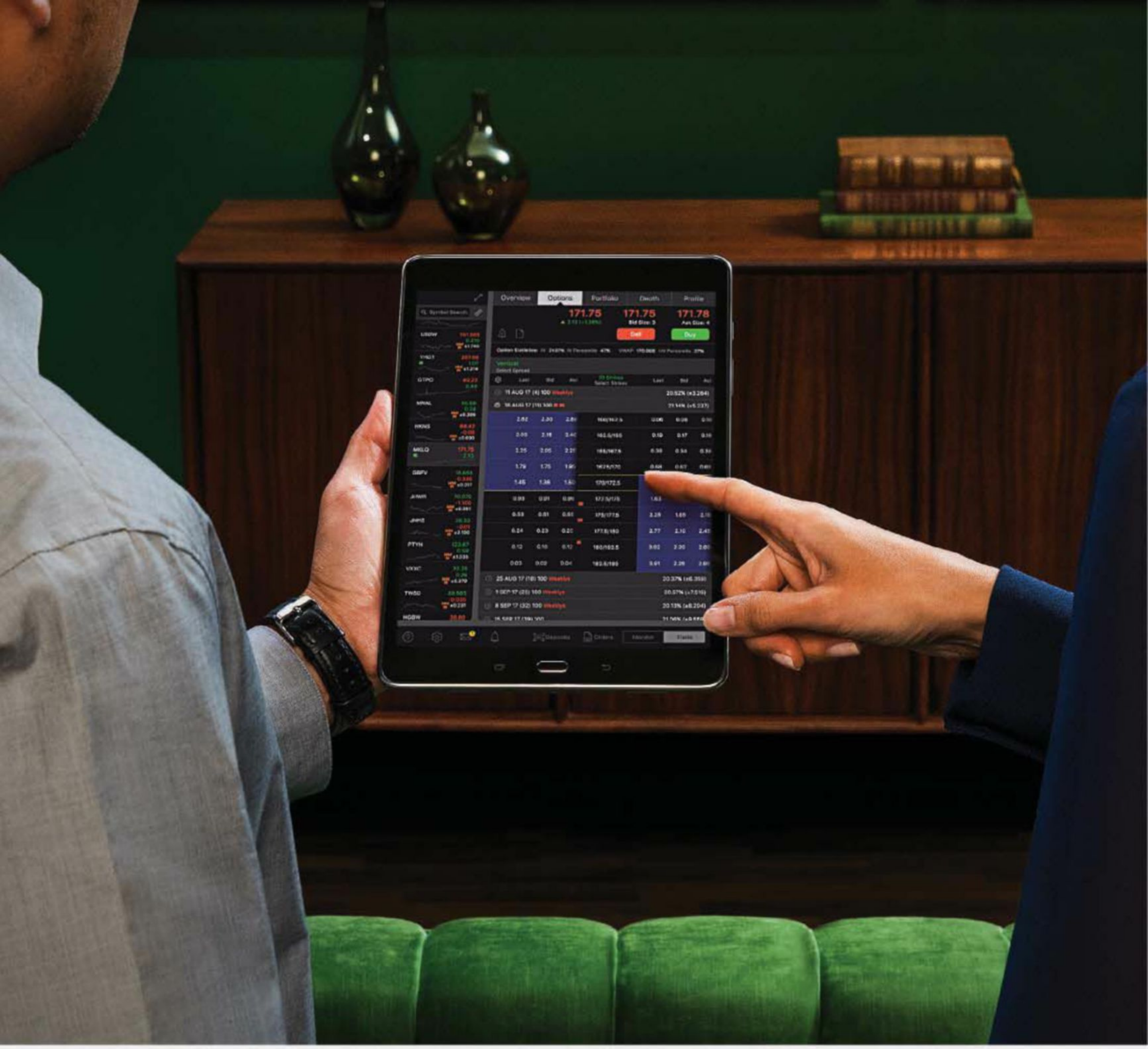
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● The North American International Auto Show, the industry's key U.S. exhibition, begins in Detroit

● Drugstore operator Walgreens Boots Alliance holds its annual meeting on Jan. 17 in Scottsdale, Ariz.

● Schlumberger on Jan. 18 reports fourth-quarter earnings, providing a window on the oil and gas recovery

Sloooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooooowest  Rollout Ever

The production increase for Tesla's lower-priced Model 3 is way behind schedule—and it just got pushed back another three months

When Elon Musk first unveiled the Tesla Model 3 sedan in March 2016, consumers stood in long lines at showrooms to place $1,000 deposits, giving Musk an iPhone moment unprecedented in the auto industry. When people stand in line at an Apple Store, they typically walk away with a new phone; the all-electric Model 3 had yet to be built.

Overwhelming demand inspired Musk to announce in a May 2016 letter to shareholders that he was advancing Tesla Inc.'s production plans by two years: It would build a total of half a million cars annually by the end of 2018, rather than 2020—a fivefold production boost in just two years. For Tesla, which had no experience manufacturing cars in high volume, the already steep production learning curve suddenly looked like a hockey stick. "We are hellbent on becoming the best manufacturer on Earth," Musk said during its May 4, 2016, earnings call. When asked how many Model 3 sedans Tesla expected to make, Musk said "100,000 to 200,000" in the second half of 2017.

Musk has had to walk back those audacious production goals again and again. While Tesla made about 101,000 cars in total in 2017, it delivered only 1,770 Model 3 sedans to buyers in the year's second half. In August, Tesla said it expected to achieve a manufacturing rate of 5,000 Model 3 vehicles a week by the end of the year. In November the company backpedaled, saying it would hit 5,000 units a week in late March 2018, citing "production bottlenecks," primarily at its mammoth battery plant in Nevada, known as Gigafactory 1. Musk conducted that earnings call from the Gigafactory, saying he was on the "front lines" of production hell.

With Model 3s rolling off the production line so slowly, manufacturing half a million cars in 2018 appears highly unlikely. And the slow pace is raising questions among investors about ▶

TROY HARVEY/BLOOMBERG

January 15, 2018

Edited by James E. Ellis

Businessweek.com

◀ whether Tesla will be forced to raise more cash. Meanwhile, many consumers who have been waiting for their car for almost two years will have to wait even longer. “I have no idea what’s going on behind the scenes,” says Michelle Krebs, director of automotive relations at Cox Automotive. “They vastly underestimated how challenging it is to mass-produce vehicles, and quality should be their focus. Tesla needs to stop promising what they can’t deliver.”

On Jan. 3, Tesla delayed the production goal by yet another quarter, saying in a statement that it now expects to hit 5,000 units a week by the end of June, with a “focus on quality and efficiency rather than simply pushing for the highest possible volume in the shortest period of time.”

Concentrating on quality makes sense for the carmaker. “While Tesla’s repeated guidance revisions could begin to risk damaging its elite brand, a mass-recall would probably be far more damaging,” wrote analyst Romit Shah of Nomura Instinet in a note to clients. Still, the continued delays give rivals more time to chip away at buzz-driven Tesla’s reputation as the preeminent EV maker.

The Model 3, which starts at $35,000 before options or incentives, is Tesla’s effort to bring an affordable electric car to the masses. But the coveted $7,500 federal EV tax credit will be out of reach for some Model 3 reservation holders. Under existing law, the tax credit starts to phase out once an automaker sells a total of 200,000 electric or plug-in hybrid vehicles in the U.S.—a number Tesla is expected to hit this year. So the longer mass production of the Model 3 is delayed, the more likely it is that tax credits will be used up by purchasers of Tesla’s more-expensive Model S sedan or Model X SUV instead.

“We’re very grateful to everyone at Tesla who has poured their heart and soul into helping with the Model 3 ramp and creating the progress we are seeing,” Tesla said in its Jan. 3 press release. “We’re also very appreciative of our Model 3 customers, who continue to stick by us while patiently waiting for their cars.”

Musk has a habit of setting aggressive goals and then not meeting them. Tesla struggled mightily with production snags involving the seats and falcon wing doors of the Model X. Some investors are used to its history of missed deadlines and say that, in the long run, a quarter or two delay doesn’t really matter. Tesla’s stock surged 43 percent in 2017, despite the factory setbacks.

But it’s clear that lately the automaker’s been more skilled at marketing than manufacturing. “The materially missed launch cadence could be the result of too optimistic assumptions on the company’s part as regards the ease of manufacturing the Model 3,” wrote JPMorgan Securities analyst Ryan Brinkman in a note to clients. “The highly (over?) engineered Model X has been held up even by management as having not been designed for manufacturing, and the Model 3 was to mark a marked departure in terms of its ease of assembly.”

The delays have fueled speculation that Tesla will need to raise more capital soon. Brian Johnson, an analyst at Barclays Capital, projects that Tesla will burn through $4.2 billion this year and assumes the company will raise $2.5 billion in an equity offering, probably during the third quarter. Tesla ended September with about $3.5 billion in cash and projected an additional $1 billion in capital expenditures during the last three months of 2017. The production delays also may defer some spending, says Cowen & Co. analyst Jeffrey Osborne.

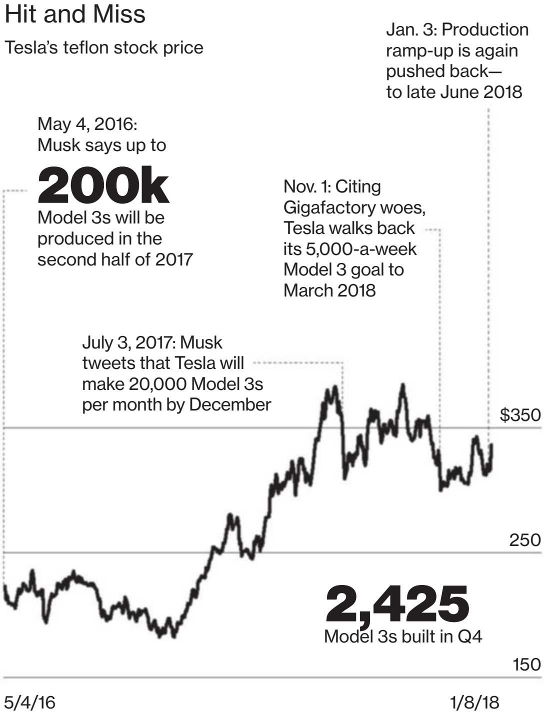
Still, Tesla has increased its deliveries of Model 3s in recent weeks. That, plus the fact that Musk visited Chile over the holidays, was a sign to some investors that the worst is over. “The production hell is behind them,” says Ross Gerber, chief executive officer of Gerber Kawasaki Wealth & Investment Management. “Clearly if Elon was not getting the cars off the line, he would be sleeping at the factory again.” —*Dana Hull*

THE BOTTOM LINE Tesla pushed back its production timetable for the Model 3 sedan yet again in early January—the latest sign of the carmaker’s difficulties adjusting to high-volume manufacturing.

“They vastly under-estimated how challenging it is to mass-produce vehicles”

Hit and Miss

Tesla’s teflon stock price



DATA: COMPILED BY BLOOMBERG

Will Amazon Give Cosmetics a Makeover?

● It's become the biggest seller of beauty products online. But upscale brands worry about its lack of cachet

For beauty companies, image is everything. For Amazon.com Inc.—which made a name for itself based on assortment, price, and speedy delivery—not so much. In fact, some beauty brands see the internet giant's way of doing business as an affront to glamour itself. With its utilitarian website—a scroll of endless products on white backgrounds—Amazon doesn't carry the prestige that companies such as Estée Lauder Cos. and Coty Inc. want for their premium brands. The cosmetics makers have instead focused on their own sites and retailers where they can tightly control presentation and pricing.

Yet with Amazon expanding into every corner of retailing, these brands may have to reverse that strategy quickly—or risk losing a high-growth opportunity that could offset declining foot traffic at physical stores. They also could boost profits by selling through Amazon, because the online retailer takes less of a cut on many sales than some department stores and specialty retailers, according to Becca Edelman, a senior beauty research associate at digital marketing company L2 Inc. "Amazon has established itself as a major player in the beauty market," she says. "It has a growth channel offering much bigger margins than brands would otherwise have."

Amazon has quietly become the largest online beauty retailer in the U.S., with 21 percent of the market, according to analysis company 1010Data. Its expansion has encroached on specialty retailers, but most of the products sold are still mass-market brands, such as Clairol or CoverGirl, as well as young independent labels, rather than pricier premium goods. That's largely because many cosmetics companies are concerned that putting their upscale lines on Amazon would lessen their cachet.

Brands have fought hard to keep their sales channels limited. The European Union's top court ruled last month that luxury-goods companies, including Coty, aren't violating antitrust rules by restricting where their products can be sold. "The quality of luxury goods is not simply the result of their material characteristics but also of the allure and prestigious image which bestow on them an aura of luxury," the EU judges said in the case. "An impairment to that aura of luxury is likely to affect the actual quality of those goods."

Such thinking is one reason Estée Lauder has no plan to sell on Amazon—at least through June—Chief Executive Officer Fabrizio Freda said last year. Coty CEO Camillo Pane said in a November interview that although Amazon is "an important partner" and represents a "massive" opportunity for the company's lower-priced brands, its luxury lines are bound by more selective distribution agreements. Coty and Estée Lauder declined to comment further.

Premium retailer Sephora has gone as far as dropping some prestige cosmetics that started selling on Amazon, Edelman says. Sephora, owned by Paris-based LVMH, declined to comment.

Nonetheless, Amazon is pushing forward: It signed a deal with online retailer Violet Grey for access to a set of luxury brands, according to *Women's Wear Daily*. It also offers a monthly luxury beauty sample box and is testing a two-hour delivery program in Dallas with retailer Sally Beauty Holdings Inc.

In an email, Amazon said it is "uniquely positioned" to innovate in the beauty market. It's ▶

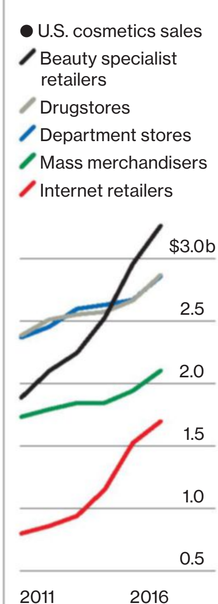


ILLUSTRATION BY 731; DATA: EUROMONITOR

◀ been working with luxury brands "to make sure their products are presented in an optimal environment," including enhanced images, more product details, and expanded editorial content. Amazon has created specialized sections for luxury beauty products on its website and also a separate section for salon, spa, and dermatology goods. These so-called storefronts help customers discover new products, the company said.

Amazon's move comes as beauty companies are adjusting to lower foot traffic at department stores, and pharmacy chains such as CVS Health Corp. have reported stagnating sales of retail merchandise. In response, Estée Lauder has invested in website improvements and expanded its selection sold at Sephora and Ulta Beauty Inc., which specialize in beauty products.

Mass and premium products are increasingly being sold side by side at shops such as Ulta—something once unthinkable in an industry that prizes exclusivity. Now, specialty retailers are one of Estée Lauder's fastest-growing distribution channels, accounting for 11 percent of total sales.

Even so, Amazon's history of quickly becoming a force in new retail categories suggests that cosmetics makers will have to contend with it sooner or later, says Stephan Kanlian, chairman of the master's degree program in cosmetics and fragrance marketing at the Fashion Institute of Technology in New York.

Some luxury brands have embraced Amazon's platform. Revlon Inc. says it has sold its line of Elizabeth Arden Inc. products on Amazon since late 2016. And Anastasia Beverly Hills, the eyebrow specialist that's attracted 15 million Instagram followers with its list of Hollywood celebrity clients, has gone on Amazon to improve its margins, while continuing to handle its own customer service inquiries, L2's Edelman says. The company declined to comment on its relationship with Amazon.

Tmall, the Chinese online retailer operated by Alibaba Group Holding Ltd., sidesteps the control issue by letting Estée Lauder customize its section of the website. "The reality today is we only sell on platforms where we control our assets, our virtual store," Freda said in November.

FIT's Kanlian says cosmetics companies might not have that luxury for much longer, given Amazon's retailing heft. "The drumbeat becomes louder, louder, and louder until the point that it is inevitable—because the business is there," he says. "The consumer traffic is there." —*Stephanie Wong*

THE BOTTOM LINE Amazon has won 21 percent of online cosmetics sales, putting pressure on beauty brands that want to restrict the sales of their products to upscale channels.

Ikea Tries Breaking Out of the Big Box

● As fewer young buyers head to its suburban warehouses, it's opening smaller stores and services closer to urban customers

Whether in San Diego, Novosibirsk, or Tokyo, the Ikea experience is nearly as standardized as its flat packs. The blue-and-yellow big box, the vast showroom maze, the Swedish meatballs in the cafeteria—this formula propelled Ikea to global No. 1 in furniture retailing, with €38.3 billion ($45.7 billion) in sales and more than 400 stores in 49 countries.

There are no meatballs in Ikea's newest London outlet, part of a shopping mall in an urban neighborhood near the 2012 Olympics complex. One of two dozen small-scale stores that Ikea has opened since 2015, it measures only 900 square meters (9,688 square feet), while the typical suburban Ikea is almost 30 times that size. It has a few model rooms fitted out with furniture and accessories, but hardly anything can be purchased and taken home immediately. Instead, shoppers use touchscreen computers to place orders and arrange for delivery or pickup later.

Even Ikea's trademark do-it-yourself ritual is optional: Customers can request in-home help assembling that Billy bookcase from TaskRabbit, a San Francisco-based startup Ikea recently acquired. Ikea is trying to future-proof itself with these initiatives, along with others including pop-up stores and an expansion of its e-commerce footprint. "We will test and try to develop a new world of Ikea," says Ikea Chief Executive Officer Jesper Brodin. "It's a revolutionary speed that we're taking on right now."

● Brodin

Ikea can't afford to move slowly. Foot traffic at traditional Ikea stores has been stagnant for most of the past five years, as young people—long its core customers—cluster in big cities, drive less, and do more of their shopping online.

"The entire premise that Ikea developed was that consumers would be willing to drive their cars 50 kilometers to save some money on something that looks amazing," says Kantar Retail analyst Ray Gaul. "Young people like Ikea, but they can't or don't want to drive to Ikea. Ikea has no choice but to invest in better services."

Ikea also is scrambling to catch up in e-commerce. Online sales of furniture and appliances worldwide are expected to grow almost 12 percent annually over the next three years, outpacing more-established web shopping categories such as consumer electronics, according to data analytics group Statista. Yet Ikea currently offers online sales in only half the markets where it operates, according to Bloomberg Intelligence.

Ikea is battling aggressive competitors such as Wayfair Inc., a Boston-based home-furnishings e-tailer founded in 2011 that now does more than $4 billion in sales across the U.S. and Europe. Amazon.com last fall launched its own furniture lines, including a mid-century-modern brand called Rivet aimed at cost-conscious millennials. Ikea says it plans to offer online sales globally by the end of 2018 and will soon begin selling some goods on third-party sites such as Amazon and Tmall, Alibaba's big Chinese e-commerce site, although details haven't been disclosed.

The 24 smaller-format outlets Ikea has opened are in Canada, China, Europe, and Japan; so far there are none in the U.S. Each is slightly different, allowing the company to test various alternatives: downtown streets vs. shopping malls, with or without cafes, and with floor space ranging from about 900 to about 4,000 sq. m.

At the small London store, the only refreshment on offer comes from a coffee machine. Instead of a supervised kids' play area, another staple of the Ikea experience, it has a couple of tablet computers loaded with *Candy Crush*. Still, with as many as 20 staff members on duty at peak times, customers can expect "more of a personal shopping experience" than at a traditional Ikea, says London store manager Mirco Righetto. Employees at the store, for example, help customers plan larger projects such as kitchen renovations with the aid of 3D virtual-reality software.

Ikea also is using pop-up stores to try new formats. One in central Madrid offers only bedroom furnishings; another, in Stockholm, specializes in kitchens and lets shoppers cook on the premises. The company is also rolling out technologies such as an augmented-reality app launched last fall, called Ikea Place, that lets customers visualize how their purchases will look inside their homes.

Part of the digital expansion includes an overhaul of logistics capabilities to speed the process of ordering, pickup, and delivery. "It's a huge investment to make sure we transform into a multichannel company," CEO Brodin says.

The payoff from these initiatives isn't yet clear. Visits to the ikea.com website have grown about 10 percent annually over the past two years, but brick-and-mortar stores still account for well over 90 percent of sales. And some customers aren't sold on the smaller stores. "The showroom isn't extensive enough," says Bora Assumani, a fitness instructor shopping at the London store. "I like to be able to touch and see everything before I buy." Another shopper, Susan Davies, says she wants "a bigger selection of little things to buy now."

Still, Ikea says its efforts are attracting new customers who might otherwise never have shopped at Ikea. In Madrid, 70 percent of people visiting the bedroom pop-up store had never been to an Ikea big box, says Stefan Sjostrand, Ikea's global commercial manager. What's more, he said, e-commerce sales in Madrid have risen more than

▲ A new London store is far more compact than Ikea's standard outlets

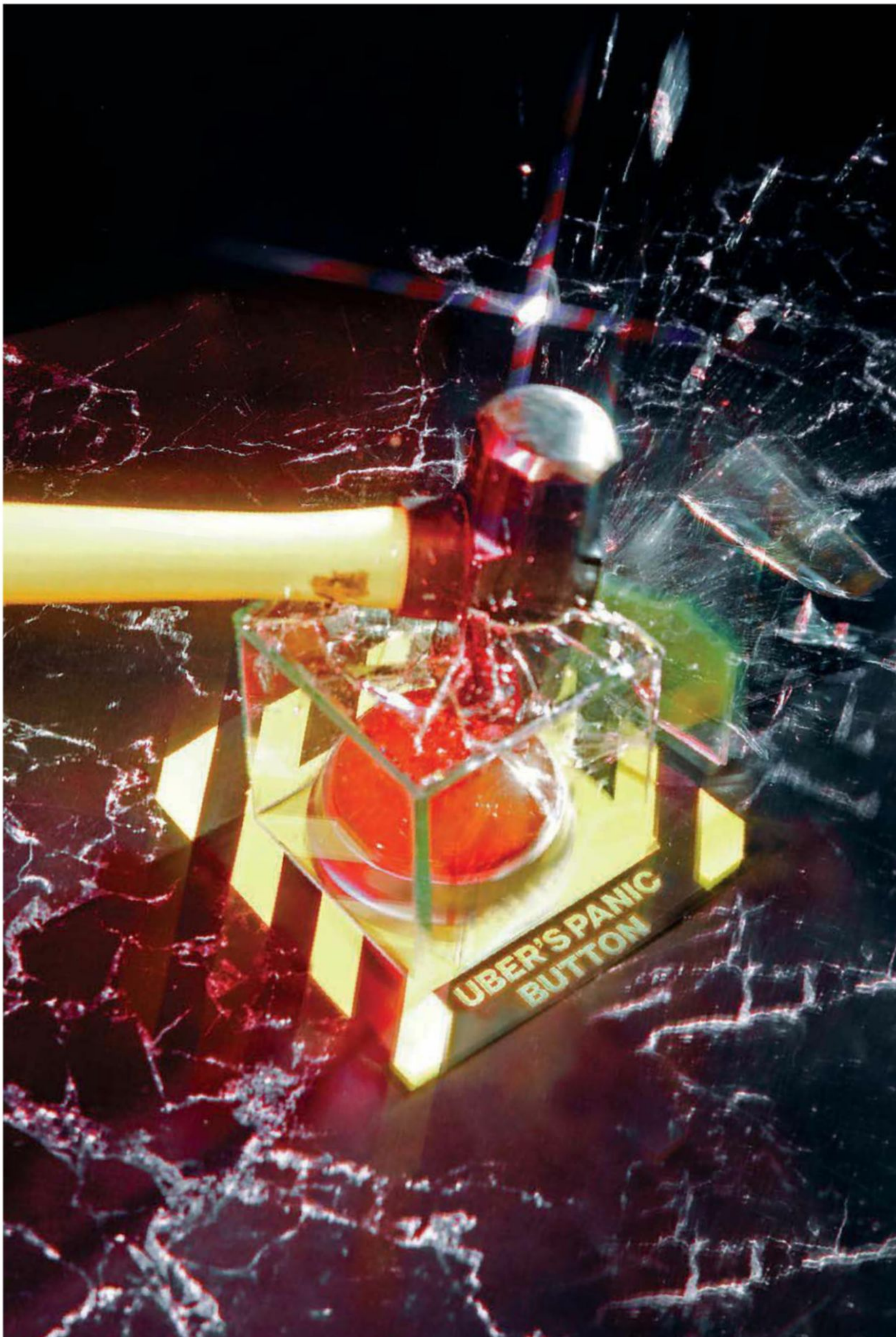
50 percent since the shop opened. And in Canada, sales at new, smaller outlets in Quebec City and London, Ont., have been so strong that Ikea now plans to open full-sized suburban stores nearby. "We're surprising the customer," Sjostrand says. "They're getting an emotional connection to the brand." —*Carol Matlack, with Sam Chambers and Anna Molin*

THE BOTTOM LINE Ikea is opening smaller stores to experiment with various ways to reach young consumers who are less likely to drive to its mammoth suburban warehouse locations.

ANNA RINGSTROM/REUTERS. COURTESY IKEA. DATA: IKEA, WORLD FACTBOOK

LOOK AHEAD

- IBM reports earnings. Investors will be looking for evidence to justify the rosy view of one RBC analyst
- Fired Google engineer James Damore is pursuing a class action, alleging "illegal hiring quotas"
- Munich hosts the annual Digital Life Design conference, a lead-up to Davos's World Economic Forum



PHOTOGRAPH BY CAROLINE TOMPKINS FOR BLOOMBERG BUSINESSWEEK

● The company remotely locked down office equipment to shield files from police raids

Edited by
Jeff Muskus

Businessweek.com

In May 2015 about 10 investigators for the Quebec tax authority burst into Uber Technologies Inc.'s office in Montreal. The authorities believed Uber had violated tax laws and had a warrant to collect evidence. Managers on-site knew what to do, say people with knowledge of the event.

Like managers at Uber's hundreds of offices abroad, they'd been trained to page a number that alerted specially trained staff at company headquarters in San Francisco. When the call came in, staffers quickly remotely logged off every computer in the Montreal office, making it practically impossible for the authorities to retrieve the company records they'd obtained a warrant to collect. The investigators left without any evidence.

Most tech companies don't expect police to regularly raid their offices, but Uber isn't most companies. The ride-hailing startup's reputation for flouting local labor laws and taxi rules has made it a favorite target for law enforcement agencies around the world. That's where this remote system, called Ripley, comes in. From spring 2015 until late 2016, Uber routinely used Ripley to thwart police raids in foreign countries, say three people with knowledge of the system. Allusions to its nature can be found in a smattering of court filings, but its details, scope, and origin haven't been previously reported.

The Uber HQ team overseeing Ripley could remotely change passwords and otherwise lock up data on company-owned smartphones, laptops, and desktops as well as shut down the devices. This routine was initially called the unexpected visitor protocol. Employees aware of its existence eventually took to calling it Ripley, after Sigourney Weaver's flamethrower-wielding hero in the *Alien* movies. The nickname was inspired by a Ripley line in *Aliens*, after the acid-blooded extraterrestrials easily best a squad of ground troops. "Nuke the entire site from orbit. It's the only way to be sure."

Other companies have shut off computers during police raids, then granted officers access after reviewing a warrant. And Uber has reason to be cautious with the sensitive information it holds about customers and their locations around the world. Ripley stands out partly because it was used regularly—at least two dozen times, the people with knowledge of the system say—and partly because some employees involved say they felt the program slowed investigations that were legally sound in the local offices' jurisdictions. "Obstruction of justice definitions vary widely by country," says Ryan Calo, a cyberlaw professor at the University of Washington. "What's clear is that Uber maintained a general pattern of legal arbitrage."

"Like every company with offices around the world, we have security procedures in place to protect corporate and customer data," Uber said in a statement. "When it comes to government investigations, it's our policy to cooperate with all valid searches and requests for data."

Uber has already drawn criminal inquiries from the U.S. Department of Justice for at least five other alleged schemes. In February, the *New York Times* exposed Uber's use of a software tool called Greyball, which showed enforcement officers a fake version of its app to protect drivers from getting ticketed. Ripley's existence gives officials looking into other Uber incidents reason to wonder what they may have missed when their raids were stymied by locked computers or encrypted files. Prosecutors may look at whether Uber obstructed law enforcement in a new light. "It's a fine line," says Albert Gidari, director of privacy at Stanford Law School's Center for Internet & Society. "What is going to determine which side of the line you're on, between obstruction and properly protecting your business, is going to be things like your history, how the government has interacted with you."

"Uber maintained a general pattern of legal arbitrage"

About a year after the failed Montreal raid, the judge in the Quebec tax authority's lawsuit against Uber wrote that "Uber wanted to shield evidence of its illegal activities" and that the company's actions in the raid reflected "all the characteristics of an attempt to obstruct justice." Uber told the court it never deleted its files. It cooperated with a second search warrant that explicitly covered the files and agreed to collect provincial taxes for each ride.

Uber deployed Ripley routinely as recently as late 2016, including during government raids in Amsterdam, Brussels, Hong Kong, and Paris, say the people with knowledge of the matter. The tool was developed in coordination with Uber's security and legal departments, the people say. The heads of both departments, Joe Sullivan and Salle Yoo, left the company last year. Neither responded to requests for comment.

Ripley's roots date to March 2015, when police stormed Uber's Brussels office, say people with knowledge of the event. The Belgian authorities, which accused Uber of operating without proper licenses, gained access to the company's payments system and financial documents as well as driver and employee information. A court order forced Uber to shut down its unlicensed service later that year. Following that raid and another in Paris the same week, Yoo, then Uber's general counsel, directed her staff to install a standard encryption service and log off computers after 60 seconds of inactivity. She also proposed testing an app to counter raids. Workers in Uber's IT department were soon tasked with creating a system to keep ▶

◀ internal records hidden from intruders entering any of its hundreds of foreign offices. They used software from Twilio Inc. to page staffers who would trigger the lockdown.

The security team, which housed many of Uber's most controversial programs, took over Ripley from the IT department in 2016. In a letter shared with U.S. attorneys and made public in a trade-secrets lawsuit against Uber, Richard Jacobs, a former Uber manager, accused the security group of spying on government officials and rivals. Jacobs's letter makes an oblique reference to a program for impeding police raids. A 2016 wrongful-dismissal lawsuit by Samuel Spangenberg, another Uber manager, also references its use during the May 2015 tax authority raid in Montreal.

The three people with knowledge of the program say they believe Ripley's use was justified in some cases because police outside the U.S. didn't always come with warrants or relied on broad orders to conduct fishing expeditions. But the program was a closely guarded secret. Its existence was unknown even to many workers in the Uber offices being raided. Some were bewildered and distressed when law enforcement ordered them to log on to their computers and they were unable to do so, two of the people say.

Later versions of Ripley gave Uber the ability to selectively provide information to government agencies that searched the company's foreign offices. At the direction of company lawyers, security engineers could select which information to share with officials who had warrants to access Uber's systems, the people say.

Another option was engineered for times when Uber wanted to be less transparent. In 2016 the security team began working on software called uLocker. An early prototype could present a dummy version of a typical login screen to police or other unwanted eyes, the people say. Uber says no dummy-desktop function was ever implemented or used, and that the current version of uLocker doesn't include that capability. The project is overseen by John Flynn, Uber's chief information security officer. —*Olivia Zaleski and Eric Newcomer*

THE BOTTOM LINE From San Francisco, Uber routinely protected foreign offices from police raids by rendering computers unusable, often shielding evidence from warranted officials.

Colonoscopy? I'll Take a Blood Test

● Israel's Medial EarlySign offers less-invasive, more data-driven screenings to unwilling patients

Nobody likes getting a colonoscopy. For the people who catch colon cancer early thanks to that bowel camera, the standard screening—every 5 to 10 years from age 50 to 75—proves invaluable. For the 993 people in 1,000 who don't test positive following a colonoscopy, the pain (and for the uninsured, the expense) can be enough to make them skip the next one. People who've shirked their exams often number among the 50,000 Americans who die from colon cancer each year. "More noninvasive ways of screening are needed," says Matthew Kalady, co-director of the colorectal cancer program at the Cleveland Clinic. "If you could pick up colon cancer early and noninvasively with a simple blood test, that would be just fantastic."

An Israeli health-tech company is trying to use machine learning software to do just that. ColonFlag is the first product from Medial EarlySign, and while poorly named, the software predicts colon cancer twice as well as the fecal exam that's the industry-standard colonoscopy alternative, according to a 2016 study published in the *Journal of the American Medical Informatics Association*. ColonFlag compares new blood tests against a patient's previous diagnostics, as well as Medial's proprietary database of 20 million anonymized tests spanning three decades and three continents, to evaluate the patient's likelihood of harboring cancer. Israel's second-largest health maintenance organization is already using the software, and Medial (a mashup of "medical" and "algorithms") is working with Kaiser Permanente and two leading U.S. hospitals to develop other uses for its database and analysis tools.

"Our algorithms can automatically scan all the

● The number of Americans who die from colon cancer each year

50k

ILLUSTRATION BY KURT WOERPEL

patient parameters and detect subtle changes over time to find correlative patterns for outcomes we want to predict," Nir Kalkstein, Medial's co-founder and chief technology officer, says, characteristically clinical. The database allows his team "to find similar events in the past and then identify from the data correlations that can predict these events."

Other companies are building massive databases with an eye toward predictive medicine, including heavy hitters such as DeepMind Technologies, owned by Google parent Alphabet Inc. In Boulder, Colo., startup SomaLogic Inc. is predicting heart attacks based on combinations of certain proteins in cardiac patients. In Salt Lake City, Myriad Genetics Inc. assesses hereditary cancer risks based on DNA profiles. DeepMind's public U.K. tests have largely focused on managing understaffed wards; Myriad's tests cost thousands of dollars; and most of the other companies have had trouble delivering actionable results. With 45 employees, Medial has the first test that's becoming an unobtrusive, critical part of doctors' rounds by using the cheap, easy blood tests they routinely conduct.

Kalkstein has some experience with both bureaucracy and big data sets. He served his mandatory years in the Israel Defense Forces (IDF) with an elite cybersecurity research unit, then started a company called Final (short for "financial algorithms") on the day of his discharge, in 2001. Despite knowing nothing about finance, he proved adept at writing code that could predict stock market activity based on past market reactions to similar events. "We only looked at the data and the story it told us, without the use of any economic models," Kalkstein says.

Final made Kalkstein a billionaire, according to the *Jerusalem Post*, but left him unsatisfied. By 2009, he says, he decided to "invest my time and resources only in things that will make a positive impact on people's lives." With some pals from college and the IDF, he started Medial out of a garage near his house in the Tel Aviv suburbs, recruiting tech executive Ori Geva as chief executive officer and consultant Ofer Ariely as chairman.

The team lacked health-care know-how, but learned quickly. In 2011, Medial held an informal contest with intensive-care-unit doctors at Rabin Medical Center, Israel's largest hospital, to predict which ICU patients would survive. The data scientists trounced the MDs. "To see in many dimensions at the same time is very difficult," says Varda Shalev, a primary-care physician who also runs the research and development arm of Maccabi Healthcare Services, which now uses ColonFlag. "With machine learning, it becomes easy."

Shalev helped lead Kalkstein's team to use colon cancer as a proving ground in 2011, a couple of years after she lost a patient a little too young for the screening. "You always blame yourself," she says. Maccabi's 2 million electronic patient records, stripped of identifying information, were among the first to feed Medial's database, and Maccabi was the first to build ColonFlag into its alerts system. The software consistently identified patients at 10 times the normal risk of harboring cancer and flagged tumors six months to a year ahead of doctors' diagnoses, while the cases were still beatable, according to a Kaiser study published last year in the journal *Digestive Diseases and Sciences*. All told, studies by Medial, Kaiser, and Oxford University identified 100 Maccabi patients with cancer and another 100 with potentially precancerous adenomas. The HMO now uses ColonFlag on any blood test from an older patient who's refused a colonoscopy or the chemical test.

"To see in many dimensions at the same time is very difficult. With machine learning, it becomes easy"

The Israeli company will have to tread carefully to avoid the public outcry faced by companies, including DeepMind, that are building large-scale databases from patient records. "It's critical that de-identification be done in a rigorous and responsible way," says Deven McGraw, former deputy director for health information privacy at the U.S. Department of Health and Human Services. Some doctors are skeptical because Medial's studies have looked at the blood tests of patients known to have later acquired colon cancer. (A blind study is under way.) And a computer's prediction about the usefulness of a colonoscopy might never be as reliable as, well, getting a colonoscopy. Even Medial executives acknowledge that the success of Kalkstein's past enterprises hardly guarantees success in this new field. "What Final is doing is much easier," says Ariely, Medial's chairman. "Their data is clean, and if they're wrong, no one dies."

For now, Kalkstein's team is focusing mainly on R&D. Medial has raised $40 million from investors led by Hong Kong billionaire Li Ka-shing's Horizon Ventures, and the company says its next product, due in the second quarter, will predict the onset of diabetes. Further away: a wearable device that seeks to predict seizures in epileptics, giving them precious seconds to pull over their cars or clamber out of their bathtubs. It's also working on analytics to predict conditions including heart failure, acute kidney injury, and sepsis. There's always more work to be done, Kalkstein says. "No other sector has such a huge potential of being a force multiplier for the type of resources, algorithmic and financial, which I can invest." *—Paul Tullis*

THE BOTTOM LINE Medial is the leader in cheaper, less-invasive screenings by software, but it has yet to prove itself to much of the medical community.

LOOK AHEAD

- Payment processors Vantiv and Worldpay plan to complete their merger on Jan. 16
- American Express announces results for its last full quarter under longtime CEO Ken Chenault on Jan. 18
- Security company ADT is expected to go public again. It was taken private by a buyout firm in 2016

● Finance hasn't had its #MeToo moment. Women say the culture of banking and a web of legal agreements keep harassment hidden

Three women who've had long careers in banking sat down for lunch together in Manhattan on the first Wednesday of the year. It didn't take long before they asked one another the question: Why hasn't the Harvey Weinstein effect hit finance?

After the movie mogul was accused last October of sexual harassment and assault, powerful men have been pushed out of jobs in the media, the arts, politics, academia, and the restaurant business because women spoke up to allege egregious behavior. Something is different on Wall Street. While the #MeToo movement spreads far and wide, these companies have seemed practically immune.

Some bankers and executives will tell you that's because the industry cleaned out bad behavior more than a decade ago, after a string of lawsuits revealed what women were putting up with across top companies. That's not the case, according to interviews with 20 current and former Wall Street women, who asked not to be identified describing personal experiences and observations.

Some say they've been grabbed, kissed out of the blue, humiliated, and propositioned by colleagues and bosses but have stayed quiet because of cultural and financial forces that are particularly strong in banking. They say they have a lot to lose by speaking out, no certainty about what they'd gain, and legal agreements that muzzle them.

Few industries have been as savvy about staying out of court, where cases can receive attention from the press and the public, by getting new employees to sign away their rights to sue. That means when women in trading and banking are harassed, many have to arbitrate their complaints in a private system. "If you consider why you're not hearing anything, it's most likely around arbitration," says Ana Duarte-McCarthy, who ran diversity efforts at Citigroup Inc. until she left in 2016. She does credit Wall Street for focusing on anti-harassment training before other industries. But the arbitration system, she says, "creates the potential for a cloak of invisibility."

Financial companies were among the earliest to adopt the arbitration system, says Alex Colvin, a professor at Cornell University. “Arbitration is almost always a private system where nobody else has a right to know what’s going on,” he says.

Jennifer Hatch, who runs wealth manager Christopher Street Financial and started her career at JPMorgan Chase & Co. and Bear Stearns Cos., says some women feel pressure to remain silent because of the amount of money they stand to lose. “People spend their entire educational and professional career trying to get to this pot of gold, and some guy dropping his drawers is not going to get in the way of that,” she says. And much of Wall Street pay gets handed out in bonuses controlled by bosses. “Access to this pot of gold is based on, ultimately, the complete discretion of the men in this club,” Hatch says.

That club can be so intimidating that some of the women interviewed say they worry that pointing fingers would permanently alienate bosses, colleagues, and even rivals. They look around and see companies that prize discretion, expect sacrifice, fixate on reputation, and are built on relationships.

According to the biggest U.S. banks, whose chief executive officers are all men, the situation is improving. “Half our company’s senior leadership team and half of our employees are women,” says Brian Marchiony, a spokesman for JPMorgan Chase. “And we strive every day to foster diversity and a workplace environment of mutual respect and trust.” According to Andrew Williams, a spokesman for Goldman Sachs Group Inc., the company has reinforced its policies “to make it even easier for women, or any other employee, to come forward.”

When women complain to employers in the finance sector, as in other industries, they often agree to settlements that keep them from going public. One of the women at the lunch in Manhattan said she didn’t want to be named because of a nondisclosure agreement she signed decades ago.

Wall Street has seen some changes since Weinstein’s fall. Morgan Stanley fired former Congressman Harold Ford Jr. after investigating his behavior with a woman outside the firm. He denies a claim that he grabbed her.

And as the Weinstein allegations fueled the #MeToo movement, two Wall Street veterans published posts online in October about being harassed, though their stories take place years ago. Sallie Krawcheck wrote about a man at a conference run by Sanford C. Bernstein & Co., where she was research director, who invited her to his hotel while “sticking out his tongue and wiggling it at me.” After leaving in 2002 for Citigroup, she found out her harasser was about to get a job at the bank. When she told its CEO what the man had done, the boss suggested maybe it was all a misunderstanding. She threatened to quit before Citigroup agreed not to hire him, she wrote.

Jacki Zehner, the first female trader to become a Goldman Sachs partner, shared an account of being pulled out of a cab by a colleague who wanted to take her into his home after drinks. “I was hanging onto the door handle on the other side,” she wrote. “Finally, the driver intervened.” Zehner, who left the bank in 2002, says she’s still too afraid to name that colleague. Krawcheck wrote that she’s withholding her harasser’s name because she got her revenge when she blocked his job. “My hope is that women who work in the financial-services sector take inspiration and courage from women’s voices in other industries,” Zehner says. “I want to be a person not afraid to speak truths. We’re talking about big forces.” —*Max Abelson*

THE BOTTOM LINE Although Wall Street women say they’ve experienced harassment, the industry is unusually savvy about keeping disputes with employees out of the public eye.

Who Wants to Be Bitcoin’s Watchdog?

● The U.S. Commodity Futures Trading Commission has raised its hand. Some think it’s going too fast

At a meeting with staff of the U.S. Commodity Futures Trading Commission late last year, Chairman J. Christopher Giancarlo ticked off a list of the watchdog agency’s achievements. Among them: It emerged as the federal overseer of digital currencies like bitcoin. For better or worse, Giancarlo added.

● Giancarlo

That may have been meant as a humorous aside, according to people who were there, but some in the crowd saw it as an unusually frank assessment. Cryptocurrency gives regulators a lot to be nervous about. Bitcoin prices are swinging wildly but are still up about 1,500 percent over the past year. It and other virtual tokens have captured the imaginations of investors who hope to get in on the money of the future, even though it’s challenging to ▶

PHOTOGRAPH: ANDREW HARRER/BLOOMBERG

◀ actually buy things with digital cash. The CFTC, a government agency created in 1974 to monitor agricultural futures and less well-known than the U.S. Securities and Exchange Commission, has an opportunity to increase its profile by becoming a key regulator in this new market. That also means that any blowups will be on its watch.

Giancarlo, a former executive at a swaps brokerage firm who became an agency commissioner in 2014 and chairman last year, is fond of referring to the CFTC as a "21st century regulator." In December he took the agency headlong into the cryptocurrency fray when he allowed two exchanges to offer futures contracts based on bitcoin—which will allow investors to bet on the price rising or falling without buying the cryptocurrency itself. This could clear the way for new investment products and make it easier for large institutional investors to get involved. "Ignoring bitcoin trading doesn't make it go away," Giancarlo says. "Technology is a given, and the agency needs to keep pace."

The fast-tracking of bitcoin futures provoked a storm of criticism, including from the biggest banks, which are responsible for settling the trades, as well as some Democratic lawmakers. Both Secretary of the Treasury Steven Mnuchin and Securities and Exchange Commission Chairman Jay Clayton privately questioned why the process was moving so quickly, according to people familiar with the discussions. SEC spokesman John Nester says "the characterization is inaccurate." A spokeswoman for the Treasury Department declined to comment.

The CFTC chairman maintains that he could do little to stop the two exchanges, CME Group Inc. and Cboe Global Markets Inc., from going forward. That's because they used a process set up under U.S. commodities law known as self-certification. It lets regulated exchanges launch their own products and bypass any formal review as long as they pledge not to run afoul of the agency's rules. Giancarlo, in an interview, took pains to point out that the CFTC "did not approve" the new futures products.

Indeed, one risk is that individual investors could interpret the emergence of a regulated futures market as a stamp of approval for a volatile and little-understood asset—at a time when some classic signs of a bubble are emerging. For example, in an echo of the 1990s dot-com boom and 1960s 'tronics craze, stocks with even the slightest connection to cryptocurrency or blockchain are suddenly shooting up in price.

Meanwhile, Congress has chronically underfunded the 700-person CFTC even as it has given it greater swaths of territory to police. This includes the $483 trillion market for financial derivatives called swaps. The agency's $250 million budget hasn't risen in step with the new authority, driving down employee morale and leading the agency's workers to unionize. It even ran out of cash several years ago and was forced to borrow from the Treasury just to keep its doors open.

To critics, that's not a recipe for successful oversight. "Ultimately regular investors are going to lose money," says Lee Reiners, a former Federal Reserve Bank of New York supervisor who is now director of the Global Financial Markets Center at Duke School of Law. "The CFTC will end up having to bear some responsibility for that."

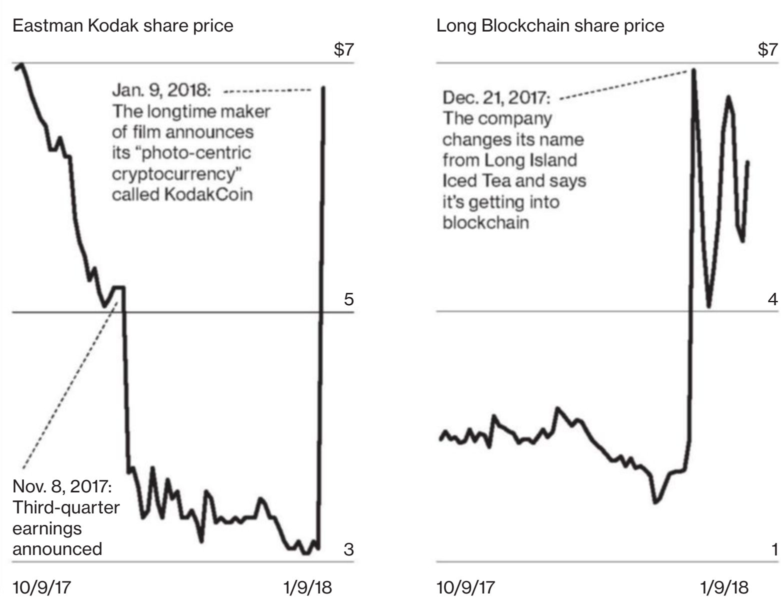
Giancarlo says the agency was able to demand some tougher safeguards for bitcoin futures investors. For one, he says, traders will have to put up a much steeper amount of collateral than they would for a typical, much less risky futures trade in, say, oil or wheat. And in asserting its jurisdiction in futures trading, he adds, the CFTC will be in a better position to protect the public by gaining insight into the underlying cash markets where bitcoin and other cryptocurrencies are traded directly.

A CFTC advisory on its website warns consumers that many exchanges where virtual currency is traded are unsupervised by regulators and that prices may be manipulated, among other risks. Using its authority to go after fraud, the agency has brought enforcement cases against platforms offering bitcoin trading to retail customers and

"Ignoring bitcoin trading doesn't make it go away"

Crypto, You Say? I'm In

Traders are piling into stocks claiming any connection to virtual currency or the blockchain technology behind it



DATA: COMPILED BY BLOOMBERG

in September filed suit over an alleged bitcoin Ponzi scheme.

Giancarlo says that despite his inability to slow the new bitcoin futures markets, his agency is ready to watch over digital currencies. He's asked Congress for a 13 percent budget increase to add three dozen workers and boost technology to monitor cryptocurrency derivatives. The CFTC first identified bitcoin as a commodity in 2014, Giancarlo says, before he was made chairman. The agency "has been well prepared," he says. One of his first steps after being named chairman was to set up an office called LabCFTC, which focuses on digital markets.

The chairman's embrace of new technology has been praised by some lawmakers and former CFTC members as necessary and forward-thinking. "It's actually pretty gutsy of the CFTC to have taken this on in a full-throated way," says Bart Chilton, a former Democratic commissioner who also has an interest in digital currency. Chilton is helping launch one backed by oil reserves.

Under Clayton, the SEC has refused to allow bitcoin exchange-traded funds, mostly because of concerns that the underlying markets for bitcoin are opaque and unregulated. In January, Clayton issued a statement on initial coin offerings, in which people raise money for projects or companies by selling their own virtual tokens. "There are tales of fortunes made and dreamed to be made," Clayton wrote. "We are hearing the familiar refrain, 'this time is different.'" He wrote that currencies issued in ICOs often fit the legal definition of securities and fall under the SEC's jurisdiction.

Mnuchin heads a council of regulators that monitors risks to the financial system; it's put cryptocurrencies on its agenda. He often quotes JPMorgan Chase & Co. Chief Executive Officer Jamie Dimon on the subject. The banker has called bitcoin a "great product" for criminals and derided its investors as "stupid," though he's recently softened his stance.

In the wake of the criticism over the futures markets, the CFTC has been working to deal with some concerns. It's scheduled public meetings later this month that will address the CFTC's oversight of digital currencies. It also issued a flurry of papers to explain bitcoin trading and its decision on the futures contracts. Among them was that advisory for consumers. One of its tips: "Do not invest in products or strategies you do not understand." —*Robert Schmidt and Ben Bain*

THE BOTTOM LINE The CFTC has allowed futures trading in bitcoin to move forward. Its chairman says the agency is ready to handle the new market.

PHOTOGRAPH: RAZAN ALZAYANI/BLOOMBERG. DATA: VANGUARD ANALYSIS OF MSCI DATA, FRANKLIN TEMPLETON, BLOOMBERG INTELLIGENCE

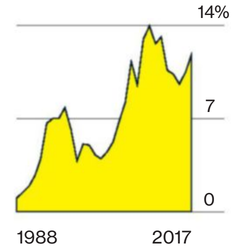
Careers | Global Guru

Mark Mobius, 81, who became one of the most recognized authorities on investments in Africa, Asia, Eastern Europe, and Latin America, plans to retire from Franklin Templeton Investments on Jan. 31. Hired in 1987, Mobius headed one of the first emerging-markets equity funds available to U.S. investors. —*Ben Bartenstein and Charles Stein*

Going Mainstream

Over the course of Mobius's career, developing nations came to represent a significantly larger portion of the global equity market as investors sought profits in fast-growing economies.

Emerging markets' share of the MSCI All Country World Index



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Emerging-market nations Franklin Templeton invested in when Mobius joined the firm in 1987. Today the company invests in about

50

"People on the ground had a distinctive advantage,"

says Michael Rosen of Angeles Investment Advisors. Based in Singapore, Mobius traveled about 250 days a year. "When he started, there was no internet and you could barely make a phone call."

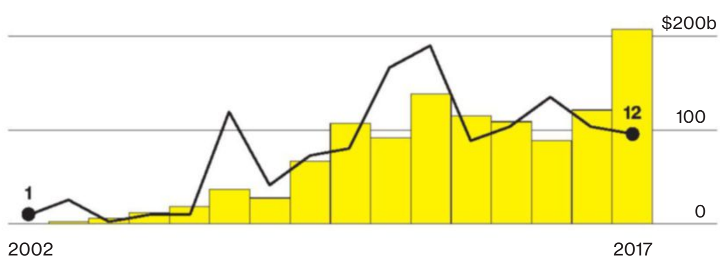
"He was a missionary for the whole concept of emerging markets,"

says Dan Fuss, a longtime bond manager at Loomis, Sayles & Co. "It was seen as high-risk, exciting, and off the wall."

Once, individual investors who wanted to place a bet on stocks in developing nations were restricted to a handful of mutual funds, some with steep commissions and management fees. Now they can buy a variety of low-cost ETFs.

Emerging-markets ETFs

Assets under management at yearend / New funds launched during the year



LOOK AHEAD
- India publishes producer price data for December on Jan. 15
- China releases fourth-quarter GDP figures
- A decision on Turkey's benchmark lending rate is due on Jan. 18

An Oil Industry Held Hostage By Marxist Rebels

Peace talks in Colombia break down after a pipeline attack

From a distance, the muffled sounds of laughter could be heard along with the loud crackle of a microphone. Marxist guerrillas from the National Liberation Army were hosting an event for residents of Noanamá, a village in the rainforest in northwestern Colombia. After updating the audience on the latest developments in peace negotiations with the government, rebels took turns at the mic taunting one another with rhyming ditties that were met with raucous laughter and applause.

Among those trying out their wit that evening was an Afro-Colombian rebel whose nom de guerre is Negro Primero. He joined the group, which is best known by its Spanish initials, ELN, when he was 15 years old, he said, but would not share his current age or where he's from. He did concede that he'd previously been stationed in Arauca, an oil-rich province that's been the group's stronghold for the past 35 years. Asked what kept him and his comrades in the bush—more than a year after the Revolutionary Armed Forces of Colombia (FARC) had agreed to demobilize—he responded: "Let me ask you something, my little gringo. What would you do if you were born here, amid this misery and injustice?"

A 101-day cease-fire—the first in three years of negotiations between the ELN and the government—expired on Jan. 9. While the rebel leadership, which claims around 4,000 fighters, had pledged to carry on with talks, its rank and file resumed attacks on a vital oil pipeline that runs through Arauca just hours after the truce ended.

Since it was inaugurated in 1986, the 485-mile conduit, which connects the Caño Limón oil field operated by Occidental Petroleum Corp. to the port of Coveñas on the Caribbean Sea, has been dynamited about 1,000 times—or once a week, on average. There've been so many holes made in it that some locals refer to it as *la flauta* (the flute).

The attacks have claimed 167 lives and put the pipeline out of commission for 3,800 days, or 10.4 years, according to the state oil company, Ecopetrol SA, depriving the company and its private-sector partners of hundreds of millions of dollars in revenue. Some 1.5 million gallons of crude have been spilled since 2000 alone, which hasn't endeared the ELN to environmentalists.

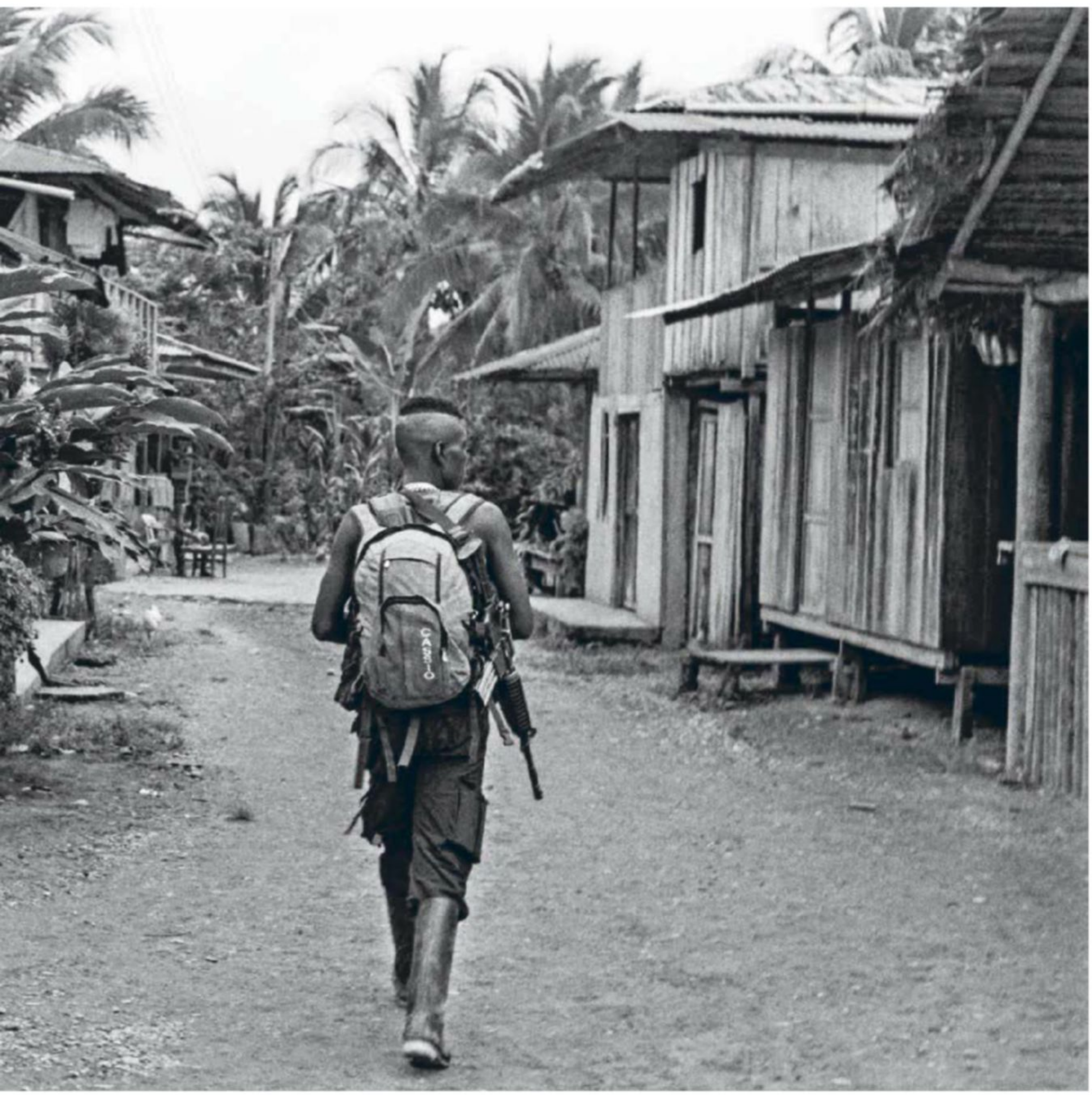
The group was founded in 1964 by students inspired by the Cuban revolution and Catholic priests steeped in liberation theology. Unlike the FARC, which relied heavily on drug trafficking to

fund itself, the ELN has supported itself through a combination of kidnapping, extortion, and voluntary contributions. Víctor de Currea-Lugo, a professor at the National University of Colombia in Bogotá and a leading expert on the group, points out that Arauca is virtually the only place in the country with little to no coca crops, thanks to an eradication campaign carried out by the ELN.

The distinction never made much difference in Washington, which designated both the ELN and the FARC as terrorist organizations in 1997. Under President George W. Bush, Washington sharply ramped up military aid to Colombia, with just shy of $100 million earmarked for training and equipping a Colombian brigade dedicated to protecting the pipeline.

The renewed attacks in Arauca complicate matters for President Juan Manuel Santos, who's been working to lure foreign companies to Colombia to explore for oil and minerals. The Colombian Petroleum Association, an industry group, expects investment by private oil companies to jump as much as 45 percent in 2018, to $4.9 billion, spurred by an improvement in security and the introduction last year of tax breaks for those investing in former conflict zones. Yet in a meeting with reporters in December, the association's president, Francisco José Lloreda, said that's still too little to replenish crude reserves, which have dipped to the equivalent of five years of production. Colombia's neighbors, Ecuador and Venezuela, have about 40 years and 340 years of reserves, respectively.

"We have used the pipeline as a strategy to influence government [policy] and to pressure ▶



◀ An ELN combatant walks through a village in northwest Colombia

RAMÓN CAMPOS IRIARTE

◀ multinationals," says Negro Primero. "But we are not using it as a tool to influence the negotiations." After more than 40 attacks in the first nine months of 2017, including one that shut down the pipeline for seven weeks—the longest it's been nonoperational in 30 years—there'd been no incidents while the cease-fire was in effect. The show of goodwill didn't mollify Juan Carlos Echeverry, who stepped down as president of Ecopetrol in August. He calls the ELN "an anachronism" and says the group "needs to stop its irrational violence."

Negro Primero says a treaty like the one struck with the FARC in 2016 will amount to surrender or, even worse, could lead to the ELN's annihilation. Since laying down arms, 11 former FARC fighters have been assassinated, presumably by right-wing paramilitaries or paid hit men working for landowners or politicians who would prefer to see the rebels behind bars or dead rather than reintegrated into society. The ELN rebels are demanding guarantees of their safety if they disarm.

Bruce Bagley, a professor at the University of Miami who's an expert on the conflict, acknowledges that Santos hasn't fulfilled many of the pledges made in the peace process with the FARC. In particular, the government has dragged its feet implementing land reform and ensuring security. The ELN argues its struggle is necessary to help bring about racial and environmental justice and fairer land distribution, and to resist exploitation by foreign corporations.

For Santos, the chances of concluding an accord with the ELN before his term ends in August look increasingly dim. On Jan. 10 he ordered his chief negotiator back to Bogotá from Quito, where talks were being held. "The conflict will intensify, without a doubt," says De Currea-Lugo, the academic. "Those who are most against peace in this instance have won."

Negro Primero seems less than eager to lay down the U.S.-made M16 rifle that lies by his side during our conversation. "We're proud to be the last armed insurgency on the continent," he says. "We'll fight to the end if we have to."
—*Maximo Anderson*

THE BOTTOM LINE Colombia's National Liberation Army has spent more than three decades targeting oil companies. The government needs peace to lure investment to the country.

● Days a key Colombian oil pipeline has been out of commission because of bombings

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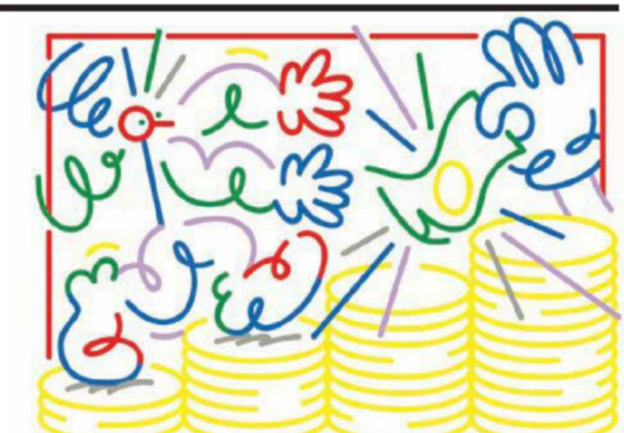
The Downside of The West Bank's Credit Boom



● The increased availability of loans threatens to widen the gap between the haves and have-nots

The Palestinian economy is crippled by restrictions on trade, investment, and access to natural resources, but driving around Ramallah you might get the impression it's thriving. Underground parking lots are brimming with Audis and BMWs, residential buildings are popping up at a frenetic pace, and cafes and restaurants are buzzing with customers.

Helping create the appearance of wealth in the West Bank city is the emergence of a consumer loan market that was all but nonexistent just a decade ago. Its growth can be attributed to a 2008 law enacted by the Palestinian Authority that forced banks in the Israeli-occupied territories—which preferred to lend their money abroad—to extend at least 40 percent of their credit to locals. The value of outstanding loans has more than doubled in the past four years, to $6.4 billion, of which $2.6 billion has gone to residents. "This is a relatively new phenomenon," says Samir Abdullah, a former Palestinian Authority planning and labor minister now at the Palestine Economic Policy Research Institute. "It's opened a new world of possibilities for some Palestinians, and of course the banks are quite happy, too, because they charge relatively high margins on the loans."

The credit growth has allowed members of the Palestinian middle class—those who already have a steady job—to boost their quality of life. But the overall picture for the West Bank's economy is still one of stagnation. Unemployment in the West Bank and Gaza is at about 30 percent (compared with 4.3 percent in Israel). The West Bank economy is expected to grow about 2 percent annually in coming years, lagging population growth, which has been running at almost 3 percent a year, according to the World Bank.

The economy is hamstrung by the myriad regulations Israel imposes on the occupied territories. As a result, Palestinians import more than three times what they manage to export—a degree of trade imbalance the World Bank says is a defining feature of failed states such as Somalia.

The expansion in credit could lead to an asset bubble, notably in real estate, and widen inequality between those with a steady job—typically people working for nongovernmental organizations or the Palestinian Authority—and those who don't have a reliable income. "In many ways it's just leading to higher prices, which makes life unaffordable for many," says Chris Harker, a lecturer at the Institute for Global Prosperity at University College London. "All this debt is a coping mechanism, a way to deal with the disillusionment of the failed Oslo peace process."

Palestinian economic officials aren't concerned. The debt buildup is still low by global standards, and the banks are careful in their lending, according to Palestine Monetary Authority Governor Azzam Shawwa, a former banker. He says the loan default rate is relatively low, though he's concerned that recent turmoil following U.S. President Donald Trump's decision to recognize Jerusalem as Israel's capital could derail growth. "There's no credit bubble here, and there won't be one, because banks are very conservative," Shawwa says. "We have a very sophisticated credit-scoring system here. Banks aren't lending wildly."

With Trump's envoys shuttling back and forth in pursuit of an elusive peace deal, Shawwa stresses that there's much to do to strengthen the economy, such as granting Palestinians more control of land and resources, including water, in the West Bank. "The Palestinian economy is being managed conservatively, [and] we are doing everything we can to boost growth," he says. "But eliminating restrictions and allowing us to invest in infrastructure would really help the economy to take off." *—David Wainer, with Fadwa Hodali*

THE BOTTOM LINE The value of outstanding loans in the West Bank has more than doubled, to $6.4 billion, in the past four years, improving life for the middle class but not boosting the economy.

ILLUSTRATION BY JORDY VAN DEN NIEUWENDIJK; DATA: CKINETICS PROJECTIONS

Can India Turn Garbage Into Cash?

● A southern city pioneers a blueprint for how the country could clean up

It's 6:30 a.m. in the Indian city of Mysuru (formerly known as Mysore), and the streets are filled with the sound of whistles blowing as workers in olive-green aprons and rubber gloves begin a door-to-door search. They've come to collect one of the country's biggest unexploited resources: garbage.

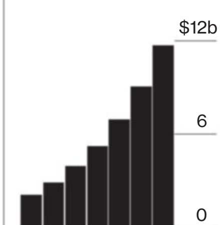
The southern metropolis is in the vanguard of a campaign by Prime Minister Narendra Modi to clean up India and recycle rubbish into compost and electricity. The task is gargantuan, but the approach in Mysuru—which relies heavily on the involvement of civic groups and private companies—may provide a blueprint for how the country can build an economy around trash. "We don't want waste to be waste. We want to get wealth out of it," says D.G. Nagaraj, health officer of Mysuru City Corporation, a municipal agency. "Zero landfill is our motto."

Investment in facilities to turn waste into compost and energy could reach $3 billion by 2027, according to a 2015 report commissioned by Assocham, an umbrella group that represents various industry chambers.

India's cities are among the largest generators of garbage in the world, producing about 62 million tons of solid waste every year. And that could increase fivefold by 2051, spurred by rising wealth and consumption along with urbanization, according to a 2016 paper by researchers at New Delhi's Jamia Millia Islamia University.

About 82 percent of India's garbage is collected, and of that only 28 percent is treated and processed, according to a report commissioned by India's Parliament. Much of it winds up in open dump sites, which lack systems to prevent toxins from leeching into the soil and groundwater, or it's tossed anywhere, where it's consumed by ▶

● Projected cumulative investment in facilities in India to convert waste into compost or energy



▲ The compost plant in Mysuru is eligible for federal subsidies

SAMYUKTA LAKSHMI/BLOOMBERG

◀ goats and cows or clogs drains and waterways.

Mysuru, a city of about 1 million famed for its palaces built by kings and maharajahs, has long been a model of urban management for the rest of India. It introduced public street lighting in 1908 and built an underground drainage system by 1910. In 2014 the city began requiring households to segregate wet and dry waste into green and red bins.

Of the 402 tons of garbage the city produces each day, about half is treated at a compost plant and almost a quarter is manually sorted at nine recycling centers. As an incentive, the city allows the centers to retain most of what they make from the sale of scrap and compost. "Waste is not a problem if it is converted into money," says D. Madegowda, 75, one of the volunteers who set up a recycling plant near a graveyard in the neighborhood of Kumbar Koppalu, where scrap items such as used rubber gaskets are for sale.

As an additional incentive, India's central government last year began offering subsidies for compost plants. "Hopefully we will now be able to break even," says Chandra Shekhara, assistant manager of Mysuru's only compost plant, which is run by Mumbai-based Infrastructure Leasing & Financial Services Ltd. Shekhara says that before the federal grants, only about 70 percent of the costs of the facility were being covered through the sale of fertilizer to farmers.

The incentives have helped boost the nation's production of compost to 1.3 million tons in August from 0.2 million tons in March 2016. Modi's administration has also made it mandatory for the electricity board to buy power from the country's seven existing waste-to-energy plants. An additional 56 such generating plants are under construction, though Mysuru is too small to make one viable at present.

In Mysuru, trash collection is funded by a levy that's collected along with property taxes. Radio jingles, WhatsApp messages, street plays, and door-to-door campaigns have been deployed to raise public awareness of the program, and authorities report there's been a fair degree of cooperation so far. Still, officials anticipate that penalties may need to be deployed to encourage more households to segregate their waste, says Nagaraj of Mysuru City Corp.

Environmental activist Almitra Patel, who led litigation in 1996 in the Supreme Court against open dumping, which paved the way for the introduction in 2000 of the nation's first regulations for municipal solid waste management, says that while progress has been slow nationwide, "there are sparks of hope everywhere." She cites Suryapet, Warangal, Kolar, and Vengurla as other Indian cities that are making headway. "Wherever the commissioner, mayor, and local representatives work together for the cause, there is great success," she says. —*Bibhudatta Pradhan*

THE BOTTOM LINE Investment in facilities to recycle India's waste into compost and energy could reach $3 billion by 2027, spurred by recently introduced federal incentives for new plants.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● Congress has until Jan. 19 to pass a budget and keep the government from shutting down

● Trump's plan to sell drilling rights in most U.S. coastal waters gets its first public hearing

● Vice President Mike Pence leaves for the Middle East on Jan. 19, with stops in Egypt, Jordan, and Israel

The GOP Has a POT Problem

● Jeff Sessions' decision to go after legal marijuana could pose trouble for Republicans in 2018

As a presidential candidate, Donald Trump promised to leave the issue of marijuana legalization to the states. Then he chose Jeff Sessions as his attorney general, and it was only a matter of time before that changed. Sessions has long pined for a crackdown on pot. "Good people don't smoke marijuana," he said in 2016. As a senator from Alabama he watched over the past few years as eight states voted to legalize the drug for recreational use, despite federal laws that still treat pot as a controlled substance on a par with heroin.

On Jan. 4, Sessions reversed an Obama-era policy of leaving decisions about pot laws to the states. The change gives the 93 U.S. attorneys discretion to bring cases against recreational pot businesses and users. A U.S. Department of Justice press release promised "a return of trust and local control to federal prosecutors" and "to reduce violent crime, stem the tide of the drug crisis, and dismantle criminal gangs."

The move sets up a potential legal battle between states and federal prosecutors. It also threatens to widen a rift in the Republican Party, pitting social conservatives against younger, more libertarian, and business-minded Republicans, who either disdain federal meddling or view legal marijuana as something an economic nationalist like Trump should embrace—a flourishing, job-creating domestic industry. A federal crackdown risks chilling the growth, creating even more pressure on the divided GOP.

Legal marijuana sales in the U.S. hit $6 billion in 2016 and will reach $50 billion in a decade, according to the investment bank Cowen & Co. Tax revenue from these sales has been a boon for state governments. In Colorado, which legalized recreational pot in 2012, sales topped $1.2 billion through the first 10 months of last year, leading to an infusion of tax revenue that's been used to improve schools and fight the opioid epidemic. In Washington, where there's no state income tax, cannabis fees and taxes contributed $319 million last fiscal year that the state uses to prop up its general fund, pay for health care, and enforce its pot ▶

January 15, 2018

Edited by Matthew Philips

◀ laws. In California, where recreational pot went on sale for the first time on Jan. 1, state and local tax revenue could exceed $1 billion a year by the mid-2020s, according to the nonpartisan Legislative Analyst's Office. And right now, a majority of Americans—64 percent according to a Gallup poll from October—believe pot should be legal.

"It's too late to put the cat back in the bag," says Robert Mikos, a professor at Vanderbilt University who specializes in drug law. "It's hard to get a precise figure, but there are probably 5,000 companies authorized by their states to produce, process, or distribute marijuana. The federal government doesn't have the resources to stop that." U.S. attorneys must balance those limited resources with the political desires of their boss in D.C. and the priorities of the states they live in. Andrew Lelling, the U.S. attorney in Massachusetts, where recreational pot goes on sale in July, said in a statement that he couldn't "provide assurance that certain categories of participants in the state-level marijuana trade will be immune from federal prosecution." Other U.S. attorneys, including Robert Troyer in Colorado and Annette Hayes in the Western District of Washington, have hinted that they'll focus on prosecuting crimes that would also violate state laws, such as pot shops selling to minors.

Despite Trump's campaign rhetoric, the Justice Department felt the change was overdue and after discussions with the White House didn't fear it would stoke the president's ire, because of his strong personal views against drugs, according to two sources familiar with the decision. Trump publicly talks about how he's shunned alcohol and tobacco, a legacy he's said stems from watching alcoholism ravage his older brother, Freddy. The Justice Department thought the announcement wouldn't get much attention amid the general chaos in Washington, according to one of the sources. Instead, the news grabbed headlines and angered a number of Republicans.

That could be a problem, especially for Republicans facing reelection battles in states with legal marijuana. Nevada Senator Dean Heller and Representative Mark Amodei are Democratic targets, as is Colorado Representative Mike Coffman. At least a half-dozen GOP-held California House seats are in play, including those held by Steve Knight and Dana Rohrabacher. "This is a freedom issue," Rohrabacher told reporters, calling for a change in federal law to protect legal marijuana in states. In a separate statement, he said Sessions' decision "places Republicans' electoral fortunes in jeopardy."

Republican Senator Cory Gardner of Colorado, the chairman of the Senate GOP's campaign arm, took to the Senate floor the same day as the announcement to slam the decision as "a trampling of Colorado's rights, its voters" and demand it be reversed. Gardner accused Sessions of breaking a promise to him prior to his confirmation as attorney general and threatened to block Justice Department nominees unless Sessions reverses course. Gardner says he and the rest of the Colorado delegation met to discuss pushing a rider to a funding bill that would prohibit the Justice Department from spending money on marijuana enforcement in states that have legalized pot.

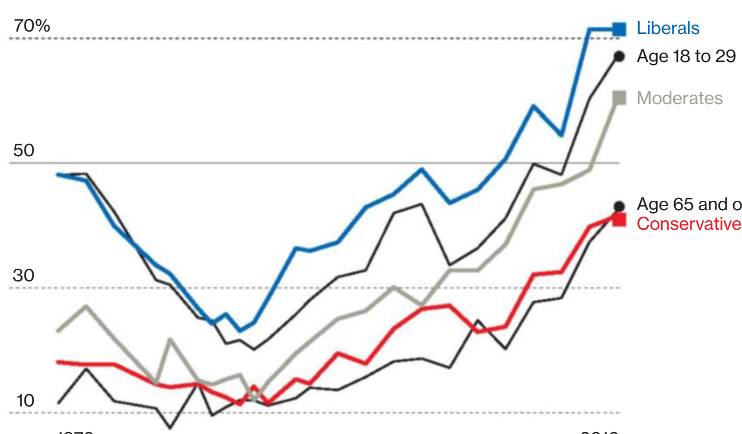
Bob Ferguson, Washington's Democratic attorney general, has threatened to sue the federal government over the issue. He'll have to overcome a 2005 ruling by the U.S. Supreme Court that found people in states with legal marijuana weren't protected from federal enforcement of the Controlled Substance Act. "That's what we were trying to establish, and we lost," says Randy Barnett, a Georgetown University law professor who argued the case. "This is the current state of law."

A federal crackdown could threaten jobs in Trump country. Take Washington's rural Okanogan County, where Trump won 56 percent of the vote. More than 400 people there earn an average of $14.18 an hour growing and processing legal cannabis. Just north of the border in Canada, Prime Minister Justin Trudeau has committed to recreational legalization by July. There are at least 80 cannabis companies on Canadian stock exchanges. "You look at Canada, where you have a half-dozen publicly traded companies with multibillion dollar market caps—why would an investor want to tie their money up in the U.S.

"It's too late to put the cat back in the bag"

A Growing Consensus

Support for marijuana legalization has steadily risen among people of different ages and political beliefs



DATA: GENERAL SOCIAL SURVEY

when global opportunities abound?" says Patrick Moen, general council at Privateer Holdings Inc., a marijuana private equity company backed by tech investor (and Trump supporter) Peter Thiel.

Sessions is also fighting against public opinion, even in his own party. Last year for the first time, a majority of Republicans said they favor legalization. Days after Sessions' announcement, the House of Representatives in both Vermont and New Hampshire voted to legalize recreational pot. "Red states, blue states, purple states—they are all going the same direction," says Washington's Ferguson. "Sessions isn't going to stop it." *—Karen Weise and Sahil Kapur, with Jennifer Kaplan, Margaret Newkirk, Drake Bennett, and Steven T. Dennis*

THE BOTTOM LINE Sessions' decision to reverse course on legal marijuana threatens to open a divide inside the GOP between social conservatives and states'-rights advocates.

Devin Nunes, Comeback Kid

● Recovering from an early blunder, the House Intel chairman is raising questions about the origins of the FBI's Trump-Russia probe

Republican Representative Devin Nunes's days as a power broker seemed to be over last spring. After an ill-advised maneuver where he secretly received intelligence reports from a White House aide, then returned to the White House to brief President Trump on his discovery, Nunes, chairman of the House Intelligence Committee, was forced to step back from leading the committee's high-profile probe of Russian election interference.

But Nunes never stopped investigating, he just changed targets. He's used his subpoena power to scrutinize the origins of the FBI's investigation into Trump and the conduct of the FBI and U.S. Department of Justice in their probe of Hillary Clinton, and he's become central to GOP efforts to raise doubts about the Trump-Russia probe. Nunes, who served on Trump's presidential transition team, doesn't hide his intent to show Trump-Russia collusion claims have no merit. "You should stop chasing Russian ghosts. You're missing the big story," he likes to tell reporters.

Nunes's stumble came in March, when he took a late-night trip to the White House, where he was given information that U.S. intelligence had "incidentally collected" information about Trump associates during surveillance of foreign nationals. The next day, Nunes held a press conference about the information and returned to brief Trump on it. That led Democrats and watchdog groups to call on him to recuse himself from the probe, with some alleging he'd mishandled classified information.

On April 6, Nunes said he would step back temporarily—he didn't use the word "recuse"—while the House Committee on Ethics evaluated his actions. Within weeks, he was again actively involved in the investigation. On Dec. 7 the Ethics Committee ended its inquiry, agreeing there was no reason to take action against him.

Nunes has paid particular attention to the so-called Trump dossier, which contains unverified information about suspicious links between Trump and Russia, and to its author, former British spy Christopher Steele. In August, Nunes demanded from the Justice Department and FBI "any and all documents" related to their dealings with Steele and the dossier. He also began a battle to get the bank records of Fusion GPS, the investigative firm that assembled the dossier. By October, that led Perkins Coie, the law firm that represented Clinton and the Democratic National Committee, to confirm that it hired Fusion in April 2016 to compile information on Trump's ties to Russia.

The saga took another turn on Jan. 9, when Senator Dianne Feinstein, the top Democrat on the U.S. Senate Judiciary Committee, released a transcript of its interview with Fusion GPS co-founder Glenn Simpson. Her goal was to refute GOP claims that the FBI treated the dossier as verified intelligence and used it to justify investigating the Trump-Russia connection. Nunes had announced on Dec. 2 a potential contempt of Congress case against Deputy Attorney General Rod Rosenstein and FBI Director Christopher Wray for allegedly failing to produce material related to the probes. Rosenstein and Wray appealed to House Speaker Paul Ryan to block Nunes's request, but Ryan sided with Nunes. On Jan. 3, Rosenstein and Wray agreed to provide access to the material. ▶

● Nunes

WIN MCNAMEE/GETTY IMAGES

◀ Nunes's actions have shredded any remaining comity on a panel once known as a bastion of bipartisanship—"It is regrettable," says ranking Democrat Adam Schiff—and all but ensured that it won't be able to produce a unanimous final report. Instead, Republicans are expected to reject the notion of any collusion, with Democrats saying more time and resources are required.

The upshot for Republicans is Nunes's improved standing in the party. "He's been a tremendous leader," says Representative Mark Meadows of North Carolina, chairman of the conservative House Freedom Caucus. "Sure, he's taken his lumps. But he's come out better for it." *—Billy House*

THE BOTTOM LINE Nunes has used his position as chairman of the House Intelligence Committee to raise questions about government investigations into Trump-Russia ties.

The Hazards of Punishing Pakistan

● By withholding security aid, the president prolongs a decades-old love-hate relationship

In Lahore and Karachi, American flags were burned in front of TV cameras after President Trump's decision on Jan. 4 to withhold $2 billion of security aid from Pakistan to punish it for allegedly harboring terrorists. The country's government issued angry statements claiming no insurgents were being given sanctuary and that the U.S. wasn't fully appreciative of the thousands of Pakistani soldiers killed fighting militants.

The rancor isn't new. The U.S. relationship with Pakistan, which deepened during the Cold War, is both strategic and troubled. The complications increased with the Soviet invasion of Afghanistan in 1979, when the U.S. funneled arms and cash through Pakistan's main spy agency to the Afghan guerrilla resistance—the mujahedeen. Among the foreigners who flocked to the chaos in Afghanistan was Osama bin Laden. Since Sept. 11, the U.S. has given Pakistan billions of dollars in military aid and continued to rely on it as a main supply route into Afghanistan. Yet despite its assistance capturing and killing many senior al-Qaeda leaders, Pakistan has been routinely accused of continuing to support militants carrying out attacks on Afghanistan and India. Bin Laden hid in Pakistan for years before being killed in a Navy Seal raid in 2011.

Under President Barack Obama, U.S. aid to Pakistan slowly dwindled, and portions occasionally were frozen by Congress amid accusations that Islamabad wasn't doing enough to root out the Taliban-affiliated Haqqani network. Things have gotten worse under Trump. In August he made a point of calling out Pakistan for its apparent duplicity while outlining a plan to end the war in Afghanistan—troop increases and prodding Pakistan's nemesis India to take a larger role. Trump foreshadowed his decision to cut off funding in a New Year's Day tweet in which he said the U.S. has "foolishly" given more than $33 billion and received only "lies and deceit" in return. "What was coming was in the cards," says Mahmud Ali Durrani, a retired Pakistan army major general and former ambassador to the U.S. "This is one of the lowest points in the relationship between the two countries."

"The U.S. has cut aid to Pakistan before, and that didn't cause Pakistan to change its behavior"

Trump risks alienating a key U.S. ally in the war on terror, one that has nuclear weapons and finds itself boxed in by India to its east and Afghanistan to its west. Already, Trump has managed to unite Pakistan's ruthlessly adversarial politicians seven months before national elections, shifting the political conversation from one of accusations of corruption to unified defiance against the U.S.

Trump may also end up driving Pakistan closer to extremists in Afghanistan including the Taliban and the Haqqani network, which may find ways to stymie his renewed efforts in that country. One drastic measure Pakistan could take would be closing overland access to landlocked Afghanistan, as it did for eight months in 2011 and 2012 after NATO forces killed Pakistani troops. "If Pakistan decides to retaliate by shutting down supply routes for NATO forces, then there could be big problems," says Michael Kugelman, a senior associate for South Asia at the Woodrow Wilson International Center for Scholars in Washington.

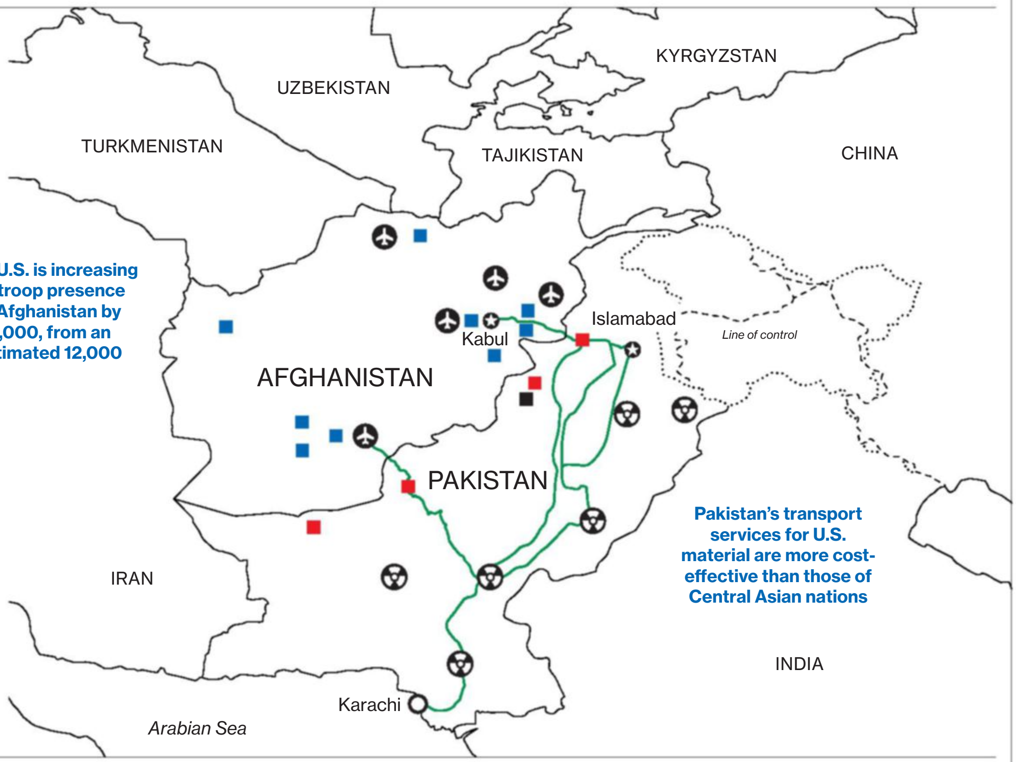
Those routes are lucrative for Pakistan, which profited from transit and port fees, so it may be reluctant to block U.S. access. The country is also facing economic stress and speculation that it may go to the International Monetary Fund for its

◀ Protesters in Lahore on Jan. 4

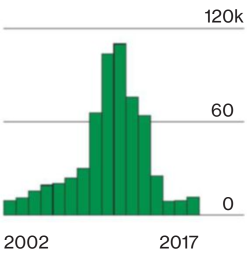
RANA SAJID HUSSAIN/PACIFIC PRESS/SIPA/AP PHOTO

Why Pakistan Matters

The country provides the best and cheapest supply routes to U.S. forces in Afghanistan



U.S. troops in Afghanistan



GRAPHIC BY BLOOMBERG BUSINESSWEEK. DATA: LONG WAR JOURNAL, INSTITUTE FOR THE STUDY OF WAR, FEDERATION OF AMERICAN SCIENTISTS

13th bailout since 1988. Plus, it lost revenue when it last closed NATO access. "The Pakistani route is less a necessity and more a lower-cost convenience for the U.S.," says Husain Haqqani, Pakistan's ambassador to the U.S. from 2008 to 2011. "The U.S. must decide if the higher cost would be a price worth paying for a freer hand in conducting the war in Afghanistan. Pakistan must decide if it wants to forgo the economic benefits of transshipment."

If it does, the country may lean more heavily on China as a source of investment. China is financing more than $50 billion in infrastructure projects in Pakistan as part of its Belt and Road trade initiative. It overtook the U.S. as the largest investor in Pakistan four years ago and has since doubled its direct investment there to $1.2 billion a year. With more Chinese funding, Pakistan could push back further against American demands.

But, as Haqqani points out, Chinese loans are no substitute for American cash and high-tech weaponry. "Pakistan is perennially short of foreign exchange," he says. "Moreover, China charges higher interest on loans." Pakistan for its part may also want to avoid further sanctions, including on travel—more of its elite are schooled and work in America than in China. The U.S. also remains Pakistan's largest export market. Nonetheless, "the U.S. has cut aid to Pakistan before, and that didn't cause Pakistan to change its behavior," says Kugelman at the Wilson Center. "How these moves play out will go a long way toward determining the trajectory of this very troubled relationship."

U.S. officials have left open the prospect of releasing the aid should Pakistan prove cooperative. For its part, Pakistan says it's done more than any other nation in the battle against terror. Security vastly improved in the years since the army decimated groups launching attacks in Pakistan after a school massacre in 2014. Residents in the financial hub of Karachi until a few years ago lived in fear of kidnappings and street warfare. Now restaurants are crowded, business is thriving, and bombings are unheard of.

The lack of U.S. money could hurt Pakistan's ability to modernize its aging military equipment, because Islamabad is reliant on U.S. technology, says Abdul Basit, a research fellow at Singapore's S. Rajaratnam School of International Studies. If relations don't improve, the U.S. may shift drone attacks from Pakistan's tribal areas deeper into the country, to areas such as the restive southwestern province of Balochistan, Basit adds. In the end, though, the decision on aid is unlikely to have long-term impact on regional dynamics—the U.S. will be unable to impose a solution in Afghanistan, even if it has Pakistan's full support, he says. "There will definitely be anger and frustration in Islamabad," Basit says. "But is Islamabad going to adjust its behavior? They might make some technical moves. But in terms of a strategic shift? I don't think so." *—Chris Kay, Faseeh Mangi, and Iain Marlow*

THE BOTTOM LINE The Trump administration's decision to halt $2 billion in security aid to Pakistan may make the country turn more toward China as a source of investment.

THE FIRST STEP IS ADMITTING YOU HAVE A PROBLEM. EASY:

THE JOBS CRISIS P44

SUPERWEEDS P54

A TRANSIT HELLHOLE P60

WHAT'S HARDER IS COMING UP WITH SOLUTIONS...

PROBLEM: INCOME INEQUALITY

IN A RADICAL EXPERIMENT, FINLAND IS GIVING SOME RESIDENTS $670 A MONTH—NO STRINGS ATTACHED

BY CLAIRE SUDDATH
PHOTOGRAPHS BY JUUSO WESTERLUND

SOLUTION: FREE MONEY

JUHA JARVINEN AND TWO OF HIS CHILDREN
AT HOME IN JURVA

ONE AFTERNOON IN THE FINAL DAYS OF 2016, STEFFIE Eronen got a phone call from her husband, Juha. The Eronens had spent Christmas with relatives in Savonlinna, Finland, and Juha had just made the two-hour drive home so he could return to his job as an electrician. The couple live with their 5-year-old daughter in a cozy, two-bedroom apartment in Mikkeli, a quiet, midsize city in the southeastern part of the country. Juha was calling to let his wife know he was home safe, and oh, by the way, an important-looking letter had arrived for her from the Social Insurance Institution of Finland–or, as everyone calls it, Kela.

"Open it," Steffie said.

There was a pause as Juha tore into the envelope. Then he laughed.

"You got it!" he exclaimed.

"Got what?"

"Basic income," Juha told her. "You're in the program!"

Earlier that year, Finland had announced an unprecedented socio-economic experiment. Two thousand residents would receive €560 a month (about $670) for two years, with no strings attached, and the government would study how the money affected their lives. Specifically, Finland wanted to know if the payments, called basic income, freed up people to take part-time or freelance work as they looked for something permanent–stopgap measures that the country's existing benefits system tends to discourage. To that end, it selected participants who were unemployed and poor.

Steffie, 38, was both of those things, and for months she and her husband had joked that she might make the cut. Chances were slim; the names were being drawn from a pool of about 177,000 people.

"Ha-ha, very funny," she told Juha over the phone.

No, really, he said.

The couple have been together for seven years and married for four, and they have the kind of affectionately antagonistic banter that develops when two people are raising a small child in a small apartment. They went on like this, Juha insisting and Steffie telling him to stop it, until Juha finally cried "Oh, for f---'s sake!" and hung up. A few days later, Steffie came home and read the letter herself. Over the next two years, Finland was going to give her €13,440 (about $16,000). With it, she could do whatever she pleased.

BASIC INCOME IS, AS THE NAME IMPLIES, SIMPLE AND earnest in its intentions. It assumes that a society thrives when its members are cared for and so seeks to provide them with the means to care for themselves. A robust economy–with jobs, yes, but also the freedom to advance and innovate–allows most people to prosper on their own. But skills become obsolete. People are laid off or get sick. Basic income furnishes a regular stipend so their fundamental needs will be met no matter what.

In its truest form, universal basic income, or UBI, money would be given to everyone. Warren Buffett would get it. LeBron James would get it. So would drug addicts and convicts and people who create Instagram hashtags for their dogs. Technically, Finland's experiment wasn't universal, but if the government liked the results, the hope was for the system it eventually implemented to be so.

Historically, the idea of basic income crops up when people want to right an economic wrong. It's there in Thomas More's 1516 book *Utopia*, which describes a society that has no crime because it can "provide everyone with some means of livelihood so that nobody is under the frightful necessity of becoming…a thief." There it is again, in a 1796 pamphlet by American political theorist Thomas Paine, who argued for the creation of a "national fund" out of which "every person, rich or poor" would receive £15 once he or she turned 21 and £10 every year thereafter. Earth's resources were supposed to be available to everyone, Paine argued, so people deserved "compensation in part for…the system of landed property."

With the U.S. facing growing income inequality, a tenuous health-care system, and the likelihood that technology will soon eliminate many jobs, basic income has been catching on again stateside. If predictions from places such as the consulting firm PwC and the McKinsey Global Institute are right, tens of millions of Americans will see their jobs become automated within the next decade. These losses would be in addition to the 7 million manufacturing jobs the U.S. has shed since 1980.

Such pressures have prompted business leaders like Richard Branson, Elon Musk, and Mark Zuckerberg to praise the idea. "There is a pretty good chance we end up with a universal basic income…due to automation," Musk said on CNBC last year. "I'm not sure what else one would do." In July, Hawaii became the first state to legislate a formal study of basic income. "We have a heavy reliance on tourism and other service-related sectors of the economy, which are more susceptible to automation. This is an effort to look at possible solutions to that," says Chris Lee, a Democratic state representative, who introduced the bill after reading about basic income on Reddit.

Y Combinator Research, an offshoot of the Silicon Valley incubator, is also planning a five-year study involving 3,000 residents of two yet-to-be-announced states. This project will be bigger and longer and will involve larger payments ($1,000 per month) than Finland's, but its $60 million price tag will be privately funded and administered–an approach that would be nearly impossible to scale. "We're free from political whims," says Elizabeth Rhodes, Y Combinator's basic income research director, "but we can't do this without the government's help."

That's where Finland comes in. So far, it's the only country willing to try.

IT'S COLD IN FINLAND. AND IN THE WINTER, VERY DARK. Ask a Finn what the weather's like, and she won't tell you how hot or cold it is outside, but how light or dark. The country has only five and a half million people, most of them clustered in the south—a sensible choice considering its northern third is inside the Arctic Circle. Finland is also the easternmost of the Nordic countries, wedged between Sweden and Russia, both of which, at one time or another, have invaded and taken it over. As a result, Finnish culture is a pleasant mix of Scandinavian (they're whizzes at sweetbreads and lingonberry jam) and Russian (ditto herring and vodka).

Three-fourths of Finland is forested, and after World War II the country supplied lumber, paper, and other raw materials to rebuilding European economies. Within decades it had transformed from the continent's bumpkin cousin into a sleek, modern, wealthy country. Adjusted for inflation, the average income for a Finnish family doubled from 1948 to 1979. Things improved further in 1992, when Nokia Oyj introduced its first mobile phone. At its height, the company accounted for 4 percent of the country's gross domestic product.

With its wealth, Finland created a network of social institutions designed to ensure that everyone enjoyed a certain quality of life. Kela was founded in 1937 to administer a national pension program and has since expanded to encompass roughly 40 services. There's child-care assistance. Money for housing. Stipends for college students. Unemployment. Retirement benefits. Paid parental leave for mothers and fathers, guaranteed for at least one year. "We do have many benefits compared to other places," says Marjukka Turunen, director for change management at Kela. Turunen has short, closely cropped blond hair and speaks with the crispness of a person who values method and organization, necessary traits for her job.

The country pays for its social programs with relatively high taxes. Finland's progressive income tax tops out at about 31 percent, but local taxes and pension contributions can push the effective rate closer to 50 percent. Kela redistributes about $15 billion every year, helping give Finland one of the lowest levels of income disparity in Europe. The richest 20 percent of Finns earn four times what the poorest 20 percent earn, compared with eight times in the U.S. The median annual income is about $43,000—about a quarter less than in the U.S. but well above Italy's and Spain's.

In other words, most Finns are financially secure. Even in the capital, Helsinki, you won't find much homelessness or panhandling. Most families own a house and a car and take regular vacations. The trade-off is that quotidian purchases can be expensive. (Ever paid $8 for coffee? I have. In Finland.) And the wealthy are often frustrated by how much of their earnings is siphoned off. "I don't spend much ▶

ERONEN AND HER DAUGHTER, JANNA, AT HOME IN MIKKELI

◀ time in Finland anymore," says Bjorn Wahlroos, chairman of three of the country's largest companies, forestry conglomerate UPM-Kymmene Oyj and two banks, Nordea and Sampo Group. "Too expensive. I still have a home there, but I spend most of my time in France and Sweden."

Finland has other problems, too. Like the U.S. and the rest of Europe, it's suffering from manufacturing job losses and general economic sluggishness. On top of that, Nokia's demise in the face of smartphones coincided with the 2008 recession, twin crises from which the country hasn't recovered. The unemployment rate is 7 percent, almost twice the U.S. figure. With more people relying on Kela, public debt almost doubled from 2008 to 2015. Last year, Finland reduced the amount of time people could receive unemployment benefits, hoping to save about €200 million a year.

"The welfare state was never perfect, but it used to work," Wahlroos says. "Now we're looking at a future labor force with a lot of irregular and low-paid jobs. Given that, I think it's intellectually dishonest to maintain that our present system of social security can be fixed."

Previously, Finns' complaints about the system related mainly to its sluggish bureaucracy. Think waiting in line at the DMV is bad? Try working with a federal agency running 40 programs, each with its own recipient database and payment system. "The administrative burden, it's too much," Turunen says. "Somehow this has to be gotten rid of."

Take those unemployment benefits, for example. If you lose your job in Finland, you'll receive two types of unemployment: Most of your salary is covered by a union, to which you probably paid dues while employed. (Some 70 percent of Finns are unionized.) Kela will cover the rest for 400 days—down from 500—or until you get another job. Remain unemployed, and you'll be shifted to what's called a labor market subsidy, which doesn't pay your full salary but has no end date. All the while you'll have to prove to Kela that you're looking for work. Be careful, though—if you find temporary or freelance employment that brings in more than €300 per month, your benefits will be reduced. And when that work ends, you might have to wait weeks or months for your full benefits to resume.

The country has been trying for years to remove the incentive to remain on unemployment. Every once in a while, a newspaper columnist or academic floats basic income as a possible solution. Wahlroos first publicly suggested it in 2001, inspired by the conservative, free-market economist Milton Friedman. Friedman supported the idea of a negative income tax, in which people who earn less than a certain amount receive money at tax time rather than owe it. (This exists in the U.S. as the earned income tax credit.) Basic income is essentially the same thing, Wahlroos argues, but paid monthly. "In the U.S., you might think this idea is socialism," he says. "I don't think Milton Friedman would like you to say he was a socialist."

In the winter of 2015, the government, which is dominated by the right-leaning Centre Party, announced a formal study, run by Kela, to see if basic income was viable. The public

"I DON'T MIND IF SOMEONE SAYS, 'OK, PAY ME HUNDREDS OF EUROS, AND I'LL JUST START PAINTING UGLY PICTURES OR WRITING BAD POEMS'... IT'S POSSIBLE MANY OF THOSE PAINTINGS WON'T BE THAT BAD"

adored the idea. In national polls, almost 70 percent of Finns supported it. Asked what level of income would be sufficient, on average they suggested €1,000 a month, almost one and a half times the minimum retirement pension in Finland. But the plan didn't go over well with the Central Organisation of Finnish Trade Unions (SAK), the country's largest union. "It takes social policy in the wrong direction," Ilkka Kaukoranta, chief economist of SAK, told Bloomberg News last year, arguing that people would stop working.

Wahlroos says that isn't the point. "I don't mind if someone says, 'OK, pay me hundreds of euros, and I'll just start painting ugly pictures or writing bad poems,'" he says. "We are actually paying many of those people more in other benefits right now. And it's possible many of those paintings won't be that bad."

Kela designed Finland's experiment with help from think tanks and economists from around the continent, following parameters set by the government. The payments would start in January 2017 and run for two years, concluding in time for parliamentary elections in 2019. Kela's then head researcher, Olli Kangas, oversaw the project.

Kangas is a lithe man with thick-rimmed glasses who got his start studying social security systems in Sweden and Denmark. He says he almost panicked when Finland's prime minister, Juha Sipila, announced the timeline. "Preparing a law like this usually takes years. We had three months," he says. "It was a nightmare, honestly. Happily it happened toward summer, when days are very long."

Kangas assembled a team of about 10 Kela economists and social scientists, including Turunen. They started by studying trials conducted in other countries. There was one run by a nonprofit in Kenya, but it took only $22 a month to lift people out of poverty there. Iran had given its citizens monthly cash payments from 2011 to 2016, but they were temporary, designed to offset the rising price of gas as the government phased out subsidies to fuel companies. It turned out that the most robust studies, and those most closely aligned with Finland's goals, had been conducted by a country unlikely to implement basic income anytime soon: the U.S.

In January 1968, President Lyndon Johnson set up a commission to examine alternatives to America's welfare system. The panel eventually recommended a "basic income support program" in which every adult citizen would receive $750 per year (about $5,200 today), with an additional $450 granted per child. This never happened, of course. But the idea floated around Washington for years—Richard Nixon included it in his 1969 Family Assistance Plan, which never took effect—and inspired several city and state experiments to test low-income families' responses to different taxation and benefit levels. The largest, in Denver, lasted from 1971 to 1982 and involved 4,800 families.

Chances are you've never heard of these studies. That's because their results were often misconstrued, causing them to be written off as failures. Early analyses claimed that basic income led to a dramatic rise in the divorce rate. This was later disproved, but not quickly enough to keep U.S. senators from decrying the idea on the Senate floor or the *New York Times* from running an article in 1979 that linked basic income with the demise of the family unit. Opponents also argued that recipients would spend their newfound money on alcohol or drugs; in later reports, researchers found that hadn't happened.

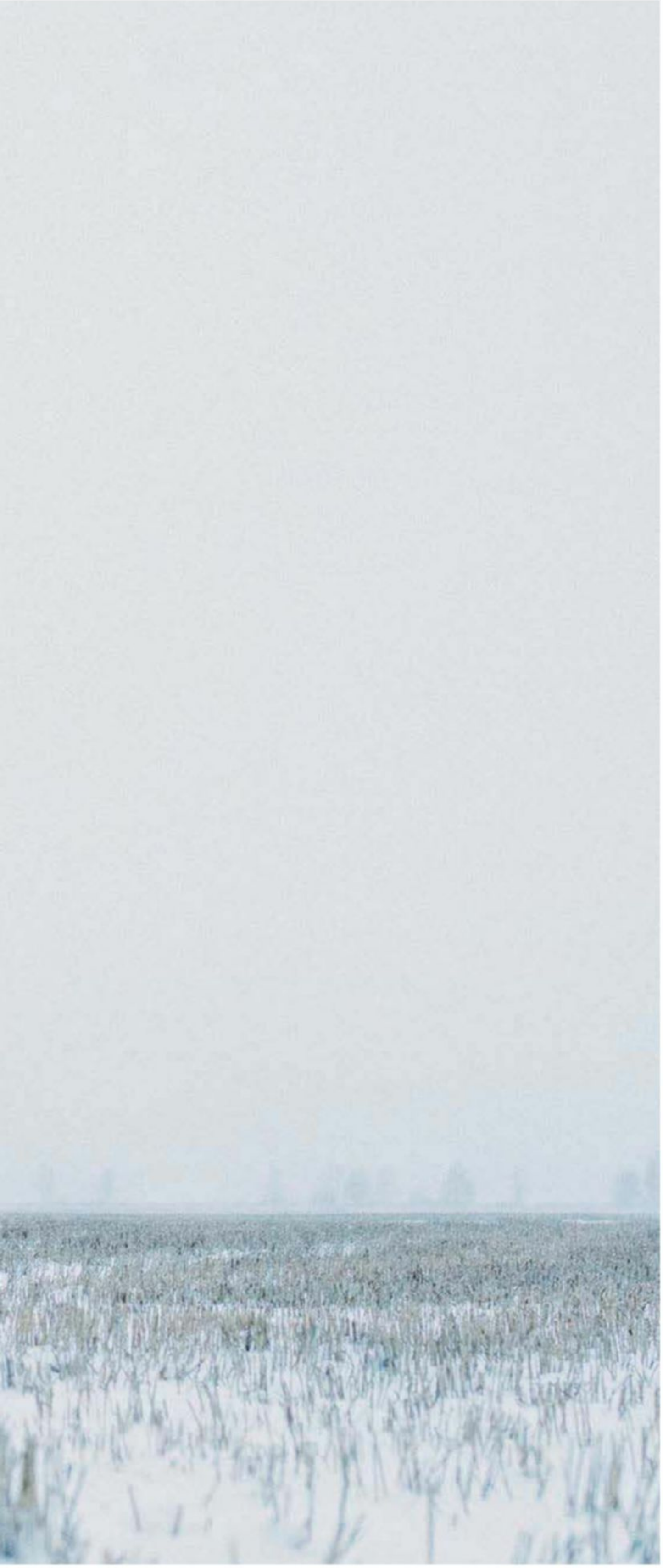
What few changes did occur were minor: Participants spent more money, but mostly on necessities, and young people worked fewer hours, largely because they went back to school. The cash didn't pull people out of poverty or otherwise dramatically change their lives. By the time the experiments concluded in the early 1980s, President Ronald Reagan was seeking to reduce federal welfare programs rather than expand them, and the country moved on.

Still, the studies were the best thing Finland had to go on. Kangas liked their focus on low-income families. Turunen suggested narrowing the scope to those who were also unemployed, since Kela already had their names and income information.

Initially the agency hoped to involve 10,000 people and give them monthly payments ranging from €450 to €750 so it could study the influence of income level on behavior. Participation would be compulsory, which meant the country would be forcing some people to take less money than they were receiving, while others would get more. But then Finland's constitutional law committee ruled that randomly raising or slashing people's benefits violated the constitution, which prohibits treating one group of citizens differently from another. The committee and Kela compromised: Participants' unemployment checks would be replaced with basic income payments of €560, the average given to someone on unemployment. If a participant had been receiving more in unemployment, he or she could ▶

ERONEN AND JANNA AT AN ADVENTURE PARK IN MIKKELI

JARVINEN OUTSIDE HIS HOME



◀ apply to have the balance reinstated. All other benefits would continue as planned. Then, to keep costs manageable, the Parliament slashed the number of participants to 2,000.

Kangas hated these changes. Including other benefits made basic income's effects harder to quantify. And 2,000 people was way too few to be worthwhile. "I don't know how that number was reached. It was a very complicated process," he says. "There was this constant political game going on behind the curtains I couldn't see."

JUHA JARVINEN KNEW IT WAS NAIVE TO HOPE FOR BASIC income, but he couldn't help it. "I read about it in the papers and was wanting it," he told me when I visited him at his home in rural Finland. Jarvinen and Steffie Eronen had agreed to let me track their first year on basic income and see what, if anything, it changed.

Jarvinen, 39, had been out of work for six years when Finland announced its experiment. His career, such as it was, had started two decades ago when, just out of high school, he found work at a cable and wiring factory in Helsinki. "It was a lot of standing around and pushing buttons, watching machines do everything," he said. "I was making €20 an hour, but I thought, I have to find something else."

Jarvinen has an ashy brown beard and likes to wear a top hat. He calls himself an "idealistic hippie," and when he gestures the beaded bracelets on his wrists jingle. After quitting his factory job in 2003, he left Helsinki with his wife, Mari, eventually settling in Jurva, a village of about 5,000 people in southwestern Finland. They bought a ramshackle house set back on a rolling country road, surrounded by fields and forest. They had six kids, and after each one, Mari went back to work as a nurse. "My wife, she's into women's equality and always wanted to work," Jarvinen said. "So I said I'd work from home."

In 2004 he started a company making custom shutters and windowsills for homes. For a while he did well. "I sold to very rich people, powerful people, in Finland and Russia. I could have made a lot of money, but it turns out I'm a bad businessman," he said. He didn't pay his taxes on time. Sometimes he refused an order. ("If I didn't like a customer, I'd tell them to f--- off.") Then came the recession. The company started losing money. Jarvinen was so stressed he stopped sleeping and eating. He spent weeks in bed. Eventually the country's tax office forced him to declare bankruptcy. "They sold my machines to pay taxes," he said. "I'm not bitter at them, just sad. The closure of my business made my depression worse."

Jarvinen had been on unemployment ever since. He got about €640 a month, plus an €800 child-care credit. His wife pulled in an additional €1,700 from nursing. That worked out to the equivalent of about $45,000 a year, not much for a family of eight. The children wore used clothing. The family's furniture was either secondhand or handmade by Jarvinen. He owned one pair of shoes. ▶

◀ Jarvinen wanted to start another business but worried that it, too, would fail. He recalled the four or five months it had taken for his unemployment benefits to kick in the first time, when the family couldn't pay utility bills and had to borrow money from one of his brothers. "I can't do that again," he said. What little part-time work he'd been offered always paid too much for him to take it without losing his benefits.

In December 2016, he'd received a letter from Kela. He was in the experiment. "It was like Christmas morning," he said of receiving his first payment, even though it would be fewer euros than he was getting before. "Yes, I have 100 less each month, but I'm free," he said. "I can really start working and then"—he paused—"I don't know!"

When Eronen got her letter, she was a year into an online training program that, if she passed, would allow her to apply for a full-time social services program at a university. It wasn't going smoothly. Originally from Germany, she'd moved to Finland in 2011 to be with her husband, and she didn't speak Finnish well. She'd tried to learn, but in 2013 she was diagnosed with breast cancer. The subsequent years of treatment, on top of caring for her daughter, left her with little energy or time to study a new language.

Eronen had also never graduated from high school. "I was lazy. I didn't see a point," she said, shaking her head at her teenage decision. "But now I have no jobs I can take, and I have to go back to school." She could complete her coursework just fine, but she tended to get flustered on group assignments and timed exams because she couldn't read Finnish fast enough. Her unemployment benefits, which came to about €950 a month, had been tied to her enrollment in school; they'd be canceled if she didn't pass her classes. "But basic income is no strings attached," Eronen said. "Even though the amount of money is less, there's a sense of freedom. I could get a part-time job."

In March, two months after the payments started arriving, she applied for positions at a supermarket, a post office, and a few shops, work she couldn't have taken while remaining on unemployment. She didn't get the jobs. By June her excitement about basic income had waned. "I haven't decided if I like it or not," she said. "If I don't find work, then nothing has changed."

Jarvinen was also struggling to transform his feeling of freedom into meaningful change. He talked often about "starting my new company," but six months on he still hadn't decided what it should do. Instead, he took up odd jobs. He renovated a neighbor's house. He fixed another's computer. He was also surprised to find a market on Etsy for large wooden drums that he makes in the style of Finland's indigenous Sami people.

At Kela, meanwhile, the first change Turunen noticed was that many participants had gone back to school, as had happened during the U.S. trials in the 1970s. She also discovered that people reported feeling less stressed. "One person called us and said, 'Is this really for real? I don't have to take a job?' " she recalls. The caller, a woman, was caring for her elderly parents full time and had struggled to prove to Kela that she was looking for work. Now she could focus on her parents. It wasn't exactly what Finland was aiming for, but Turunen was pleased anyway. "That is the point of this basic income," she says. "You can do with it what you need to."

"WITH BASIC INCOME, THERE WILL BE A LOT OF WINNERS, BUT THERE WILL BE A LOT OF LOSERS ALSO"

KELA'S RESEARCHERS ORIGINALLY ENVISIONED THE experiment as the first in a series that would help them understand the implications of expanding basic income nationwide. "With basic income, there will be a lot of winners, but there will be a lot of losers also," Kangas says. "We have to study the losers." For one thing, he points out, to provide Finns with the level of financial security they enjoy under their current system, basic income payments would have to be at least twice those of the trial. And to pay everyone, the country would have to change its tax structure.

In their proposals for further studies, the researchers estimated that a flat tax of about 55 percent would be required. Kangas says they tried calculations involving progressive taxation but worried that another showdown with the constitutional committee would result. Benefits are taxed in Finland just as income is, and the researchers didn't think the committee would allow basic income payments to be taxed at different rates when the whole idea was to ensure people received the same amount.

The wealthiest would be relatively unaffected by such a change because their taxes are already high, but a swath of middle- and upper-middle-class Finns would pay more in taxes than they'd get back in basic income. In national polls, when the possibility of a 55 percent flat tax was raised, the percentage of Finns who supported basic income dropped from 70 to about 30. "We would need to implement another study for the whole population to understand it," says Miska Simanainen, a tax specialist who was part of Kangas's team. No such studies are planned.

The government has also become less gung-ho about basic income as the trade-offs have become clearer. Turunen and Kangas were pulled off the trial partway through last year. Kangas is now one of Kela's directors, while Turunen is spearheading the reorganization of Finland's 300 municipalities into a system of 18 regions. Prime Minister Sipila declined an interview request, but in speeches he too has backed off basic income, instead emphasizing the need to spur people like Eronen and Jarvinen to find part-time jobs.

Last year, the government passed new restrictions on unemployment payments, penalizing people who refuse positions that are below their education and experience levels or within a certain distance from their homes. "I still believe in the experiment," says Pirkko Mattila, minister of social affairs and health and one of the parliamentarians who worked with Kela's researchers on the study. "The government has a goal of employment, so whether it's restrictions or this experiment, it's worth a try."

"Whatever happens in this experiment, it's unrealistic to think that basic income will be implemented in this country," Kangas says. "Politics is often much stronger than scientific results."

Finland also still struggles, despite its receptiveness to wealth redistribution, with the idea of giving people money without requiring anything in return. Eronen says she's gotten a few nasty responses from acquaintances. "My study mates were saying it was just free money," she says. "It's frustrating, hearing them say basic income people are lazy." Jarvinen has similar stories: "People say to me, 'You don't want to work.' I want to work. I think every person wants to do something with their life."

Trust is perhaps the most radical aspect of basic income. Handing out money requires a government to have faith that people know what's best for themselves—that, on the whole, they have enough intelligence and foresight to put their financial resources to good use. In almost every basic income study conducted so far, this faith has been borne out. The little money wasted on vices is more than offset by what is spent on groceries or child care. But trusting that this will hold true universally requires an even bigger leap of faith. In 2016, Switzerland's citizens overwhelmingly voted down a proposal that would've given them each the equivalent of $2,555 a month. Surveys showed they didn't think it was right for people to be given something for free.

Finland won't wrap up its study for another year. By then, Y Combinator Research's larger experiment will be under way in the two U.S. states. It will be based on a preliminary study of six low-income Oakland residents who received $1,500 a month for a year. When Rhodes, the organization's basic income director, sat down with participants afterward, she says, she didn't hear that anyone had made a big, life-changing purchase or quit a dead-end job in a huff. Instead, people had simply taken a financial sigh of relief.

"We had this student who was also working multiple part-time jobs," she says. "At first she told us that basic income hadn't changed much for her, since she was still working and still in school, but then she mentioned feeling less worried about being able to pay for school. She'd joined a band. She became involved in her community. She started to think of her life more holistically rather than just, can I make rent?"

That kind of hard-to-quantify change might not be enough to persuade a government to adopt a controversial new welfare system. Even Rhodes isn't sure basic income is viable. Or at least not as most people envision it. "In this country, it's talked about as a replacement for work, closely tied to the idea of automation, or what we'll all do when robots take over our jobs," she says. "But that's not how this works. Someone who makes $80,000 a year and has a mortgage isn't going to quit his job just because the government pays him $1,000 a month."

In Finland, Turunen agrees. "It's too dramatic for our social security system to just wipe the whole table clean," she says. "It doesn't remove our problems. Some, but not all."

IT TOOK JARVINEN THE BETTER PART OF A YEAR, BUT IN May he finally landed on an idea for his new business. "I'm going to do video work!" he announced. The next month he formally registered a digital marketing company that would make commercials and online ads for local businesses. "In the countryside, no one is doing any social media marketing or anything," he explained.

His experience in this arena was limited, though, to posting videos of his children to YouTube and Vimeo, and two months later he still hadn't booked any clients. "The footage I have, it's shaky, and it's not good. I need some new cameras," he said. He'd also had trouble finding rural businesses that needed social media campaigns. He applied for a regional grant to make promotional travel videos but didn't get it. "Nobody even replied, it's a bit sad," he said. An offer to make props for a television show about Vikings also went unaccepted. Instead, he continued selling his handmade drums for as much as €900 apiece on Etsy.

Eronen spent most of last year looking for part-time work, learning Finnish, and plugging away at her online courses. In the summer she underwent long-planned reconstructive surgery for the mastectomy she'd had during breast cancer treatment. She took two months off to recuperate, which, if she'd been receiving unemployment, would have required her to transfer to the sick-leave benefit system. Instead, her basic income payments kept coming.

When she returned to school, she initially found it difficult to catch up. She wouldn't have been doing well enough to remain on traditional unemployment, but basic income allowed her to support herself and stay in school. She kept at it, and in November was accepted to a social services program at Lahti University of Applied Sciences, about 80 miles from home. In January she moved with her daughter to a small apartment in Lahti that she'll keep during the school year; her husband will stay behind in Mikkeli. "I will miss him terribly, of course," she said. "But it's just one year, and then hopefully I can transfer to the university at Mikkeli."

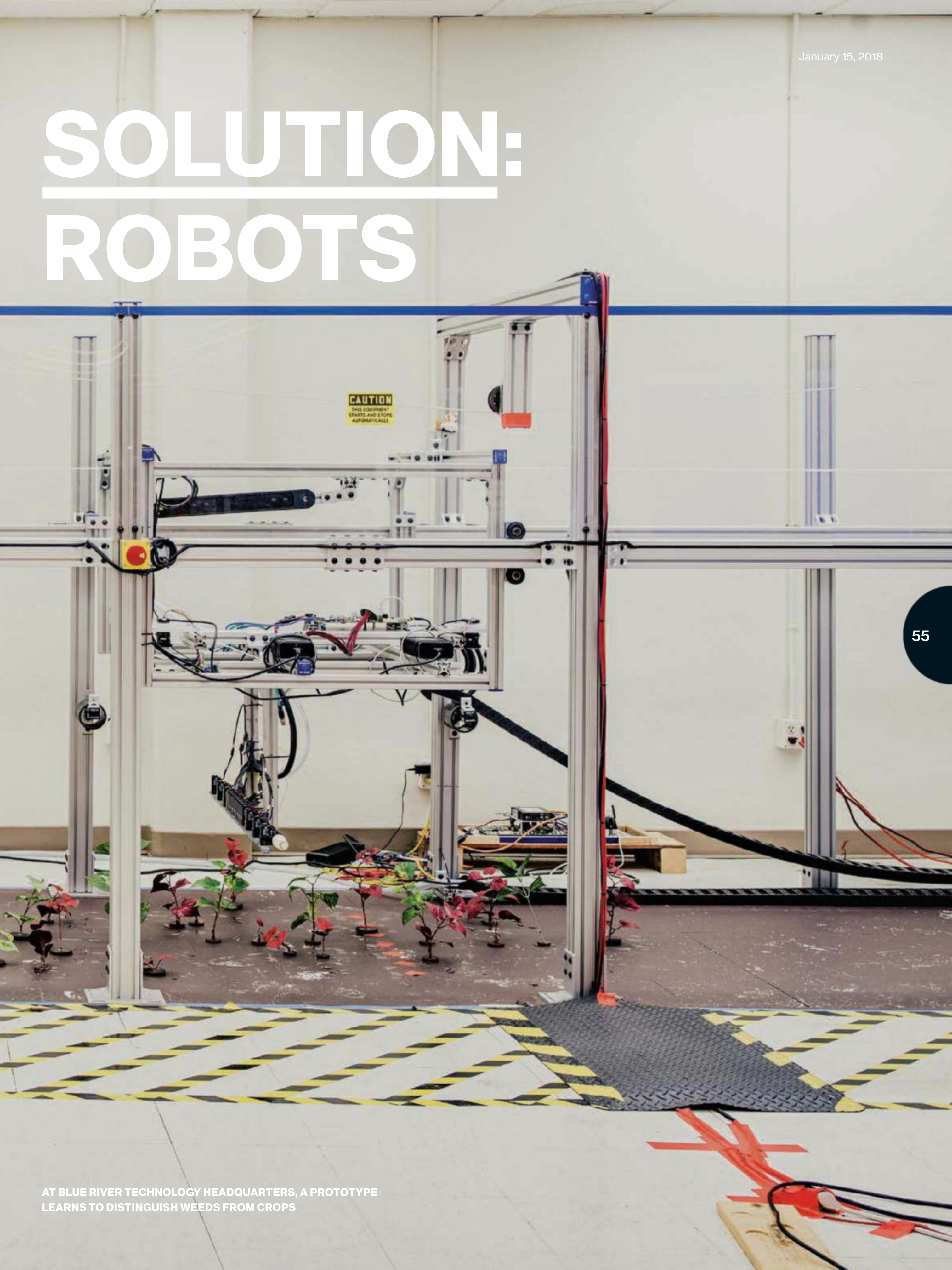
If everything goes according to plan, Eronen will graduate with the equivalent of a college degree in three years and become a social worker. She used to speak of a career helping other unemployed people look for work, but now she isn't sure. Maybe a kindergarten teacher? A child services caseworker? A health-care worker? She's never had so many careers to choose from. "I'm excited," she says, speaking by phone from her new apartment in Lahti. "It's a lot of possibilities." Her classes start this week. Ⓑ

PROBLEM: WEEDS

MICROSQUIRTS OF POISON FROM AI-POWERED MACHINES ARE REVOLUTIONIZING GLOBAL AGRICULTURE

BY AMANDA LITTLE
PHOTOGRAPHS BY JUSTIN KANEPS

SOLUTION: ROBOTS



AT BLUE RIVER TECHNOLOGY HEADQUARTERS, A PROTOTYPE LEARNS TO DISTINGUISH WEEDS FROM CROPS

AN EARLY VERSION OF BLUE RIVER'S WEEDER IS TESTED IN AN ARKANSAS COTTON FIELD

COURTESY BLUE RIVER TECHNOLOGY

JORGE HERAUD IS IN A CALIFORNIA lettuce field, and he's about to lose his mind. It's a balmy, cloudless day in October 2014. Salinas Valley stretches out around him like a Hidden Valley Ranch commercial, its endless rows of emerald leaves pushing up through the black soil. Heraud has come here to test Potato, a robot you might call the agricultural equivalent of an Apple 1 prototype circa 1976. The machine is trying to thin baby lettuce plants so the hardiest ones have space to mature. If you're imagining a C-3PO-style bipedal contraption with pincerlike hands that do the yanking, Potato isn't that. It looks like a huge metal Pez dispenser laid sideways on a rack hitched to the back of a tractor. The robot "sees" the seedlings via cameras mounted on the rack. In milliseconds it identifies the strongest plants and zaps the weaklings with jets of fertilizer so concentrated it's deadly.

Or that's what Heraud's machine is supposed to do, but right now it's on the fritz. Robots like controlled environments, and Potato's delicate equipment isn't responding well to the heat, dust, and the vibrations from the tractor. Electrical components are short-circuiting, nozzles are failing, and dirt is gumming up the cooling fans. About every half-hour, all day long, the monitors on the PCs that guide Potato freeze into blue screens of death.

Heraud's agony deepens as the failures mount. For months his team has been testing beta versions of Potato, each with a salad-themed moniker—Caesar, Cobb, Chicken, Wedge, Jello. All are first-generation renderings of a product they've officially named LettuceBot, which Heraud has already begun leasing to farmers—prematurely, apparently.

In two days he has to face his investors at a board meeting. They've plowed $13 million into his startup, and they want to hear he has a reliable product. A Peruvian-born engineer with deep-set, blue-green eyes and a stolid demeanor, Heraud internalizes stress. Lately his skin has been breaking out into prickly rashes; he's had insomnia and heartburn. LettuceBot isn't even what he'd originally pitched to his investors. He'd envisioned a robotic weeder that could perform far more complex tasks and radically reduce herbicide use. Such a machine would disrupt a $28 billion industry dominated by agrochemical companies including Syngenta, Bayer, BASF, DowDuPont, and Monsanto, while also salvaging soil microbiome, saving countless aquatic and amphibious species, and restoring purity to the world's waterways. He'd named the company Blue River Technology with these goals in mind.

When Heraud confesses his field-test failures to the board, they don't vote to oust him as he'd feared, but instead encourage him to turn things around. Over the next year, he and his team of 20 engineers launch a 24/7 troubleshooting offensive they call "the surge." They take turns sleeping on cots in the closet of their Silicon Valley office. They call in husbands and wives to turn wrenches and clamp tubes. They redesign fans, build mounts, change materials, and reformulate chemicals. Heraud consumes Tums by the fistful. By late 2015 they have a glitch-free LettuceBot that can handle the elements. They expand their contracts with farmers in Salinas and Yuma, Ariz. By early 2017, about a fifth of all the lettuce grown in the U.S. has been thinned by a LettuceBot.

Heraud and his investors are buoyed by the success, but other news excites them more. Microchip maker Nvidia Corp. has released a computing platform with outsize processing power. It's designed for navigation in self-driving cars, but it also means that a farming robot can crunch a lot more data captured by mobile cameras. Heraud may be able to build that weeding robot after all. But what he can't possibly imagine as his team begins to cobble together their first dream machine is that in September 2017 the green-and-yellow-tractor company, Deere & Co., will acquire Blue River for $305 million. And the oldest brand in agriculture will be on board with Heraud's most idealistic, even extravagant goal of all—not just of slashing agrochemical applications worldwide, but of fundamentally transforming the way we grow food.

BLUE RIVER'S SUNNYVALE, CALIF., headquarters is located in a glass-and-steel building down the street from Juniper Networks, Lockheed Martin's space division, and Yahoo! "Welcome to agriculture 2.0," Heraud deadpans, gesturing at the generic cubicles and gray carpet tiles that make up his office space. Of the company's 72 employees, only a handful, including Heraud and his co-founder, Lee Redden, have any dirt-under-the-fingernails growing experience; the rest are mostly software and mechanical engineers with degrees from Harvard, Stanford, Oxford, and Caltech. One of few clues that this is a farming company is the "I [HEART] SOIL" sticker on Heraud's ThinkPad—along with a reminder of the enemy, a framed photograph of a yellow Cessna crop-duster spewing herbicides on an oceanic cornfield.

Heraud, 47, grew up in Lima, the math-loving only child of an electrical engineer and an elementary school teacher. By the age of 5 he was spending his free time adding columns of numbers in the phone book. Weekends and afternoons he tagged along with his dad at his company, Digita, which specializes in factory automation. In the summers, he stayed on his grandparents' farm north of Lima, where his family grew 200 acres of tomatoes and rice.

He loved the fun parts of farm life—driving tractors and ATVs, raiding the soursop orchards, gathering eggs from the coop, and eating his grandmother's cakes and pies. But the drudgery seemed inane. He was up by 5:30 a.m. and in the fields with his cousins by 6 a.m., pulling weeds. "I understood early on that a farm, even a small one, is basically a big outdoor factory," he says. "There'd be dozens of us kids in the fields bending and picking, bending and picking weeds. I must have been 7 when I first thought, This is a job for machines."

Heraud excelled at school and by 14 was designing software for his dad. He went to Pontificia Universidad Católica de Perú, a South American hub for mathematicians, and continued working on the side, heading a project to automate a chicken feed factory. Stanford soon snatched him up with a scholarship to its electrical engineering master's program. After graduating, he took an engineering job at Trimble Inc., an early GPS-based technology company. Heraud led the team of engineers that designed the first self-driving tractor, a technology now used to produce about 80 percent of the developed world's food.

In 2008 he became Trimble's director of business development, buying companies that made things such as digital sensors that measure soil moisture, until he realized he wanted his own enterprise. He returned to Stanford to get an executive MBA. While there, he posted "Let's solve agriculture's biggest problems," on the university intranet. Redden, a 24-year-old Nebraskan Ph.D. student in robotics, replied. Redden also grew up working summers on a farm, in his uncle's 6,000 acres of cornfields, and was a whiz kid like Heraud. By 15 he was working as a car mechanic and had a side business building and fixing motorcycles, four-wheelers, and go-karts. At Stanford, he'd built dozens of robots that could perform everything from pingpong training to infant CPR. "But they all just sat on a laboratory shelf collecting dust," he says. "I wanted to do something that could live in the world."

Heraud researched the scourges of agriculture: hypoxic dead zones in the Gulf of Mexico and Baltic Sea, the colony collapse of bees, soil degradation, and human health problems from allergies to cancers. "Everything tied back to the blind, rampant, broadcast spraying of chemicals," Heraud says. He and Redden figured they could teach machines to differentiate between crops and weeds, then eliminate the weeds mechanically or with targeted doses of nontoxic substances. The two first considered hot foam, laser beams, electric currents, and boiling water. They'd market the robot to organic farmers, who spend heavily on chemical-free weeding methods including mechanical tillage, which can be both fuel-intensive and damaging to soil.

After months of research, they faced a disappointing truth: There was no way around herbicides. "Turns out zapping weeds with electricity or hot liquid requires far more time and energy than chemicals—and it isn't guaranteed to work," Heraud says. Those methods might eliminate the visible part of a weed, but not the root. And pulling weeds with mechanical pincers is a far more time-intensive task for a robot than delivering microsquirts of poison. Their challenge became applying the chemicals with precision.

In the early days of the startup, Heraud had pitched his company to the investment divisions of Monsanto and Syngenta, the giants of the industry he was planning to eradicate—or at least thin—with his weeding robot. He wanted access to their chemists and botanists and the credibility the association would give him among mainstream farmers who could field-test his prototypes.

The response was tentative. "We loved Jorge's Trimble background—smart guy—but at first there was some starry-eyed idealism," says Syngenta Ventures' investment director, Gabriel Wilmoth, who passed on the first investment round but kept tracking the evolution of the LettuceBot. By the third round, he bought in. Kiersten Stead, an investment director at Monsanto Growth Ventures, also provided some funding. The backing was nominal by Big Ag standards—a few million dollars—and partly a way to keep tabs on the young competition. It was also, perhaps, an admission of defeat.

WEEDS ARE ELEGANT MASTERS OF adaptation and procreative success, and the Genghis Khan of weeds—the one most hellbent on total domination—is pigweed, aka Palmer amaranth. It can grow as high as 10 feet in the shape of a ponderosa pine, with a stalk the width of a corncob. A single plant can produce a million seeds, and a pigweed-infested field will spew hundreds of millions, raising the probability that a mutation of the plant will come along that can resist an herbicide. "To a farmer, pigweed's like a staph infection resistant to every antibiotic," Heraud says.

For decades chemists at Monsanto, Syngenta, and other agrochemical companies struggled to make products that are molecularly "selective," meaning lethal to weeds but not to crops. Failing that, they genetically engineered crops, beginning with Roundup Ready cotton, corn, and soy, to tolerate the herbicide glyphosate, so it could be sprayed over entire fields. The solution worked until it led to the overuse of glyphosate and, in turn, superweeds. In 2006 an Arkansas cotton farmer noticed that the Roundup he was spraying on his fields wasn't killing the pigweed the way it used to. ▶

◀ Two years later there were 10 million acres of Roundup-resistant weeds in the U.S., and by 2012, 30 million acres. Today there are 70 million acres, an area of land roughly the size of Nevada.

Chemical companies have responded by reformulating old, high-potency chemicals such as Dicamba and 2,4-D, but this approach has brought its own host of problems. Dicamba has caused chemical drift, killing off 30 million acres of neighboring crops in the past 18 months. Pigweed, meanwhile, has kept on dropping its tiny genetic bombs by the trillions throughout America's farmlands.

If robots can prevent herbicides from having any contact with crops, it means that 18 classes of chemicals previously considered too damaging to be widely sprayed suddenly become viable. "We're both ratcheting down the volume of chemicals that need to be used, but also expanding how many types can be used," Heraud says. In other words, Blue River's success might be the worst thing that could happen to the herbicide industry, or it could open up an avenue to sell new products.

IT'S A STEAMY, EARLY SUMMER DAY IN Marianna, Ark., and we're deep in the heart of cotton country. Marianna looks like many small towns in the Arkansas Delta—population 4,000, median income $24,000—a farming community suffering from low crop prices. Many of the houses at the city center, once-beautiful, gingerbread-trimmed Victorians, are abandoned, their porches sunken and windows broken, kudzu crawling in, evidence of the one resource this town remains rich in: weeds.

Heraud has come to the weed capital of the world to test See & Spray, his first robot weeder, in cotton fields owned by 37-year-old Nathan Reed, a third-generation Marianna farmer who cultivates cotton, corn, rice, and soybeans on 6,500 acres. A dome of fabric that looks like a huge white hoop skirt protrudes off the back of Blue River's tractor to protect the robot from dust and rain. Eight computers are stacked sideways beneath the domed cover, and above the shrouded robot three large

HERAUD

tanks are filled with water dyed electric blue—a faux herbicide for the test run.

A software engineer is in the cab of the tractor looking at a laptop that displays a composite view of the ground beneath the robot gathered by 16 cameras. It shows cracked brown soil with cotton seedlings poking up about 3 inches and a random assortment of weeds that, to the untrained eye, are indistinguishable from the cotton plants. The robot does the differentiating for us. See & Spray is scanning the plants, Heraud explains, and within 30 milliseconds—about a tenth of the time it takes for you to blink your eyes—it's distinguished the cotton from the weeds and decided how much and where to spray. The screen shows circles around the cotton plants and squares—dozens of them overlapping—around the weeds.

Psst pssst pst pssssst pst—tiny bursts of blue "herbicide" are shot from 128 nozzles across eight rows of cotton plants. Patches of blue ink land on clumps of weeds in perfect rectangles, some the size of a sheet of paper, others a thumbnail. "There's a misfire—you woulda murdered my cotton plant," Reed jokes, pointing to a seedling shot with blue.

"That's why we don't use the red dye," Heraud says. "It'd look too gory."

In its early days in Yuma, the LettuceBot did indeed murder entire fields of lettuce. Its nozzles sprang leaks and dripped hyperconcentrated fertilizer on acre after acre of seedlings. Heraud got on a plane and went to make things right with the affected farmers. His team fixed the problem by adding an automatic abort function to nozzles that drip for more than five seconds, then they thinned the farmers' next 100 acres for free.

On Reed's field we notice a lot of blue-spattered cotton plants, while the weeds next to them are untouched. The machine is getting confused because some of the cotton is runty and withered—not as healthy as the cotton See & Spray is programmed to recognize. The robot needs to be fed first hundreds, then thousands, and eventually millions of images of cotton to learn the many variations of the plant, how its leaves change shape and texture over time, how they look when they're sickly and healthy, and during all stages of growth. The robot's ability to draw from this image archive and make distinctions and decisions is "deep learning."

The Blue River team built the memory of See & Spray by going to a cotton farm in Australia, hitching a video camera to a modified shopping cart, and spending three months pushing it around different fields, uploading about 100,000 images of cotton. But the Arkansas cotton, struggling in a wet, cold spring, isn't looking enough like the Australian cotton for 100 percent accuracy. Each day for a fortnight, Heraud's team will take tens of thousands of new cotton images, and each day the robot will become more accurate.

For now, though, See & Spray is making toddleresque mistakes. Suddenly, Heraud slaps his thigh. "Nailed it!" he shouts, breaking his characteristic composure. He's looking at a cotton plant surrounded by a nasty weed. The machine has outlined the weed in blue liquid and spared the struggling seedling at the center.

Where Heraud sees lowered chemical use, Reed sees savings. Because of his location, herbicides account for about 40 percent of his operating costs—more than $500,000 a year. On an acre of cotton, he typically uses about 20 gallons of herbicide. After several weeks of trials, it appears the See & Spray robot can manage his weeds with 2 gallons per acre. A robotic weeder is also a huge advantage for no-till agriculture, a practice Reed has adopted in recent years. Tilling is a way to manage weeds without chemicals, but it also erodes and dries out soil, disturbs the microbiome, kills earthworms, and releases trapped carbon. Avoiding tillage eliminates those fuel costs and reduces irrigation needs. See & Spray also liberates Reed from an economic hamster wheel; to use broadly applied sprays like Roundup, each season farmers must buy expensive seeds genetically modified to resist the chemicals. A robot that targets only the weed will allow Reed to buy nonengineered seeds, which cost roughly 75 percent less. But Reed, like many farmers, is struggling to get by. A robotic weeder will be an option only if Heraud can lease his robots at a competitive price.

AS SEE & SPRAY WAS BUSY CRUNCHing data in Reed's fields, Heraud was hatching a plan to produce an affordable machine. "We'd been seriously courting Jorge for months and following his progress for years," says John Teeple, Deere's director for advanced technology. In September the farm equipment multinational bought the three-year-old Silicon Valley startup. "It was clear that Blue River was becoming the industry leader in robotics and machine learning and that this for us would be a perfect synergy," he says.

Heraud had no ambivalence about giving up his independence. "Last week we were a tiny company that might succeed or fail," he says after the acquisition. "A young startup with six lettuce thinners and two weeding prototypes. Any more scary scenarios"—like the leaky nozzles on the LettuceBots—"could be a fatal blow." He estimates that Blue River will release its first See & Spray bots in the U.S. in early 2020 and in Europe in 2021—several years sooner and on a much larger scale than it could have without Deere's army of mechanical engineers, forge factories, and 10,000 dealers around the world.

His next step, with Deere's backing, will be to move Blue River's robots beyond herbicides to fertilizers, the culprits behind toxic algae blooms, which are killing fish and making lakes unswimmable. Farmers typically spend up to 10 times more annually on fertilizers than weed killers—about $150 billion a year. But the shift is a big leap for a robot. It must gather a range of visual signals—the colors, sizes, and textures of a plant's leaves—and from this data extrapolate the plant's health and how much nourishment it needs. "It's a ton more processing power, but it's doable," Heraud says.

"IT'S NOT EITHER/OR—SHOULD WE DO TECHNOLOGY OR AGRO-ECOLOGY, SUSTAINABLE FARMING OR INDUSTRIAL FARMING. IT'S BOTH/AND"

The next link in this technological chain could be a kind of agricultural Swiss Army knife: a robot that can apply not only herbicides and fertilizers but also insecticides, fungicides, and water all at once, delivering only as needed.

The implication of plant-by-plant—rather than field-by-field—farming is not just the prospect of vast reductions in chemical usage. It could also, in theory, end monocropping, which has become the new normal—cornfields and soybean fields as far as the eye can see—and has given rise to the kind of high-calorie, low-nutrient diets that are causing heart disease, obesity, and Type 2 diabetes. Monocrops also leach soil nutrients and put food supplies at risk, because single-crop fields are more susceptible to blight and catastrophe. Modern farmers have been segregating crops in part because our equipment can't handle more complexity. Robots that can tend plants individually could support intercropping—planting corn in with complementary crops such as soybeans and other legumes.

Danielle Nierenberg, president of Food Tank, a think tank that advocates for sustainable agriculture, isn't particularly comforted by this vision of AI farming. "Lots of questions need to be asked, like which chemicals will be deployed by these bots?" she says. "And which of the many problems inherent with industrial agriculture will persist even as we cut back on herbicides?"

One of those problems is the potentially coercive power of monopolies. Deere is cast as a villain in the right-to-repair movement, in which urban and rural DIYers are fighting for laws limiting the use of proprietary software and hardware that make it almost impossible for individuals to fix their own gadgets or machines—a problem that could economically devastate an owner of a $200,000 AI-enabled tractor. Deere's ability to make farmers dependent on the usage and, increasingly, the maintenance of its specialized equipment bears relation to Monsanto's system of locking farmers in to its herbicides and seeds. If Blue River's sophisticated robots succeed as the company hopes, it could mean that farmers, and our food supply, are even more dependent on a handful of corporations. There's also the possibility, however remote, that a software-dependent food system may become vulnerable to hackers who could manipulate the dosages of toxic chemicals on the fields.

Heraud prefers not to fixate on worst-case, sci-fi scenarios. "It's not either/or—should we do technology or agro-ecology, sustainable farming or industrial farming," he says. "It's both/and. We need all solutions." He brings me back to the connection he made as a kid between farms and factories. "A hundred years ago, factories were a nightmare, spewing black smoke, with terrible working conditions and people dying. A lot of agribusiness is in that state right now, with massive inefficiencies, harmful chemicals, a huge carbon impact. But compare that with modern factories, designed to be smart, automated, safe for the environment and humans, ergonomics on every single job. They've turned around." The happy paradox, he insists, is that "robots don't have to take us away from nature—they can help us restore it." Ⓑ

PROBLEM: AMERICA'S CRUMMIEST TRANSIT CENTER COULD GET WORSE

THINK PENN STATION IS BAD? LET'S GO INTO THE CRUMBLING TUNNELS THAT LIE BENEATH

BY DEVIN LEONARD, WITH ELISE YOUNG
PHOTOGRAPHS BY NOLAN CONWAY

SOLUTION: PRAY

TO GET TO NEW YORK'S PENN STATION, EVERY NORTH-bound Amtrak passenger makes the last leg of their journey, through tunnels beneath the Hudson River, in the dark. Trust me: They should be glad. One day this autumn, an Acela pulls into Newark, N.J., and a railway spokesman escorts me onto the rear engine car, where we stand and take in the view facing backward. As we descend into one of the Hudson tunnels—there are two, both 107 years old, finished in the same year the Wright brothers built their first airplane factory—a supervisor flips on the rear headlights, illuminating the ghastly tubes.

Our train (unsurprisingly) is operating at reduced speed because of an electrical glitch, which just gives us more time to gawk at the damage. There are eerie, nearly fluorescent white stains on the tunnel walls that look like they were painted by a giant with a roller brush. The pale swaths are remnants of the salt water that inundated the passages five years ago, during Hurricane Sandy. Sulfates and chlorides have been eating away at the concrete ever since, exposing reinforcement bars underneath. "Keep your eyes peeled," says Craig Schulz, the affable Amtrak spokesman, "and you'll see some of these areas where there is literally just crumbling concrete."

As we emerge into the bowels of Penn Station, Schulz points to wooden flood doors above the tunnel entrances. They were installed during World War II to hold back the river if the tubes were torpedoed by a Nazi submarine. In the gloom, the doors look a full century older than their vintage. They seem more suited for a dungeon than a modern rail system like this one—the Northeast Corridor, which runs from Boston to Washington D.C., serving an area that generates a fifth of U.S. gross domestic product. Before we step off the train, Schulz repeats Amtrak's mantra: The storm-ravaged tunnels are safe, for now, but the railroad doesn't know how long it will be able to keep them in service.

I'd been assigned to write a story about Pennsylvania Station, but I wanted to get a caboose-eye view of the decaying tunnels leading up to it, because the only imaginable way the station could be any worse is if it were underwater. Penn, the Western Hemisphere's busiest train station, serves 430,000 travelers every weekday—more than LaGuardia, JFK, and Newark airports combined. More than 200,000 people also use the subway stops that connect to Penn through harshly lit, low-ceilinged subterranean corridors. Locals race through the place; out-of-towners proceed more anxiously, baffled by the layout of what is truly not one station but three: Amtrak shares the space with the Long Island Rail Road and New Jersey Transit. All who schlep through the complex are united by a powerful urge to leave. "Everybody just wants to get the hell out of there," says Mitchell Moss, director of the Rudin Center for Transportation Policy and Management at New York University.

There are too many people in Penn Station because there are too many trains—more than 1,300 arrivals and departures every weekday, twice the number from four decades ago. With so much traffic, small problems routinely compound into big ones; a 10-minute delay for one train backs up dozens more, and then tens of thousands of people are kept from their destinations. Every late train bleeds the economy: Executives miss board meetings, tourists don't spend, hourly workers get a smaller paycheck.

TRAINS ARE TYPICALLY PACKED, DREARY, AND LATE

In the last year, Penn Station's troubles have ripened into gruesome new forms. In April, a rumor spread through the commuter crowds that shots had been fired. People dropped briefcases, phones, and heels in the pandemonium, which spread in part because the station has no coordinated public address system. Alexander Hardy, a Bronx-based writer who was headed to Washington, D.C., watched the stampede, which left 16 people injured, from behind the counter of a Dunkin' Donuts, where he hid with half a dozen others. "I'm texting my friends to ask what the hell's happening," he says. Finally, Amtrak gave the all-clear; there hadn't been a shooting after all. Hardy stepped out of the doughnut shop. A woman, separated from her child, was screaming. Hardy took a bus to the capital. A few weeks later, a sewage pipe spewed waste onto a heavily trafficked concourse—an honest-to-God shitstorm. "I'm like, 'Literally, it's raining in Penn Station,' " recalls Marigo Mihalos, a booking agent from New Jersey who witnessed the fecal deluge on her way to work.

After two trains derailed in Penn Station last spring, the railway said it would reduce service by 20 percent during peak hours for eight weeks to do repairs, forcing many commuters to take buses and ferries. New York Governor Andrew Cuomo told his constituents to brace for the "summer of hell." As the station festers, civic groups and preservationists are renewing their call for elected officials to move Madison Square Garden (non-New Yorkers may not be aware that a 21,000-seat stadium is located directly above Penn Station) and build a new space, cavernous and sunlit. But nothing in the station's political history or the present-day debate suggests cause for hope.

As the gateway to America's largest city, Penn Station should inspire awe, as train stations do in London, Paris, Tokyo, and other competently managed metropolises.

Instead, it embodies a particular kind of American failure—the inability to maintain roads, rails, ports, and other necessary conduits. For generations, the officials connected to Penn Station have been blind to, or unable to deliver on, the idea that improving the station would more than pay for itself. (One estimate, from the Business Roundtable, says that a dollar invested in infrastructure yields as much as $3 in economic growth.) In the final days of 2017, the situation reached perhaps its bleakest point yet, when the Trump administration signaled its disinterest in coming to the rescue: The president will not honor an Obama-era commitment to New York and New Jersey to foot half the cost of a new tunnel, dumping planners back at square one.

Penn Station is a debacle reaching across time. Its past is a slow-motion disaster of inaction and canceled reforms, its present an ongoing disgrace. And its future could be truly catastrophic, in the form of a tunnel failure that pinches shut one of the most vital economic arteries in America.

ON A HOT SATURDAY IN JUNE, PENN IS LOUSY WITH people trying to exit the city. Outside a McDonald's that has never known sunlight or fresh air, the sweaty throngs give strange looks to a bearded man in shorts who appears to be remaining in the station voluntarily. His name is Justin Rivers, and he leads $35 tours called Remnants of Penn Station. A dozen or so takers appear for this, his second tour of the day. The first one, Rivers tells the group, ran 20 minutes long because guests couldn't stop asking questions about the Summer of Hell. "People are just really interested," Rivers says. "Penn Station has been in the press almost daily because it's falling apart."

His tourgoers are among the many New Yorkers—and others with an interest in urban planning—who know that today's decrepit facility sits beneath what used to be a gorgeous hall, inspired by the Roman Baths of Caracalla. It was demolished in the 1960s, to the dismay of preservationists. Rivers leads his flock through modern-day Penn, pointing out vestiges of the old place: an original staircase leading down to the tracks; a Long Island Railroad waiting room; a ghostly, red-lettered sign for the long-gone Pennsylvania Railroad.

As he dodges homeless people and glassy-eyed tallboy vendors, Rivers, who's also written an off-Broadway play about the original station's demise, tells the story of Alexander Cassatt, the visionary railroad president who began construction on both Penn and the Hudson tunnels at the turn of the last century. He died before the building opened in 1910, to a crowd of 100,000. In its early days, Penn was the kind of place you might go without a ticket to glimpse stars such as Charlie Chaplin and Mary Pickford boarding the Orange Blossom Special to Florida or the Chicago-bound Broadway Limited.

But after World War II, the once-powerful rail companies withered as the government built interstate highways and subsidized air travel. In 1970 the successor to Pennsylvania Railroad declared bankruptcy, and soon the station and its tunnels became the property of Amtrak, the new federal railroad. Perennially underfunded, Amtrak didn't—and still doesn't—have much cash to spend on either Penn Station or the tunnels. Instead, says Daniel Baer, senior vice president of the engineering and ▶

WHEN WORKERS AND TOURISTS ARE STRANDED, PENN'S FAILURES TAKE AN ECONOMIC TOLL

◀ consulting firm WSP USA, the railroad tends to fix things only when they're already broken. "Amtrak is in a situation where they're constantly chasing their tail," he says.

The addition of New Jersey Transit trains in the 1990s was both an economic boon to the region—I bought a house in Maplewood, N.J., in 1996 so I could ride the new Midtown Direct to work—and the beginning of Penn Station's transformation from mere malodorous eyesore to Hieronymus Bosch-grade hellhole. With Jersey commuters swarming the place, farsighted politicians presented grand visions for upgrading it. They all failed.

Vision 1: In the late 1990s, New York Senator Daniel Patrick Moynihan raised $350 million to replace Penn with a new station in the building right next to it, an historic post office. ("My dad always said, 'Only in New York could you knock down a magnificent Beaux Arts masterpiece only to find another one by the same architect across the street,'" remembers Maura Moynihan, his daughter.) The effort fell apart after Sept. 11.

Vision 2: In 2008, New York Governor Eliot Spitzer was on the verge of pushing through a multibillion-dollar plan to relocate MSG and renovate Penn into a cathedral-like space. It collapsed with the rest of Spitzer's political career when he was caught patronizing prostitutes and resigned.

Vision 3: In 2009, New Jersey Governor Jon Corzine put together a fully funded $8.7 billion project for new tunnels—Access to the Region's Core, or the Biblical-sounding ARC. But in a case of extreme political myopia, Corzine's successor, the White House-eyeing Chris Christie, canceled the plan to keep gasoline taxes low.

"THE SUMMER OF HELL? TO ME, THAT WOULD BE A WARM DAY AT THE BEACH COMPARED TO THE HELLFIRE WE WOULD BE IN IF ONE OF THOSE TUNNELS HAD TO BE TAKEN OUT OF SERVICE"

CHRISTIE'S FOLLY BECAME CLEAR IN OCTOBER 2012. Hurricane Sandy struck the region with 80-mile-an-hour winds, and the water off New York rose higher than at any time in the city's recorded history. The Hudson River surged over the banks of Manhattan, poured into a submerged railyard, and flooded Penn Station's venerable tunnels. A few days later, Amtrak pumped out 13 million gallons of seawater from those tubes and two that run beneath the East River. But chemicals had penetrated the walls and begun gnawing away at concrete and power systems that dated to the time of the Orange Blossom Special.

Even after Sandy, a post-ARC construction effort called the Gateway Program languished. At a hearing in Trenton in 2015, Stephen Gardner, an Amtrak vice president, tried to stoke some urgency among legislators by brandishing a fearsome-looking hunk of wire from the tunnels' malfunctioning electrical system. "Mr. Chairman, this is a portion of the feeder cable that failed," he said. "These are 1930s-vintage, lead-lined, oil-filled, paper-insulated copper cables, and they do a pretty amazing job. As you can see here, they are quite an antique, and we rely on them every day." Tom Wright, president of the Regional Plan Association, a local urban policy group, attended the hearing. He was stunned: "I mentioned to Steve afterwards, 'Jesus, that looks like a set piece from the old *Bride of Frankenstein* movie.' He kind of laughed and said, 'Actually, I think it's older than that.'"

The same month, one of New Jersey's Democratic senators, Cory Booker, rode through one of the tunnels in a special Amtrak observation car, equipped with floodlights. Booker was shocked to see cracks in the walls. "It was incredibly eye-opening," he says in an interview, adding that Amtrak officials told him if there were another storm as strong as Sandy, the tunnels might not survive.

In the era of climate change, hurricanes are becoming stronger and more frequent. Sandy, as bad as it was, only flooded the Hudson tunnels halfway. A storm that completely inundated the chambers could cause them to crack up from the inside, taking out lighting, radio, and ventilation systems. If the walls were weakened enough, the worst-case scenario could occur: total collapse. In some areas, the tunnels sit just below the riverbed, and William Ryan, a special research scientist at Columbia University's Lamont-Doherty Earth Observatory, says there is less sediment there than there used to be. Ryan spent years, starting in the late 1980s, mapping the bottom of the Hudson using echo sounding and reflection profiling. His team found that the 1960s creation of Battery Park City—an expansion of Manhattan Island into the Hudson, using landfill from the excavation of the World Trade Center site—altered the way the river flows. As a result, a good part of the silt protecting the train tunnels has been carried off.

The most likely tunnel-disaster scenario, however, requires no storms at all. Amtrak says that within seven years, one of them is likely to have been so weakened by Sandy's aftereffects that it will have to be taken out of service for at least 18 month's worth of repairs. "There will come a time when the reliability of the tunnels starts to decay," says Charles "Wick" Moorman, the co-CEO of Amtrak until the end of 2017. "The curve, once it starts, may be fairly sharp. We'll just have to see. Nobody knows. This is a great science experiment. Kids playing with chemicals."

If Amtrak and New Jersey Transit have to rely on a single Hudson tunnel, they could operate just six trains an hour, rather than the current 24. It's hard to overstate the economic impact that would have on New York City. "The Summer of Hell?" Booker asks. "To me, that would be a warm day at the beach compared to the hellfire we would be in if one of those tunnels had to be taken out of service."

SHABBY INFRASTRUCTURE DEMEANS A GREAT CITY

According to the Partnership for New York City, a group that represents its business community, some 30 percent of Manhattan's workforce lives west of the Hudson. These commuters could try to cram onto the Port Authority's PATH trains, which carry 292,000 commuters a day through different Hudson tunnels, but they're already near capacity. There are always ferries. But does a region that has prided itself on being ahead of the rest of the world truly want to see the large-scale return of a mode of transportation from the 19th century?

Others could drive to work, but the trans-Hudson bridges and tunnels available to cars already have punishing rush-hour delays. Imagine the backups, road rage, and pollution if tens of thousands of additional commuters had to use them. Common Good, a bipartisan government-reform organization, estimates that 50,000 more automobiles crossing the Hudson each day would sap productivity by $2.3 billion per year. And that's nothing compared with the biggest number of them all. The Northeast Corridor Commission, a panel created by Congress in 2008, projects that the U.S. economy would lose $100 million *per day*–$36.5 billion a year–if the entire train route from Boston to Washington ever shut down.

IN 2015 THE GOVERNORS OF NEW YORK AND NEW JERSEY agreed to a deal on Gateway: The states would pay half the cost of building new tunnels to Penn, and the Obama administration pledged that the federal government would cover the other half. That year and the next, Donald Trump campaigned as the guy who would rebuild America's crumbling infrastructure, promising a $1 trillion plan to repair roads, bridges, tunnels, the electrical grid, and more. It was possible to think that Penn Station might be saved.

But after Trump was elected, the New York City native dashed those hopes. He eliminated billions in funding for Gateway-related projects in his 2018 budget. And in the waning days of 2017, Trump made it official: His administration would not abide by the Obama-era commitment to pay for half of the new tunnels. K. Jane Williams, deputy administrator of the Federal Transit Administration, sent a curtly worded letter to New York and New Jersey officials that snidely made the deal sound made-up. "We consider it unhelpful to reference a nonexistent 'agreement' rather than directly address the responsibility for funding a local project where 9 out of 10 passengers are local transit riders," she wrote. In the Trump administration's view, Penn Station's issues are a distinctly local concern. It's true that in the Trump era, nothing is ever certain, and the Gateway corpse could reawaken. But it seems unlikely that the current political cast will succeed where so many of their predecessors have failed.

Meanwhile, across the street from the station, work has begun on the renovation of the James A. Farley Post Office building–the Beaux Arts masterpiece Senator Moynihan eyed in the 1990s. Separate from the Gateway project, it's being converted into a new entrance hall for Amtrak and LIRR trains (and a glassy shopping center) and is scheduled to open in 2020. In August, Cuomo, who's widely seen as considering a bid for the presidency, held a triumphant press conference at the site that had the feel of a political rally. "At a time when there is confusion in this country, and there is anger in this country, and there's anxiety and despair, New York is headed in the only direction we know, which is going forward!" he said, slicing the air with his right hand.

But the $1.6 billion Moynihan Train Hall, as it will be known, isn't likely to significantly reduce congestion, according to NYU's Moss. Amtrak and LIRR passengers will still be able to access the train complex from the existing Penn Station, which is a block closer to the center of Manhattan. (The Cuomo administration says the impact will be greater.) Moss is among those who scoff at the idea of prettying the upper-level train station experience when what lies beneath is a such mess. "We don't need a transit temple," he says. "We need to focus on the tunnels and getting more tracks into Manhattan."

I don't frequent Penn Station as much as I used to. My wife and I sold our house in New Jersey in 2016 and moved into Manhattan, just before the commute got infernal. Of course, now we have to deal with the subways. Have you heard? They're falling apart, too.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PURSUITS

For the past decade, the casual Brooklyn aesthetic has dominated American restaurants. Now chefs are returning to pricey elegance—but not at the expense of a good time. *By Kate Krader Photographs by Adrian Gaut*

THE NEW FORMAL

Caviar, served on egg custard at the Office, is a hallmark of the fine dining revival

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Edited by Chris Rovzar

Businessweek.com

In December 2008, then-*New York Times* restaurant critic Frank Bruni dropped a culinary bombshell. He bestowed three stars on Momofuku Ssäm Bar, an East Village dining room with no tablecloths, no elegant glassware, and no coffee service. There, inside a shoebox-size space stocked with benches and paper napkins, diners used tongs to yank at a communal roasted pork butt and, with their hands, wrapped the drippy tendrils in lettuce cups. No restaurant so casual had received such a distinction, and the news spread. "Chefs from around the world would show up at Ssäm," Momofuku chef-owner David Chang later said, citing the likes of René Redzepi from Copenhagen's Noma and Ferran Adrià from Spain. "That review took everything to a different stratosphere."

Bruni's take on Ssäm came just after the 2008 stock market crash. In New York City, Wall Street plays no small role in the restaurant economy, and the effect was on display. "If there was a single, most pronounced narrative toward the end of my time as restaurant critic, it was the migration of extremely ambitious cooking into humble and casual settings," says Bruni, whose tenure as a critic at the *Times* ran from 2004 to 2009. "Ssäm Bar was the harbinger."

Will Guidara, co-owner of Eleven Madison Park (which topped the World's 50 Best Restaurants list in 2017), puts a finer point on it: "Fine dining was under attack."

A casual-dining revolution followed, armed with flea market décor, foraged ingredients, and a phalanx of food trucks. Fancy, ambitious restaurants with jackets and elaborate silverware began to shutter, including Charlie Trotter's in Chicago (2012), Alain Ducasse's Adour in New York (2012), and Fleur de Lys in San Francisco (2014). Chefs who didn't already have a fast-casual concept in their portfolio raced to find one. The ones who stayed high-end locked patrons into tasting menus.

And then in June 2016, at the start of a record-breaking 18-month run for the Dow Jones industrial average, a restaurant called Le Coucou made its debut in New York. Its open kitchen showed off gleaming copper pots and chefs sporting tall, white toques. In the front of the house, a battery of captains in fitted uniforms attended to customers at candlelit, cloth-topped tables. The menu from French-trained chef Daniel Rose smartly tweaked the classics, with dishes such as warm oysters with seaweed butter and crispy skinned duck with foie gras and figs. The prices were likewise elevated: Dover sole with grapes cost $48; a veal tongue starter with sturgeon caviar went for $38. The place was an immediate success, hosting everyone from Kanye West to Henry Kissinger.


Oysters at the Office in Manhattan turn up in a whimsical nautilus shell

Just as resoundingly as Ssäm Bar led a swing toward the hypercasual, Le Coucou heralded a return to finer dining—but an evolved model. Rather than a library-still environment replete with beige, like New York's remaining formal icons Per Se and Jean-Georges, Le Coucou offered a colorful sense of theater, with arresting lighting and friendly service. It turned out the public was hungry for a restaurant experience that felt not quirkily humble, but like an event. One with real chairs instead of stools, where you could make reservations that would be honored, and where the playlist wasn't crushingly loud—but everyone was having fun.

A number of similarly minded restaurants, such as Bellota in San Francisco, La Table in Houston, and Del Mar in Washington, have sprouted up since the beginning of 2016. Common to each dining experience—call it Luxe Redux—are these items:

1. Reimagined classic dishes, often evoking France, the country that invented fine dining. French cuisine was set aside for its fussiness in the Brooklyn era.

2. An a la carte menu, with familiar plate sizes. (Remember appetizers, entrees, and desserts?) This class of chefs views the tasting menu format as too formal and restrictive and the jumble of shared plates as confusing.

3. No burgers. You might see a stray one on a lunch menu but generally not for dinner. Gone are the days when a restaurant wasn't allowed to open without a headline-making, Instagram-ready patty smothered in cheese and bacon jam.

4. Table seating, with chairs. Many Luxe Redux restaurants also have counters, but you'll fret no more about having your awkward first-date conversations overheard along the benches at a communal table.

5. Waiters in pressed shirts and, yes, suits. A rock band T-shirt is no longer work-appropriate attire. Tattoos, however, are allowed.

PHOTOGRAPHS BY ADRIAN GAUT FOR BLOOMBERG BUSINESSWEEK

6. A new class of stylish sommeliers, as comfortable with inexpensive, unorthodox bottles as the big-ticket ones. "Traditional sommeliers wanted to sell you a $175 bottle of wine. Anything less, and you were dead to them," says Kevin Boehm, of Chicago's Bellemore. "This new group came up after the markets crashed, when restaurants couldn't afford $80,000-a-year sommeliers" and wine captains became creative by taking on other roles.

7. Expensive options. If this style of dining has a signature dish, it's duck, comforting but more ambitious than roast chicken. Oh, and caviar. Lots of caviar.

Look at the Office, the classically minded bar and restaurant at New York's Mandarin Oriental from Nick Kokonas and chef Grant Achatz, the duo behind the avant-garde Alinea in Chicago. Retro cocktails have been reimagined (the Old-Fashioned is made with bananas and miso), and dishes such as prime rib-eye tartare ($45) are decorated with tiny herbs and flowers. Kokonas characterizes the Office, which serves oysters in a giant silver conch shell, as an "intentional throwback to that sort of dark mahogany-walled place from long ago."


The Office also dresses up its mussels, in a colorful vintage terrine

Or take Midtown Manhattan's tired Four Seasons, which vacated its space in the Seagram Building in July 2016. In its place came two fancy-but-lively dining rooms in 2017: the Grill and the Pool. At the former, chef Mario Carbone uses a salvaged duck press to make a roasted vegetable sauce, tableside, for his pastas. Co-owner Jeff Zalaznick notes that the most popular dishes tend to be the most expensive, including the $67 prime rib and a $92 Dover sole served with crab and shrimp. Both are prepared in front of diners by captains clad in Tom Ford tuxedos. Power lunch still reigns in this room, which hums at midday with patrons poking at $36 chopped salads. Adjoining the restaurant is the Pool, where chef Rich Torrisi transforms foie gras terrine into ribbons presented in an ice bowl, with crispy orange chips arrayed on the linen alongside.

It's not just a New York thing. Chicago's steakhouse-heavy Boka Restaurant Group recently opened Bellemore, where chef Jimmy Papadopoulos serves an anachronistic-seeming oyster pie in a room with spacious tables and an art deco décor. The savory pastry is filled with rich oyster custard, topped with osetra caviar, and presented with a glass of Champagne, all for $65. "I thought we'd sell three of those oyster pies a night. We sell 15," says Boehm, Boka's co-founder. "There's a demand for this kind of dining. People are sick of sitting in uncomfortable spaces and sharing their food." Boehm also points to the plateware as a key element of this style of dining. "The china is not the mishmash that you see in hipster restaurants," he says. "But it's also not the bright-white Bernardaud. That got so boring."

And at the light-filled Del Mar in Washington, chef-owner Fabio Trabocchi makes Spanish cuisine an event. He has his servers, clad in seersucker suits in coordinated colors, individually plate paella rather than serve it in the traditional family style.

In Bethesda, Md., Peter Chang, who has a reputation for spicy Sichuan food in low-price settings, has opened a flagship called Q by Peter Chang, where he's serving scallops with XO sauce ($30) and braised pork belly with Chinese biscuit ($26).

At DaDong, the 400-seat Beijing transplant in Manhattan, elegantly clad sommeliers offer a range of glasses, from Champagne to orange wine from California, all underneath ceilings playing black-and-white video art. The signature Peking duck is $96; director of operations Celso Moriera says almost half of guests ordering a la carte also get the $42 caviar supplement. DaDong's showstopper is steamed king crab in egg-white flan: A whole one goes for $560; on average, the restaurant sells five a night.

"There's absolutely an appetite on diners' parts to be dazzled, and restaurants like Le Coucou and the Grill are answering the call," says Caroline Potter, chief dining officer at OpenTable Inc. "However, they're dialing back the fussiness when it comes to service and ambiance."

Those two restaurants are among the hardest tables to find in New York, and in early December, when DaDong opened its reservation line, its bookings filled through February. Hedonism has returned, and these restaurants are politely holding the door. Even Ssäm Bar has evolved—gone are the benches and chopstick dispensers, replaced by banquettes and real napkins. "Our goal isn't to be the young kid anymore," David Chang says. "We decided it was OK to grow up a little bit." B

Data Driven

New golf technology helps you tweak your game this winter, so you can come out swinging in summer

By James Gaddy

Albert Einstein was once asked if he played golf. "No, no," said the man who devised the theory of relativity. "Too complicated." The story has served as a humbling reminder that even geniuses can find golf to be, as Bobby Jones, a co-founder of the Masters Tournament, described it, "a mystifying game."

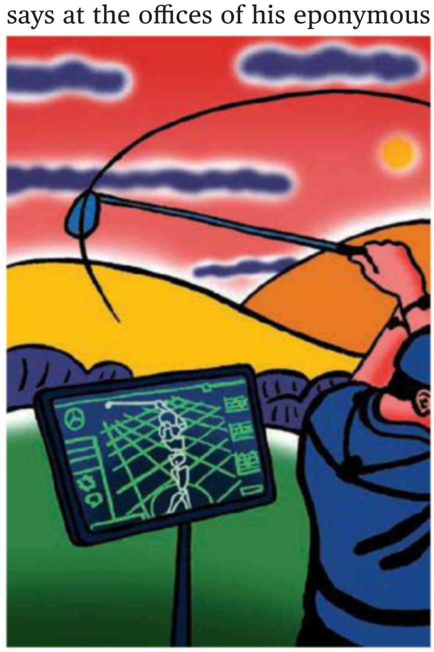
But in the past year, golf instructors have begun using an unassuming piece of technology that aims to take the guesswork out of your stroke. MySwing, introduced in late 2016, is a small box with 17 motion-capture sensors that attach to various parts of the body—the shin, the top of the feet, around the arms and chest and forehead. A separate one attaches to the club.

Once the sensors are calibrated on a Windows-based device, a skeletal avatar appears on screen and begins to move with you in real time. Take a few swings, and the feeling is similar to a science-fiction fantasy. (Everyone from *Game of Thrones* to NASA creates characters using mapping tech from MySwing's Beijing-based parent company, Noitom Ltd.—"motion" spelled backward.) The system re-creates the angles, tilt, and rotations of your swing and plays it back from overhead, behind, and the side.

The key, though, is the software, which produces line graphs and bar charts that tell you whether you need to be more patient with your arms and get your lower body to do a better job of initiating the downswing. It can observe, with sometimes excruciating detail, that the bum shoulder you got from playing college football is costing you 20 degrees on your turn, or that your right leg is overcompensating for a weak left one.

Swing-analyzing technology isn't new, says golf instructor Ben Shear, who advises top pros such as Luke Donald and hosts the *Golfers Edge* show on SiriusXM's PGA Tour Radio channel. But the old systems took an hour to set up, whereas MySwing takes about 20 minutes from start to finish. The sensors attach wirelessly, another first, and can be used indoors or outside. Most important, it's only $6,000, a relatively affordable piece of equipment for a country club that wants a competitive advantage. (TrackMan Golf, the shot-monitoring technology familiar from television tournament broadcasts, runs closer to $25,000.)

"It's like any technology," Shear says at the offices of his eponymous performance-training boutique in Scotch Plains, N.J. "It just keeps getting better, cheaper, faster, cooler." He's been using MySwing since it was introduced and is now one of hundreds of instructors who teach with it around the world, from Australia to Sweden.



The system is primarily meant for instructors, but Peter Gauthier, MySwing Golf Inc.'s chief executive officer, says a few motivated amateurs have bought the system for themselves. Golfers as a group are generally educated professionals who are equipped to understand the volume of data if they're so inclined.

Pros typically use it in conjunction with a coach, finding it most helpful at locating that extra tweak in their game that will get them over the hump for their Tour card. But Shear thinks it's even better for amateurs, especially when combined with a physical evaluation that might quash the tendency to make unrealistic comparisons to the players they see on TV. "A lot of golfers are guys who sit behind a desk working 60 hours a week, they've got three kids who are all in sports, and they're driving them everywhere," Shear says. "They're not going to get to the gym four times a week. But they still want to know what their physical capabilities are. And then I can build a golf swing around what they can actually do."

Some limitations may not be physical. "If you can't chip and putt, then this isn't going to help you all that much," Shear says with a laugh. "If you've got a 4-footer and you just rolled it by 10 feet, then that's why you're not good at golf." B

ILLUSTRATION BY GAURAB THAKALI

A Touch of Class

Luxurious gloves regain their grip on fashion. *By Troy Patterson*

"We're on a mission to bring back glove culture," says Niklas Magnusson, bespoke glove cutter at Hestra, a family company in Sweden founded in 1936. He's in New York on a four-city North American tour to measure clients for custom orders and, while he's at it, resize their ideas about how gloves can look and feel.

Just as the hat, buffeted by the winds of social change in the mid-20th century, stopped being a full-brimmed sartorial statement, so the glove ceased to be anything more than a grudging, ugly defense against frostbite. "People tend to buy gloves that are designed for the coldest day they're going to wear them," Magnusson says. But in recent years, dapper men in temperate climes have revived the stylish glove. You can even see it in pop culture: The paws of Ryan Gosling in *Drive* and Ansel Elgort in *Baby Driver* are handsomely wrapped in supple leather as they grip the steering wheels of their getaway cars.

Magnusson is currently evangelizing about the peccary, a piglike mammal native to the Amazon, whose hide makes an excellent glove leather. "You have great dexterity, but it's also quite warm," he says. Gloves made of it are also exclusively priced ($400 for the peccary pair above, second from right), because when Hestra gets the skin, it's typically been scratched by big-cat predators and pocked with shotgun pellets.

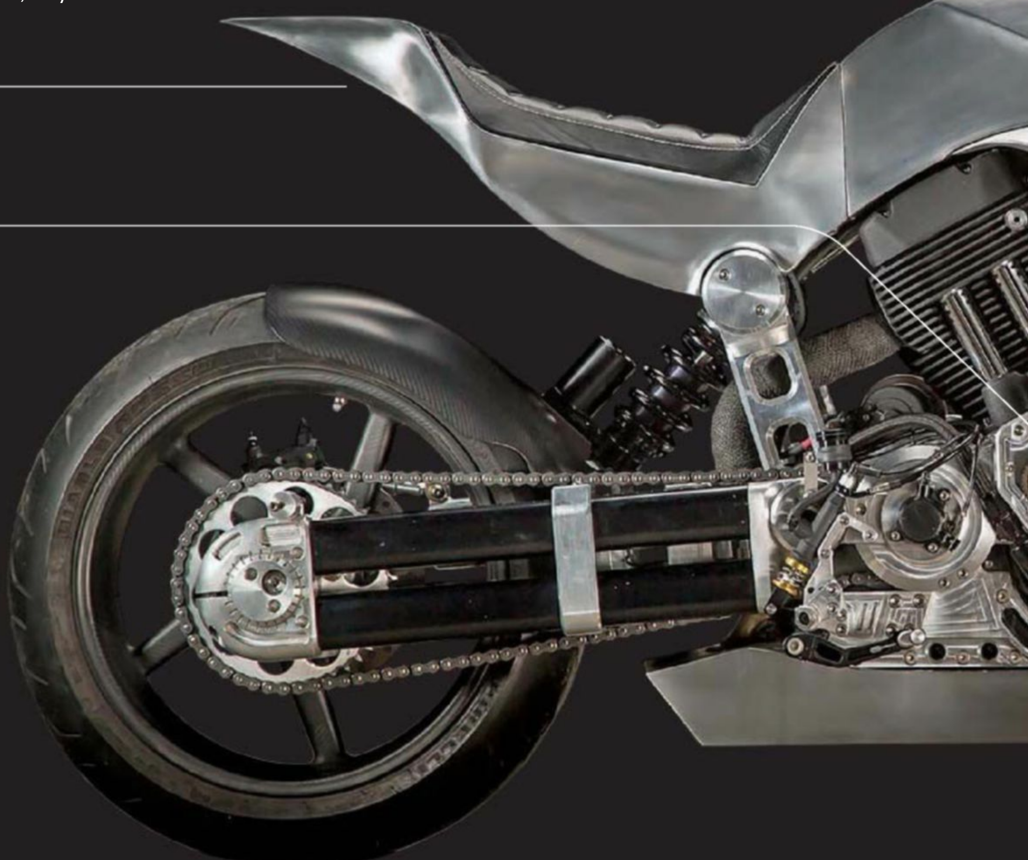
Magnusson says he wishes he had more competitors. Many old glovers have died out or spread themselves thin in diversifying their offerings. One exception is France's Lavabre Cadet, whose line for Camille Fournet Paris includes yellow lambskin driving gloves with silk-lined fingers and an alligator closure (€480, or about $576, above middle).

Dents, a U.K. company founded in 1777 that's much favored by the royal family, makes the fleecy York (£107, or about $145, far left). The outer suede and interior fur are made from one piece of lamb shearling. In France, Causse Gantier carries the torch; the brand, founded in 1892, was acquired by Chanel in 2012. It's skilled with nubuck, a calfskin it buffs into a suave velveteen, which is paired above with a cashmere lining (€312, far right).

If you prefer your lambskin glossed, you can do worse than Hermès's buttery Nervure gloves ($840, second from left), which boast black leather so painstakingly worked that a delicate nub on each index finger renders the pair touchscreen-friendly. B

PHOTOGRAPH BY JANELLE JONES FOR BLOOMBERG BUSINESSWEEK. PROP STYLIST: GÖZDE EKER

Building a Better Bike



Revival Cycle's entry-level bike, the 140, starts as another hand-built cycle, the 2012 Confederate X132 Hellcat. The team keeps the original engine, suspension, and frame but hand-forms the new alloy tank, belly pan, and tail section.

The original Hellcat bike costs $54,450. Revival's work more than doubles the price.

A 2.1-liter V-twin engine produces 132 horsepower and 140 pound-feet of torque (hence the name).

The 140 runs on Pirelli Diablo Rosso II tires. Its Brembo and Beringer stainless-steel disc brakes are set in carbon-fiber wheels.

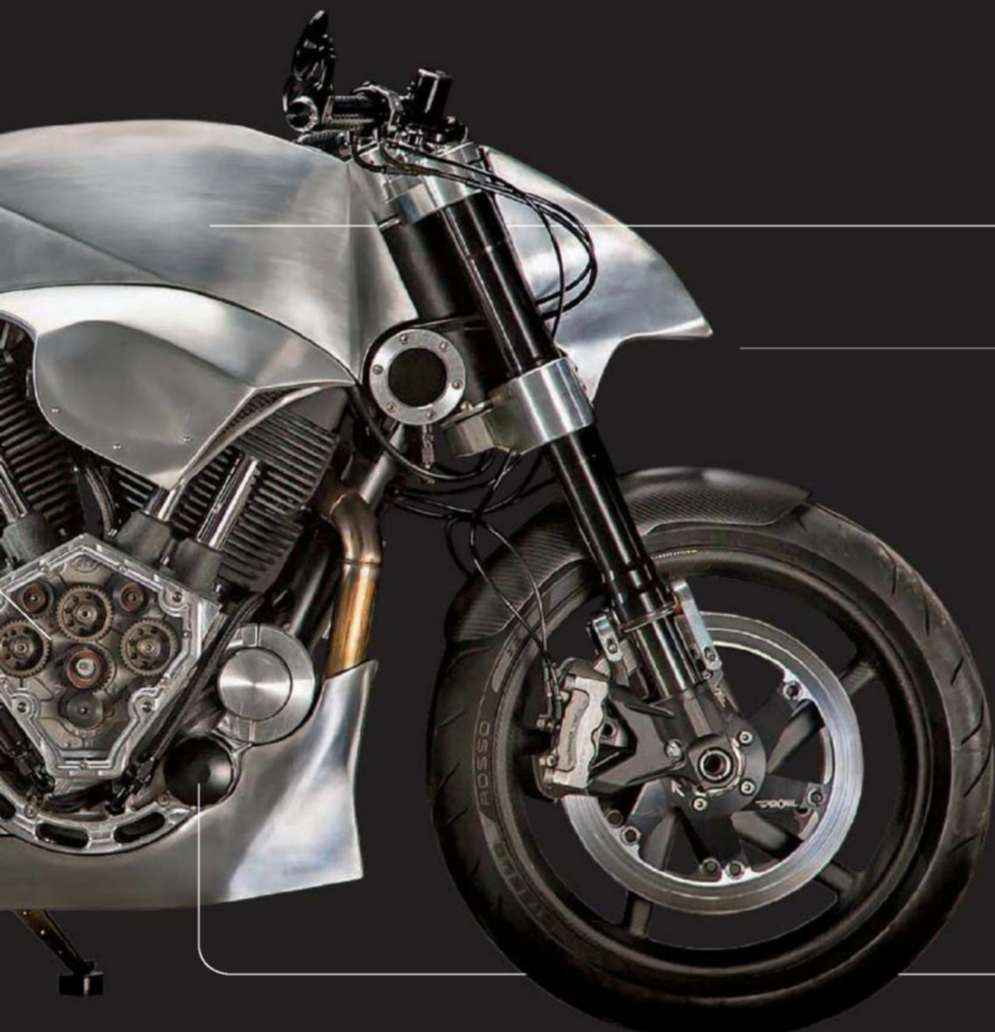
Every day, in a nondescript, sun-beaten warehouse 15 minutes outside of Austin, you'll find a handful of foot-long beards and tattoos so bad they're excellent. The guys at Revival Cycles weld metal and pound leather with the kind of grit you could stick in your jaw and chew.

The crew creates composite motorcycles and rebuilds vintage bikes: cafe racers, dirt bikes, and track rockets as potent to ride as they are arresting to look at. The variety of forms is jolting, from a flat-seated scrambler-type with insectile blue-and-white tanks to a reimagined Ducati painted up like Christmas. Most cost six figures and take many months to make. The entry-level 140 motorcycle (above), a beast of brushed alloy that takes about 650 hours to build, starts at $115,000.

Revival is the brainchild of Alan Stulberg, 42, a former software salesman who taught himself how to weld by building a shipping container, and Stefan Hertel, a mechanical engineer who once lived a quiet life making medical devices in Michigan. "They are literally engineering new [parts], and then they just bury them in the bike, and it's not even the selling point," says Mark Buche, an executive at BMW Group's motorcycle wing, Motorrad. "It's not just them bolting together some parts." Under Hertel, who's 37, the engineering team has applied for 10 patents.

It all started a decade ago, when Stulberg lost his job ("I was unaware of how much I didn't fit in," he says), broke up with his girlfriend, and rode for a year through Europe on a KTM LC4 Enduro dirt bike. Appreciating the size and breadth of the biking community there, he realized that other people would like seeing motorcycles built from the ground up as much as he did. So Stulberg opened Revival Cycles in 2008. Hertel joined soon after.

For six figures, Revival Cycles will pair vintage parts with cutting-edge engineering to make you a one-of-a-kind masterpiece. *By Hannah Elliott*



Today, Revival occupies multiple fabrication shops, employs a full-time staff of 19, and sells branded goods online and from a retail store in downtown Austin. It also turns out six built-from-the-ground-up motorcycles a year. Clients can give as much input as they want into the design process, though most defer to Hertel's genius. Last year, Revival's revenue was in the mid-seven figures, up from $12,000 its first year, Stulberg says.

"Alan is an artist and designer and imaginer, and Stefan is this engineer savant," says Rob Stalford, a crude oil options trader in Houston who bought a Revival in 2013. "These guys have incredible vision."

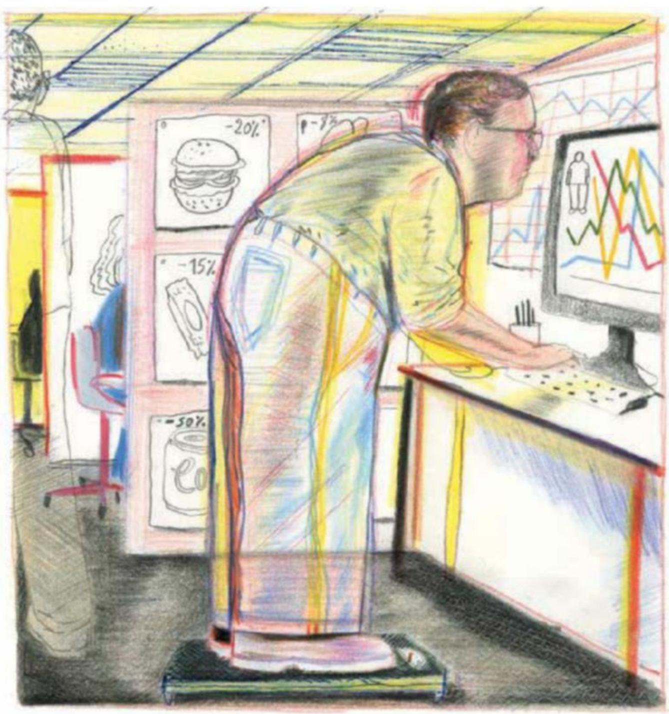
The team's decision to not limit itself to one style of bike makes the work inefficient and costly—but it's constantly building a knowledge base and, thus, a creative edge. Stalford saw the benefits when he ordered his Revival. Hertel and Stulberg started it by eliminating all the stock plastics from the 900SS-SP Ducati that served as the base, then rebuilt it from the chassis out, creating their own lightweight steel frame, adding new bearings and lights, polishing the heads on the 90-degree V-twin engine, and upgrading the clutch, electronics, and brakes, among many other things. They polished the flat aluminum body until it shone like a mirror and added custom drop handlebars wrapped in oxblood leather. The process took 1½ years.

Even if you don't want to buy a bike, you can attend one of several annual Revival motorcycle shows, where even suits are welcome. The next is in April. "I wanted to create something new," says Stulberg, who knows how intimidating his world of motorcycles can be. "I want to make everyone feel at home." Ⓑ

COURTESY REVIVAL CYCLES

It’s the Obesity, Stupid

Economics is often the base reason why a nation gets fat. Can it also be the key to losing weight? *By Joe Weisenthal*



I’ve always been drawn to unconventional diets. I was raised as a vegetarian, and at different points in my life I’ve characterized my diet as vegan, macrobiotic, Atkins, low-carb, paleo, or keto. (Yes, I’m really popular at dinner parties.) It hasn’t been torture. In fact, I enjoy the tinkering.

Of course, around the world, not everyone has this luxury. The economy is a huge determiner of what we eat. The premise of the book *The Economists’ Diet* is to take insights from broad global issues and apply them to personal dietary behavior. Authors Christopher Payne and Rob Barnett observe that many of us live in a world of abundance: In wealthy, developed markets, cheap food is everywhere, and so obesity has skyrocketed. Payne, a financial stability expert, and Barnett, an analyst of the politics of fossil fuels, met while working at Bloomberg LP (Barnett still does) and soon found themselves obese, after endless rich dinners with clients and fast lunches from McDonald’s.

They write about their efforts to lose weight by applying the lessons they learned studying economics. By now, there’s been enough behavioral work inspired by *Freakonomics* (and its various ripoffs) to recognize that the field may have a lot to teach us in this area. For them, it meant losing a combined total of 120 pounds over 18 months.

A primary argument of the book is that to lose weight, we essentially need austerity. The authors liken obesity to a government going deep into debt. Eventually you have a choice to make: a catastrophic default (a bad health event) or an uncomfortable reduction in government spending (eating less). We need to set our own conditions of scarcity amid this abundance. How do we do this? One approach, drawn from the work of behavioral economist Dan Ariely, is to set meta-rules. For example, rather than trying to decide what to eat every day for lunch, just come up with a simple rule that you’ll only have salad. Remove the temptation to even consider a bad decision. (You are going to be unhappy and hungry at times.)

The book is filled with various behavioral approaches to good decision-making that won’t really surprise you (but that, also unsurprisingly, work): Buy groceries online to reduce temptation, make a habit of saying no to bread and chips, always order the smallest size, cook at home, and don’t eat if you’re not hungry. One thing that makes Payne and Barnett’s work distinct from most diet books is the relative lack of discussion about nutrition. They’re economists, not medical professionals, and it’s refreshing to read a book and not have to wonder whether the science is bunk.

The Economists’ Diet diverges with some popular thinking about weight loss. Earlier this year, I read Dr. Jason Fung’s fantastic *The Obesity Code*, based on his experience treating people with Type 2 diabetes, which argues that, ultimately, cutting calories is a failed idea. Fung posits that your body will just adjust to a new equilibrium, and you’ll never be able to sustain feeling hungry. He advocates instead for a low-carb, high-fat diet that leaves you with reduced insulin levels but satiated. Like Fung, Payne and Barnett argue for skipping meals, but for different reasons. Fung believes fasts are important, leading to long periods of low insulin levels; Payne and Barnett mostly see skipping as a chance to reduce calories. It’s a basic economy.

The Economists’ Diet is not a panacea. Rather, it’s an enjoyable account of the thought process of two non-diet professionals who hacked their way into a system that worked for them. Economics is ultimately about building a toolbox to analyze different problems; the beauty comes when we put those tools to work in a new space. B

ILLUSTRATION BY YANN KEBBI

Pretziada Ceremony Fireplace Set

A hearth without the proper tools is like a kitchen without knives. *Photograph by Yasu+Janko*

THE CHARACTERISTICS
Italian design company Pretziada was founded in 2015 by Ivano Atzori and his partner, Kyre Chenven, a set designer from California. They're based in Atzori's native Sardinia, where they've worked with local artisans to reinvent the region's classic wares, such as shepherd's boots and nuptial vases. For the Ceremony fireplace set, they collaborated with French designer Ambroise Maggiar and metalworkers Fratelli Argiolas. The collection pays tribute to the importance of the hearth in Sardinian homes, but refashioned in a minimalist design. Each tool is made from laser-cut, hand-welded iron.

THE COMPETITION
At €695 ($834), the nine-piece Ceremony fireplace set is on the high end compared with others that are also designed with the more contemporary home in mind, but you get a lot for the money. In contrast, Swedish designer Emma Olbers's fireplace set will run you $460 for five pieces. Available at Sag Harbor, N.Y., home-goods mecca Monc XIII, it's made from beechwood and comes with brass details, a horsehair brush, and all-natural leather handles. The $900 Henry, a set of four hand-forged iron pieces from home furnishings wholesaler Arteriors, in Carrollton, Texas, employs heavy-duty materials for a more rustic feel.

THE CASE
All fireplace tool sets work pretty much the same, but it's not often that such a large set—which includes a poker, blower, broom, shovel, ash bucket, tool stand, and tongs—is also compact. The designers wanted to make something that honored the essentialist lines of traditional country tools but was contemporary and decorative as well; even the andirons have a sculptural element. Pretziada also left it with a clear finish, so all of the hand welding is visible. It's home décor that's supremely functional when everyone is gathered around on a cold winter day but beautiful enough to keep out after warmer weather arrives. *€695; pretziada.com*

C.W. Nicol

The multitalented philanthropist is restoring Japan's forests. *By Adam Popescu*

WITH HIS BUSHY BEARD AND deep-set blue eyes and clutching an ax in his massive hands, C.W. Nicol might just be the most intimidating tree-hugger you've ever seen. A Santa dressed in a down coat and a blue beanie, the 77-year-old Welshman may also be Japan's best hope for protecting its forests.

In the mid-1980s he bought up 47,000 square kilometers (18,147 square miles) of decrepit parkland in Nagano prefecture, a three-hour train ride from Tokyo, and founded the Afan Woodland Trust, named after a forest in Wales. Today the preserve is home to 148 types of trees and 137 varieties of wild mushrooms, as well as almost 60 species of wildlife, including owls, red foxes, and black bears, many of which are threatened or endangered. "We brought a dead forest back to life," Nicol says. The role of conservationist is but another line in his colorful dossier, one that includes best-selling author, whisky mogul, actor, and singer. He's also been an explorer who worked as a game ranger in Ethiopia and lived with the Inuit in the Canadian Arctic, where legend says he introduced Kikkoman soy sauce to the local diet.

Nicol has always been fascinated with Japan, especially after childhood bullies led him to take up martial arts. He started studying the language in the '60s, between his Arctic and East African stints, and by the mid-'70s he was a full citizen. His 1975 book, *Moving Zen*, has been credited for bringing karate to the West.

While 67 percent of Japan is already protected, that designation means more on paper than it does in the field. Effective forestry takes effort: Cutting back underbrush allows tree saplings to grow; moving rocks in streams optimizes irrigation. Rural farmers once cared for the wilderness as well as they did for their crops. But as they retired and younger folks decamped for the cities, the wilderness suffered. "The forest has become completely wild—humans hardly ever go in there," says John Harris, a Canadian speechwriter who's spent the past 32 years in Japan. "Japanese life is so urban-centered now, these vast areas are neglected."

Harris calls Nicol the "guru of forest preservation in Japan." Nicol spent a decade digging ponds, bolstering riverbeds, planting and clearing space for trees—hard labor he did himself using traditional tools and horses, which aren't as destructive to new growth as heavy machinery. He's using his low-impact approach to forestry to create a sister preserve in his native Wales. In Japan, Nicol thinks he can persuade the government to designate more areas as protected. "If I can change Japan and make people care about the forests here, I'll be happy," he says. "That'll be something worth protecting." B

b. 1940, Neath, Wales

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While on a research trip to Devon Island, killed two polar bears in self-defense and ate them

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Still acts in the occasional commercial

ILLUSTRATION BY SAM KERR