The Economist

What if bitcoin fell to zero?

Inside Xinjiang's economy

How to solve the chip shortage

Predicting pathogens

AUGUST 7TH–13TH 2021

The people's panopticon

Open-source intelligence comes of age

TOWARDS A DREAM

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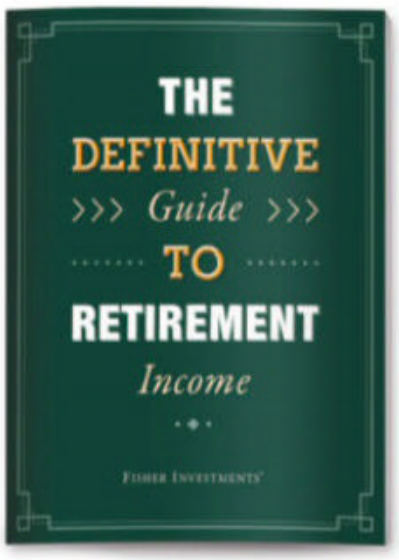

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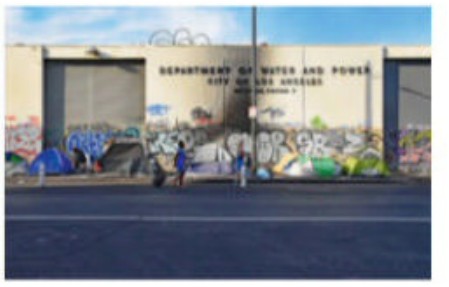

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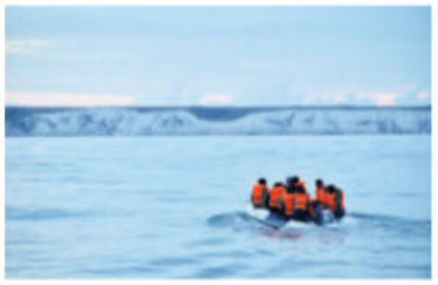

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to take part in *"a severe contest between intelligence, which presses forward, and an unworthy, timid ignorance obstructing our progress."*

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The Taliban intensified their assault on **Afghanistan's** cities, with fighting raging in Herat, the country's third-largest, Lashkar Gah, the capital of Helmand province, and Kandahar. The Taliban also claimed responsibility for a bomb attack at the home of the defence minister in Kabul. The jihadists have been emboldened by the imminent withdrawal of American forces from the country.

Muhyiddin Yassin, **Malaysia's** prime minister, lost his majority in Parliament when 11 lawmakers from a coalition partner withdrew their support. Mr Muhyiddin has clung on to power despite a slim majority by forestalling a vote of confidence. He has promised to reconvene Parliament in September and face a no-confidence motion then.

Covid-19 continued to rage across **South-East Asia**. Indonesia crossed 100,000 recorded total deaths from the virus. Daily infections in Thailand and Malaysia are hitting new highs and cases in the Philippines are once again sharply on the rise.

Officials in **China** said the country's recent increase in covid-19 infections could be traced to a Russian airliner that landed in Nanjing. Travel to and from Beijing has been curtailed. All 11m residents of Wuhan, the city where covid-19 was first identified, are to be tested again.

The recent **flooding** in China's central Henan province killed at least 302 people with another 50 missing, according to the mayor of Zhengzhou, where most of the deaths occurred.

In **Hong Kong** the authorities charged Anthony Wong, a pop star, with corruption for singing at a pro-democracy rally in 2018. Mr Wong fronts a band that has been blocked from streaming sites in China because of the political themes of its songs. He was charged along with a candidate to the Legislative Council for providing entertainment with the intent to sway people's votes.

Laurel Hubbard became the first openly **transgender athlete** to compete in a solo Olympic sport. The New Zealander was eliminated from her weightlifting event after failing three lifts.

Andrew Cuomo came under pressure to resign as governor of New York after the state's attorney-general released a report into allegations of sexual misconduct, and concluded that he had harassed 11 women. Mr Cuomo denies that his actions were inappropriate. Joe Biden was among the many Democrats who called on him to step down.

Ebrahim Raisi, a hardline cleric, was inaugurated as president of **Iran**. He took office amid allegations that Iran was behind two attacks on international shipping. A drone laden with explosives hit an oil tanker managed by an Israeli-owned firm off the coast of Oman, killing two people. Days later, gunmen boarded a bitumen tanker owned by a firm in Dubai, allegedly redirecting it towards Iran before leaving the vessel.

Zambia's government deployed the army ahead of a general election. The ruling party has attempted to buy off or bully voters in a bid to defeat Hakainde Hichilema, an opposition candidate who could possibly win if the election were fair. It will not be.

Pedro Castillo, the new left-wing president of **Peru**, appointed Guido Bellido, a political novice, as prime minister. Mr Bellido is under investigation for an alleged "apology" for the Shining Path rebels and has been criticised for making homophobic and sexist social-media posts. Pedro Francke, a leftist economist, was appointed finance minister.

Brazil's highest electoral court opened an inquiry into Jair Bolsonaro's statements about elections in 2022. The president has repeatedly claimed, without any evidence, that there will be fraud in the electronic voting system.

Mexico launched a lawsuit against American gunmakers for their alleged complicity in allowing weapons to cross the border illegally. The suit, lodged in a court in Boston, claims the companies do little to stop their guns falling into the hands of drug cartels.

A Belarusian sprinter at the Olympics sought help from the Japanese police after her coaches tried to send her home when she criticised them. Poland offered Krystina Timanovskaya asylum. In Ukraine, Vitaly Shishov, a Belarusian activist who helped people flee the repressive regime in his homeland, was found hanged in a park. In **Belarus** two opposition activists went on trial in a closed courtroom.

Firefighters battled to tackle the worst wildfires in **Turkey** for decades, which have killed at least eight people. The biggest blazes were in regions packed with seaside resorts.

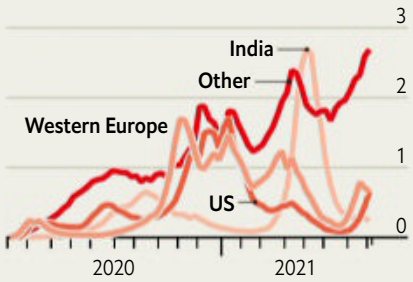
Prosecutors in Germany said that the trial of a 100-year-old former guard at Sachsenhausen **Nazi concentration camp** would go ahead in October. The unnamed man is accused of taking part in the murder of more than 3,500 people at the camp.

More than 200,000 protesters marched in **Paris** and other French cities against a government edict compelling people to show a covid pass before boarding trains and planes and entering restaurants and cafés. It was the biggest demonstration against the new law so far.

Coronavirus briefs

To 6am GMT Aug 5th 2021

Weekly confirmed cases by area, m



Vaccination doses

	Total '000	% of over-11s with 1st dose	2nd
Malta	765	>99	99
Iceland	470	93	88
UAE	16,884	90	81
Mongolia	4,173	90	82
Uruguay	4,826	89	77
Israel	11,178	87	80
Chile	25,689	86	76
Denmark	7,494	84	65
Singapore	7,767	82	68
Canada	49,762	82	69

Sources: Johns Hopkins University CSSE; Our World in Data; United Nations

The WHO made a plea to rich countries to delay giving out **booster shots** of vaccines until the end of September so that supplies can be diverted to poorer countries, where the vast majority of people have not been inoculated.

New York became the first city in America to require proof of vaccination for customers entering restaurants, gyms and other indoor venues. Enforcement will begin on September 13th.

More cities in America, including Atlanta, Los Angeles and Washington, DC, reintroduced rules either requiring or recommending that people wear **masks** in public indoor spaces. Louisiana said that everyone over five, regardless of vaccination status, should wear one in public. **Florida's** governor, Ron DeSantis, rejected a mask mandate. Hospitalisations from the disease and new cases are at their highest in the state since the start of the pandemic.

→ *For our latest coverage of the virus please visit economist.com/coronavirus or download the Economist app.*

Gary Gensler, the chairman of America's Securities and Exchange Commission, called for more protections for investors in the **cryptocurrency markets**, which he described as a Wild West rife with fraud and swindlers. Mr Gensler wants federal securities laws to apply to digital currencies and more powers for the SEC to oversee the market. If not, he worries that "a lot of people will be hurt" by bad investments.

Another challenge to traditional banking is emerging from "buy now, pay later" (BNPL), which enables shoppers to spread their payments for goods, sometimes with no interest or credit check but a fee for late instalments. Square, a payments firm run by Jack Dorsey, has offered to buy **Afterpay**, based in Melbourne and a global pioneer in BNPL, for $29bn, Australia's biggest-ever takeover. Regulators have expressed concern about BNPL's lax lending rules. The industry has ballooned during the pandemic. Apple is said to want to enter the market.

The meme machine

Robinhood's stock had a rollercoaster ride after the firm floated on the stockmarket. The share-trading app had a terrible IPO, with its share price closing 8% down. A few days later the multitude of small investors who favour the app, especially to buy and sell "meme" equities, rushed to buy share options. The frenzied trading pushed the stock up by 85% over the offer price.

General Motors reported net income of $2.8bn for the second quarter and raised its profit forecast for the year. The carmaker was boosted by its lending business. GM Financial benefited from accelerated demand for used cars as output of new vehicles stalled amid a global dearth of semiconductors. GM kept up production of its bestselling models by diverting chip supplies from its less-popular ones, but warned the shortage could affect future profits.

The proposed $40bn takeover of **Arm**, a chip designer based in Britain, by **Nvidia**, America's most valuable semiconductor manufacturer, was reported to be in trouble. The British government is said to be worried about the national-security implications, though no decision on scrapping the deal has been taken.

The **euro zone's GDP** grew by 2% in the second quarter compared with the previous three months, a better showing than America and China, which grew by 1.6% and 1.3% on that measure. Germany's economy expanded by 1.5% and France's by 0.9%.

Big **energy companies** reported bumper quarterly profits, boosted by the higher price of oil, still their main source of income despite the industry's move to cleaner fuels. ExxonMobil, which recorded a loss in every quarter last year, made a net profit of $4.7bn.

PepsiCo agreed to sell a majority stake in its Tropicana and Naked fruit juice brands to a private-equity firm for $3.3bn. Although packed with vitamins, fruit juices also have a high sugar content; Pepsi wants to focus on zero-calorie and healthier energy drinks.

Taming the dragon

Tencent was forced to bring in new restrictions on the amount of time that children can play its video games following a backlash from Chinese state media. The Chinese internet conglomerate said that the authorities had told gaming companies to live up to their social responsibilities, adding more pressure on tech firms in China as the government confronts the industry's growing clout. Tencent's share price fell sharply. A measure of Chinese tech stocks listed in New York, the Golden Dragon index, has had its worst month since the global financial crisis of 2007-09.

An early target of China's regulatory crackdown, **Alibaba**, reported a 34% rise in revenue for the second quarter, year on year. Profit was down, however, as the group spent cash on rejigging its various digital platforms. Like others in the Chinese tech industry Alibaba is also adapting to the government's new edicts. It will "respond positively with actions", said Daniel Zhang, the chief executive.

More companies in America announced that they will require staff to be **vaccinated** against covid-19, a policy that was first adopted by big banks but is spreading across all industries. Following similar moves recently from Google and Facebook, Microsoft will now ask all employees and guests to show proof of a jab, (and will not re-open its offices fully until October), as will Walmart, Disney and Tyson Foods, a meat supplier. Netflix wants the actors and crew on its film sets to be inoculated.

Zoom reportedly agreed to pay $85m to settle a class-action lawsuit that accuses it of sharing customers' data with third parties, including Facebook and Google. Part of the settlement requires the video-conferencing company to take extra steps to prevent Zoom-bombing, where hackers crash a meeting to display pornography, racist imagery and other items that are definitely not on the agenda.

The people's panopticon

Open-source intelligence is a welcome threat to malefactors and governments with something to hide

THE GREAT hope of the 1990s and 2000s was that the internet would be a force for openness and freedom. As Stewart Brand, a pioneer of online communities, put it: "Information wants to be free, because the cost of getting it out is getting lower and lower all the time." It was not to be. Bad information often drove out good. Authoritarian states co-opted the technologies that were supposed to loosen their grip. Information was wielded as a weapon of war. Amid this disappointment one development offers cause for fresh hope: the emerging era of open-source intelligence (OSINT).

New sensors, from humdrum dashboard cameras to satellites that can see across the electromagnetic spectrum, are examining the planet and its people as never before (see Briefing). The information they collect is becoming cheaper. Satellite images cost several thousand dollars 20 years ago, today they are often provided free and are of incomparably higher quality. A photograph of any spot on Earth, of a stricken tanker or the routes taken by joggers in a city is available with a few clicks. And online communities and collaborative tools, like Slack, enable hobbyists and experts to use this cornucopia of information to solve riddles and unearth misdeeds with astonishing speed.

Human Rights Watch has analysed satellite imagery to document ethnic cleansing in Myanmar. Nanosatellites tag the automatic identification system of vessels that are fishing illegally. Amateur sleuths have helped Europol, the European Union's policing agency, investigate child sexual exploitation by identifying geographical clues in the background of photographs. Even hedge funds routinely track the movements of company executives in private jets, monitored by a web of amateurs around the world, to predict mergers and acquisitions.

OSINT thus bolsters civil society, strengthens law enforcement and makes markets more efficient. It can also humble some of the world's most powerful countries.

In the face of vehement denials from the Kremlin, Bellingcat, an investigative group, meticulously demonstrated Russia's role in the downing of Malaysian Airlines Flight MH17 over Ukraine in 2014, using little more than a handful of photographs, satellite images and elementary geometry. It went on to identify the Russian agents who attempted to assassinate Sergei Skripal, a former Russian spy, in England in 2018. Amateur analysts and journalists used OSINT to piece together the full extent of Uyghur internment camps in Xinjiang. In recent weeks researchers poring over satellite imagery have spotted China constructing hundreds of nuclear-missile silos in the desert.

Such an emancipation of information promises to have profound effects. The decentralised and egalitarian nature of OSINT erodes the power of traditional arbiters of truth and falsehood, in particular governments and their spies and soldiers. For those like this newspaper who believe that secrecy can too easily be abused by people in power, OSINT is welcome.

The likelihood that the truth will be uncovered raises the cost of wrongdoing for governments. Although OSINT might not prevent Russia from invading Ukraine or China from building its gulag, it exposes the flimsiness of their lies. Eliot Higgins, Bellingcat's founder, is right when he describes his organisation as "an intelligence agency for the people". No wonder that Russia's spy chief railed against it, most recently just this month.

Liberal democracies will also be kept more honest. Citizens will no longer have to take their governments on trust. News outlets will have new ways of holding them to account. Today's open sources and methods would have shone a brighter light on the Bush administration's accusation in 2003 that Iraq was developing chemical, biological and nuclear weapons. That would have subjected America's invasion of the country to greater scrutiny. It might even have prevented it.

Some will warn that OSINT threatens national security—as when, for example, researchers use data from fitness trackers to reveal remote CIA outposts and radar satellites to locate American missile-defence systems. But, if OSINT can tell the world about such things, a country's enemies are already able to know them. Pretending otherwise does not make states any safer.

Others will point out that OSINT can be wrong. After the Boston Marathon bombing in 2013 internet users scrutinised the crime scene and identified several suspects. All were innocent bystanders. Or OSINT could be used by bad actors to spread misinformation and conspiracy theories.

However, every source of information is fallible and the scrutiny of imagery and data is more empirical than most of them. Hence, when OSINT is mistaken or malign, competing OSINT is often the best way to put the record straight. And over time, researchers and investigators can build a reputation for honesty, sound analysis and good judgment, making it easier for people to distinguish trustworthy sources of intelligence from charlatans.

The greatest worry is that the explosion of data behind open-source investigations also threatens individual privacy. The data generated by phones and sold by brokers let Bellingcat identify the Russian spies who last year poisoned Alexei Navalny, an opposition leader. Similar data were exploited to pick out a senior Catholic priest in America, who resigned last month after his location was linked to his use of Grindr, a gay dating app.

A see-through world

The privacy of individuals in a digital age is fraught with trade-offs. At the level of states and organisations, however, OSINT promises to be a force for good. It is also unstoppable. Before the invasion of Afghanistan in 2001, America's government was able to buy up virtually all the relevant commercial satellite imagery. Today too much data are available for that to be possible.

A world where many American, European, Chinese and Russian satellite companies vie to sell images is one of mutually assured surveillance. This is a future that open societies would be wise to embrace. Tools and communities that can unearth missile silos and unveil spies will make the world less mysterious and a little less dangerous. Information still wants to be free—and OSINT is on a mission to liberate it. ■

Chipmaking

A self-solving problem

Markets, not nationalism and subsidies, are the cure for the chip shortage

One firm's crisis is another's opportunity. A shortage of semiconductors has helped pump up the valuations of firms such as Nvidia, whose chips power everything from video-gaming to machine learning and data centres (see Business section). But boom time for sellers means misery for buyers. Carmakers, whose products have become computers on wheels, are among the victims. Profits at Ford, America's second-biggest carmaker by volume, fell by half in the most recent quarter amid a global shortage of chips. Analysts say the industry might build around 5m fewer cars this year, all for want of their tiniest components.

Carmakers are not the only firms feeling the pinch. Apple and Microsoft have also warned that they will be affected. Politicians are being drawn in, too. Chips will be on the agenda later this month when America's vice-president, Kamala Harris, visits Vietnam, which has a flourishing electronics industry. Angela Merkel, the outgoing German chancellor, has lamented Europe's small share of global chip production.

The shortage is the result of a sudden surge in demand. Chipmaking is a cyclical business which, between the peaks and troughs, has been enjoying strong growth for decades as computers creep into every corner of society. That trend was amplified by the pandemic. Locked-down consumers shopped online, logged into meetings remotely, and wiled away the hours with video-streaming and video-gaming. The result has been a spike in demand for the semiconductors that power the data centres and gadgets that make such things possible, clogging factories with orders.

The crisis has had three consequences, two encouraging and one less so. The first is an investment boom. Big producers such as Intel, Samsung and TSMC are planning to spend hundreds of billions of dollars on extra capacity over the next few years. As in many markets, high prices are the best cure for high prices.

The second is that the chip industry's customers are adapting, too. When demand collapsed early in the pandemic, carmakers cut their orders with chipmakers. The car industry's size and clout mean that it is used to ordering suppliers around. But when demand recovered, it found itself at the back of the queue, because of long lead times and competition for capacity from the even bigger and more influential tech industry.

The unpleasant experience of being the supplicant rather than the boss has prodded carmakers to take tighter control over supplies of vital components. Following in the tyre-treads of Tesla, Volkswagen has announced plans to develop driver-assistance chips in-house. Other firms are forging closer relationships with chipmakers. Toyota, a Japanese firm, has weathered the shortage relatively well, partly because it was slower to cut orders when the pandemic hit. In June Robert Bosch, a big supplier of automotive parts, cut the ribbon on a €1bn ($1.2bn) chip factory of its own in Dresden. Redesigned supply chains will be more resilient.

The third, unwelcome effect has been a surge of techno-nationalism. America is planning to hand out billions of dollars to lure chipmakers back from East Asia. Europe wants to double its share of global production, to 20%, by 2030. Even Britain has declared the fate of a small chip factory in Wales to be a matter of national security.

There is some force in the argument that chips have come to occupy what used to be called the "commanding heights" of an economy, in the way that oil refineries or car factories did in the 20th century. The concentration of production in Taiwan, in particular, is an uncomfortable geopolitical risk. But as last century's governments discovered, subsidies lead to overcapacity and gluts—and, eventually, to yet more calls for public money to prop up uncompetitive businesses. The chip shortage is mostly a self-solving problem. Governments should resist the temptation to see themselves as saviours. ■

Democracy in Africa

Zambia's crucial election

Hakainde Hichilema deserves to be elected, but the world should prepare for a rigged vote

In the late 1980s Zambians, inspired by the changes sweeping through eastern Europe, demanded the end of their own one-party state. In 1991 Kenneth Kaunda, the country's founding president, reluctantly agreed to multiparty elections. He lost. But in leaving office willingly, even personally removing the presidential pennant from his car, Kaunda ensured that his country was a trailblazer for democracy. By the end of the decade nearly every country in Africa had gone to the polls. During the commodities boom of the 2000s the economy of the continent's second-largest copper producer grew by about 7% per year. Though far from perfect, Zambia seemed more likely to become the next Botswana (democratic and middle-income) than the next Zimbabwe (despotic and wretched).

How things have changed. Since it took office in 2011 the Patriotic Front (PF) has failed Zambians. In particular, under Edgar Lungu, president since 2015, corruption, human-rights abuses and poverty have all spread. The PF has increased external debt at least sevenfold, with loans spent on graft-ridden Chinese-built infrastructure. In June Amnesty International reported an "increasingly brutal crackdown" on opponents of the regime. Annual inflation is running at 25%, nearly the highest in two decades, and forcing 40% of Zambians to eat fewer or small- ▸▸

er meals, according to a recent study by a local NGO. Some middle-class Zambians are considering what Zimbabweans have done for decades: fleeing to South Africa.

All of which explains why the forthcoming elections matter. On August 12th Zambians should do as they did in 1991 and 2011—vote out the incumbent president. The main opposition candidate, Hakainde Hichilema, would be a huge improvement on Mr Lungu. The businessman promises to clamp down on graft, open serious talks with the IMF about reforms and a loan, and win back the trust of foreign investors put off by the PF's punitive policies of heavily taxing and seizing mines. Zambians seem to like his ideas. Academic analysis of polls suggests that, in a fair fight, he would win just over half of the vote.

Sadly, it is not a fair fight. The PF must have read a textbook on election-rigging. While campaigning, it has abused state resources, from handing farmers subsidies to using taxpayer-funded helicopters. It has corroded the guard-rails of democracy, dismissing impartial members of the electoral commission, installing pliant judges in the Constitutional Court, and co-opting civil-society leaders. The police have blocked Mr Hichilema from campaigning, citing covid-19 rules which seem not to apply to Mr Lungu. PF stooges have intimidated the opposition.

There are also fears that, after the polls close, voting tallies could be altered and the internet shut off (see Middle East & Africa section.) Whether the declared outcome is an outright victory for one candidate or a run-off if no one gets over 50%, Zambia could see legal challenges, protests and blood on the streets.

Outsiders must hope for the best and prepare for the worst. Unfortunately, when it comes to criticising their peers' elections, African countries are as toothless as an anteater. China, for all its pontificating about non-interference, usually backs the incumbent; the Chinese ambassador spoke warmly of the PF at the party conference at which it nominated Mr Lungu as its candidate, in April. America, Britain and the European Union often point out flaws in elections but are sometimes too willing to declare rigged votes "good enough", as with Malawi's stolen election of 2019. A year later Malawians peacefully overturned that dodgy ballot and voted for a new president in a re-run.

Anteaters with teeth

This would be harder in Zambia. Judges are less independent and the security forces have more guns. Still, Western countries can, for instance, warn against further violence and put pressure on the electoral commission to allow independent monitors to observe not just voting but the counting of votes as well. Western diplomats can also start to identify African mediators who could help in any post-election negotiations. They must not suggest that an election is passable by "African standards".

Mr Hichilema has highlighted the stakes in the election. It could be the difference, he says, between recovery and "Zambia deteriorating into a broken economy and failed state". Zambians should heed his warning. So should the rest of the world. ■

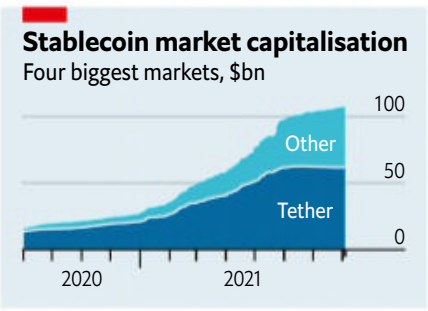
Regulating cryptocurrencies

Unstablecoins

Why regulators should treat some cryptocurrencies like banks

TWELVE YEARS after bitcoin was born, governments are still struggling to cope with cryptocurrencies. Britain has banned Binance, a crypto exchange and the European Union's regulators want transactions to be more traceable. On August 3rd Gary Gensler, the head of America's Securities and Exchange Commission, said cryptocurrency markets were "rife with fraud, scams and abuse" and called on Congress to give his agency new regulatory powers. The price of bitcoin, the biggest cryptocurrency, gyrates with regulators' every word.

Governments have an obligation to fight the deception, tax evasion and money laundering that plagues the crypto world. Police seizures of bitcoin suggest that they are becoming more zealous. The harder issue they must grapple with is whether cryptocurrencies threaten the financial system. Were bitcoin to collapse, our crypto "stress test" suggests that its holders would lose hundreds of billions of dollars but that the fallout would be manageable (see Finance section). Yet there is another danger posed by "stablecoins", a special type of cryptocurrency that pegs its value to conventional money.



Pledges of stability often lead to financial crises. Because banks offer deposits that are redeemable on demand and superficially riskless, but which are backed by longer-term, less liquid and riskier assets, they are vulnerable to runs. Stablecoins are similar. The biggest, Tether, has issued $62bn-worth of tokens which it says are redeemable for a dollar apiece. But of the assets backing the tokens in March only about 5% were cash or Treasury bills, according to Tether's public disclosures. It says it will update the figures soon and that it is "fully backed by reserves".

Most of the assets were riskier—about half of them commercial paper. Stablecoins' growth from a value of $14bn in August 2020 to over $100bn today has given them a big financial footprint. Extrapolating Tether's disclosures implies that it owns over $30bn-worth of commercial paper, which probably makes it the asset class's seventh-largest investor, not far off funds run by Vanguard and BlackRock, according to JPMorgan Chase. With estimated leverage of 383-to-1, Tether would be unable to honour all its tokens after losses of just 0.26%—a safety cushion that regulators would never allow at a bank.

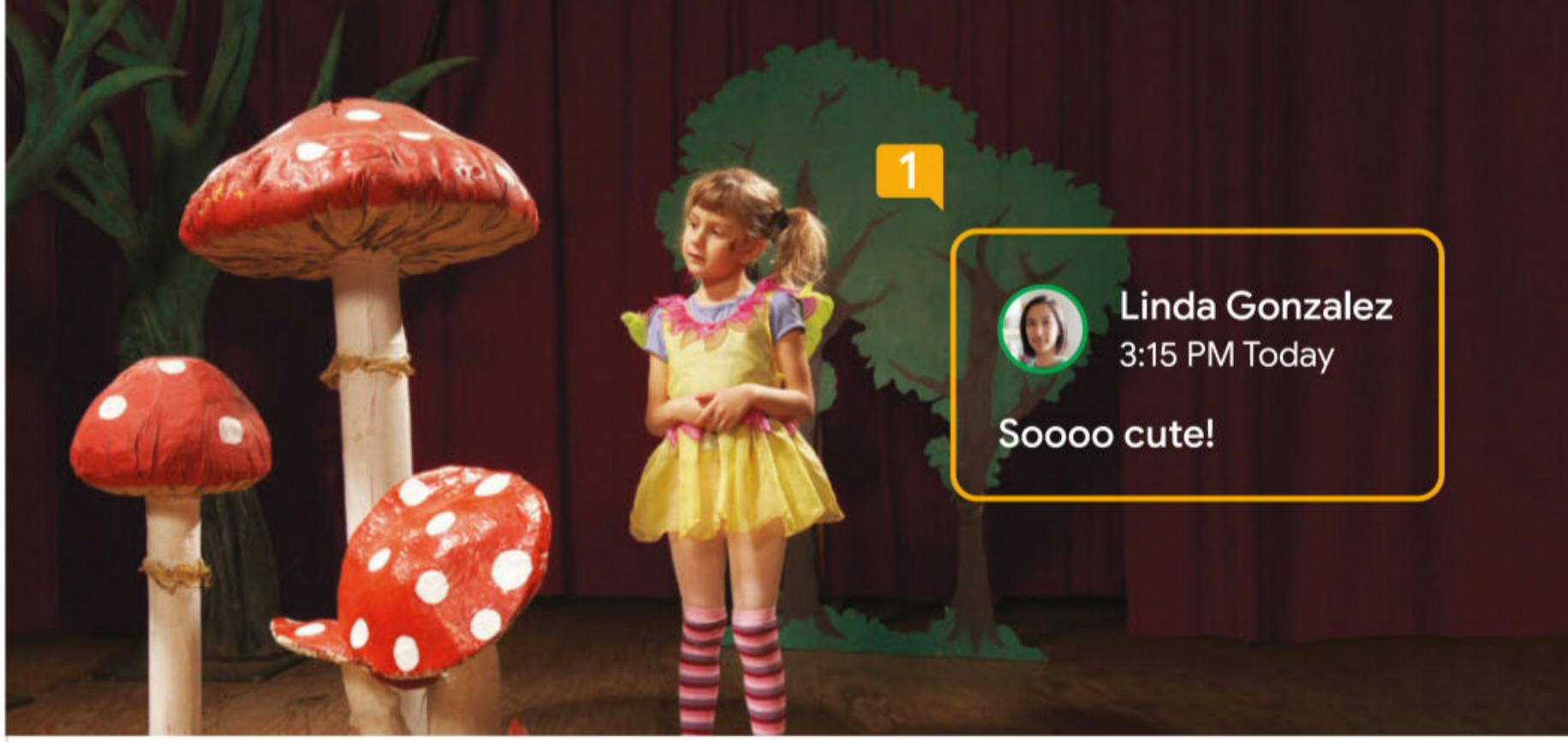
Few stablecoins say much about their balance-sheets. Tether's disclosures of the breakdown of its assets are puny and fall far below the standards expected of a bank. In February Tether was among the defendants who agreed to an $18.5m fine with New York's attorney-general, which said that in 2017 Tether had misled the market about its US dollar backing and that it had not accurately disclosed the transfer of $625m of its assets to Bitfinex, an online trading platform. Tether says the funds were repaid and that it has a "total commitment to transparency".

No wonder Mr Gensler calls cryptocurrencies a Wild West. Some policymakers have compared stablecoins to the period of "free banking", when privately issued banknotes of uncertain

How Netflix transforms Hollywood

Duffer 1

Duffer 2



Act II: Costumes

😀 8 👏🏾 2 👍🏻 14 🍄

is how Oakwood Elementary ✓ *nails* the fall play. 🎭 38

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backing and worth circulated in America's economy in the 19th century. A more useful comparison is with money-market funds, which were created in the 1970s to circumvent rules limiting the interest banks could pay depositors. After promising to maintain the value of their shares at a dollar, money-market funds blew up in 2008 in the global financial crisis. American taxpayers stepped in to forestall a fire sale of their assets and a crash in the market for commercial paper, on which the real economy depends. A collapse of stablecoins could look similar.

Regulators must act quickly to subject stablecoins to bank-like rules for transparency, liquidity and capital. Those failing to comply should be cut off from the financial system, to stop people drifting into an unregulated crypto-ecosystem. Policymakers are right to sound the alarm, but if stablecoins continue to grow, governments will need to move faster to contain the risks.

It may be tempting to ban stablecoins, especially if central banks launch their own digital currencies—much as private banknotes were replaced with government monopolies on physical cash. Yet it is possible that regulated private-sector stablecoins will eventually bring benefits, such as making cross-border payments easier, or allowing self-executing "smart contracts". Regulators should allow experiments whose goal is not merely to evade financial rules. But first they must prevent the repackaging of risks with which the world is all too familiar. ■

Developing vaccines

Vaxelerando

Scientists responded rapidly to the pandemic. Next time they could be even faster

As the Delta variant of covid-19 continues to spread across large parts of the world, the shame is that vaccines are still in such short supply. Worse, they are being hogged by rich countries even though the need elsewhere is so great. For that, blame politics. The triumph, however, is that vaccines exist at all. And for that, praise science.

The sequence of the virus's genome was made public on January 11th 2020, just one month after a new respiratory illness was first reported in Wuhan, in China. Days later, on January 15th, Moderna, working with America's National Institutes of Health, had completed the design of the prototype molecule that would comprise its vaccine. Sixty-two days after that, on March 16th, human trials began. Maggie Keenan, a 91-year-old Briton, received the first clinical Pfizer vaccine on December 8th. By comparison, the vaccine against polio in America took 20 years to make the journey from trials to licence.

And yet scientists could do even better. By the beginning of 2021, according to our statistical model of excess deaths, the pandemic had claimed between 4m and 8m lives. If mass vaccination had got under way even a bit sooner and scaled up just a little more quickly, hundreds of thousands of people could have been saved. That is a goal worth striving for in the next pandemic—and, recent research suggests, it is entirely possible.

The foundation for this is decades of scientific and medical research. Katalin Karikó, one of the pioneers of the mRNA technology that underpins the two most successful vaccines, made by Pfizer and Moderna, spent 30 years studying how mRNA can help fight disease. Her research was often too radical to attract government grants or institutional support. But it is part of a body of work that vastly enlarges the scope to cope with infectious diseases, including those that are new.

As we explain this week (see Science & technology section), the pandemic has seen a new set of biochemical and computational tools come to the fore in predicting the evolution of viruses. One approach is called "deep mutational scanning", which observes random changes in a pathogen's crucial proteins under laboratory conditions. Using machine learning, scientists can form predictions about which combinations of these mutations will, for instance, make the disease spread faster and hence come to dominate a pandemic in much the way that Delta is dominating covid-19.

Armed with these predictions, manufacturers could prepare stockpiles of vaccines and therapies before pathogens have mutated and spread. One day, people could even be vaccinated pre-emptively. Such a degree of preparedness, and the rapid deployment of doses that it will make possible, could save many lives.

The same faster-is-better logic also applies to other areas of pandemic response. Testing and contact-tracing ought to be available as soon as the first signs emerge that a pathogen is going global. The pandemic has shown that large centralised testing facilities, while they are quick to get up and running from scratch, have slower turnaround times than smaller, more local facilities which can process samples on site.

Such facilities ought to be ready for the next pandemic, relying on rapid, purpose-built genetic testing that has only just started to come online in airports around the world. By the time the next pathogen arrives, the same technology which allows the covid-19 testing centre in Berlin's new Brandenburg airport to turn around a sample in less than an hour should be widely available.

Regulators must also play their part. Health authorities are already grappling with the modular nature of the new vaccine-production systems, streamlining their approval processes so that shots may be updated to confer protection against the coronavirus variants. The new vaccine "platforms" can churn out one vaccine as easily as another, with only minor changes. The authorities should start thinking about how to ensure the safety of platform-produced vaccines against entirely new pathogens without having to start the approval process from scratch each time.

There is no knowing when the next pandemic will come. New pathogens are emerging from complex, unpredictable environments all the time, often far from scrutiny or regulatory control. A fresh disease could be about to take off right now, as a freak bacterium escapes from an antibiotic-abusing factory farm, say, or a mutated virus sweeps out of a laboratory or a forest, as a bat passes it on to a new host which can infect humans. You cannot stop all pandemics, but you can prepare for them better. ■

MINISTERO DELLA CULTURA

POSITION DESCRIPTION

DIRECTORS OF ITALIAN MUSEUMS

Background

On August 4, 2021, the italian Ministry of Culture (MiC) issued an **international call for applications** for 4 positions of Director for the museums and the archaeological sites mentioned below:

Museo Nazionale dell'Arte Digitale (Milano)
Parco Archeologico di Cerveteri e Tarquinia
Parco Archeologico di Sepino
Pinacoteca Nazionale di Siena

The Position

The new Directors will provide **strategic leadership and management expertise** for the above mentioned institutions.
They will lead the Administrative Board and the Scientific Committee of their respective institutions.
Each Director will supervise **(i)** the institution's managerial, organizational and financial planning activities; **(ii)** all cultural programs of the institution; **(iii)** all details of the institution's relations with visitors, local communities, national and international stakeholders, as well as national and international peer institutions.
Application guidelines and further details are available at the following link: **cultura.gov.it/museitaliani**

Deadline: September 10, 2021

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Created by Jeff Bezos in 2020 with a $10 billion commitment to address climate change and protect nature, the Earth Fund will be fully disbursed in this current decisive decade.

As we build our senior team we are looking for leaders with deep technical expertise and a track record of shaping bold ideas and driving action. Candidates will be committed to the urgent task of systems change that will be needed to promote economic wellbeing and social justice while delivering climate and nature solutions. Preferred location: Washington DC, but flexible for extraordinary candidates.

Director, Nature Solutions - 5268

Director, Economics of the Future - 5264

Director, Technology Acceleration - 5269

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Perrett Laver

AMERICAS ASIA PACIFIC EMEA

Appointment of Director General

Science Foundation Ireland sfi For what's next

Science Foundation Ireland (SFI) is the national foundation for investment in research in the areas of science, technology, engineering, and mathematics (STEM), which assist in the development and competitiveness of industry, enterprise, and employment in Ireland. It also promotes and supports STEM education, engagement, and career development, and the value of STEM to Ireland's economic and societal development. With a vision to further enhance Ireland's reputation as a Global Innovation Leader in scientific and engineering research, SFI's new Strategy 2025 – Shaping Our Future – is designed to meet current challenges and to position Ireland to take advantage of future opportunities.

The Board of SFI is now seeking to appoint an outstanding individual to the role of Director General (Chief Executive Officer) of the Agency. Reporting to the Board, the Director General will be an inspiring leader with a proven track record of achievement in academia, industry, or government/public sector. They will bring a deep understanding of the international research environment, and the strategic vision, leadership and management experience to deliver effectively on the mission and vision of the Agency.

SFI will be supported in this appointment process by the executive search firm Perrett Laver. For further details, including job description, person specification and information on how to apply, please visit **https://www.perrettlaver.com/campaigns/sfi-director-general**. For informal enquiries please contact **SFI@perrettlaver.com**. The deadline for applications is **noon IST on Wednesday 1st September 2021.**

Perrett Laver

AMERICAS ASIA PACIFIC EMEA

Crime and punishment

Regarding your leader calling for life sentences to be reduced ("Pointlessly punitive", July 10th), for the past 29 years I have spent countless hours meeting men serving life sentences without parole. One of them is my biological father. Your arguments about excessive sentencing struck a chord. On Father's Day, I was reminded of the diminishing returns of many life sentences during my visit to several prisoners aged over 60. These remorseful men believe they could use their experience to turn around almost any troubled youngster. That is a bold claim, but these older offenders could help in programmes to tackle rising crime.

Like too many black Americans, I have family members who have succumbed to gun violence. So although I am not overly sympathetic towards convicts, I do think there should be the possibility for rehabilitation and forgiveness. Many life sentences go beyond the point of being productive.

STEFAN JOHNSON
New York

I was disappointed with your Benthamite conclusion that prisons are about preventing crime, not atonement. That asserts just one viewpoint about why we penalise people and disregards a rich debate about the nature of punishment. Imprisonment is not just to deter people from committing crime, it is also a catharsis, and retribution for both the victim of the crime and a society morally disgusted by it.

ALEX REAY
Coventry

You held up Norway as a model for sentencing. But consider that Anders Breivik was given just 21 years, Norway's maximum life sentence, for the murder of 77 people. That puts the value of killing a person at a little over three months in prison. Your description of Brenton Tarrant's sentence of life without parole as "wrong" for murdering 51 people at two mosques in New Zealand was equally galling.

You condoned a policy that values victims' lives cheaply. Thankfully, most American jurisdictions are unlikely to adopt your recommendations.

EVAN NEBEL
Arlington, Virginia

A new war on drugs

"Narco-state on the Med" (July 24th) scratched the surface of the Captagon drug trade in Syria. Captagon is not a new drug. It was first manufactured in the early 1960s and originally prescribed for depression and narcolepsy. By the 1980s it was banned because of its terrible side effects. It has now made a huge comeback in the Syrian war as a source of profit for powerful men on all sides of this tragedy. This hideous drug is ravaging entire communities and countries. Just ask doctors in Saudi Arabia, who are facing Captagon addiction of epidemic proportions among Saudi teenagers and young men.

For the story in Syria I recommend "Proof of Life", a book by Daniel Levin, which tells not only how Captagon generates enormous profits in the country, but also the way the drug lords combine the business with the weapons trade and human trafficking, from sex slavery to Western hostages.

MICHAEL RICHTER
St Gallen, Switzerland

Spreading disease theories

Your What If? column about why "germ theory" was not adopted in the 1680s was based on a false assumption ("Germ of an idea", July 3rd). As I noted in a book with the same title as your article, many early modern natural philosophers believed that some diseases might spread from person to person, by contagion, because of a tiny pathogen.

Given the state of microscopy there were many different "germ theories". Benjamin Marten, a physician in London, published an especially prescient theory of animate contagion in 1720. Carl Linnaeus, a botanist in the 18th century, claimed that minuscule living pathogens caused disease. These ideas gradually spread. By the late 18th-century, possibly most British physicians believed that diseases including typhus, smallpox, measles, tuberculosis, childbed fever and influenza circulated by person-to-person contagion, but were agnostic about the exact nature of the agent.

The story is not about an intellectual or cultural failure. It is about doctors wrestling with unreliable and fragmented evidence and developing a range of plausible explanations, some of which were later vindicated. Our own confusion about how covid-19 spread (by contaminated surfaces, droplets or aerosols) should give us some humility in assessing the efforts of scientists centuries ago.

MARGARET DELACY
Portland, Oregon

The efforts of Ignaz Semmelweis to prevent post-partum maternal deaths from sepsis were "ignored", you say. Not quite. His colleagues were so offended by the implication that their contaminated hands were killing their patients that they attacked Semmelweis ruthlessly. Eighteen years after his discoveries, his colleagues committed him to an asylum, where he was beaten by the guards and died.

Sadly, it's the usual story when anyone presents evidence that contradicts groupthink. Alfred Wegener, an amateur geologist, was similarly assailed by professional geologists for his theory of continental drift, 50 years before his ideas were accepted. Delia Bacon was harassed for proposing that a group of Elizabethan writers collaborated on the works of Shakespeare, more than a century before the New Oxford Shakespeare edition agreed that a group of writers contributed to Shakespeare's plays.

We don't always welcome new ideas.

RICHARD WAUGAMAN
Potomac, Maryland

For all intensive purposes

Johnson wrote about eggcorns, solecisms that can "make more sense than the phrases they replace" (July 17th). One of the most pervasive eggcorns appears in "The Twelve Days of Christmas", where "four colly birds" has become "four calling birds" (though what are calling birds?).

HENRY PLOEGSTRA
Holland, Michigan

My favourite eggcorn is duct tape. The cloth tape with an adhesive backing was originally called duck tape. It was developed to seal ammunition boxes on naval vessels and made from sturdy canvas duck, from the Dutch *doek*, also known as ducking. Duct tape is more appropriate, given the identical pronunciation and the tape's use in air ducts.

JACK AUBERT
Falls Church, Virginia

On the origin of malapropisms, Mrs Malaprop's name was invented by Richard Sheridan in "The Rivals" as an abbreviation of the French expression *mal à-propos*, which can be translated as "improperly" or "at the wrong time".

TONY HAYS
San Clemente, California

Johnson's wry note suggested replacing "one fell swoop" with "one foul swoop". Macduff wails in Macbeth, "Did you say all? O hell-kite! All? What, all my pretty chickens and their dam, At one fell swoop?" Shakespeare is using an avian metaphor to compare the murder of Macduff's wife and children to a hawk suddenly swooping down on defenceless prey. Surely "one fowl swoop" is to be preferred?

PROFESSOR MICHAEL MAINELLI
Emeritus professor
Gresham College
London

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Trainspotting, with nukes

Academics, activists and passionate amateurs are making use of intelligence capabilities once reserved for superpowers

IN 1960 JOHN KENNEDY, the Democratic candidate for the American presidency, accused the incumbent Republican administration of having allowed a "missile gap" to open up between America and the Soviet Union. The idea seemed plausible. The Soviet Union's success in launching the first satellite, *Sputnik*, on a rocket which could double as an intercontinental ballistic missile (ICBM) had naturally led to speculation that it was far ahead of America in the deployment of such weapons.

Plausible, but wrong. Soviet ICBMs could be counted on the fingers of one hand. But although, by the final days of the campaign, President Dwight Eisenhower had strong evidence of this from the CORONA spy-satellite programme, he could make no mention of it. The ability to spot ICBM sites from space was so precious that it was worth risking the White House to keep it secret.

What was then world-historic is now the stuff of student projects—albeit an exceptional project for an exceptional student. When rumours of new Chinese ICBM launch sites fluttered through Washington, DC, earlier this year, Decker Eveleth applied himself to the problem. His resources were easily sourced satellite pictures; common sense, which told him the silos would be on flat land far from American radars in Japan and South Korea; and a degree of stick-with-it-ness sufficient to the challenge of systematically examining all the empty plains of western China.

Having slogged all across Inner Mongolia without luck, he hit gold in neighbouring Gansu. There, in the Gobi desert, he could see 120 missile silos under construction, the largest such effort mounted anywhere on Earth since the end of the cold war. A month later Matt Korda, a 26-year-old researcher at the Federation of American Scientists, an NGO, discovered the same telltale grid pattern in a secluded part of Xinjiang.

Mr Eveleth first dabbled in the interpretation of satellite data two years ago, when he was a sophomore in college. "A class had some very boring readings," he says, "so I opened Google Earth." That led him to Geo4Nonpro, a crowdsourced project which let budding hobbyists and seasoned experts collaborate to annotate satellite pictures of everything from uranium mines in India to chemical-weapon facilities in Syria. "It's fun," says Mr Eveleth. "There's a happy feeling you get when you look at a site and think: I'm the first person to know what that is."

Geo4Nonpro was run by the James Martin Centre for Nonproliferation Studies (CNS), a part of the Middlebury Institute for International Studies at Monterey, California. The CNS is a leader in gathering and analysing open-source intelligence (OSINT). It has pulled off some dramatic coups with satellite pictures, including on one occasion actually catching the launch of a North Korean missile in an image (pictured above) provided by Planet, a company in San Francisco.

Satellite data, though, is only one of the resources feeding a veritable boom in non-state OSINT. There are websites which track all sorts of useful goings-on, including the routes taken by aircraft and ships. There are vast searchable databases. Terabytes of footage from phones are uploaded to social-media sites every day, much of it handily tagged. "On their phone people have the same quality information I used to have to go into a secure facility for," says Bruce Klingner, who worked as an analyst for the CIA and the Pentagon's Defence Intelligence Agency for 20 years. "It's just really kind of mind-boggling."

And it is not just the data. There are also tools and techniques for working with them—3D modelling packages, for example, which let you work out what sort of object might be throwing the shadow you see in a picture. And there are social media and institutional settings that let this be done collaboratively. Eclectic expertise and experience can easily be leveraged with less-well-versed enthusiasm and curiosity in the service of projects which link academics, activists, journalists and people who mix the attributes of all three groups. The intelligence world is thus being democratised, a development which is challenging governments, reshaping diplomacy and chipping away at the very idea of secrecy.

An archaeology of knowledge

When Eliot Higgins began analysing YouTube footage of weapons used in the Syrian civil war in the early 2010s it was seen as a "weird amateur hobby", he says. But he saw their potential. In 2014 Mr Higgins founded Bellingcat, a collective of researchers, investigators and "citizen-journalists" funded by a range of charities which now has 18 full-time employees. In its first year it cut its teeth on an investigation into the shooting down of a Malaysia Airlines flight, MH17, over eastern Ukraine.

Local people had posted videos of a Russian missile launcher moving through the area. Mr Higgins and a band of volunteers roamed Google Earth to identify various trees, road bends and buildings visible in those videos so that they could say exactly where it had been when. Ukraine@war, an anonymous blogger, identified a specific field as the likely launch site. Photographs taken later showed the same launcher back in Russia—and missing one missile.

When a Ukraine International Airlines flight, PS752, crashed outside Tehran on January 8th 2020, five days after America had assassinated a leading Iranian general, Bellingcat was on the case again. So were the members of a channel on Slack, an instant-messaging and collaboration tool, called "Arms Control Wonk Podcast": the podcast in question was founded by Jeffrey Lewis of CNS. The channel's 1,000-strong membership bats around thoughts on everything from missile tests to the spread of covid-19, says Paddy Kerley, an Irish cyber-security professional who enjoys scrutinising North Korean nuclear facilities in his spare time. Others have equally esoteric interests. "There's one guy reverse engineering a Sidewinder [missile] that he bought parts of on eBay—you know, normal things normal people do." Membership costs $5 a month, $3 for students.

Photographs taken at the PS752 crash site showed the mangled parts of a rocket and damage that seemed consistent with a missile attack. Wary of misinformation, the Bellingcat team ran a search for previous uses of the same images. It came up blank, suggesting the photos were new.

A video posted anonymously to Telegram, an encrypted messaging service, showed a light streaking into the sky, a flash and a boom just prior to the crash. A series of nondescript apartment blocks and a construction site were visible in the foreground. The Slack team divided into groups to pan through freely available satellite images of Tehran looking for the same pattern. They lighted on a spot in a suburb to the west of Imam Khomeini International Airport (see illustration).

Locating that spot gave the analysts a bearing. The 11 seconds between the flash in the sky and the sound of the explosion provided a distance. According to FlightRadar24, a website which displays the transponder signals of aircraft, the location thus calculated sat on the flight path of PS752. It had been downed by a surface-to-air missile launched from nearby.

The next day Canada's prime minister, Justin Trudeau, said that "intelligence from multiple sources" showed that the plane had been brought down by Iran's own air defences. Such accusations were "psychological warfare against Iran", thundered an Iranian spokesman. But the evidence of what had actually happened continued to accumulate, thanks both to government briefings (the sorry chain of events had been captured by American spy satellites; the mobile-phone conversations of panicked revolutionary guards had been intercepted) and to the people using OSINT techniques. On January 11th Hassan Rouhani, Iran's president, publicly acknowledged that a "disastrous mistake" had been made.

As in the case of MH17, the OSINT efforts were not the last word. But on both occasions the open availability of evidence gathered from diverse sources and analysed independently was incriminating in a way that *parti-pris* pronouncements from intelligence agencies would not have been on their own.

The order of things

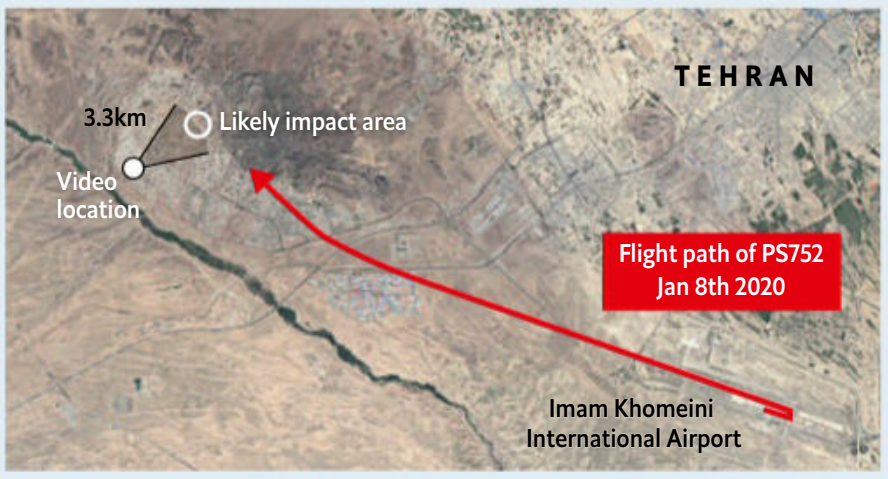
In reacting to events such as the downing of aircraft, the OSINT community typically relies on data that are already out there. For other projects it acquires new data it expects to have use for—often from space. The capabilities that CORONA provided in the 1960s are now handily outstripped by a bevy of commercial satellite operators (see chart on next page). Planet has been launching cameras on tiny "cubesats" since 2013 and now has a constellation of about 150 with which it aims to photograph all of the Earth's land surface every day. Its cheaper images have a resolution of three metres per pixel, picking out objects the size of a car; its sharper ones are 50cm per pixel, showing more detail. Companies like Maxar, a maker of bigger American satellites, and Airbus, a European aerospace giant, provide higher-resolution images.

When, in the 1990s, the American government sought to encourage the develop-

Enhance 224 to 176

A mobile phone captures video of an apparent missile striking an object over Tehran

A trawl of satellite imagery turns up the configuration of buildings and street lights visible in the video



The 11-second delay between the light from the explosion on the video and its accompanying sound shows that it occurred 3.6km away—a ground distance of 3.3km using Pythagoras's theorem. That matches the flight path of PS752

Sources: Bellingcat; Google Earth; *New York Times*

ment of such ventures, it imagined controls over the high-resolution stuff. That policy foundered when companies elsewhere began to sell high-resolution images on the open market; better that American companies be able to compete than that they go under. Though "shutter control" by the American government remains possible, the law it rests on is not used. Subtler suasion may be at play, though. Dr Lewis has the impression that some at the Pentagon have been less than pleased with some of the images published by his team; when the government is a big customer, such anger could matter to the revenue of the companies involved.

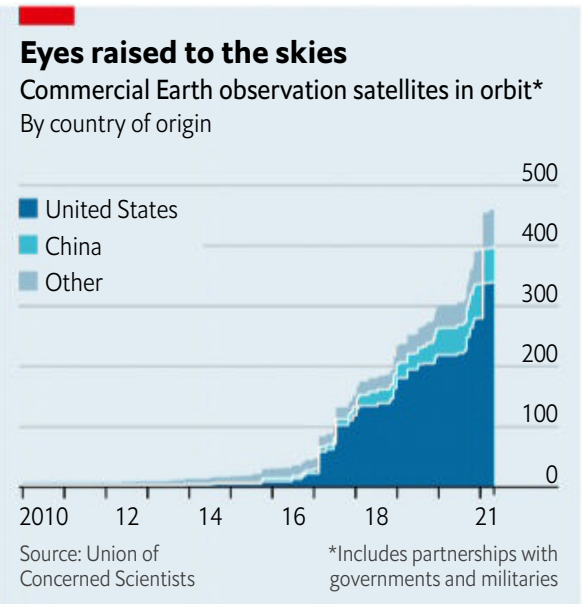
The government is a big customer because the commercial images provide a useful supplement to its classified in-house capabilities. They also provide a rhetorical resource: pictures bought commercially can be used publicly without revealing anything about classified capabilities. "We are providing a particular role in society that most open countries, including the United States, net benefit from," says Will Marshall, the CEO of Planet. "It might occasionally expose something inconvenient for them, but that's the new state of the world."

You can look

If government is the biggest consumer, though, Dr Lewis may be the keenest. He and his colleagues have used data from Planet, Maxar, Airbus and others to analyse missile programmes in China, Iran, North Korea, Russia, Saudi Arabia and other countries. The evidence base they have built to further their work on non-proliferation has earned them an impressive reputation for unearthing missile launchers, rocket factories and nuclear plants.

"Overhead" imagery, as it is known, is not magic; it needs interpretation, and that means knowing what you are looking for. A haunting lesson comes from a second-world-war reconnaissance mission. In 1944 a plane sent to photograph a chemicals plant in northern Poland which the allies planned to bomb turned its cameras on early and captured images of a large industrial complex nearby. It was only three decades later that Dino Brugioni and Robert Poirier, a pair of CIA analysts working in their spare time, pointed out that those early frames were the first aerial images ever taken of the Auschwitz-Birkenau concentration camps.

Further flights took pictures of the roof vents where Zyklon-B crystals were inserted into the gas chambers; of long, snaking lines of prisoners; of smoke billowing from the pits behind Birkenau's crematorium. None were recognised for what they were. "There simply was no historical or intelligence precedence [sic] for genocide on such a scale," wrote Mr Brugioni in an essay in 1983. "Most World War II interpreters I have spoken to found the concept unbelievable, unimaginable, and completely incongruous." Other intelligence officers had more sense of what was going on; but they did not know about the photos, and the interpreters did not know to ask them.



Today's OSINT community does not suffer from such compartmentalisation, and it has sources on the ground from which it can learn more about structures seen from the sky. In 2017 reports of "counter-extremism" and "political education" camps built by China to detain Uyghur and other Muslim minorities in Xinjiang, a western province, began circulating in local and foreign media outlets. The Australian Strategic Policy Institute (ASPI), a think-tank, gathered this evidence in a single database, supplemented it with photographs shared on Chinese social media and started looking at satellite images for structures which fitted the bill. They identified 28.

China unwittingly made adding to the tally easy. In August 2018 journalists at *BuzzFeed News* noticed that Baidu Maps, a Chinese app, was systematically blotting out some places in Xinjiang. A number of the blots covered camps found by ASPI. Searching Baidu Maps for the easy-to-see blots and then looking at uncensored satellite data of the same spots revealed a gulag archipelago of several hundred more camps, most of them previously unknown.

Had China built such a machinery of repression three decades ago, stories from inmates and their relatives would doubtless have trickled out. America would have seen the facilities involved with its spy satellites, had it looked, and might have vouched for their existence. But the digital record furnishes evidence that is publicly accessible and visually compelling; nothing has done more to make the oppression of the Uyghurs international news.

Ever better hardware for phones, a technological trend which can be relied on, means ever better hardware for satellites. Planet's cubesats are now far more capable than those it launched in 2013. Other companies are pioneering new forms of satellite observation. Capella, Ice-Eye, Umbra and Xpress-SAR are radar-satellite startups offering "synthetic aperture" technology which can take detailed pictures of surface features even through clouds, foliage and, sometimes, thin roofs. (It can also provide entirely unexpected insights. In 2018 Harel Dan, an analyst at a company in Israel, showed that the powerful radars used by American Patriot missile batteries interfered with the operations of a European radar satellite, Sentinel-1, thereby revealing hitherto unknown air-defence sites.)

Hyperspectral sensors, capable of making fine distinctions in the analysis of light beyond the visible blue, green and red bands, reveal things as diverse as wakes in turbid water, the health of crops or the difference between new and old paintwork. They may also show things which, wavelength-restricted as their own eyes are, human interpreters have yet to imagine. It is in part to guard against missing such things that satellite images are increasingly fed into machine-learning software which will see patterns humans might not pick out, or even think to look for.

This is not all being done for the benefit of spooks and their civilian OSINT counterparts. Seeing the world in detail and watching it change over time has all sorts of applications for agriculture, for investors, for commodity companies, for environmental monitoring of corporate activities and more. But OSINT is a happy fellow traveller.

But you better not touch

The infovorous energy and ecumenical spirit of online OSINT are not unprecedented. The men and women who staffed the Foreign Broadcast Information Service, America's wartime proto-OSINT organisation, were "the greatest collection of individualists, international rolling stones, and slightly batty geniuses ever gathered together in one organisation", remarked a journalist who visited their Washington office in 1943, a "unique combination of newspapermen and PhDs" consumed by "casual kidding in 17 foreign languages [and] the feeling that something big may come over at any minute".

The same buzz is now replicated in online chats and Slack channels. To locate a tent from a scrap of road marker glimpsed through a gap in the canvas wins kudos. What other high jinks can compare with using Denis Rodman, a basketball player, to measure the size of an H-bomb? Photographs of Mr Rodman standing with Kim Jong Un allow a reliable estimate of the North Korean dictator's height (it would be foolish to trust official statistics on such a matter). From Mr Kim's height you can estimate the size of his head; from that you can get the size of nuclear weapons with which he has posed.

The techniques of OSINT are not only applicable in closed states and war zones. In 1978 William Arkin, who had until recently been an intelligence analyst tracking Soviet nuclear forces in East Germany for the American army, tried to work out where their NATO equivalents in the West were. He found what seemed to be telltale terms used in unclassified descriptions of some military units and found the addresses of the bases they were stationed at. In the antediluvian days before Google Earth he travelled round Germany looking at the sites thus identified. They turned out all to have a distinct double-fence security set-up and identical guard towers, measures which confirmed the presence of something particularly dangerous and worth protecting.

When Mr Arkin's findings were published in 1981 America accused him of having used classified information from his army days. To avoid criminal charges he had to prove the information was all in the public domain. In a new book, "Restricted Data", Alex Wellerstein, a historian at the Stevens Institute of Technology, describes the proceedings: "A colonel shouted the names of bases, and Arkin would then display the tangled web of documents proving that each base contained nuclear weapons." As they ran through base after base, the colonel "slumped deeper and deeper into his seat". Mr Arkin walked free.

Some may sympathise with the colonel. If OSINT makes keeping military secrets harder it may give comfort to enemies. "We often get complaints from professional photo interpreters, that they don't like seeing their method described so explicitly in public", says Dr Lewis, "because they think it might help the adversary."

Many of his colleagues are acutely aware of these risks. Melissa Hanham of Stanford University says that when her OSINT work led her to a theory of why North Korea's submarine-launched ballistic missiles were failing she decided that it would be wrong to publish it, lest it help the missileers. She is working with various OSINT organisations to develop a code of conduct for open-source researchers faced with such ethical quandaries.

The room for improvement that can be revealed by OSINT is not just in dictatorships. In early 2018 Nathan Ruser, then a student and now an analyst at ASPI, got interested in the data made publicly available by Strava, an app that allows users to log exercise routines. It showed joggers looping around New York's Central Park, cyclists streaming down Shanghai's Bund and swimmers thronging Bondi Beach. It also showed lonelier fitness regimes being pursued in various hotspots around the world, thus revealing what turned out to be CIA bases in Somalia and Djibouti and a Patriot missile battery in Yemen. Was this embarrassing? Yes. Is it likely to lead to better security in future? Again, yes.

If security services can benefit from OSINT, can they also use it to their own ends? When Bellingcat identified the two Russian agents who had poisoned Sergei Skripal, a Russian spy living in the English city of Salisbury, the Kremlin was apoplectic. "Bellingcat is closely connected with the intelligence services," fumed Sergei Lavrov, the country's foreign minister, "which uses it to channel information intended to influence public opinion."

If such accusations were to stick, the organisation would be weakened. It is to give the lie to them that Bellingcat meticulously documents the databases it draws on, the methods it uses and the crosschecks by which it validates things. To plant a falsehood that passed muster would mean starting a paper trail years before: not impossible, but hard to do on the fly. And hard to get away with, too, in an open community full of frenemies eager to probe each other's conclusions.

Why didn't you tell the world?

The most general challenge posed by OSINT is the weakening of a certain sort of state power. Dr Wellerstein argues that treating secrecy as simply denying people information misses something crucial. "It's about the control of the information. It's about the ability to dole it out as you see fit to get your ends...and governments have always known this." Dr Lewis was originally attracted to OSINT in the early 2000s by his frustration during the run-up to the Iraq war. He felt that civil society had no way to check dubious claims being made on the basis of intelligence released through choreographed public statements and secret briefings to news organisations. Now, to an increasing extent, it does.

In undermining state monopolies on intelligence, OSINT is increasingly capable of challenging the narratives states promulgate. The CNS and other OSINT groups, for example, have consistently provided a sense of North Korea's nuclear abilities more realistic than that offered by recent American administrations, which repeatedly claimed they would not allow North Korea to develop capabilities which, judging by the OSINT evidence, it already had.

If revealing inconvenient truths undermines policies based on ignoring the facts, though, it is not necessarily a road to peace. A country given a bloody nose in a border skirmish might be less inclined to back down if its citizens are shown evidence of its failure. Secrecy enables face-saving, and thus de-escalation.

Consider the resolution of the Cuba crisis in 1962. The removal of Soviet nuclear weapons from the island was achieved through a deal which also saw America remove its Jupiter missiles from Turkey. This quid pro quo was kept secret for decades; Kennedy even lied about it to former presidents. "Any other course", his aides later wrote, "would have had explosive and destructive effects on the security of the United States and its allies." Secrecy enables malfeasance, perhaps, but it can also serve as a lubricant. In an age of OSINT the withdrawal of the Jupiters would quickly have become common knowledge.

But would the quid pro quo have been necessary at all in such an age? Cuba was a crisis because the missiles were already there when America first became aware of the situation. Today, one imagines, it would have been on the ball a lot earlier. And if, for some reason, it had missed what was under its nose, driven, chatty and motivated satellite-data wonks would have delighted in telling the government, the press or Twitter what was what. A reduced capacity for subterfuge may, in some cases, be a genuine loss. A lessened risk of strategic surprise is a real benefit. ■

Mr Kim and his bomb (Dennis Rodman included for scale)

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Homelessness

Gimme shelter

SEATTLE

The pandemic made homelessness more visible in many cities. Now policymakers have a chance, and funding, to tackle the problem

SEATTLE'S SKID ROAD has lived many lives. In the 1850s loggers "skidded" felled trees down the steep hill that led to the waterfront on Elliott Bay. Roughly 100 years later Murray Morgan, a local writer, described Skid Road as "a place of dead dreams", where passers-by would encounter "men sitting on kerbs and sleeping in doorways". Today's Skid Road has evolved further. A homeless encampment has overtaken a park blocks away from where tourists peruse posh shops. A woman sits in her underwear on a milk crate. Tarpaulins shelter those without tents.

Unsheltered homelessness—which includes people who live in cars, parks or abandoned buildings—has been rising for the past few years. The Department of Housing and Urban Development (HUD) estimates that 226,000 Americans were living unsheltered in December 2020, up by 30% since 2015. Last year, rough sleepers accounted for about 39% of the country's total homeless population, the highest proportion in a decade. The 2% increase in America's overall homeless population between 2019 and 2020 is due entirely to the growth of unsheltered homelessness.

A federal moratorium on evictions for those behind with their rent, a pandemic-relief measure, ended on July 31st, threatening more homelessness. But on August 3rd, facing a political backlash, the Centres for Disease Control and Prevention (CDC) again halted evictions in covid-stricken areas. The new protections are expected to cover 90% of the country for two months—time for the administration to arrange rental assistance for those in need.

Before the pandemic, tents could reliably be found in city centres up and down the west coast. Now encampments have cropped up in leafy neighbourhoods all around places such as Los Angeles, Portland and Seattle. "It doesn't matter where you are now," says Jon Scholes, the president of the Downtown Seattle Association. "You see people who are visibly homeless."

The seeming increase in encampments is hard to quantify. Because of the pandemic, HUD allowed communities to opt out of its yearly count of homeless people in January. In lieu of official data, Karen Snedker, a sociologist at Seattle Pacific University, conducted her own tent census in areas with the largest encampments and found 220 more tents in July 2020 than in the last three months of 2019. Dr Snedker reckons the 50% spike was greater than normal seasonal change would suggest.

The visibility of encampments does not necessarily mean that overall homelessness rose during the pandemic. As the virus began to spread, many worried that shelters would act as incubators for covid-19. States and cities across the country moved people into hotels where they could safely quarantine. King County, which includes Seattle, saw reduced rates of covid-19 and higher exit rates to permanent housing after moving homeless people from shelters to hotels. A study published in March reported similar results for a hotel scheme in San Francisco, where the number of tents fell in the past year.

But there weren't enough hotel rooms to house all America's homeless. Gregg Colburn, of the University of Washington, says the pandemic divided the country's homeless into two groups: those who were able to take advantage of emergency programmes, and those who fell through the ▸▸

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cracks when shelters shut down. It is hard to know whether the increase in the number of tents is a result of more people tumbling into homelessness, or previously sheltered people moving outside.

Three things conspired to keep tents where they cropped up. First, the pandemic: the CDC advised against breaking up encampments. It worried about dispersing people who might have caught covid-19.

Second, political paralysis: attitudes towards homeless "sweeps" (the forced break-up of encampments) have exposed the fault lines among liberals on the west coast. Leftists argue that sweeps can be traumatic for those in encampments, many of whom are struggling with mental illness or substance abuse. Moderates counter that allowing people to live outside helps no one. Increased wariness towards the police in the wake of George Floyd's murder in Minneapolis last year led Seattle to disband its "Navigation Team", which brought together police officers and outreach workers to break up encampments and refer their residents to shelters.

The third factor stopping the break-up of encampments is legal uncertainty. The Ninth Circuit Court, which covers most western states, decided in 2018 that Boise, Idaho, could not criminalise sleeping outdoors on public property when shelter is not available. Cities around the region were left wondering what to do. The parameters are murky. Sleeping may be allowed, but what about tents?

Cheques and balance

As America ponders a post-pandemic future, municipalities are mulling what to do about the camps. Thanks to federal stimulus funds and budget surpluses, policymakers are swimming in cash. California's new budget for the 2021 fiscal year sets aside $12bn for homelessness programmes. Seattle will put more than a third of the $128m the city received from President Joe Biden's $1.9trn stimulus package passed in March towards the problem.

But shelling out cash does not guarantee success. California has spent more than $13bn over three years trying to reduce homelessness. Yet it still has half the country's total unsheltered population. Some 70% of California's 160,000 homeless people are sleeping rough.

In years past, says Jason Elliott, a senior adviser to Governor Gavin Newsom, California would "sort of write a cheque and hope good things happen". But he argues that the financial rewards or cuts for local governments that meet—or fail to meet—their goals, which are baked into the $12bn package, are "the most accountability that's ever been applied to homelessness funding in anyone's lifetime in California".

One of the arguments against generous benefits is the idea that poor or homeless people will move west to places where they can receive most help. But in 2019, 70% of San Francisco's homeless previously lived in the city, and all but 8% had lived in California. "People don't move four states over because there are better services," says Marc Dones, the CEO of the King County Regional Homelessness Authority.

The causes of homelessness can seem intractable, involving everything from poverty and systemic racism to mental illness and drug abuse. Shelter alone is not a solution. Policy wonks fret that western metro areas will follow in the footsteps of New York City, which has more homeless people than any other city even though a right-to-shelter law means only 5% of them are sleeping rough.

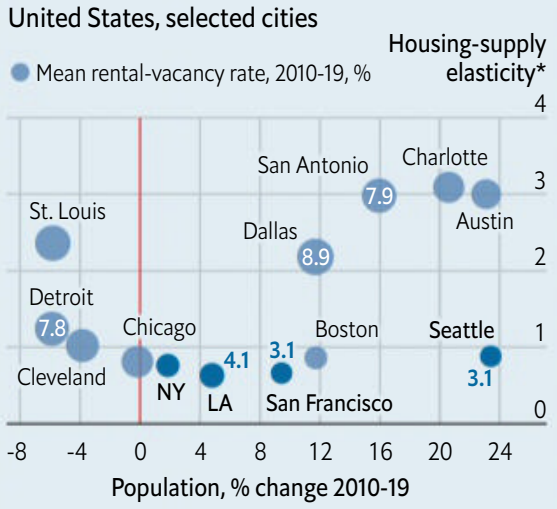
The engine that drives the problem is the high cost of housing. In their forthcoming book "Homelessness is a Housing Problem", Mr Colburn and Clayton Aldern compare the population-growth rates and housing-supply elasticity of several American cities (see chart). The cities most notorious for homelessness have absorbed an influx of people without building enough homes to house them. Fewer homes mean lower vacancy rates and higher rents.

Increasing the amount of affordable housing involves rezoning for high-density apartment buildings rather than single-family homes. A bureaucratic thicket and NIMBYism make that tricky. Geography also complicates matters. Seattle, San Francisco and Los Angeles are encircled by water and mountains. Constructing new homes in the West has increasingly meant building on forested and rural lands where wild areas meet the city, and where there is greater risk of wildfires.

It is a rare moment when the resources, sense of urgency and political will to tackle homelessness align. "My fear is just sort of throwing money up in the air," Dr Snedker says of Seattle's efforts. But "I'm hopeful that we can use this really dark moment to do something productive." ■

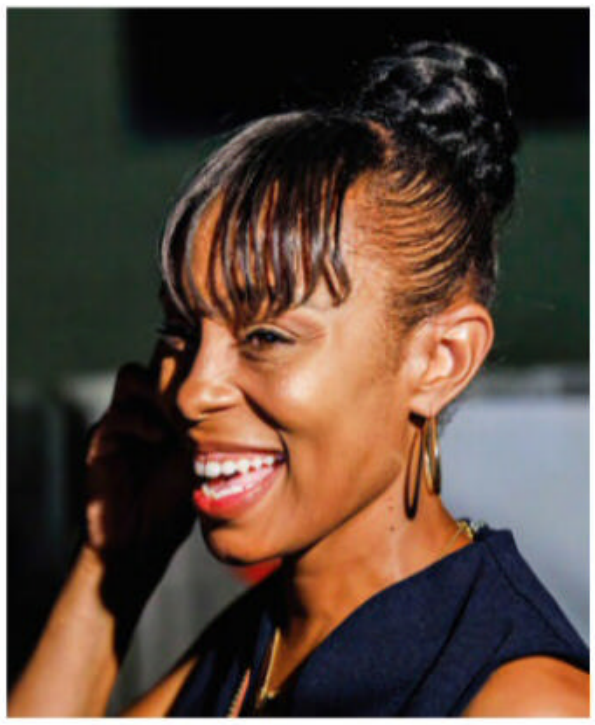
Builders wanted

United States, selected cities



*Higher numbers imply more housing as rents rise

Source: "Homelessness is a housing problem: how structural factors explain US patterns", University of California Press, 2022



A political litmus test in Ohio

The party of Biden

CLEVELAND

The Democratic Party's moderate mainstream shows its strength

CHEERS ERUPTED across the restaurant patio, the night air thick with cigar smoke. Young men in yarmulkes and African-American retirees clinked plastic cups of whisky. They were toasting the victory on August 3rd of Shontel Brown (pictured), Cuyahoga County's Democratic Party chair, in the primary for the special congressional election in Ohio's 11th district. The seat is reliably Democratic, so Ms Brown is set to become its congresswoman after the general election in November.

Stretching from Cleveland to Akron, Ohio's 11th district was an unlikely site for a vicious political fight. Ms Brown, an underdog in the polls who became the party establishment's favourite, defeated 12 other candidates, notably Nina Turner, a left-wing former state senator and an outspoken critic of moderate Democrats. For Ms Brown, her triumph was a clear rebuke of Ms Turner's confrontational stance: "When you demand all or nothing, usually you end up with nothing."

The race to fill the seat, vacated by Marcia Fudge after her appointment as secretary of housing and urban development, was billed as a referendum on the ideological balance in the party. Like other recent progressive challengers, from Louisiana to New York City and Virginia, Ms Turner fell short. In this deep-blue district, policy differences were minor. A contest led by two African-American women took the issue of diversity off the table. Instead, the race turned on which candidate would work best with President Joe Biden and navigate

local concerns. Ms Brown branded Ms Turner as insufficiently loyal to the president and the Democratic Party. Her victory suggests the mainstream of the Democratic Party remains firmly in control.

Left-wing candidates have struggled since the election of Mr Biden. The president's ambitious proposals, including vast spending on infrastructure and social programmes, have complicated the narrative for challengers to the party establishment such as Ms Turner. A prominent supporter of Senator Bernie Sanders (who returned the compliment by stumping for her in Akron on July 30th), Ms Turner courted controversy for her barbs aimed at the Democratic Party's standard-bearers, including Mr Biden.

That left her vulnerable to attack. Ms Brown charged that Ms Turner would be ineffective in office. Support from Hillary Clinton and the Congressional Black Caucus reinforced the perception that Ms Brown would, in her own words, "walk in the door with good relationships".

Antipathy for the left also drove well-funded advocacy groups including the centrist Third Way and Democratic Majority for Israel to jump into the fray. They spent heavily in support of Ms Brown and against Ms Turner. Though Ms Turner accumulated a $3.9m war chest, outside groups alone spent more than $2m on advertisements against her. This served to amplify Ms Brown's message and sustain her momentum in the final weeks in the race, just as Ms Turner's financing dried up and she struggled to stay on the air.

Yet for all the national attention and money, local factors also mattered—in particular the importance to Cleveland's large Jewish community of America's relationship with Israel. Although Ms Turner had been careful to moderate her position, her ties to Rashida Tlaib and Ilhan Omar, two high-profile left-wingers in Congress, suggested an affinity with critics of the Jewish state. Turnout in historically Jewish neighbourhoods including Shaker Heights and Beachwood was significantly higher than elsewhere. Ms Brown thanked Jewish voters in her victory speech. Minutes later, she was interrupted by a phone call from the president.

Nine months after his triumph in the presidential election, Mr Biden's honeymoon with the Democratic Party appears to be far from over. Ms Brown is poised to join a slim Democratic majority in Congress, where she will probably prove to be a loyal foot-soldier in supporting Mr Biden's agenda. Democrats may yet lose control of Congress in the 2022 mid-term elections, opening the door to recriminations and new challenges from the left. But for now, Ms Brown's success suggests Mr Biden's centre-left politics remains dominant among the party faithful. ■

Andrew Cuomo

Fall from grace

NEW YORK

The governor of New York faces calls to resign and possible impeachment

"I BELIEVE WOMEN, and I believe these 11 women," Letitia James, New York's attorney-general, said on August 3rd as she unveiled her much-anticipated report into the many accusations of sexual harassment against Andrew Cuomo, the state's governor. At 165 pages, it substantiated the claims in devastating detail and concluded that Mr Cuomo and his top aides created a "toxic" workplace that enabled him to mistreat women. Lionised a year ago for his handling of the covid-19 pandemic, Mr Cuomo now finds his reputation in tatters and his career in grave jeopardy.

Among Mr Cuomo's 11 accusers were past and present staffers as well as a state trooper whom he handpicked for his security detail. One former employee told investigators that Mr Cuomo made women feel like "prey". He touched them inappropriately, groping and kissing them, and made grossly improper comments, the report concluded.

After the report was released, politicians from President Joe Biden to longtime allies of Mr Cuomo in Albany, the state capital, called on the governor to resign. Ms James said he had violated state and federal law. New York's federal attorneys could potentially file criminal charges.

Mr Cuomo had previously denied any improper behaviour and said he intended to run for a fourth term. As the report touched off a furore, his response was grimly in character: he released a pre-taped 14-minute denial. He maintained he never touched anyone inappropriately. "It is not who I am," Mr Cuomo says. In the video, as a photograph of his mother hugging him flashes across the screen, he suggests he was brought up to be a hugger and to kiss people on the forehead.

Mr Cuomo's lawyer was ready with another rebuttal. Roughly a quarter of its 85 pages were given over to photographs not only of Mr Cuomo hugging other people but also of President Barack Obama, President George W. Bush and other politicians doing so. The message was clear: everyone hugs. The lawyer wrote that the way Mr Cuomo interacts with others is "not gender-based" and noted "he has hugged or kissed male and female members of his staff" as well as Bill and Hillary Clinton and Andrea Stewart-Cousins and Carl Heastie, the leaders of the state legislature.

"It was one of the most appalling, sleazy, manipulative and generally disgusting political exercises I've ever seen," says John Kaerny, of Reinvent Albany, a government watchdog, of Mr Cuomo's response. But he adds that it shows "he clearly does not intend to step down."

He may not have a choice. Women's groups, like the National Organisation for Women, have called on him to resign. All the Democrats in New York's congressional delegation have urged him to quit. His lieutenant-governor, who is next in line to succeed him, said she believes the women. As head of the state assembly, Mr Heastie has the power to bring articles of impeachment, which are ready to be filed. Although he has not yet committed himself to doing so, he said the conduct described in the report "would indicate someone who is not fit for office".

If Mr Heastie allows impeachment proceedings to begin, they could happen very quickly. Democrats have a supermajority in the state legislature, and state Republicans cannot wait to see the back of the governor. One possible hold-up is that the lawmakers are a little rusty on the proce-

A shadow of his former self

dure—the last impeachment was more than a century ago.

Other investigations threaten Mr Cuomo. Earlier this year Ms James released a damning report saying his administration understated the number of covid-19-related deaths in state nursing homes by as much as 50%. The report revealed that a state directive requiring the admission of covid-19 patients to homes may have put residents at risk. Ms James is looking into accusations that Mr Cuomo improperly used state staff to help write his bestselling book; the governor has said any work on the book by government employees was voluntary and done in their own time.

Mr Cuomo's immediate predecessors were also engulfed in scandal. Eliot Spitzer stepped down after a federal prostitution sting. David Paterson did not seek re-election after an ethics violation. Mr Cuomo, in office since 2011, has said that his father Mario, a liberal champion known for his eloquence who also served as governor, used to call politics "an ugly business". Andrew Cuomo has made it uglier. ■

Ghost guns

Taking aim at phantom firearms

DALLAS

Can politicians hit their target?

ACROSS AMERICA, police departments are seeing ghosts—the gun kind. "Ghost guns" are privately made firearms that do not have serial numbers and are therefore impossible to trace if they are used to commit a crime.

They are on the rise. Last year 8,712 such guns were recovered at potential crime scenes and reported to the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), more than triple the number in 2017. In 2020 police in Baltimore recovered 126 ghost guns, 15 of which were directly linked to shootings. Nearly a quarter of ghost guns seized by Baltimore's Police Department were from people too young to buy a firearm legally.

Technology is partly to blame. The internet has enabled people to buy kits or component parts and assemble them into guns without serial numbers. The well-resourced can also produce them with 3D printers. Websites that sell "80%" receivers, which are almost-finished firearms that require time and tools to put together, have thrived. Typically all you need is metal files, sandpaper, WD-40, a hammer, screwdriver, bench vice and power drill to assemble the firearm's parts: kits arrive with instructions and links to video tutorials. "This makes starting your own personal gun factory a breeze," boasts one firm, 80 Percent Arms, in its online listing for an AR-15 home-assembly kit.

Such sellers are exploiting loopholes to their advantage. Because they are peddling unfinished kits and not completed guns, these companies have technically not been required to mark a serial number on the "frame" or "receiver", which contains all the gun's operating parts. Nor have they been obliged to conduct a background check on buyers, as licensed gun-dealers must do. This means that people who might be barred from buying a gun, such as convicted felons, the mentally ill or the under-age, are able to do so with relative ease.

Who ya gonna call?

Police departments and politicians are worried. In 2019 the House Committee on Homeland Security argued in a report that "terrorists and other bad actors may seek to exploit the availability of these weapons for dangerous ends", and called ghost guns a "homeland-security threat". They have already proved to be a threat to public safety. Perpetrators of several mass shootings, including one two years ago in Dayton, Ohio, that killed nine people, have used home-assembled firearms.

Various levels of government are starting to crack down, including state legislatures and counties. So far this year ten states have introduced bills to regulate unserialised weapons, and more are expected this autumn. Governors in several states, including Nevada and Hawaii, have signed laws that take aim at ghost guns. "There's huge interest in this" among state legislators, says Kris Brown of Brady, a gun-control organisation. "In the hyper-partisan world in which we live, these kinds of bills have a reasonable shot of getting through even conservative legislatures," she adds.

Facing Republican resistance to new gun laws, the Biden administration has not pushed for a solution through Congress; instead, it is aiming to do so through an executive order, requiring the Department of Justice to come up with new ways to curb ghost guns. The department has proposed requiring all vendors of kits containing the parts to assemble a firearm to run background checks; requiring manufacturers to include a serial number on firearm "frames" sold in kits; and obliging federally licensed dealers to add a serial number to any non-serialised gun they sell. The gun lobby has been more muted in its criticism than usual; comments on the proposed rules are due next month.

Will the crackdown work? Requiring serialisation and background checks gives law-enforcement officers more firepower to prosecute people who are up to no good. However, America has so many guns already in circulation that malefactors who want a weapon will easily find a way to get one. State laws can only do so much, because firearms can flow in from neighbouring states with laxer rules. A federal law would be much better.

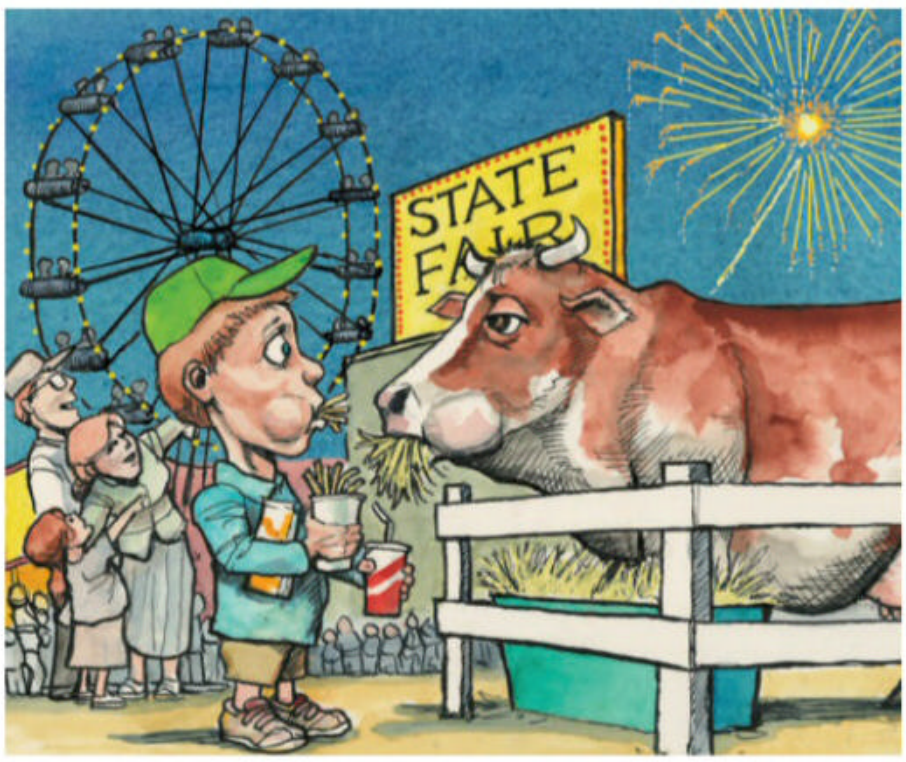
Haunted hunting

One federally licensed firearms dealer predicts that some gun-parts sellers will try to find loopholes. Already there has been a run on AR-15 gun kits, which are sold out on many websites. Whenever people think a particular type of firearm is going to be targeted by new regulation, it boosts sales. For example, the sale of AR-15s spiked after the Sandy Hook massacre in 2012, when people thought Democrats might ban assault weapons. (They tried to, but Republicans blocked them.)

The most effective way to combat gun violence is through universal background checks for gun sales, says Adam Winkler, author of the book "Gunfight". But as technology makes it cheaper and easier to create your own gun, the background-check process could lose some of its efficacy, he says. Catching people who are illicitly selling and manufacturing guns would also require significantly more resources. Yet the ATF has been starved of funding and manpower. It has had a permanent, Senate-confirmed director in just two of the past 15 years, because of effective opposition by the pro-gun lobby. Despite politicians' best efforts, ghost guns may haunt America for many years. ■

Lexington | The great American carnival

State fairs reveal the enduring delights of American folk tradition—and the dynamism it has lost



CRYSTAL CORONAS says she knew this year's Delaware State Fair was different the instant she let slip her Hollywood Racing Pigs for the first time. As Kevin Bacon, Snoop Hoggy Hog and Kim Kardashi-ham careered around the wood-chip track, competing for an Oreo biscuit, Ms Coronas looked up and saw a crowd revelling in post-lockdown delight. "People were screaming," she recalled after another porcine performance. "They were so excited to see the show. I guess covid's been hard for everyone."

Many visitors to Delaware's 270-acre fairground expressed that sentiment. The ten-day carnival was the first organised fun they had had since the pandemic began. "It's just great to be out the house," was a line Lexington heard often as he and his family sauntered in blistering heat around the carnival's circus- and farm-animal shows, its funfair and junk-food booths. Though Delaware was one of the few states to go ahead with its annual fair last year, it was a covid-diminished affair. This year's carnival, the curtain-raiser to a four-month season of state fairs that will ripple across the country before ending in Louisiana in November, is pretty well business almost as normal. Over 300,000 people—representing a third of Delaware's population—were expected to attend it. Upcoming fairs in bigger states, such as Texas, Oklahoma and Minnesota, are predicted to draw 2m, and contribute up to $400m to their local economies.

That is largely down to organisation. The fairs grew from a 19th-century tradition of agricultural shows, which had the dual aim of binding communities and educating farmers about technology. And even as their budgets have ballooned, most retain that Tocquevillean spirit. Delaware's is organised by a non-profit outfit run by a board of 80 local worthies and many volunteers.

Such eager participation, and the evidence of Lexington's saunter, also point to the huge demand for these folksy events. Outside the jazzy metros, nostalgia is a potent cultural register in America. It is manifest in an ageing white population and its taste for retro pop and country music, and pastors and politicians who, like organ-grinders, keep playing the same old tunes. The carnivals, which peddle nostalgia for agrarian skills and frolics, are an extreme version of the same.

Visitors to the Delaware show—located outside the unjazzy town of Herrington, at the meeting of the state's rural and conservative south and its more affluent Democratic north—are greeted by a fairground organ, cranking out 19th-century hits. After an opening assault of deep-fried offerings, they head past Ms Coronas's family menagerie, which also includes camel and pony rides and "the world's smallest horse". The family's five generations of circus history are another feature of this rose-tinted show. Ms Coronas's parents were trapeze and high-wire artists before settling in Florida to train race pigs.

The fair-goers—families, older couples and teenage gaggles—then proceed, via more hot and corn dogs, to the show's towering Ferris wheel. Or they could visit the byres where farm youths were fine-tuning their show-ring skills, as their great-grandfathers did before them. When a 17-year-old hand told your columnist her family had been in the same spot for four generations, he assumed she was speaking of their farm. In fact she was referring to the precise corner of the barn, well-placed for the milking-machine, where she was watching over her Guernsey calf, Dee-Dee.

Most people said they had come for the artery-clogging food. Otherwise they cited some aspect of its immemorial traditions. For well-heeled visitors from northern Delaware, these represented "Americana": a playful affirmation of what it was to be American. For rural folk such as Bryan, a carpet-fitter, the fair was a link to childhood, a memory of family outings and friendships gone-by; even if, he said glumly, "so much has changed—you don't see so many people you know."

There was much to like in this, not least the fact that the carnival is a rare place where America's two tribes do still mingle. Ironically, perhaps, given its historical (and in Iowa continuing) importance as a political soapbox, it has become a reverie on the past that everyone can enjoy. Even the sharps operating the fairground games in Delaware seemed wearily benevolent. Michael, a paunchy Alabaman running a $5 "shoot-the-hoops" stall, lamented that the punters only rarely listened to his advice on how to beat its almost impossible odds. "It's a carnival game, so of course there's a trick," he said mournfully, pocketing another $5. It was amusing, heart-warming even; yet very different from the aspirational qualities the state fairs were once known for.

Only after the second world war did they abandon their mission of educating rural Americans about the modern world. Most of their visitors no longer worked on the land. To the extent that today's carnivals retain an equivalent purpose it is the reverse: to help suburban Americans know one end of a cow from the other.

State of a fair

Perhaps it is time to renew some of their original modernising purpose. The flipside of small-town America's nostalgia is mistrust of the future. That can have unfortunate consequences, and manifestations of the social malaise it can represent were evident at the fairground. Consuming quantities of sugary food is another great holiday tradition; but it is all too common in American daily life as well. The incidence of obesity is shockingly high in Delaware and has doubled in just 20 years. It also seemed that almost no one at the fair was following its guidelines on masking and social distancing—though over a third of Delawarean adults are unvaccinated against covid-19.

America's nostalgic folk culture is great fun. Yet how good it would be, Lexington reflected, as he tried to dissuade his sugar-crazed children from demanding more cash to liberate goldfish, if some of its former dynamism and confidence could be regained. ■

Bolivia's woes

Fraud, coup or prologue?

LA PAZ

A squabble over protests in 2019 could help Evo Morales get back into politics

AT A CRAFT fair in a rich neighbourhood of La Paz, Bolivia's administrative capital, Paula Maceda, a 22-year-old selling home-made rucksacks, sighs as the topic of the government comes up. "We are sick of politics," she says. "We want jobs, vaccines, food." In 2019 she was at university when signs of fraud in an election apparently won by the leftist president, Evo Morales, led to weeks of protests. After the police and army withdrew their support, Mr Morales resigned and fled to Mexico. In El Alto, a poor city of 1m people on the frigid plain above La Paz, Ms Maceda's family shut themselves indoors as pro-Morales mobs torched police stations. Across Bolivia 36 people were killed. In the final days of 2019 her class debated the crisis: "Some of us thought there had been fraud, others thought it was a coup."

Nearly two years later, the quarrel about what happened still dominates Bolivian politics. In March the government of Luis Arce, a former finance minister under Mr Morales and the winner of a new election last year, jailed his predecessor, the right-wing interim president, Jeanine Áñez, on charges of having carried out a coup.

Further unrest looms. On July 28th the attorney-general announced that he would end an investigation into the alleged fraud. Opposition groups in La Paz and Santa Cruz, a city brought to a standstill by the earlier protests, called for new demonstrations in the first week of August, as *The Economist* went to press. Following Mr Arce's election, Mr Morales returned to Bolivia late last year, and appears to be keen to get back into politics.

Despite all the talk of fraud or coup, what occurred in 2019 was hardly clear-cut. After a 24-hour pause in the rapid count of votes sparked the first protests, audits by the Organisation of American States (OAS) and the European Union (EU) found grave irregularities, such as a hidden server used to send tally sheets that was not reported to electoral authorities. Following Mr Morales's forced resignation, the vice-president and heads of Congress also resigned, which led to a power vacuum. In talks mediated by the Catholic Church and the EU, opposition leaders and some legislators from Mr Morales's Movement to Socialism (MAS) decided that Ms Áñez, the second vice-president of the senate and the next in line according to the constitution, would fill it. Later that day, however, the legislators refused to swear her in. More protests erupted, this time against Ms Áñez.

MAS leaders now accuse the opposition, the OAS and half a dozen foreign ambassadors of conspiring to spark a civilian uprising to oust Mr Morales. The attorney-general confirmed many of the irregularities found by the OAS but concluded they were due to "negligence", not fraud. The opposition denies taking part in a coup. It argues that the origins of the uprising and the rupture of democracy lay not in 2019 but in 2016, when Mr Morales ignored constitutional term limits and a referendum in which 51% of Bolivians said he should not be allowed to run again.

Since 2019 such rows have been routine. Under Ms Áñez, the attorney-general's office rushed to open cases against Mr Morales for fraud, corruption, terrorism and sedition. The same office closed most of them as soon as Mr Arce won and filed cases against 60 officials from Ms Áñez's government. Human Rights Watch, an international monitor, says both sides have resorted to "revenge justice". Even Mr Arce's justice minister, Iván Lima, calls prosecutors' timeline "imprecise" and the crimes ▸▸

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29 A Russian town in Uruguay

of which Ms Áñez is accused (terrorism and sedition) "unconstitutional".

Part of the problem is that the line between the executive and judicial branches has long been blurry. In 2011 Bolivia began to elect judges by popular vote. Although the move was presented as a way to democratise the courts, it facilitated political control instead. Candidates are selected by the MAS-dominated Congress, which prizes loyalty over experience. Short mandates (two to six years) also make judges vulnerable to pressure. Well over half are interim nominees who can be kicked out at any time. "There is a problem with judges' independence," Mr Lima admits.

A plan for judicial reform was set aside earlier this year as the MAS focused on the coup case. According to Jorge Richter, Mr Arce's spokesman, this case is needed to restore democracy. The government is "unwilling to turn the page on impunity", he says, adding that the MAS's return to politics will also restore prosperity, by reintroducing an economic model the "coup" thwarted: public investment, import substitution and wealth redistribution.

But for many economists this model is woefully outdated. Growth has been slowing since 2014 when commodity prices fell and the MAS began dipping into foreign reserves to fund spending. Reserves are down to $4.7bn (12% of GDP) from a peak of $15bn in 2014. Although cheques to the poor, low-interest loans to businesses and cash to state firms are expected to push growth to 5% this year, Bolivia will struggle to service its debts. The pandemic caused the mostly informal economy to shrink by 9% last year.

The MAS's obsessive focus on talking about a coup could help rehabilitate Mr Morales. So could its strategy of blaming Ms Áñez for the covid-19 crisis, even though she inherited a creaking health system from Mr Morales. Three-fifths of people think Mr Arce is doing a good or average job and more than half expect their livelihoods to improve soon. According to Mr Richter, Mr Arce occasionally meets Mr Morales in order to "assess threats from political enemies".

To critics this sounds like an attempt to stifle the opposition. "They recovered power and vowed never to give it up again," says María Teresa Zegada, a sociologist. In the final hours of the outgoing Congress, MAS legislators changed the rules so that many nominations, including that of the head of the police, no longer need a two-thirds majority. Cecilia Requena, a senator from Comunidad Ciudadana, the largest opposition party, says that her party is not told what will be discussed in each legislative session. Congress is merely a funnel for Mr Arce's orders, she claims.

But the MAS is not as unified as it would like people to think. The coup narrative "masks an enormous frustration" about cronyism, corruption and unfulfilled social promises under Mr Morales, argues Magali Vianca, a lawyer who worked in several MAS administrations before leaving the party. After losing its two-thirds majority in Congress last year for the first time since 2009, the MAS also lost ground in regional elections in March.

Although 75% of people in El Alto voted for Mr Arce last October, the mayoral candidate backed by Mr Morales got just 20% of the vote. The winner was Eva Copa, a 34-year-old former MAS senator. In her earlier role Ms Copa negotiated with Ms Áñez; photos of the senator and the interim president fuelled hope for reconciliation in Bolivian politics. It was fleeting. In December the MAS accused Ms Copa of aiding the "coup" and forced her out of the party.

How Ms Copa manages as mayor (in a fortress-like office, built after protesters razed the previous two) will be a test for left-wing alternatives to the MAS. So far, she says, she is squeezed "in the middle like a sandwich". The same goes for many people in El Alto. Relatives of the protesters who were killed in the chaos after Ms Áñez took office, possibly by soldiers she sent in, complain that the MAS is using their deaths as a "political flag".

Many people no longer care whether what occurred in 2019 was fraud or a coup. Ms Maceda says she is too busy trying to earn enough to feed her siblings. As for Mr Morales, people will protest if he tries to run for president again, she thinks. "We won't trip over the same stone twice." ■

The legacy of immigration

You say pirozhki, I say empanada

SAN JAVIER

Descendants of Russian émigrés are not taking up an offer to move back

NEAR THE banks of the River Uruguay, Tatyana Bochkariov, a mother of six, wears a colourful *talichka*, a type of dress typical in 19th-century Russia. Her eight-year-old son Pavel climbs an orange tree in front of the family home and calls out to his mother in Russian, his first language. Only a few trappings of modernity—their fleece jackets, gas-powered heating and Pavel's toys—distinguish the family from the Russian peasants who came to Uruguay a hundred years ago.

The Bochkariovs live on the outskirts of San Javier, a town of 1,700 people on the border with Argentina. It has been a "Russian colony" since 1913 when 300 families moved there in search of religious freedom. Pastries sold in bakeries there, looking much like any other South American *empanada*, are billed as *pirozhki*. Russian is used on street signs alongside Spanish.

Back in the U.S.S.R.

Although many Russian-Uruguayans were persecuted under the military dictatorship of 1973-85, as they were suspected of being communists, they are now free to speak Russian, wear traditional clothes and practise their religion. Near San Javier is a community of Old Believers, an austere Russian Orthodox sect that protested against church reforms in the 17th century.

Such old-fashioned piety has piqued interest back in Russia. In 2006 Vladimir Putin, Russia's president, started a programme which would pay those with Russian heritage to move back. In 2019 the Russian media announced that eight Old Believers living in Brazil and the United States had become naturalised Russian citizens. Around 3,000 "compatriots" worldwide had applied for resettlement in the first nine months of 2019.

In San Javier few seem to have taken up the offer. Last year six visas were issued to Uruguayans, compared with nine in 2019. Leo Lorduguin, a 21-year-old, hardly knows of anyone who has moved. He is proud of his Russian heritage, but is also happy to be Uruguayan, pointing to the country's security and democracy. "I like that a man of Russian descent can prepare an excellent *asado* [barbecue] in just the same way as someone who has no ties to Russia can finely grill *shashlik* [kebabs]," he says. "In Uruguay both are respected and these cultural exchanges are encouraged."

Climate change

Moving story

Pacific countries face more complex problems than sinking

"HOW DOES a nation survive being swallowed by the sea?" So went the tagline for "Anote's Ark", a documentary film following Anote Tong, then president of Kiribati, as he toured the world warning that his islands were drowning. In 2014, he bought 20 square kilometres of land in Fiji, for Kiribati's 120,000-odd people to move to as a "last resort".

"Anote's Ark" came out in 2018, two years after Mr Tong retired. The government that succeeded his was unimpressed. "It's a drama, like a Star Wars film," says Teburoro Tito, Kiribati's ambassador to the UN. "The story is very convincing, but I must say, it's not true." The land in Fiji is being turned into a commercial farm.

Mr Tito has a point. In research published in 2010, Paul Kench, now at the Simon Fraser University in Canada, measured the size of 27 atolls over a period of decades and found that while 14% had shrunk and a couple had disappeared, 43% stayed the same size and another 43% became bigger. Many of the ring-shaped coral reefs have been able to adapt to sea-level rise, changing shape as sediment is eroded and pushed around. Tuvalu's land surface, for instance, increased by 3% between 1971 and 2014 despite a rise in the local sea level of 4mm a year, twice the global average for that period. Mr Kench describes Mr Tong's tale of sinking islands as "largely an emotional narrative".

Such narratives have their uses. Kiribati, Tuvalu and the Marshall Islands, low-lying archipelagoes deep in the South Pacific (see map on next page), are among the first countries to face the full onslaught of climate change. Stories like Mr Tong's help capture international attention and much-needed funding—seven of the world's 15 most aid-dependent countries are islands in the Pacific. But there are other, more immediate effects of climate change that threaten the lives and livelihoods of the citizens of these countries. They are less arresting, harder to explain and, as in the changing shape and size of islands, sometimes counterintuitive. But the upshot is the same: the countries may soon become uninhabitable.

Start with the phenomenon of shape-shifting islands. The Intergovernmental Panel on Climate Change, a consensus-building body on climate science, warns that the natural adaptation of coastal ecosystems may be only temporary: faster rates of sea-level rise, stronger waves and a growing human population may reduce their capacity to adapt.

That is one risk. Another, more urgent one stems from even small rises in the sea level. These can cause exceptionally high tides to briefly but entirely inundate the narrow strips of low-lying land that comprise most atolls. Such "king tides", as they are known, are becoming more frequent. The saltwater can kill crops such as banana and papaya and seeps into groundwater, making it unfit to drink. Desalination plants are pricey and, like all machines, can fail. "The islands are not drowning," says Michael Walsh, a former economic adviser to Kiribati. "But, humans and plants alike, they may well die of thirst."

Changing weather patterns are another factor that could make low-lying islands uninhabitable long before most of them disappear. Last year, Cyclone Harold damaged 21,000 houses in Vanuatu. Cyclone Pam in 2015 was one of the strongest ever to ▸▸

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hit the South Pacific. Cyclones and tsunamis in the region are predicted to become ever more intense.

Many islanders have picked up and moved. Some 30,000 Marshallese, or more than a third of the country's people, have migrated to America, many in the past two decades. Yet few cite climate change as the reason for their move. The Marshall Islands Climate and Migration Project, a research outfit, notes that the main reasons given are "education, health care, work, and family connections".

Already poor and dependant on aid, Pacific island countries have been particularly hard hit by covid-19. Travel restrictions have decimated the tourism industry and curbed seasonal migration to Australia and New Zealand.

Pacific leaders have ideas to revive their economies. Tuvalu makes lots of money from licensing its .tv internet domain (along with Vanuatu, it also sells passports to rich people). It now wants to set up an internet banking system and offer more services online. There are also ways to keep islands habitable: Kiribati plans to dredge its lagoons and use the sand to raise the surrounding islands higher above the sea. Tuvalu has embarked on a land-reclamation project. But the spectre of climate change makes it harder to drum up investment for such schemes. "I am trying to change the minds of the many people who say, 'We cannot invest in your country, you're finished'," says Kiribati's Mr Tito.

The depressing long-term solution, as in Mr Tong's last resort, may be to move. The Marshall Islands hopes to renegotiate its post-colonial "Compact of Free Association" with America, which expires in 2023, to ensure a permanent right of residence in the United States for all Marshallese. Tuvalu has no such option. Maina Talia, a climate activist, thinks that the government should take Fiji up on its offer of a home where Tuvaluans could practise the same culture rather than "be dumped somewhere in Sydney".

Earlier this year, the government of Tuvalu, which until recently insisted that there would be no Plan B, established a new UN initiative. Its aim is to work with "like-minded countries" to figure out how and where such countries could be relocated, how they could continue to function ex-situ, and whether they could still lay claim to vast exclusive economic zones if their land disappeared under water.

Relocating a country would raise other big questions, too, for both the international system and the way in which people think about statehood. "How to prepare to move a nation in dignity, that has never been done before," says Kamal Amakrane, a migration expert whose ideas helped spark the UN initiative. He is confident that countries would be able to retain all the elements of statehood, but says that the world needs to start planning now. "This is happening," Mr Amakrane warns. "We have 10-15 years to prepare for it." ■

Human-animal conflict

Snakes in the city

MUMBAI

Reptiles are an increasingly common sight in the urban jungle

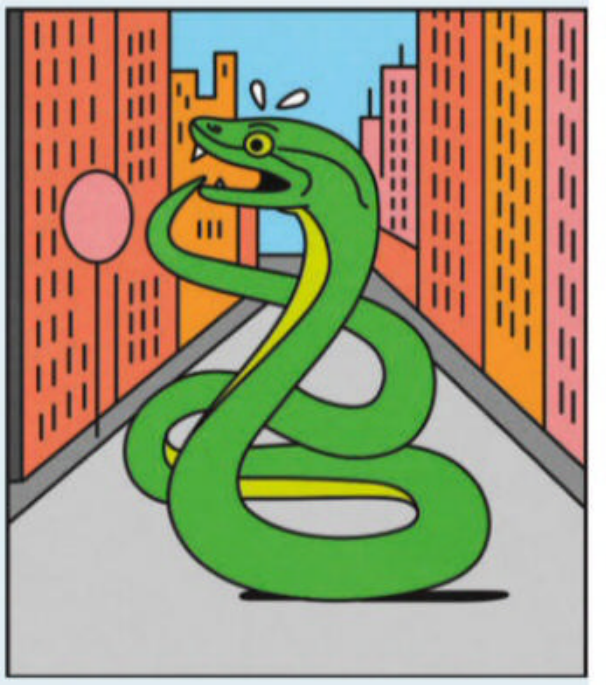
"IT'S BEEN raining snakes amid the recent heavy downpour," reported the Mumbai edition of the *Times of India* on July 26th, in a news piece about a rock python which "refused to be evicted" from an autorickshaw. The same paper contained reports of three other pythons rescued from a shipping container, and yet another that was found trapped in a fisherman's net. A lost python spotted on a city beach made the papers the next day. Later that week a 28-year-old man found a snake in the distant suburbs, wrapped it around his neck and walked through a nearby market area as his friends made videos for social media. He died after it bit him three times.

It is not literally raining snakes. But a week of torrential downpours has had the same effect, driving snakes and other reptiles out of their burrows and into the city, where they seek warmth, shelter and gastronomic delights.

There are plenty to be found. Mumbai is highly built up and densely populated. But it is also full of ground-level foliage, warm nooks such as car engines, and lots of rubbish, the last of which attracts rats that make New York's rodents look malnourished. The rats, in turn, attract hungry snakes.

"Rock pythons are rarely found in cities," says Santosh Shinde of Spreading Awareness on Reptiles & Rehabilitation Programme (or SARRP, Sanskrit for snake), the outfit that rescued the reptile in the rickshaw. Nonetheless, he says, "Last year we found 25 pythons in one month." As for venomous snakes, it would be easier to list the parts of Mumbai they are not found. SARRP rescued 130 reptiles in June, when the monsoon starts, up 14% from last year.

"In the summer we get a lot of snakes that are dehydrated and in the monsoon displacement is very common," says Madhurita Gupta of the Snake Conservation Trust, another serpent-saving society. "But this year it has become too much." She attributes the increasing number of snake-sightings to three factors: extreme rainfall driven by climate change, development encroaching on Mumbai's forests and the piles of festering garbage that blight the city.



When people see a snake, they "immediately go to pray or throw [an auspicious] red cloth", says Dr Gupta. Or they "try to kill or attack it, and then they get bitten". Her staff are trying to teach the public to distinguish venomous snakes from others. So is Mr Shinde, who argues that, just as people know the difference between a Doberman and a Pomeranian, they should be able to tell a harmless rat snake from the deadly "big four": cobras, kraits and two types of viper. The WHO reckons 58,000 Indians die every year of snake bites. Official estimates are lower, but still high enough to give India the highest snakebite-mortality rate in the world. On August 13th this year, Hindus mark Naag Panchami, a day on which snakes are worshipped. The best way to honour the creatures may be to learn a little more about them.

The Tokyo Olympics

That 2021 feeling

TOKYO

The games are not a flop. Nor are they a success

JAPAN HAS set several records in recent weeks. Its Olympic team has racked up 21 gold medals, the most in its history. It has a new youngest-ever gold medallist, a 13-year-old skateboarder, Nishiya Momiji. And it has achieved new heights in its daily covid-19 caseload, now exceeding 14,000.

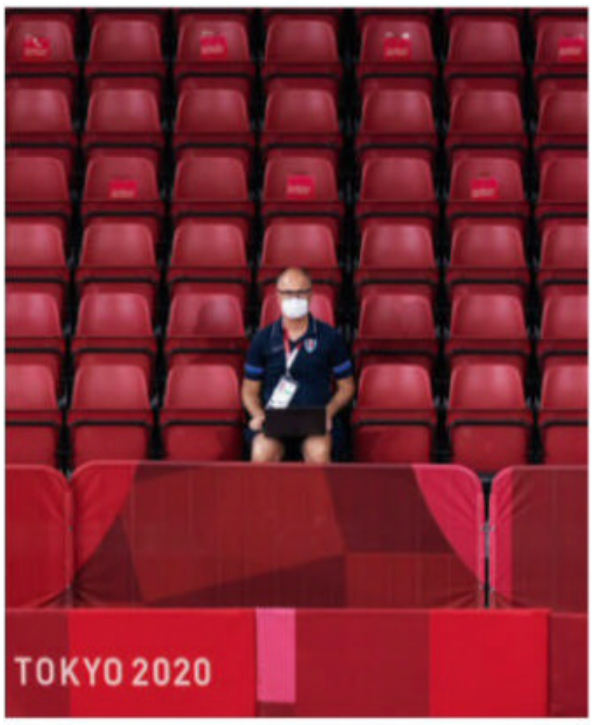
The combination has generated mixed feelings about the Olympics. Many Japanese have celebrated the athletic triumphs, despite misgivings about the games before they started. Barred from attending most events in person, sports enthusiasts have gathered at outdoor venues to try to catch glimpses of cyclists or skateboarders. Television viewing figures have also been strong. But enthusiasm for sports has not rubbed off on the event as a whole or on its organisers, as Japanese leaders had hoped. The approval ratings for Suga Yoshihide, the prime minister, and his cabinet have dipped below 35%—another new record.

These games are likely to be remembered not as a symbol of how humankind overcame the pandemic, but as an example of how strange life became because of it. The oddity has been on display from the start. On opening night, a long column of protesters marched through central Tokyo to the new Olympic stadium. During quiet moments in the ceremony, their chants—"Stop the Olympics"—could be heard inside the mostly empty venue. Farther up the same street, fans gathered, streaming the ceremony on their smartphones and glancing up to catch fireworks and drone shows rising above the stadium's rafters.

With the events under way, Olympians have shuttled between hotels and venues, where they compete in front of scatterings of volunteers, officials and journalists. Around the host cities, reminders of the games are muted. Absent are the big crowds and good cheer that usually accompany such events.

"It's a little lonely," laments Iizuka Masaki, a collector of sports pins waiting outside the heavily guarded gates to the Tokyo stadium in the hope of finding partners from abroad to trade with. When the Japanese and American baseball teams faced off on August 3rd in Yokohama, the loudest noises near the stadium came from the buzzing of cicadas.

Mr Suga has alternated between calling medal-winners to congratulate them and calling press conferences to announce new covid countermeasures. With the Delta variant dominant and hospitals under strain, the government decreed this week that only critically ill or high-risk patients would be admitted to hospitals. Others must recover at home. (Deaths have remained relatively low, thanks in part to high vaccination rates among the elderly.) The state of emergency in Tokyo and Okinawa was expanded on August 2nd to include four more prefectures.



And the crowd goes wild

Officials insist that the rising case numbers in Japan have nothing to do with the games. Strictly speaking, that may be true. Some 500,000 covid tests have been conducted on Olympic participants, of which just 0.02% have come back positive. Although a few athletes—and the entire Greek artistic swimming team (yes, that is an Olympic sport)—have had to drop out because of positive tests, the competitions have unfolded smoothly. A handful of athletes and support staff have had their credentials revoked for breaking protocol and wandering around, but as yet no evidence has emerged linking reckless Olympians to viral clusters among the wider population.

Since the start of the pandemic, however, Japan's ability to contain it has relied on co-operation from the public. The government lacks the legal authority to impose strict lockdowns; its emergency declarations are, in essence, requests for people to limit their movements and for businesses to close early and stop serving alcohol. The current state of emergency is the fourth. Fatigue is setting in.

Holding the Olympics has reinforced the complacency. Foot traffic, for instance, has fallen far less during the current state of emergency than it did during past ones. "Since the Olympics are being held, it makes people think it's okay to go out," says Onishi Moeri, who joined a crowd taking pictures beside the Olympic rings early this week. It has been, muses Mr Iizuka, "a very unusual Olympics". ■

Covid-19 in Myanmar

The second horseman

SINGAPORE

The Burmese army is making a bad pandemic worse

THAN THAN SOE has not had a day off since covid-19 began charging through Myanmar at the end of May. She runs a charity in Yangon, Myanmar's biggest city, which transports covid patients to hospitals and corpses to cemeteries. Her organisation collects as many as 60 bodies a day. "We are very tired but we keep going," says Ms Than Than Soe. Two volunteers recently got infected and died.

Covid is ravaging Myanmar. Daily cases, taken as an average over seven days, have hovered around 5,000 since mid-July, but limited testing means that this is probably an underestimate. The share of tests that return positive results has exceeded 35% since mid-July, which suggests widespread, uncontrolled transmission. Only Iran and Mexico have higher positivity rates. Myanmar, which borders countries that are home to about a third of the world's population, risks becoming a "super-spreader state", according to Tom Andrews, the UN's expert on the country.

Almost every South-East Asian country is experiencing its worst outbreak yet, and for many of the same reasons: low rates of testing and vaccination, weak or overwhelmed health-care systems and the presence of more transmissible variants such as Delta. But Myanmar offers the virus particularly hospitable conditions, thanks to the army. After a coup in February, testing, contact-tracing and treatment of covid ground to a halt. Public hospitals emptied of medical workers, thousands of whom joined protests against the coup. When a state bordering India reported an outbreak in June, the junta was too busy quelling resistance to do much about it.

In any case, lockdowns are impossible to enforce when people believe their lives are in danger. Violence unleashed by the coup has spurred many Burmese to take flight. Some 230,000 people fled their homes between February and June, bringing the total number of displaced people in Myanmar to 680,000. The camps where some have found refuge often have limited health care. The jungles where others flee have none.

But the struggle to find medical assistance has become a national problem, shared by refugees and city folk alike. Myanmar had few doctors to begin with. In 2018 there were just 0.7 for every 1,000 people—fewer even than in India, which had 0.9. Their number has been depleted by the ▸▸

junta. The regime has arrested top health officials, including the former head of the national vaccination programme. Hundreds, perhaps thousands, of health workers have gone underground. The security services have attacked medical personnel and facilities, killing at least 18. Junta officials reportedly entrapped, and later arrested, three doctors by posing as covid patients seeking treatment. Many hospitals have closed their doors; the UN believes that just 40% of health-care facilities are still functioning. Almost all those that are open are full, according to the Myanmar Red Cross Society.

Many people who are ill are treating themselves at home. They are keeping doctors like Moe Oo (not his real name) busy. Through his telemedicine service, which he offers free of charge, he is teaching patients how to check their vital signs and oxygen levels, and inject antibiotics or insulin. Many find it tricky to perform such tasks, he says. But they are the lucky ones. Drugs and other medical supplies are in short supply. Shortages of oxygen have been exacerbated by a rule banning the sale of the life-saving gas to residents of Yangon unless they get permission from local officials appointed by the junta. Dr Moe Oo has watched, helpless, as four of his patients, gasping for air, have succumbed to the virus.

Myanmar is counting around 360 deaths from covid each day. This is one of the world's highest fatality rates, relative to population. Yet it is probably an undercount, something which the junta has implicitly acknowledged: it is building ten crematoriums in Yangon, which will be capable of dispatching more than 3,000 bodies a day. ■

Banyan Flagging enthusiasm

Ordinary Malaysians suffer from the machinations of their politicians

IN KUALA LUMPUR, the chief city, as elsewhere in Malaysia, white flags hang from windows—cries of help from households for whom the pandemic has brought economic distress and even too little to eat. For the relatively prosperous country's success in handling the coronavirus in 2020 has turned to calamity this year, with over 1.1m infections and a tardy roll-out of vaccines.

Among proudly middle-class Malaysians, the pandemic has crystallised how their country too often benefits mainly the well-connected. Certain factory-owners have been allowed to continue operating even during lockdowns (thus seeding infections among workers). Politicians flout health rules that carry swingeing penalties for other infringers.

In this context, the black flags that mostly young, educated Malaysians are also hanging outside their flats represent not a cry for help but a political statement: the *bendera hitam*, or black-flag movement, is a protest against the elites' various failures of governance, of which the pandemic is just the most glaring. Young medical workers demand better pay and conditions, while activists call for a political promise to lower the voting age, from 21 to 18, to be kept. The hashtag #Kerajaangagal ("failed government") is popular on social media. Bridget Welsh of the University of Nottingham Malaysia says such challenges represent "a new political training ground", one confronting the old political hierarchies that have dominated for so long and that operate through patronage, corruption, colonial-era anti-sedition laws and gerrymandered elections.

It was not supposed to be this way. When the United Malays National Organisation (UMNO), which had ruled since independence, was at last dislodged by an opposition coalition in 2018, Malaysians expected politics to change. But the new government, itself led by defectors from UMNO, proved unwieldy and fissiparous. The current prime minister, Muhyiddin Yassin, brought it down last year by re-defecting. He then cobbled together a new a parliamentary majority, including UMNO, through back-room machinations.

Although Mr Muhyiddin stuffed his cabinet with backers, many quickly grew disenchanted. Early this year he sought emergency powers until August 1st from the *agong*, or king (a handful of sultans take turns at the job). That was not only in order to deal with the pandemic, the ostensible reason, but also in order to suspend Parliament and so head off any challenge from a no-confidence vote. In late July the prime minister suspended Parliament again as soon as it had reconvened, citing infections in the building.

The move may only buy time, argues James Chin of the University of Tasmania. A rare rebuke from the king after Mr Muhyiddin unilaterally withdrew emergency ordinances—the *agong* declared that Parliament should have been consulted—may prove fatal. On August 3rd Ahmad Zahid Hamidi, UMNO's leader, withdrew support for Mr Muhyiddin, so doing away with his majority. Facing down calls for his immediate resignation, on August 5th Mr Muhyiddin said the king had agreed to a no-confidence vote in September.

But anyone imagining that the opposition or even the king are chiefly motivated by the wishes of the people should think again. The mercurial Anwar Ibrahim, who for decades has eyed the top job and is chief among those calling for Mr Muhyiddin to go, has ruined his reformist credentials, not least by allying with some of UMNO's sleaziest elements. UMNO itself appears unreformable: Mr Zahid, for one, faces 87 corruption charges. As for the hereditary sultans, their authority has flourished during the bickering and with it their huge but opaque business interests. Despite his dressing-down, Mr Muhyiddin has bent over backwards to please the current *agong*, the acquisitive sultan of Pahang.

Ordinary Malaysians, meanwhile, feel angry and ignored. The pandemic has emptied the exchequer and, Ms Welsh points out, revealed gaping holes in the safety net. Among the young, unemployment has reached nearly 12%. Mr Muhyiddin now hopes to get credit for a vaccination programme that is starting to pick up speed. Beyond that, little suggests the elites care to sort out popular concerns. On the contrary, *bendera hitam* supporters attempting to march on Parliament were stopped by police, who all too predictably are now probing the movement for evidence of sedition. There is no doubting Malaysia's sense of crisis. Yet the stench of politics is still a long way from being cleared.

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Xinjiang's economy

Controlled growth

AKTO

China's efforts to lift the economy of the far-western province may smother it

CHINESE OFFICIALS used to insist that social harmony in Xinjiang could be achieved only by developing the far-western region's economy. But in 2014 the government began to argue that for economic development to occur, stability was needed first. This small shift in wording heralded the fiercest storm.

Authorities had long been troubled by occasional violence involving Uyghurs, a mainly Muslim ethnic group that makes up more than 40% of Xinjiang's population of 26m. Over the past five years China has demolished thousands of Xinjiang's mosques, thrown a million of its people into camps for "re-education", placed the rest under high-tech surveillance and cut their links with the outside world. The government has shrugged off international criticism and Western economic sanctions against companies and officials deemed responsible for these abuses.

Buildings and roads around Xinjiang are decked today with signs proclaiming that the government wants "long-term peace". It says there have been no "terrorist" incidents in Xinjiang since 2017, when it began rounding up Uyghurs for even the most trivial displays of religious or ethnic loyalty, such as praying in a public place or wearing a beard.

Now China is turning back to the economy. That does not mean easing repression. Highways remain dotted with checkpoints. Cameras rotate to track people as they walk past. The detention camps seem to have transferred many inmates to regular prisons. But Xinjiang is also launching industrial zones, pouring money into infrastructure and building new cities.

Already, Chinese officials are boasting of success. In July Chinese diplomats at the UN organised a video conference in which they insisted that Xinjiang was prospering, contrary to the "smears" of Western media. Late last year Xi Jinping, China's president, said Xinjiang had scored "unprecedented achievements" in developing its economy and improving people's lives. The reality is much grimmer.

Xinjiang's economy can be divided into two halves. Much of its wealth and importance for China derives from its abundant supplies of energy. Related industries—oil and gas extraction, power generation and chemicals—account for more than half the region's industrial output. As in other resource-rich parts of the world, they are relatively disconnected from society. They depend more on capital from large state-owned firms than on labour, and are concentrated in the sparsely populated north.

The other half of Xinjiang's economy is more agrarian and more informal, centred in the south, where most Uyghurs live. This is the half the government is focusing on. There are three main planks to its efforts: fostering industries that create lots of jobs; reconfiguring the area's economic links with other parts of China and the world; and promoting tourism.

The government has long encouraged labour-intensive industries to set up in Xinjiang. Now it is trying much harder. In its latest five-year plan for the region, finalised in June, it stressed the importance of basic manufacturing. It sees factories as the best source of steady, well-paid jobs.

Human-rights groups sense ulterior motives. Analysis of satellite imagery points to factories being built alongside many of the region's expanding prisons. Testimonies from inmates suggest that forced labour is common. Many of those released from re-education camps seem to be on indefinite probation, compelled to work wherever they are assigned.

The government denies such allegations. It claims to have created jobs last year for about 2.7m "surplus labourers" in Xinjiang, many in textile factories. At pre-

sent, textiles account for only about 2% of Xinjiang's industrial output. That should soon start to rise. From Manas in the north to Bachu in the south, the government plans to boost production by building seven industrial parks, three industrial zones and a trading hub in Urumqi, the region's capital. Employment in Xinjiang's textile industry has grown from about 400,000 in 2017 to nearly a million today. The industry appeals to the government because it can be contained almost entirely within the region, from planting cotton (Xinjiang produces 20% of the world's supply) to spinning yarn and making clothes.

About 25km outside Kashgar, the biggest city in southern Xinjiang, lorries unload bales of cotton at the factory gates of Dongchunxing, a state-owned fabric-maker that started production just four years ago and now has 5,000 employees, mostly Uyghurs. At lunchtime the scene looks similar to factories elsewhere in China. Workers in loose blue uniforms saunter out, some crowding round a snack stall, others zipping off on electric motorbikes.

A five-minute drive away, though, is a more sinister sight: two police checkpoints restrict access to another textile park, managed by the government of Akto county in Kizilsu prefecture, which borders Kyrgyzstan and Tajikistan. Nearby is a cluster of dormitory-like buildings behind the high walls of what an Australian think-tank has identified as a re-education facility. At one checkpoint, a Uyghur security guard sits at a table with two books on it: a short history of the Chinese Communist Party and a selection of Mao Zedong's quotations. It is the kind of material that China believes will help cure wayward Muslims of extremist tendencies.

One difficulty with China's industrial plans in Xinjiang is that many in the West want nothing to do with them. In July America's Senate passed a bill that bars all goods from Xinjiang, unless importers can prove they were not made with forced labour—a virtually impossible standard.

The second part of China's strategy could help overcome this hurdle. It involves making it easier for goods and labour to move around and out of Xinjiang. Over the past five years, the local railway network has expanded by 1,530km, or 25%. Over the coming five years the region will build 15 civilian airports, bringing the total to 37. Links with other countries are being strengthened. Of the six trade corridors that form China's Belt and Road Initiative, three pass through Xinjiang (see map). The dry ports of Khorgos and Alashan—both on the border with Kazakhstan—have become busy. Exports from the Kashgar area, which plunged by nearly 50% in 2018 at the height of the re-education detentions, have stabilised over the past year. A manager outside the Akto textile park brushes aside a question about American sanctions. "Our products aren't for the West anyway. We sell to Pakistan and Kazakhstan," he says.

The third element, promoting tourism, could reap considerable benefits. Revenues from tourism already amounted to a quarter of Xinjiang's GDP before the pandemic. It also helps advertise China's success in imposing stability. This year about 200m tourists are expected. By 2025 the government wants to double that number to 400m, almost all from China.

From Silk Road to theme park

The message that Xinjiang is stable may also encourage more people from China's ethnic majority, the Han, to settle in the south, diluting its Uyghur culture. The Xinjiang Production and Construction Corps, a Han-dominated state-owned conglomerate that functions like a state within a state, says it wants to encourage "southward development". The *bingtuan*, as it is known, offers subsidies to migrants from outside Xinjiang. In Caohu, a village run by the *bingtuan* south of Kashgar, a Han construction worker from Shaanxi province says he was given a house when he agreed to settle there permanently.

Two years ago armoured vehicles and paramilitary police were ubiquitous in Kashgar. Today the city looks less intimidating, but retains few reminders of Uyghur identity. Streets that once echoed with calls to prayer are lined with trinket stalls. In one mosque near the centre, the room where worshippers used to wash themselves has been turned into a tourist toilet.

On heavily stage-managed trips, China has started bringing foreign diplomats to Xinjiang. When consuls-general based in Shanghai from countries including Belarus, Cuba and Serbia visited in June, Kashgar looked more like a theme park than an ancient Silk Road city, with Uyghurs in bright clothes singing and dancing to welcome the visitors. "We have seen the great effort by the government to improve the lives of local people," gushed the consul-general of Singapore, according to *Xinjiang Daily*, a state-run newspaper.

Yet even in economic terms, the government's story is unconvincing. Cash is flooding into the region: investment in factories, roads and other fixed assets rose by 16% in 2020, more than five times faster than the national average. But Xinjiang's economy grew by only 3%—a weak outcome, given such spending.

Officials may hope that Xinjiang will follow the model of coastal provinces such as Guangdong and Zhejiang, where the path to prosperity began with factories that made cheap clothes and shoes. Yet the coast's take-off was led by private entrepreneurs and made possible by a relatively free labour market. Uyghur workers, even if they are not in labour camps, cannot easily change jobs, let alone move around China without being hounded by police.

Many of the biggest investors in Xinjiang are state-owned firms, driven not by profit but by political duty. In the past Xinjiang had its own business leaders who were Uyghurs. But officials saw them as a threat. Many have disappeared into prisons and re-education camps. Far from laying a foundation for growth, the pursuit of such stability is more likely to end in stagnation. ■

Lebanon

Into the abyss

BEIRUT

A year on from the explosion at Beirut's port, there is no bottom to Lebanon's political and economic crisis

THE PROTEST outside Mohammad Fahmi's well-guarded house last month was a microcosm of Lebanon's seemingly bottomless collapse. In the crowd were relatives of the more than 200 people killed in the catastrophic explosion at Beirut's port on August 4th 2020. They were furious that Mr Fahmi, the interior minister, was stonewalling the investigation into the blast by refusing to lift immunity for a general.

It should not have been his decision to make. Mr Fahmi serves under a prime minister, Hassan Diab, who resigned last year. But Mr Diab and his cabinet lurch along in a caretaker role because Lebanon's shambolic politicians cannot agree on a new government. When the crowds grew rowdy, they were pushed back by police whose wages, paid in the debased local currency, have shrivelled to less than $100 a month. They are agents of a bankrupt state—albeit one that can still afford tear gas.

Wandering through the capital in the hours and days after the explosion, it was hard to imagine things could get any worse. Caused by a cache of ammonium nitrate—some 2,750 tonnes of the stuff had been impounded in 2013 and stored improperly—the blast left much of the city centre in ruins. Shattered glass rained down from buildings. Residents were thrown against the walls of their apartments by an explosion large enough to be felt in Cyprus, 240km (150 miles) away.

Yet a year later things are indeed worse, almost immeasurably so. The blast was not a nadir, just another twist on Lebanon's long downward spiral. There has been no accountability for the disaster. Nor is there a government empowered to tackle an economic crisis that, according to the World Bank, may rank as the third worst anywhere in the world since the 1850s.

Soon after the explosion, Lebanon's cabinet set up a committee to investigate what happened. It promised results within five days. It has had that, and 360 more, yet today even the basic facts remain a mystery. The most commonly cited death toll of 218 may be too low because it fails to count refugees and migrants. America's FBI, invited to help with the probe a year ago, believes that only about a fifth of the 2,750 tonnes of ammonium nitrate exploded. What happened to the rest—whether it was sold, moved elsewhere or somehow disposed of—is unclear.

The judge overseeing the probe, Tarek Bitar, has run into a wall of opposition. He has pushed to interrogate several ex-ministers and Abbas Ibrahim, the head of Lebanon's main intelligence agency. But lawmakers have refused to allow them to be questioned. Blame for the blast is widely shared: many senior officials knew the ammonium nitrate was there, a time-bomb waiting to go off, and did nothing about it. They have closed ranks. (Mr Bitar's predecessor was dismissed earlier this year after he charged four officials with negligence.)

Mr Diab resigned days after the explosion. But two men tapped to form a new government—Mustapha Adib, a little-known diplomat, and Saad Hariri, a former prime minister—failed to do so. On July 26th lawmakers asked another ex-prime minister, Najib Mikati, to try his hand.

He may not be successful either. The post-civil-war political system in Lebanon doles out portfolios based on religious sect, and efforts to form a cabinet have run into internecine disputes. The two main Shia parties, Hizbullah and Amal, both want to control the finance ministry. The president, Michel Aoun, wants to preserve his power base so that he can install his son-in-law, Gebran Bassil, as his successor next year. Mr Hariri wanted a government that would satisfy his backers in the Gulf. ▸▸

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Everyone has an eye on parliamentary elections scheduled for May.

Lebanon cannot afford such a delay. It tipped into economic crisis in 2019, the result of a years-long Ponzi scheme overseen by the central bank, which borrowed billions from an outsized banking industry to sustain a currency peg. The scheme unravelled when banks no longer took in enough fresh deposits to keep it going. Mr Diab estimated there was an $83bn hole in their balance-sheets last year.

The country defaulted in 2020, and Mr Diab presented a plan for repairing the banking industry. But it was doomed by opposition from the banks and their political allies. Talks with the IMF about a rescue package have stalled, as have negotiations with creditors. Western countries are unwilling to help without serious reforms, to include an audit of the central bank, whose governor, Riad Salamé, is under investigation in France and Switzerland for alleged money-laundering. The bank has burned through most, if not all, of its usable foreign reserves, which stood at $38bn before the crisis. In June it lowered the share of deposits that private banks must keep with it from 15% to 14%, in effect freeing up a bit of cash to spend on imports.

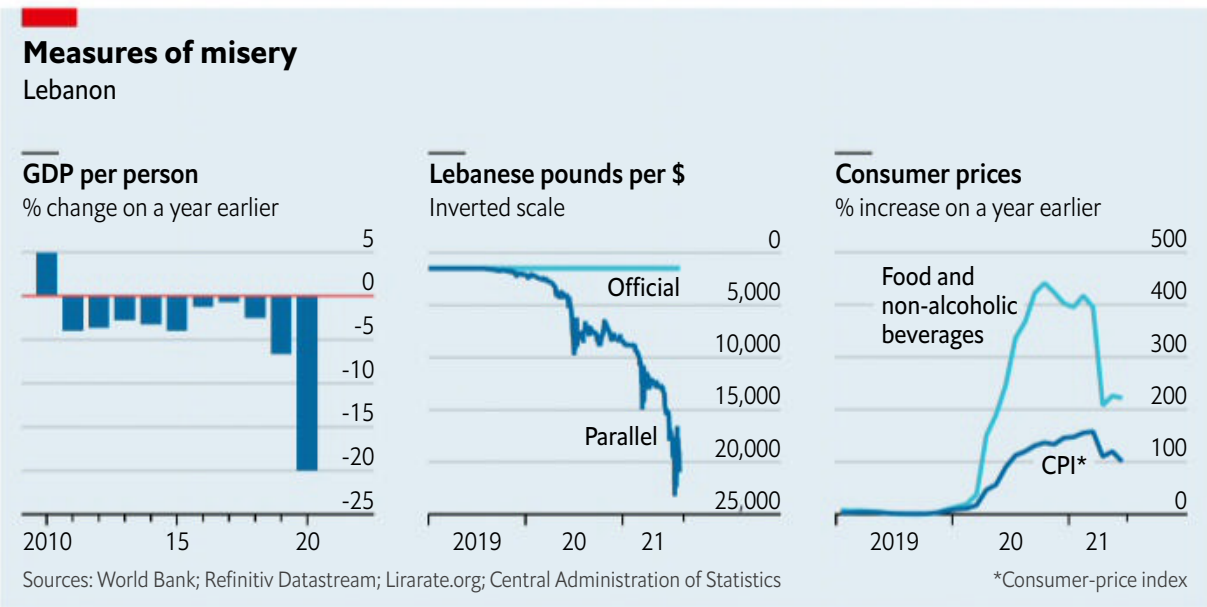
Once reliably pegged at 1,500 to the dollar, the Lebanese pound traded as low as 23,000 on the black market in July (see chart). It later rebounded to nearly 15,000—still a 90% depreciation. Inflation was 101% in June, and 222% for food. Half the country now lives below the poverty line. A family of five needs 3.5m pounds, five times the minimum wage, just to buy food each month, estimate researchers at the American University of Beirut. Some shops and restaurants have stopped listing prices because they change so often. Medicine remains subsidised, but is often hard to find. Visiting expats stuff suitcases with drugs that are no longer available, including basic items such as paracetamol.

Creaky power plants are short on fuel and provide only a few hours of electricity each day. Residents have always relied on private generators to fill the gaps, but their operators are also struggling to find fuel and buy spare parts to fix machines that were never meant to run round the clock. Nightfall brings an eerie darkness to Beirut. Dawn brings a new ritual: drivers trudge down to their cars and queue up for petrol, a litre of which, at subsidised prices, costs as little as 20 cents. That has fuelled a brisk black market. Smugglers buy the stuff in Lebanon and sell it in Syria, which is struggling with its own fuel crisis.

A glance at newspaper headlines over the past few weeks offers a bleak portrait of collapse. A young girl died from a scorpion sting that could not be treated for lack of antivenom in depleted hospitals and pharmacies. A teenage boy died trying to battle wildfires that the bankrupt state is struggling to control. A man was killed in a traffic accident while queuing for fuel on a main road south of Beirut.

The country feels exhausted. Beirutis wander the streets glassy-eyed; no one is sleeping well, without even a fan to cut the heat and humidity. Everyone seems to have caught a stomach bug this summer from food spoiled by power cuts. A small, well-heeled elite is still hosting lavish weddings and expensive lunches by the sea, but for most Lebanese the days are a brew of rage and despair. Once again, it is hard to imagine things could get any worse.

Once again, they probably will. The worsening shortage of hard currency will make it more difficult to subsidise goods. Fuel subsidies have kept inflation from being even higher. They were already reduced in June; when they are curtailed further, prices will soar higher still. The army is struggling to keep up morale. It has asked for foreign aid to feed soldiers and offers tourists joyrides in military helicopters for $150 a pop to drum up foreign currency. There will be longer blackouts and deeper shortages as the state struggles to finance basic imports. The World Bank calls this a "deliberate depression", a man-made crisis—and the men who made it are still in power, with no plan to fix it. ■



Iran

Off to an interesting start

A new president takes over, as Iran and the West face off

ON THE FIRST day of his two-part inauguration on August 3rd, Ebrahim Raisi regretted that he could not kiss the hand of his mentor, Ayatollah Ali Khamenei, owing to covid-19 restrictions. But there was no doubting the bond between Mr Raisi, Iran's new president, and Mr Khamenei, its supreme leader. Both men are hardline clerics who view the world, and the West in particular, with suspicion. "Trusting the West does not yield results," said Mr Khamenei in the run-up to the ceremony.

Some in Iran may be pushing for confrontation. On July 29th, just days before the inauguration, a drone laden with explosives was flown into the MV *Mercer Street*, an oil tanker off the coast of Oman managed by an Israeli-owned firm. Two crew members, a Briton and a Romanian, were killed. America, Britain, Israel and Romania blamed Iran, which denied involvement. Saeed Khatibzadeh, an Iranian foreign-ministry spokesman, accused Israel of creating "instability, terror and violence" and warned that "whoever sows the wind shall reap the whirlwind".

Then, on August 3rd, came another incident in nearby waters (see map on next page). Gunmen boarded a bitumen tanker, the MV *Asphalt Princess*, and sailed it towards Iran before disembarking some 15 hours later, after the crew reportedly sabotaged the engines. The crew said the assailants were Iranians, according to recordings of communications between the ship and the Emirati coastguard heard by Argus Media, an energy-information firm. Iran denied involvement. The *Asphalt Princess* is owned by a firm in Dubai that had another vessel hijacked two years ago by the Islamic Revolutionary Guard Corps (IRGC), Iran's most powerful military force.

Iran and its proxies have exchanged attacks with America, Saudi Arabia and the United Arab Emirates in recent years. A shadow war between Iran and Israel has also been escalating. Several vessels have been attacked, with each side blaming the other. Israel has struck Iranian positions in Syria and is accused of attacking people and facilities in Iran, sometimes with cyber-weapons. An attack earlier this year on Iran's main uranium-enrichment complex, in Natanz, using planted explosives, did significant damage.

If the IRGC is behind the attacks on shipping, it will come as no surprise. Its workings are murky, but it often seems to ▸▸

pursue a policy at odds with that of the weak elected government. Or at least, it did when Hassan Rouhani, a pragmatist who reached out to the West, was still president (he handed over to Mr Raisi after the maximum two consecutive terms). With hardliners now in control of the entire government, there should be less tension. "Under the new administration, Iran will be much more assertive," says Mohammad Marandi, an academic who is close to the IRGC.

All of this complicates efforts to revive the nuclear deal signed in 2015 by Iran and six world powers. That agreement, called the Joint Comprehensive Plan of Action (JCPOA), had Iran curb its nuclear programme and agree to rigorous inspections in return for the lifting of some international sanctions. But in 2018, during the presidency of Donald Trump, America abandoned the deal. In response, Iran began breaking parts of it.

President Joe Biden has promised to return to the deal if Iran comes back into compliance. In an address on August 3rd Mr Raisi said his government would take steps to lift the "tyrannical" sanctions imposed by America. But a sixth round of indirect negotiations to revive the JCPOA ended in June. There is no date set for the resumption of talks. Iran, meanwhile, has continued to expand its nuclear activity. It is enriching uranium beyond the levels required for civilian use and it has sharply curbed co-operation with inspectors.

Britain will raise the strike on the *Mercer Street* at the UN. "The UK is working with our international partners on a concerted response to this unacceptable attack," said Dominic Raab, its foreign secretary. "Ultimately, we have got to restore deterrence," said General Sir Nick Carter, its most senior military officer.

Still, America and Britain may want to limit any response in order to keep the JCPOA talks alive. Israel's leaders, never fans of the nuclear deal, may prefer more forceful action. "This time the price is going up," says Amos Yadlin, a former head of Israeli military intelligence. ■

Elections in Zambia

Victory by default

JOHANNESBURG

Polls suggest Edgar Lungu is unpopular. But is he on the way out?

FOR EDGAR LUNGU, Zambia's president, elections on August 12th would seem to come at an inauspicious time. Over the six years since he took office in 2015, the economy has on average grown at a slower rate than the population. Last year Africa's second-largest copper producer had its first recession since 1998. Inflation is at its highest level in 19 years. In July food prices were almost a third higher than a year before. In a poll published in May by Afrobarometer, a research group, more than three-quarters of Zambians said economic conditions were bad and that the country was heading in the wrong direction.

Yet it is uncertain whether time is up for Mr Lungu (pictured). "The economy will determine how people will vote, but it may not determine the result," says Laura Miti, the head of the Alliance for Community Action, an NGO based in the capital, Lusaka. Since 2000 roughly three-quarters of incumbent African presidents have won re-election, by hook or by crook. Many use the power of the state to buy off or bully voters. And that is what Mr Lungu's party, the Patriotic Front (PF), seems to be doing, to the detriment of a country that was once a trailblazer for African democracy.

Consider some of the financial ploys used by the PF. Last year it increased tenfold the budget for subsidised seeds and fertiliser to woo farmers and help business allies of the party. In May of this year it rushed through yet more subsidies ahead of the election. In July the government said it would "restructure" the personal debts owed by civil servants and transfer the liabilities to a state-owned creditor.

Incumbent parties everywhere court voters with conveniently timed bungs. But few have bailed out their bureaucrats while also claiming that they have no money to pay their own creditors. In November the government defaulted on a dollar bond, making Zambia the first African country to do so during the pandemic. Not that covid-19 has much to do with the mess. Government debt as a share of GDP has risen from 34% to 110% under Mr Lungu. Though there are some Chinese-built roads to show for the splurge, much of the money has been wasted.

Fear and repression

Inducements are coupled with intimidation. The police use covid-19 regulations as a pretext for limiting opposition candidates' travel and rallies. The ostensibly independent electoral commission has repeatedly favoured the PF in its decisions. Last year the government ditched the electoral roll and gave voters just 38 days to sign up anew. Civil-society groups say this was far easier in PF strongholds. Ruling-party "cadres" terrorise its opponents, too. Last month Amnesty International published a report about the "fear and repression" of the PF regime, which the rights group says uses illegal and at times lethal force to break up protests. In June a convoy belonging to the main opposition candi-

date, Hakainde Hichilema, was shot at by police. On July 16th a group of Catholic bishops warned that "acts of violence are intended to intimidate the citizenry to belong to a party or to choose leaders out of fear". In a worrying development, on August 1st Mr Lungu said he would mobilise the army ahead of the vote.

Zambia, one of the first African countries to embrace multi-party democracy in the 1990s, has become a place where criticism of the government is punished. The state forced the closure of an independent newspaper in 2016 and a TV station in 2020. PF loyalists storm critical local radio stations. In March 2020 the police arrested a 15-year-old boy for allegedly libelling Mr Lungu on Facebook. (He was later released.) There are fears of an internet blackout when election results are reported. State media, meanwhile, favour the PF.

Below the belt

Will the chicanery work? Zambian election results reflect two patterns. The first is the ability of parties to mobilise their core support, often ethnically based, in rural areas. The second is winning in more competitive urban areas such as Lusaka and the Copperbelt. Support for the PF appears to be waning in these parts: it lost a by-election in the Copperbelt in 2019 and, despite restrictions, there have been large gatherings for the opposition in the capital.

Mr Hichilema, whom authorities have jailed 15 times during his political career, is making his sixth run for president. This is probably his best and last chance. In the past voters have been wary of his minority Tonga ethnicity and liberal policies. But ahead of this election, with the help of social media, he has presented himself as a unifying reformist. The result is hard to call, but an analysis of the Afrobarometer data by academics at the University of Cape Town suggests that his United Party for National Development (UPND) would narrowly win more than 50% of the vote—and avoid a run-off—in a fair fight.

UPND insiders fear they will not face a fair fight, and that the PF will fiddle voter tallies and rely on a Constitutional Court packed with allies of Mr Lungu to stay in power. A proposal to subject all local election monitors to covid-19 testing seems designed to reduce accountability. Observers from the EU and other bodies are present, but spread thinly.

They will witness a pivotal election. If Mr Hichilema wins, he says that Zambia will open talks with the IMF about a bailout, tackle corruption and embrace growth-boosting reforms. But if Mr Lungu stays in office, it will mean five more years of hostility to business and impunity for graft. "This election is the most important moment in modern Zambian history," says Mr Hichilema. It is hard to disagree. ■

Abandoned refugees

Rationed out

BIDIBIDI

With the world's attention elsewhere, refugees in east Africa are going hungry

At a food distribution centre in Bidibidi, a refugee settlement in Uganda, a handwritten cardboard sign tells refugees their maize ration: 15kg for two months. That works out to 250 grams a day, to go with 60 grams of beans, a splash of oil and half a teaspoon of salt. A day after receiving hers, Ito Juani has already used some of it to repay a loan of cassava that got her through a lean spell. "The world has given up on us," she says.

Who can deny it? In the past year the World Food Programme (WFP) has slashed rations for more than 3m refugees in seven countries across eastern Africa—by 40% in the case of Uganda. In some settlements, where it gives out cash instead of food, refugees must make do with 19,000 shillings ($5.36) a month. In South Sudan, where rations have fallen by half, the WFP is taking from the hungry to feed the starving, writes its executive director, David Beasley. Officials say they have only half the money they need to feed east African refugees for the rest of the year. Donor fatigue had set in before covid-19, but tight pandemic budgets have made things worse.

Most of the 238,000 people who live in Bidibidi fled from South Sudan in 2016, walking for days to escape ethnic killings and war. The settlement briefly became the largest refugee camp in the world. Today it feels like an endless village, clusters of thatched houses sprawling over the horizon. It has shops, video halls and small businesses. Uganda's government, which is unusually welcoming, has given the refugees land to till and the right to work. But the sheer number of arrivals strains resources. The small, stony plots are the scrawniest of vegetable patches.

Fasting food

Handouts provide staple food and lubricate the settlement's complex economy. A miller will grind maize into flour for a cut of a few handfuls. A few more can be bartered for firewood from locals from nearby villages. Some are sold to maize dealers to buy goods like soap, sugar and fish. But such trade has slowed since rations were cut, says a dealer, clutching an empty sack.

The rhythm of life is set not by the seasons but by "the cycle", as aid workers call the routines of food distribution. The meagre rations rarely last until the cycle ends. "When food is distributed, the church is vibrant," says Felix Taban, a pastor. "But when it runs out, people stop coming." In the last weeks of each cycle children "don't have energy" and drop out of school, says Anna Uba Joseph, a teacher. Meanwhile, more patients show up at hospital with gastric problems and stress, says a health worker there.

Ms Juani's own ration ran out 20 days before the cycle ended, which was why she had to borrow. For those hungry weeks she stopped taking the antiretroviral drugs that treat her AIDS, because she felt ill after swallowing them on an empty stomach. Others resort to casual labour. Jane Mandera worked on a local farm with her two sons, aged ten and seven, digging under the equatorial sun for a meal and 4,000 shillings a day. In the evening she boiled up vegetables she had grown herself.

A WFP survey in March found that 42% of people in Ugandan refugee settlements had inadequate diets. Three-quarters of households skipped meals; three-fifths borrowed to eat. Stephan Deutscher of the WFP in Uganda says more are resorting to emergency measures such as selling assets or pulling children from school.

Aid workers praise Uganda's openness to refugees, but the model falters without the funds to support it. Some hungry refugees now risk returning to their abandoned farms in South Sudan. A former policeman says he can no longer provide for his family, so he is going back home to join the rebels. When will he set off? "As soon as possible," he says.

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Spain's economy

A doleful plight

LINARES

Will European aid help revive Spain's two-speed, high-unemployment economy?

A DENSE, COMPACT town of 58,000 people near the gateway to Andalucía from Spain's central plateau, Linares has been successively a centre of lead mining, a railway hub and the site of a large factory making Santana jeeps. Today it is known for having the highest unemployment rate in Spain, at 33%. The Santana factory, with more than 2,000 jobs in its heyday, closed in 2011. A large Corte Inglés department store shut in March and stands in the main square, decaying like a rotten tooth. "I've been looking for work for months," says Carlos Márquez, aged 21, who lost his pre-pandemic job selling mobile phones in a hypermarket. "There's nothing in Linares. I would have to go somewhere else."

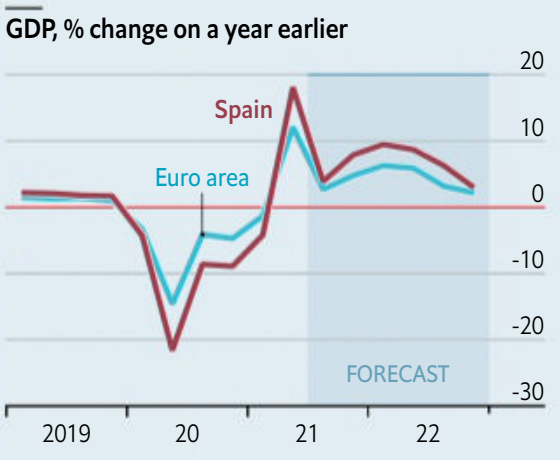
The town's reputation is overdone, insists Raúl Caro-Accino, the mayor. He points to technology businesses in industrial estates on the outskirts, with more to come. Unemployment is in line with elsewhere in southern and western Spain, the mayor insists. "We have a problem of unqualified labour," he admits. That goes for much of the country.

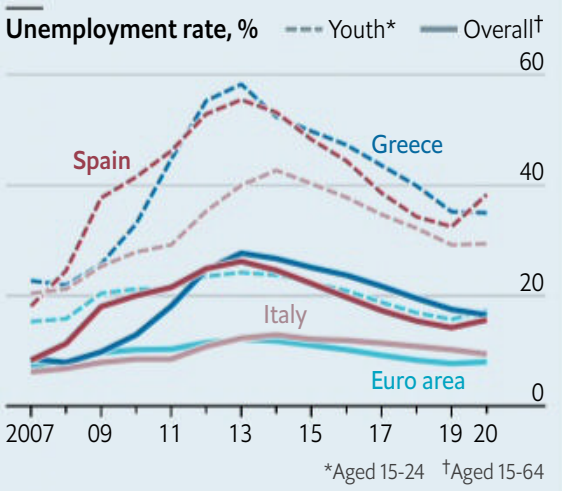
Spain has long stood out in Europe for its chronic high unemployment, especially among young people, and for the high percentage of workers on temporary contracts (currently 25% of all those with jobs). The slump occasioned by the financial crisis of 2007-09 saw millions join the jobless, though it was followed by a strong recovery (see chart). Once again, the pandemic has hit Spain's economy harder than those of its European neighbours—mainly because of its heavy dependence on tourism and vulnerable small businesses. A recovery is now under way. But only around half of the number of foreign tourists who visited in 2019 are likely to come this summer.

There are two bright spots. In contrast to 2007-09, the government has been providing emergency support: credit guarantees for firms and a state-financed furlough scheme which at its peak last year paid most of the salaries of 3.4m workers. Only 360,000 still need this help; the rest are back at their jobs. "This is the first recession in which employment and tax revenues have fallen less than the fall in GDP," says Nadia Calviño, the economy minister.

The second boost is that over the next ▸▸

Next jobless generation





Sources: Eurostat; European Commission

*Aged 15-24 †Aged 15-64

three years Spain is due to receive €70bn ($83bn) in grants from the EU's Next Generation recovery scheme, along with a similar amount of soft loans. Much of this will go on big projects aimed at creating a greener, more digital economy, such as one for electric cars and a battery factory. But there will be plenty of money, too, for overhauling public administration and vocational training, and for active labour-market policies to help the unemployed find jobs. It is a peerless opportunity to tackle Spain's chronic joblessness.

The aid is tied to reforms, especially of the labour market and pensions. And on these matters the left-wing coalition government of Pedro Sánchez is divided. The European Commission reckons Spain needs to make its labour market more flexible while tackling the abuse of temporary contracts. But Yolanda Díaz, the labour minister chosen by Podemos, the coalition's junior, far-left partner, wants to repeal a 2012 reform which introduced some flexibility, giving firm-level agreements on wages priority over industry-wide ones and cutting severance pay, though to levels that are still generous. This commitment is backed by the trade unions and is in the coalition agreement between Mr Sánchez's Socialists and Podemos. Ms Díaz also wants to abolish temporary contracts. "These proposals would lead to the most restrictive and rigid labour-market regime" in Europe, says Marcel Jansen of Fedea, a think-tank. They risk destroying jobs rather than creating them.

Ms Calviño, a former budget director at the European Commission, leads the government's reformist wing. She says Spain needs a bundle of measures that strike a balance between flexibility and curbing temporary contracts. She hopes to agree on these by the end of this year in talks with the unions and business. In a reshuffle in July she became first deputy prime minister. Since the EU can cut off funds if constructive reforms are not approved, she is likely to prevail over Ms Díaz, though not totally. The unions have influence, too. It is a strength of the Socialists that, unlike some other social-democratic parties, they have retained a working-class base. "It's very hard for a government with a feeble majority to agree on reforms that comply with the European agenda," notes Mr Jansen.

Training and education need a radical shake-up too. A third of young Spaniards leave school without any qualification, while only a quarter of school-leavers enter vocational training, compared with half in Germany, points out Manuel Pérez-Sala of the Círculo de Empresarios, a business think-tank. Much of the €6bn a year Spain spends helping people find jobs is wasted. Under European pressure the government recently reinstated a policy of linking the funding of training to results. New laws on education and training may help, if fully implemented.

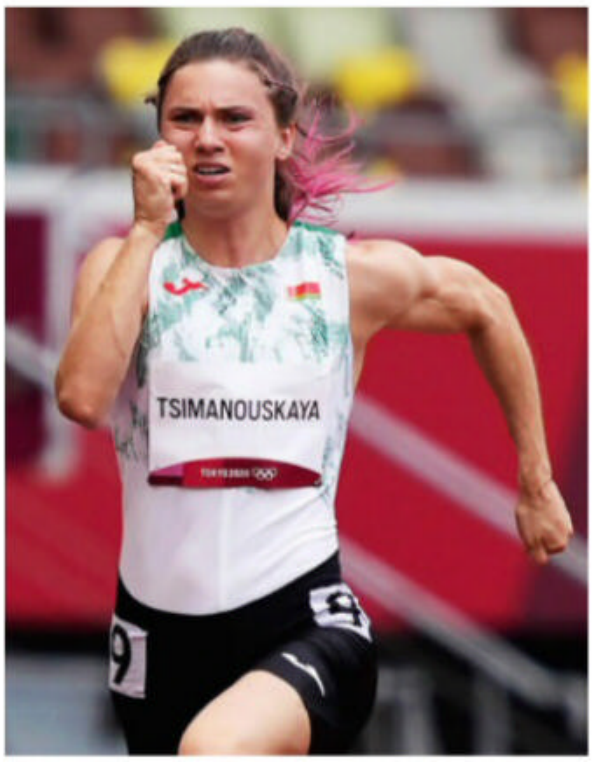
Another doubt is over how the EU money is administered. The opposition complains that control is centralised in the Moncloa, the prime-ministerial complex. Regional governments want their share. "I think they have understood that this is a co-ordinated national plan," says Ms Calviño. It has usually taken Spain a long time to spend EU structural funds. In Linares, the mayor is sceptical. "We need a more flexible administrative structure," he says. "The province is frustrated because it was promised things that didn't happen." In the end the proof of the EU's efforts will be measured not just in a greener economy but in whether places like Linares have a more productive workforce. ■

Belarus

Forget the border

Belarusian dissenters are not safe, even when they're abroad

KRYSTINA TIMANOVSKAYA is not your standard dissident. An Olympic sprinter representing Belarus in Tokyo, she had never publicly criticised the government nor its despotic president, Alexander Lukashenko. Her crime was to complain on social media that her coaches had registered her for the 4x400-metre relay without telling her. So they took her to Tokyo airport against her will, to fly her home. There she sought protection from Japan's police. The next day, Poland granted her and her family asylum. She claims that the call to send her back came not from the sports ministry but from "a higher level".



Fast and furious

Ms Timanovskaya joins an expanding collection of Belarusians in Europe living beyond the bailiwick of a regime whose old sobriquet of "Europe's last dictatorship" does not fully convey its slide towards full-blown gangsterism. On the very day Ms Timanovskaya received her Polish visa, an event in Ukraine showed why being granted asylum is not a guarantee of protection.

Vitaly Shishov, who ran an NGO based in Ukraine that helps Belarusian exiles, went missing after leaving home for a morning jog in Kyiv, the capital. The next morning he was found hanging from a tree in a nearby forest. Friends say his face was bruised, his nose broken. Ukrainian police have left open the possibility that his death might be a "murder masked as a suicide".

There is no proof that the Belarusian secret service killed Mr Shishov. But he told friends he was being followed. In June he told followers on Telegram, a social-media app: "The regime is becoming more and more terroristic. Even while abroad, you must keep your ears open."

Belarus has form when it comes to extraterritorial gangsterism. In May it concocted a bomb threat and sent its jets to force down a Ryanair flight from Athens to Vilnius, two EU capitals, as it flew across Belarusian airspace. Roman Protasevich, an exiled dissident on board, was pried off the plane with his girlfriend and arrested.

The shockwaves from last year's rigged presidential election and the repression that followed the ensuing mass protests have yet to dissipate. The torture of dissenters is still routine. On July 21st the police raided the offices of 14 NGOs and arrested their members. Anything short of devout loyalty to all state institutions risks punishment, as Ms Timanovskaya's case shows. It will not have helped her that the Belarus Olympic Committee is run by Mr Lukashenko's son. Every new wave of repression prods more Belarusians to flee.

A shaky dictatorship that borders three EU countries along with a fragile Ukraine is well placed to export its troubles. Belarus also stands accused of sending Iraqi migrants (2,600 last month alone) across its northern border into Lithuania, presumably to annoy it for giving a base in exile to Svetlana Tikhanovskaya, the opposition leader who probably won last year's vote.

Calls for the West to take a tougher stand against Belarus are likely to grow louder. The limited sanctions the EU imposed after the Ryanair plane was hijacked do not seem to have changed the regime's stance. Ms Tikhanovskaya's stock has risen a shade after her recent meetings with the leaders of America and Britain. But, like other Belarusian exiles, whether Olympic runners or dissident officials, she will be anxiously wondering what else the dictator thinks he can get away with. ■

Turkey

Up in smoke

ISTANBUL

Deadly fires are sweeping Turkey. President Erdogan is feeling the heat

THE FIRES crept up the hills, scattered and grew, helped by the wind, and raced down towards the shore. In some places, desperate locals rushed to the sea, filling up plastic buckets with water to ward off the flames approaching their homes. Others ran or drove for their lives. The sky turned grey, then orange. By the time the smoke had cleared, stretches of Turkey's coastal paradise, once covered in pine forests and olive trees, were in ashes.

At least eight people have died in the fires along Turkey's southern and western coasts at the end of July, following record temperatures and a severe drought. Thousands more have been evacuated, including tourists from seaside resorts, some boarding boats to escape. Nearly 160,000 hectares of forest have burned in Turkey this year, according to the European Forest Fire Information System, four times the average between 2008 and 2020. Wildfires have also been raging this summer elsewhere in the region (see map).

The government of President Recep Tayyip Erdogan announced in early August that most of the fires were under control. But on August 5th parts of the region remained ablaze. In Milas, near the Aegean coast, flames spread to a thermal power plant. Officials said they had removed explosive materials from the plant and emptied its hydrogen tanks.

The government, caught badly off guard by the disaster, is also feeling the heat. As local mayors pleaded for help, ministers acknowledged they had no working water bombers, and belatedly resorted to helicopters. The head of the agency responsible for the planes admitted he had gone to a wedding at the height of the crisis. Turkey eventually accepted offers of help from Russia, Azerbaijan and the EU. Volunteers and firefighters poured in from across the country, as did police trucks mounted with water cannons, typically used against protesters. Locals seethed, sensing the government had abandoned them to their fate. To smother the outcry, Turkey's media watchdog accused some television stations of spreading "fear and anxiety" about the fires and threatened them with "the heaviest of sanctions".

Mr Erdogan, an authoritarian leader admired by his supporters as a capable manager, has not shone. He has increasingly seemed overwhelmed by the crises roiling his country. On July 31st he arrived in Marmaris, an area besieged by the fires. His motorcade blocked traffic as he tossed packages of tea from his bus at local residents. Days later, he pledged that the government would rebuild destroyed property and cover the rents of those left homeless.

Turkey is reaping the effects of decades of environmental destruction, compounded by climate change. Earlier this summer, thick sheets of marine mucilage, more crudely known as "sea snot", spread over the Marmara Sea, to Istanbul's south, the result of rising temperatures, a construction frenzy and industrial run-off. A severe drought and the diversion of water for farming were probably to blame for the deaths of thousands of baby flamingos at a saline lake in Anatolia. Each year the forests lining the country's coasts recede further inland, replaced by rows of vacation homes and hotels. Mr Erdogan's ministers have promised to keep developers away from the areas scorched by this summer's fires. Even if they stick to their word, the fires have shown how much harder it has become to keep climate change at bay. ■

Chechnya

The wolf's return

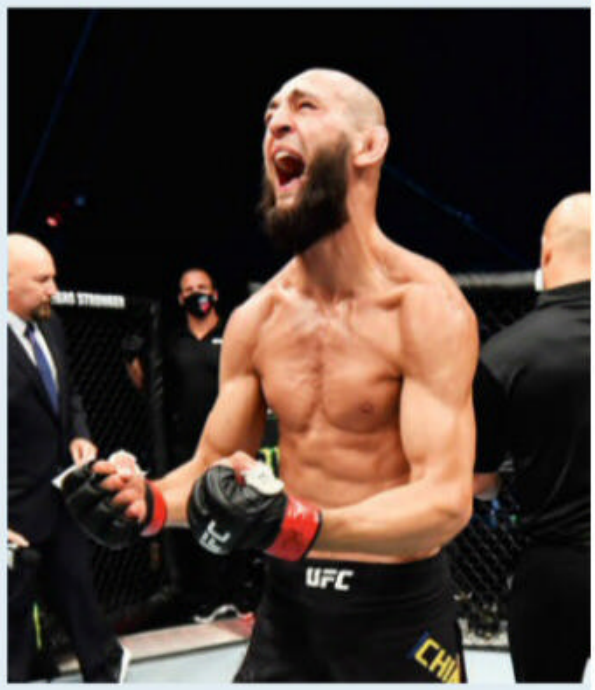
Why the comeback of a martial-arts star helps the Chechen dictator

HE VOWS TO "smash the faces" of his "chicken" foes and floored his last victim with one punch. Chechen-born Khamzat Chimaev, known as the *borz* ("wolf"), fights as ferociously as his nickname suggests. He was one of the world's hottest mixed-martial arts (MMA) stars in 2020, before being laid low by a tough opponent: a brutal bout of covid-19. He considered retiring, but was dissuaded—not by his coach or sponsors, but reportedly by Ramzan Kadyrov, Chechnya's ruler. In July Mr Chimaev announced that, after a year-long break, he is training for a fight in October.

Mr Kadyrov controls everything in the Russian republic, from dress codes to religious practices. He crushes dissenters, but loves combat sports and builds gyms for his subjects to punch and grapple. At bouts in his MMA arena in Grozny, the capital, he hollers, whoops and embraces the winners.

Many young Chechens dream of becoming famous fighters. Some are treated like heroes, plastered on billboards and housed in luxury flats. A few of Mr Kadyrov's prospects have battled in America's money-spinning Ultimate Fighting Championship. But before the *borz*, Chechnya lacked a true superstar.

The *borz*'s return was important to Mr Kadyrov—and not just because of his love for MMA. Mr Kadryov knows that Mr Chimaev will inspire more young Chechens to join fight clubs, where they will develop into highly trained, loyal warriors. Many will later join his private army. Some reckon that Mr Kadyrov's gyms, called the "Akhmat Fight Club", are recruiting pools for the Chechen special forces. (Both organisations have the same boss, Abuzayed Vismuradov, Mr Kadyrov's right-hand man.)



Apex predator

Mr Chimaev's comeback will bolster Mr Kadyrov's image. Star fighters provide a distraction from his purges of those he deems weak, such as gay people. Blood sports also do well on Instagram. Mr Kadyrov presents himself as a strong, athletic ruler, like his patron, Vladimir Putin, Russia's president. He recently sparred with the *borz* on camera, and in May the two holidayed together. They took selfies and met a lion cub.

Charlemagne | The black-cod theory of integration

Warsaw's restaurants show convergence is about more than just capital

FROM MONTE CARLO to Marbella to Milan, no glamorous destination is complete without a Nobu. The chain of gourmand-luring Japanese-Peruvian restaurants has become a staple in practically every tourist hotspot. In each location, a well-off clientele stuff themselves with chunks of black cod soaked in miso and yellowfin-tuna tartare while a DJ in expensive-looking spectacles plays unobtrusive house music.

Last summer Warsaw became the latest and, at first appearances, least likely addition to the list. Varsovians took to it well. With dishes from 25 zloty (€5.50 or $6.50) for edamame beans to 170 zloty for the signature black-cod dish, the place was crammed most nights, lockdowns permitting. Nobu's stash of *sake* was designed to last for 18 months; it was downed in three. The average spend on opening was higher than in the branch in Monte Carlo.

Rich Poles devouring sashimi reveal more than just a latent love of raw fish. Ultimately they tell a story of European convergence. At the EU's heart is a simple bet: thanks to the magic of the free movement of goods, capital, services and people, its 27 divergent economies will move together, until a life lived in, say, France is of a comparable standard to one lived in Poland. Normally, convergence is shown by a line marked Poland on a GDP chart grinding its way towards ones marked Italy, France and (still quite far out of reach) Germany. But convergence is about more than just capital. To understand it better, look at a city's restaurants.

Nobu is the top end of Warsaw's booming restaurant scene, which has turned from a stodgy affair into one of Europe's most vibrant. Nolita, a fancy restaurant, allows patrons to feast on wasabi- and teriyaki-covered octopus. A glut of vegan restaurants has made the city an unlikely mecca for those who spurn animal products. Venues serving Polish fare have flipped a once joyless culinary culture into one that is varied and, at times, excellent.

This helps convergence in a few ways. Playing catch-up with neighbours is difficult to do if a country's brightest are tempted to leave. Wages are still about three times higher in Germany and the Netherlands. But ambitious young Poles head to places like Berlin or Amsterdam not just so they can earn more, but because they are fun places to live. There is less incentive to leave when there is a throbbing city at home.

There is also a greater push to return. After working in Michelin-starred restaurants in Britain and Denmark in the first half of his career, Robert Trzópek returned to Poland a decade ago. At that time, it was still tricky to find a market for fine dining. Now, however, his restaurant, Bez Gwiazdek, which each month serves food exclusively from a different region of Poland, is packed on a Tuesday night in August. Varsovians tuck into small plates of tomatoes with fermented strawberries along with potatoes, cottage cheese and caviar.

Better nosh also offers an incentive to potential new arrivals, rather than returnees. If places such as Warsaw are to attract well-paid commodities traders as well as back-office staff, then they must become better places to live. It is a way of solving the footballers'-wives conundrum. Roy Keane, a former manager of Sunderland AFC, a football club in an unfashionable city in north-east England, complained that players were reluctant to sign as their spouses would rather live in London or Manchester. Nicer grub is one part of the solution.

Restaurants provide the starkest example of Poland's demographic convergence with the rest of the EU. Poland has, like its Western neighbours, become a country of mass immigration. Before the pandemic, in 2019, Poland issued 724,000 residency permits to people from outside the EU—around 260,000 more than Germany, the second-highest. To see the inflow's effect, head to a bar or a restaurant in Warsaw, where the staff will usually be Belarusian or Ukrainian. Order a takeaway and the rider delivering it will often hail from South Asia.

Convergence can also be a question of changing social mores. Again, restaurants demonstrate it best. Poland's ruling right-wing Law and Justice party are enthusiastic homophobes, while local politicians bait gay people with "LGBT-free zones". Eateries in Warsaw are leading the riposte. At Youmiko, a vegan sushi restaurant, a pride flag on the door is captioned "You're at home here". Politics even lurks behind the rise of vegetarian and vegan restaurants, argues Alex Webber, who edits *Warsaw Insider*, a city guide. In 2016 Poland's then foreign minister spelled out a vision of a nightmarish future with a "mix of cultures and races, a world of bicyclists and vegetarians". Eating vegan ramen is a small but delicious act of resistance.

Europe will be forged in ceviche

The drawback of convergence is homogenisation. Eating in Warsaw is sometimes a disorienting experience. In some venues one could be in Berlin, or Madrid or Amsterdam: the food would be the same, as would the furniture and the font on the menu. Even the waiter would sport the same tattoos and beard. Some in Warsaw worry the city is losing its sense of self. Ironically, that fear of homogenisation is shared by the right-wing government. If liberals worry about restaurants becoming samey, conservatives fear being dragged into the European mainstream when it comes to gay rights or abortion, which is almost completely illegal in Poland.

Convergence via consumption can go only so far. It will take higher wages, better schools and bigger prospects for those who stay before Poland can catch up with its neighbours. Would a high-flying Polish woman want to stay in a country where the government sees her as little more than a baby-machine? Would a gay person be content in a society determined to deprive him of certain rights? Still, Warsaw can be a cosmopolitan dream, even if the Polish government is, at times, a nightmare. A plate of black cod and a bowl of vegan ramen is not much. But it is a start. ■

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Britain's boat people

Get back to where you once belonged

A country that receives few asylum-seekers is determined to have even fewer

STILL, SUNNY weather in southern England brings the smell of sausages from barbecues, the off-key tinkling of ice-cream vans—and inflatable boats filled with asylum-seekers. According to the BBC, more have already crossed the English Channel this year than in all of 2019 or 2020. A new one-day record was set on July 19th, when 430 turned up.

By some yardsticks, this is trivial. Britain received 32,411 applications for asylum in the year to March. That is a third of the peak in the early 2000s and low by global standards. Britain ranked fifth among European countries for asylum claims in 2020, and 17th adjusting for population. Many poorer countries receive far more refugees (see International section).

But the impact on domestic politics is out of all proportion to the number. As Maria Sobolewska and Robert Ford show in their book "Brexitland", Britons voted for Brexit largely because they wanted more control over immigration. The sight of asylum-seekers floating across the Channel is a highly visible indication that the government might not be doing what many Britons sorely want it to, says Will Tanner of Onward, a right-leaning think-tank.

The government is therefore pulling a variety of policy levers to try to keep asylum-seekers out. But its proposals are largely misguided. Some will harm them; some, though they sound tough, will not reduce their numbers. A few are even likely to encourage more economic migrants—the sort natives feel least sympathetic to.

One approach is to make it harder to set out for Britain. On July 20th Priti Patel, the home secretary, agreed to pay the French government €62.7m ($75m) for more patrols of the northern French coast. Another is to try to deter asylum-seekers by passing tough laws. A bill now before Parliament would criminalise those who arrive illegally, as most do. It would also make it easier to detain and deport asylum-seekers, and grant those eventually permitted to stay—roughly half the total, once appeals are heard—a shorter sojourn. People resettled directly from refugee camps would be treated more generously. But there were never very many of these, and since covid-19 struck, there have been almost none.

Making it harder to leave France will probably have an effect. Asylum-seekers first took to boats in large numbers because it became hard to reach Britain by boarding lorries. That, in turn, was partly because Britain agreed in 2018 to pay for more fencing and cameras around Calais port. Crossings will probably continue despite additional patrols, but from quieter sections of the coast that are farther from Britain. The cost, in money to smugglers and deaths at sea, could well rise.

Tough laws, by contrast, may make little difference even if judges do not eviscerate them, as they may well do. Some asylum-seekers are drawn to Britain because they have relatives there, a pull that no law can change. That includes almost all those who camp in northern France before trying to make it to Britain, says Frances Timberlake of Refugee Rights Europe, a charity.

More broadly, behind the proposals lies a notion that, as Ms Patel puts it, Britain is "a destination of choice". That flatters the country. Heaven Crawley of Coventry University, who has interviewed many asylum-seekers, says they are commonly ill-informed. Many express a vague desire to go to "Europe". Others base their preference for Britain on startlingly naive reasons, such as familiarity with English foot-

Living in limbo

Britain, number of asylum-seekers awaiting an initial decision, '000

By length of time since application

Sources: The Refugee Council; Home Office

ball. "It's not like people are going to read in a paper that British policy is horrible and decide not to come," she says.

Tim Hatton of the University of Essex has studied why asylum-seekers choose the countries they do. Distance matters—the longer the journey, the fewer will make it. Policing borders more stringently or refusing to issue visas also reduces asylum claims. People are drawn to countries where many fellow-countrymen live. By contrast, attempts to immiserate asylum-seekers by detaining them, cutting their tiny stipends or restricting their ability to work have no effect.

Asylum-seekers have endured so much by the time they reach Britain that a bit more is scant deterrent. Last September inspectors found dire conditions at several detention and processing centres. One was strewn with rubble and resembled a building site. Detainees had to wear wet clothes because there were too few dry ones. Medical treatment was carried out in the open air. The asylum-seekers nonetheless said they had been treated very well.

Britain's asylum system has changed in one more way in the past few years: case-processing has slowed down drastically (see chart). Less than 30% are heard within six months, down from more than 70% in 2015. The proposed law may slow things down even more. Immigration officials have begun to put off hearing cases while they engage in largely futile attempts to return asylum-seekers to transit countries, and the law would allow that to continue.

Simone Bertoli of the University of Clermont Auvergne and others have studied the effect of processing speed on asylum claims. Countries that hear claims quickly tend to get more applications from those likely to be granted asylum, such as Syrians, and fewer from those who aren't. Conversely, migrants using the asylum system as a back door into the labour market seem to be drawn to sluggish countries. By going slow, Britain could end up enticing more of the sort of asylum-seeker most likely to infuriate the public. ■

Olympic funding

Fortune and glory

Gambling money and ruthlessness have made Britain an Olympic power

THE MODERN Olympic Games were founded to celebrate amateur sporting ideals. But times change. These days, success takes money and a hard-nosed attitude to doling it out. Few countries prove this as well as Britain, which has spent 25 years shaping up from an Olympic also-ran to a medal-winning power.

In 2008 in Beijing, Britain came fourth, ahead of countries of roughly similar size such as Italy (9th), France (10th) and Spain (14th). In 2012 in London, it came third. In 2016 in Rio de Janeiro, only America did better. Britain has spent £345m ($480m) on the Tokyo games. As *The Economist* went to press it was vying with Australia for fourth place in the medal rankings, behind America, China and Russia.

The transformation began after the 1996 Atlanta Olympics, in which Britain won just a single gold. The government decided to use cash from the recently launched National Lottery to fund top-level sport, with the express goal of winning more medals. From 1997 the effort gained impetus under New Labour, which was enamoured of performance targets, says Borja Garcia, who studies sports policy at Loughborough University. More came in 2005, with the decision to award London the 2012 games.

The result was what UK Sport, a government body charged with medal-chasing, called its "no-compromise" approach. Sports management was professionalised. Coaches, nutritionists and sports scientists were heaped upon the most promising athletes. Funding became calculating and unsentimental. Team sports often offer poor returns, points out Mr Garcia, since it takes several athletes to win a single medal. In medal-rich sports such as swimming or athletics, by contrast, a single one can win in several events. The result has been largesse for a few favoured sports, and crumbs for the rest. Funding fluctuates wildly depending on how a sport does at the Olympics, and what officials think of its prospects (see chart).

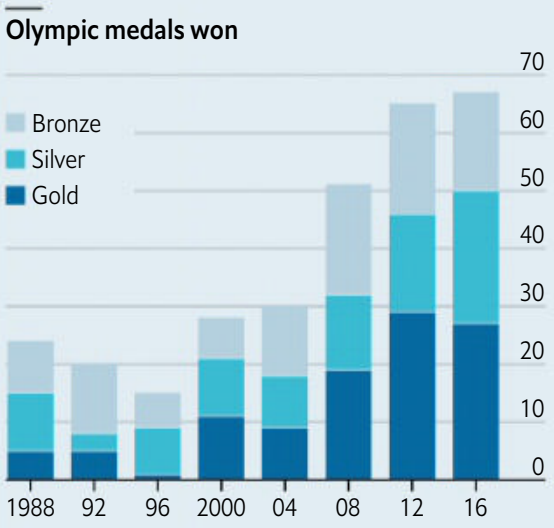
Such ruthlessness has been effective. But Stefan Szymanski, a sports-policy expert at the University of Michigan, says that targeting money on sports that are doing well risks entrenching the status quo by starving less successful ones of the cash that might help them to improve. Others worry that chasing after medals has had grimmer consequences. Dozens of gymnasts are suing the sport's authorities, complaining of negligence and abuse. Jennifer Pinches, an Olympic gymnast in 2012, says officials prioritised "podiums over people". A report in 2017 criticised a "culture of fear" within British cycling, the reputation of which has been further tarnished by a doping scandal involving its all-conquering 2012 Olympic team.

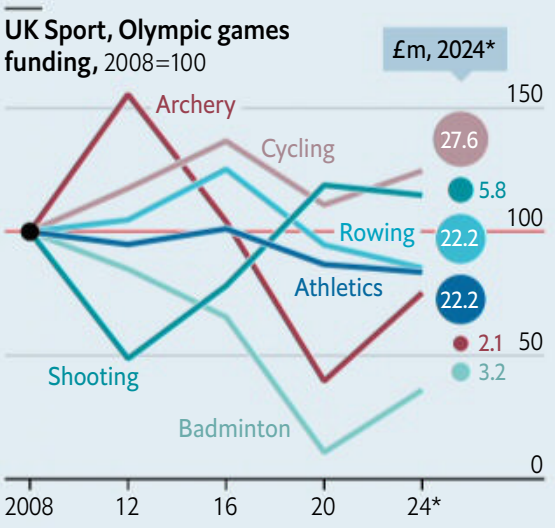
These days, UK Sport's approach has become at least a little gentler. A new funding formula provides a dribble of development cash for less-loved sports. Officials hope elite sport will promote the grassroots sort, as well as create national glory. As other countries, such as France and the Netherlands, become more hard-headed, Britain's advantage may narrow.

And even the best-laid plans of funding bodies and bureaucrats can go awry. Bethany Shriever, who won gold in Tokyo in BMX racing, failed to impress officials before the Games and had to crowdfund to pay for her training. Meanwhile Britain's rowers, a reliable (and lushly funded) source of medals in past games, are mired in recriminations after a string of fourth places. ■

Government medalling

Britain





Sources: International Olympic Committee; UK Sport

*Forecast

Bagehot | The great reversal

Is Britain becoming more meritocratic than America?

IN 1774 THOMAS PAINE left Britain for America to become a radical pamphleteer and revolutionary agitator. In "Common Sense", published two years later, he explained why he had chosen to emigrate. Britain was built on heredity, a loathsome practice rooted in theft (William the Conqueror was the original bandit who stole the people's land) and perpetuated by idiocy (what could be more absurd than giving a job to someone because of who their parents were?). "The artificial noble sinks into a dwarf before the noble of nature," he said, and Britain was a land of artificial nobles. America, by contrast, was animated by the glorious principle of merit.

Paine's argument has been a fixture of British thinking ever since. "England is the most class-ridden country under the sun," George Orwell complained in 1941: "a land of snobbery and privilege". In William Golding's novel, "Rites of Passage", published in 1980, a character laments that "Class is the British language". And it is to America that the British habitually look for opportunity unencumbered by nonsense about parentage and the pronunciation of the letter "h". Chartists in the 1830s and 1840s sang "Yankee Doodle" and waved the American flag. In the 1960s and 1970s, moderate leftists such as Tony Crosland and Shirley Williams wanted to make Britain more like America. British-American transplants like William James and T.S. Eliot were snobs; America attracted British radicals like W.H. Auden and Christopher Hitchens.

This contrast between hierarchical Britain and meritocratic America has always been exaggerated. America has no monarchy or House of Lords, but it has dynastic families such as the Adamses, Kennedys and Bushes. It has no equivalent of British aristocrats' cut-glass vowels, but it has cliques such as the Boston Brahmins and the Proper Philadelphians, not to mention the Southern gentry. America gives ambassadorships to big party donors rather than professional diplomats, a practice the British abandoned in the mid-19th century. As president, Donald Trump was flagrantly nepotistic, relying on his daughter, Ivanka, and her husband, Jared Kushner. But compared with the Bushes, Clintons and Kennedys, this was evolution, not revolution.

Social mobility stagnated in both countries as the winners from the Thatcher and Reagan revolutions consolidated their gains. But Britain is trying much harder than America to get it going once again. A combination of British angst and American complacency may be the beginning of a great reversal: Britain is becoming more meritocratic, even as America becomes less so.

True, two Old Etonians, David Cameron and Boris Johnson, recently made it to the top of the Conservative Party. But the number of MPs from modest backgrounds has been rising, especially with the conquest of northern constituencies in 2019. The Treasury, Foreign Office, Home Office and Department of Health are all led by the children of immigrants. In broadcast journalism, and arguably in business, an upper-class bray is increasingly a handicap.

The two countries' differing trajectories are perhaps most obvious in education, especially in admissions to the universities that act as gatekeepers to the elite. A comparison of Oxford and Harvard is telling. Oxford is trying hard to attract poor and working-class applicants, and several of its colleges have introduced a "foundation year" to get them up to speed before they start degree courses. In 2020, 68% of the undergraduates it admitted, excluding those from overseas, had attended state schools. That was up from 62% in 2019, and 55% a decade ago.

This meritocratic push was aided by school reforms started in the 2000s by Labour governments, and continued by the Tories since 2010, which created schools in inner cities that offer education of the highest standard. One is Brampton Academy in Newham, a poor London borough, which draws most of its pupils from ethnic minorities. Last year it won 55 places in Oxford and Cambridge, more than Eton's 48. Its sixth form is highly selective, and provides intensive coaching for Oxbridge entrance exams.

By contrast Harvard, like other elite American universities, practises plutocracy modified by affirmative action for African-American applicants and, to a lesser extent, Hispanic ones. The intention is to compensate for the terrible injustice of slavery and, more broadly, to find merit where it was once overlooked. But it is undermined by an almost wilful blindness to disadvantage that stems from class, not race. Harvard recruits more students from the richest 1% than the poorest 60%, discriminating in favour of relatives of faculty and alumni (known as "legacies"), star athletes and the "dean's list", which mysteriously tends to feature the offspring of politicians, celebrities and donors. "Holistic assessment" of candidates encourages CVs that bristle with boasts about pricey trips to Africa to help the poor. It boosts the well-connected, who can get supporting letters from impressive names. Peter Arcidiacono of Duke University calculates that three-quarters of successful white applicants in these favoured categories would have been rejected if they had been treated the regular way.

Changing places

And rather than creating institutions like Brampton Academy to prise open Harvard's gates, America's policymakers are dismantling elite public schools. Boston Latin School in Boston and Lowell High School in San Francisco, which have a fine record of getting their pupils into Ivy League universities, are being forced to drop entrance examinations and admit by lottery, which will probably mean an end to academic excellence.

Even as America's ingrained belief that it is a meritocracy is taken as licence to behave in a flagrantly anti-meritocratic fashion, Britain's anxiety about being class-bound seems to have made it hypersensitive to unearned privilege (excepting a few institutions granted special status, such as the monarchy). This anxiety may finally be producing positive results, rather than, as so often in the past, nothing more useful than self-doubt. ■

The UN's refugee convention at 70

Well-founded fears

ATHENS, AYVALIK AND TIJUANA

More people are fleeing intolerable conditions in their home countries. Fewer governments are willing to take them in

When the Turkish coastguard found them in the Aegean in the dead of night, they had been adrift for three hours. The air was hissing out of their rubber dinghy. The motor would not start. Anas and the eight other Somali men shielded their eyes from the glare of the searchlights. His wife, Faduma, the only woman, panted from stress and exhaustion. They had paid $2,000 apiece to a smuggler to reach Greece. Faduma, six months pregnant, was the first to climb onto the Turkish boat.

That was the couple's first attempt to reach Europe after leaving Somalia last year. "We are never going do this again," Anas says. He hopes to stay in Turkey.

Some 11,000km (7,000 miles) away, in Tijuana, Mexico, another couple try to cross a forbidding border. José and María, who did not want to give their real names, fled El Salvador after José appealed to police for help in recovering stolen cows. The gang behind the theft threatened to kill María and their young son. With help from a sister living in America they paid a smuggler $10,000 to bring them to Texas, where they turned themselves in to the border patrol and asked for asylum. The agents expelled them to the desert near Juárez. That was a "devastating" moment, says José.

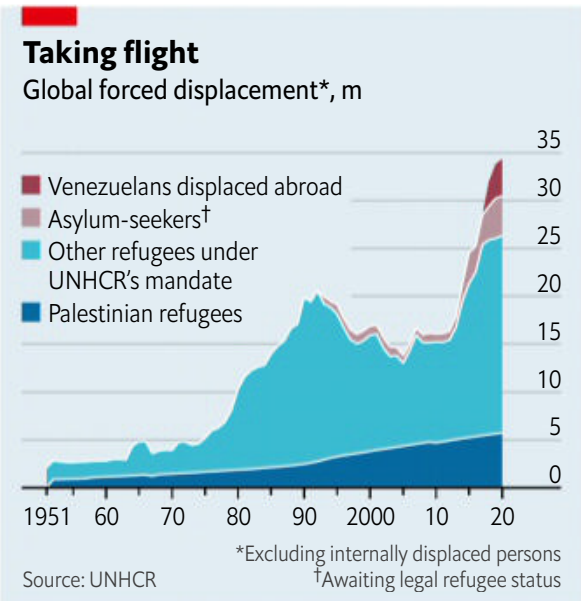
José and María made their way by bus west to Tijuana, where they live with dozens of other families in tents in a shelter. Instead of Salvadorean criminals they contend with Mexican ones. María says a man tried to grab her son as she was shopping for food. In May, when this conversation took place, José and María were still set on getting to America. "Most of all," says María, "we want a chance for our son to grow up in a place that's safe."

Anas, Faduma, José and María are caught up in a global backlash against a treaty that has just turned 70. The refugee convention, adopted on July 28th 1951, governs the obligations that states have to people who flee their countries because of a "well-founded fear" of persecution "for reasons of race, religion, nationality, membership of a particular social group or political opinion". States must not send them back to danger, a principle called non-refoulement. America incorporated the treaty's language in the Refugee Act of 1980.

Some nationalist politicians have no interest in meeting the duties imposed by the convention. Among Donald Trump's first acts as America's president was to shut the country's doors to refugees from some Muslim countries, prompting Germany's chancellor, Angela Merkel, to "explain" the convention to him. Others struggle with the political difficulties of doing so. A jump in the number of asylum-seekers on America's southern border was among the first crises faced by his successor, Joe Biden. Europe's big surge, in 2015, boosted populist parties and contributed to Britain's vote for Brexit a year later.

Politicians are still traumatised by the angry public reaction. The Netherlands' Liberals, led by the prime minister, Mark Rutte, suggest withdrawing from the convention. The immigration spokesman of Denmark's ruling Social Democratic party recently told people to "stop seeking asylum" in his country. The treaty "doesn't provide a travel card to go to whichever country a refugee or asylum-seeker wants," says Notis Mitarachi, Greece's migration minister. It may be the least popular treaty in the rich world.

If the convention has provoked a backlash, that is largely because the world has changed since its adoption. The original treaty applied only to Europeans who had been displaced by the second world war and the onset of the cold war. A protocol adopted in 1967 made its provisions global and applied them to future refugee crises. After the treaty's scope was widened the ▸▸



number of refugees grew (see chart). Many of today's asylum-seekers are fleeing violence in weak states rather than the sort of tyranny that dominated wartime Europe.

Last year, despite the pandemic's brake on migration, 1.4m people sought protection outside their home countries; nearly 10m were forcibly displaced within them. That brought the total number of forcibly displaced people to 82.4m, the highest on record. About 30m are refugees or asylum-seekers—people asking for refugee status. "The demands on the refugee system are absolutely unprecedented," says Gillian Triggs of the UN's refugee agency (UNHCR).

They are bound to grow, and further strain adherence to the septuagenarian treaty. A big reason is that refugees are hard to distinguish from the much larger group of migrants who just want to improve their lives. If everyone who wants to move could, America's population would increase by 46% and Germany's by 45%, according to a "potential net-migration index" put together by Gallup, a pollster. Motivations for migrating are becoming more complex. A West African fisherman might head north because his catch has fallen, but then run up debts to people-smugglers or wind up in a Libyan detention centre and so become a refugee, points out Petra Suric of the International Rescue Committee (IRC), an NGO. The effects of climate change may force 143m people to move by 2050, says the World Bank. That is already posing problems for interpreters of a treaty written with the Nazis' victims in mind.

Luckily for jumpy Western politicians, 86% of refugees (including displaced Venezuelans) are in developing countries (see map). Nearly three-quarters are in countries next to the ones they fled from. That is unlikely to change. But even the relatively few asylum-seekers who make it to rich countries can up-end their politics.

When a couple like José and María show up visa-less, they trigger both sympathy and suspicion. Are they dodging immigration laws or fleeing peril? Is it the sort of peril that is grounds for offering protection under the refugee convention and a mesh of other treaties? The answer might differ by country. Mexico subscribes to the Cartagena declaration of 1984, which calls on states to protect people threatened by "generalised violence", which is easier to prove than persecution. America does not. Unlike poorer parts of the world, America, Europe and Australia have elaborate systems for assessing whether individual migrants deserve asylum. But they are creaky, and suspicion is prevailing over sympathy. "The huge majority applying for asylum are not refugees," says Ylva Johansson, the EU's home affairs commissioner.

Mr Trump's administration separated migrant parents from their children, forced asylum-seekers to remain in Mexico to await hearings on their claims and signed "safe-third-country" agreements with Central American countries, giving responsibility to determine who is a genuine refugee to governments ill equipped to do so. His Justice Department directed immigration courts which, unusually for the rich world, are answerable to politicians, to narrow their interpretation of refugee law. Women no longer counted as members of a particular social group. Victims of gangs had to show that their government would not or could not protect them. Title 42, a pandemic policy, allows border agents to deport migrants to protect public health. Between October 2020 and June 2021 some 1m expulsions, including that of José and María, took place under this policy. Summary removals are "a clear violation" of the convention, says Erika Pinheiro of Al Otro Lado, an NGO.

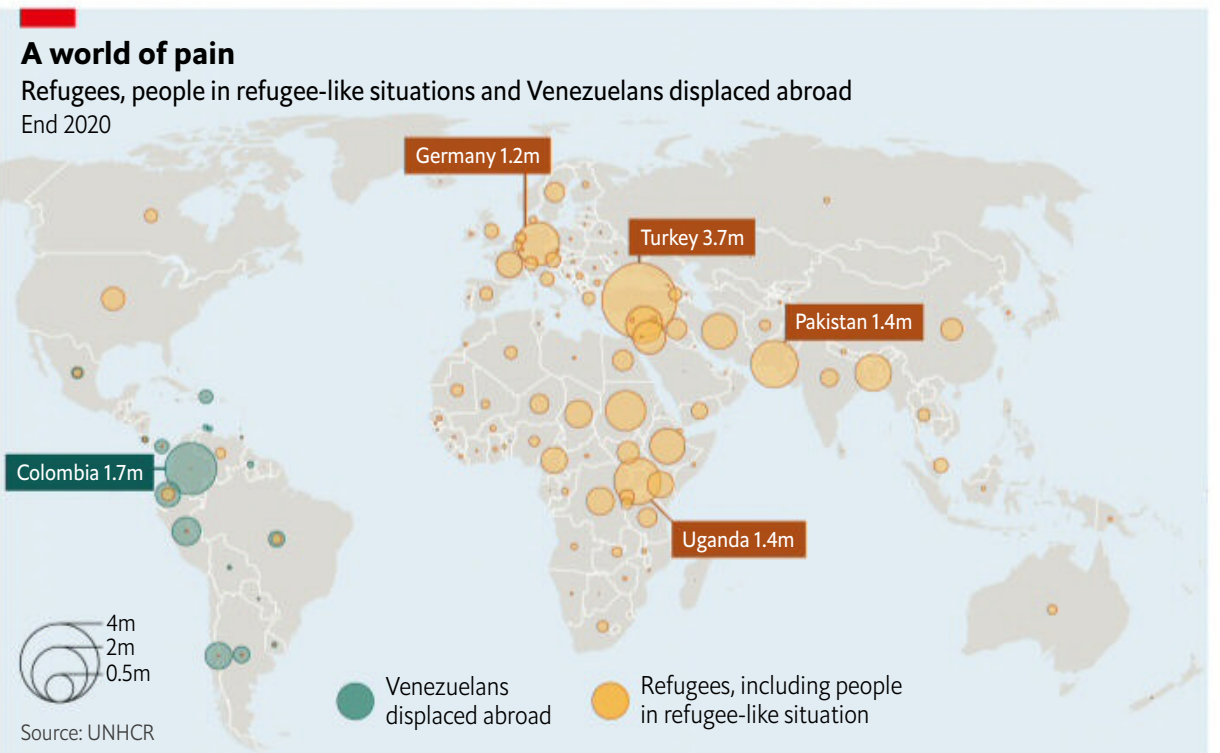
America has the world's largest immigration detention system, which currently holds 27,000 people. Immigration courts have a backlog of 1.4m cases, nearly half pertaining to asylum claims. The "labyrinth" offers no right to counsel, notes Olga Byrne of IRC. Yet in the years-long wait for a court date, asylum-seekers become part of American society and are rarely deported if their claims are denied. That encourages more to try their luck.

Europe's handling of refugees is bedevilled by buck-passing. Germany and Sweden were exceptions in 2015 when they welcomed 1.4m refugees, but even they had second thoughts after far-right parties made gains by denouncing this openness. Undocumented migrants who land on the shores of Italy and Greece are supposed to apply for asylum there. The Mediterranean states, with the EU's help, have shifted responsibility to non-European neighbours.

Europe's most conspicuous act of buck-passing—"externalisation", in the argot—is the EU-Turkey deal. In exchange for €6bn ($7bn) plus progress on liberalising visa rules for Turks and on Turkey's bid to join the EU, Turkey agreed to take back "irregular migrants". The number of Aegean crossings plunged from 860,000 in 2015 to 36,000 the following year. The arrangement was what thwarted Anas and Faduma. It exemplifies much of what is wrong with Europe's approach to refugees, but it may also point to ways in which it could work better in the future.

From pillar to post

The deal led to the establishment of "hotspots", which prevent asylum-seekers who made it to Greek islands from progressing further into Europe and make it easier to deport them to Turkey. The government reduced their size after a fire last year destroyed a camp on Lesbos. Now most of the 48,000 refugees and asylum-seekers in Greece are in camps on the mainland, where families live in converted shipping containers and single men share tents with dozens of others. Women fear using the communal loos at night. Covid-19 has kept children out of school. The government has tried to avoid granting asylum to the



trapped migrants, creating a backlog of applications that peaked at 140,000 last year.

When the Turkish coastguard fails to intercept Greece-bound migrants, the Greek one steps in. Epaminondas Farmakis of HumanRights360, a Greek NGO, estimates that 1,000 people a month are being pushed back or returned to sea. Louay Al Nassour, a Syrian, recounts that in March last year the Greek coastguard towed his boat to Rhodes, where the passengers were locked up in a warehouse. The next evening the coastguard took them back to sea, forced them into inflatable rafts without paddles and abandoned them. A Turkish coastguard vessel picked them up. Mr Nassour got back into Greece across the Evros river and is now in a camp.

Mr Mitarachi is keen to combat the impression that Greece is trampling on asylum-seekers' rights. He denies that Greece is pushing them back and insists that the country complies with the refugee convention. He says he wants to eliminate the backlog, which has now fallen to about 50,000. In 2020 Greece's asylum service gave 34,000 people refugee status or another form of protection. Officials expect some 50,000 eventually to settle there.

Turkey, with eight times Greece's population, hosts more than 80 times as many refugees and migrants—3.7m Syrians and at least 300,000 migrants from countries such as Afghanistan and Somalia. It signed the convention but with a "geographical limitation" that obliges it to protect only refugees who come from Europe. Its grant of protection to Syrians cannot be trusted because it depends on political decisions, says Minos Mouzourakis of Refugee Support Aegean, an NGO. Human-rights groups allege that Turkey has deported thousands of Syrians. The deal helps prop up Turkey's authoritarian leader, Recep Tayyip Erdogan.

Syrians enjoy more rights in Turkey than other migrants, but are not fully accepted. Just 30,000 have work permits, obliging most to work illegally. They are four times more likely to have been sacked during the pandemic than Turkish citizens, according to TEPAV, a think-tank. Yet they are finding a place. Initially housed in camps, most now live in cities. In Sanliurfa and Gaziantep, close to the Syrian border, they are a fifth of the population. They are entitled to education and health care, paid for partly by the EU. In a survey conducted in 2019, 89% of Syrian migrants said they felt at least partially integrated. Turkey has naturalised 100,000 of them.

To some advocates of refugees' rights the EU-Turkey deal is a calamity. Mare Liberum, an organisation that watches out for human-rights abuses in the Aegean, called its fifth anniversary in March "shameful". Others see in it the germ of an approach that balances the West's asylum-aversion with refugees' needs. The EU-Turkey deal is the main real-world example of "transnational asylum", an idea put forward by Nikolas Feith Tan of the Danish Institute for Human Rights, who defines it as two states co-operating to process asylum claims or protect refugees. But, he cautions, the agreement is unacceptable without Turkey's full adherence to the convention. People are looking at what might be called smart externalisation as the "next frontier" of asylum, says Susan Fratzke of the Migration Policy Institute (MPI) in Washington. What is needed are "anchors"—opportunities for refugees in the poor countries they flee to—"not walls" barring them from rich ones, says Alexander Betts, author of "The Wealth of Refugees", a recent book.

Anchors are implicit in the "global compact on refugees", adopted by the UN in 2018, which emphasises "responsibility-sharing" among countries. It casts refugees not just as charity cases but as contributors to and beneficiaries of the economic development of their hosts. The World Bank plans to lend $500m to Colombia, which in February gave temporary protection to more than 1m Venezuelans. The money will help it provide public services to them. The bank is also financing projects such as upgrading Djibouti's schools for refugees and citizens.

But, keen as rich countries are on the idea that refugees should stay as close to home as possible, they do relatively little to help the countries that host them. On average, the gap between what the UNHCR asks for to meet refugees' immediate needs and what donors give is around 45%, the agency estimates. The UN's World Food Programme said last month that it will stop food aid for 21,000 Syrian refugees in Jordan "due to funding shortages". Britain has cut its goal for development aid from 0.7% of its gross national income to 0.5%.

It is not just more money that is needed.

If politicians were boat people

Few rich countries are resettling lots of refugees, ie, handpicking them for relocation from poorer countries. Such resettlement will benefit a small minority, but it is important both in its own right and as a signal to host countries. "Europe is mistaken if it thinks it can exclusively support other countries to host refugees without hosting a fair number itself," says Catherine Woollard of the European Council on Refugees and Exiles, an NGO network.

Not my responsibility

And Western countries continue to duck their obligations to the migrants who do manage to reach their borders. Improving the speed and efficiency of vetting such asylum-seekers would help governments repatriate those who can be sent home safely. "The credibility of the asylum system breaks down if you don't find practical ways of returning people," says Ms Triggs. To shrink the pile of cases in American immigration courts, MPI suggests transferring responsibility for deciding cases to the immigration service's specialised asylum officers. When claims fail, America's government could work with governments and NGOs in the applicants' home countries to smooth their return.

Mr Biden seems open to such changes. He has begun to wind down Mr Trump's war on refugees. Although Title 42 is still in force, America has stopped expelling unaccompanied children and ended Mr Trump's remain-in-Mexico policy. The Justice Department is once again considering victims of domestic and gang violence for asylum. The White House proposes to expand processing of refugees within Central America for eventual resettlement in America, a form of transnational asylum. After saying he would stick with Mr Trump's low target for resettling refugees—15,000 this year—Mr Biden raised it to 62,500.

Officially, Europe remains welcoming. "I don't want to build a Fortress Europe," says Ms Johansson. Some European countries are upgrading their asylum systems. In its proposed "pact" on migration, the EU claims to combine sensitivity with speed. Asylum-seekers who seem to have good claims will have their applications assessed by the established systems, but those who come from countries whose citizens are rarely accepted as refugees will be swiftly returned. To ensure that that happens, the EU wants to appoint a "return co-ordinator", a new role.

Such an official may be necessary if the signatories of the refugee convention are to honour it. But "return" can easily breach the principle of non-refoulement, its main obligation. To avoid traducing the treaty as it turns 70, governments will have to spend more money and show more courage than they have done so far. ■

Semiconductors

Veni, Nvidia, Vici

Nvidia has conquered the market for artificial-intelligence chips. Can it hold on to its crown?

"WE'RE ALWAYS 30 days away from going out of business," is a mantra of Jen-Hsun Huang, co-founder of Nvidia. That may be a little hyperbolic coming from the boss of a company whose market value has increased from $31bn to $505bn in five years and which has eclipsed Intel, once the world's mightiest chipmaker, by selling high-performance semiconductors for gaming and artificial intelligence (AI). But only a little. As Mr Huang observes, Nvidia is surrounded by "giant companies pursuing the same giant opportunity". To borrow a phrase from Intel's co-founder, Andy Grove, in this fast-moving market "only the paranoid survive".

Constant vigilance has served Nvidia well. Between 2016 and 2021 revenues grew by 233%. Operating profit more than doubled in the past five years, to $4.5bn (see chart 1 on next page). In the three months to May sales shot up by 84%, year on year; gross margin reached 64%. Although Intel's revenues are four times as large and it fabricates chips as well as designing them, investors value Nvidia's design-only business more highly (twice as much in terms of market capitalisation). The data centres that make up the computing clouds of Amazon, Google, Microsoft and China's Alibaba all use its products. So do all big information-technology (IT) firms, as well as countless scientific-research teams in fields from drug discovery to climate modelling. It has created a broad, deep "moat" that protects its competitive advantage.

Now Mr Huang wants to make the moat broader and deeper still. In September Nvidia said it would buy Arm, a Britain-based firm that designs zippy, energy-efficient chips used in most smartphones, for $40bn. The idea is to use Arm's design prowess to engineer central processing units (CPUs) for data centres and AI uses that would complement Nvidia's existing strength in specialised chips known as graphics-processing units (GPUs). Regulators in America, Britain, China and the EU must all approve the deal. If they do—a considerable "if", given both firms' market power in their respective domains—Nvidia's position in one of computing's hottest fields would look near-unassailable.

Mr Huang, whose family immigrated to America from Taiwan when he was a child, founded Nvidia in 1993. For its first 20 years or so the firm made GPUs that helped video games look lifelike. In the past decade, though, it turned out that GPUs also excel in another futuristic, but less frivolous, area of computing: they dramatically speed up how fast machine-learning algorithms can be trained to perform tasks by feeding them oodles of data. Four years ago Mr Huang startled Wall Street with a blunt assessment of Nvidia's prospects in what has become known as accelerated computing. It could "work out great", he said, "or terribly". Regardless, the firm was "all in".

Around half of Nvidia's revenues of $17bn a year still come from gaming chips (see chart 2). These are also adept at solving the mathematical puzzles that underpin ethereum, a popular cryptocurrency. This has at times injected crypto-like volatility into GPU sales, which partly caused a near-50% fall in Nvidia's share price in 2018. Another slug of sales comes from selling chips that speed up features other than graphics or AI to hardware-makers.

But the AI business is growing fast. It includes specialised chips and software ▸▸

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that lets programmers fine-tune them—itself made possible by Mr Huang's earlier bet, which some investors criticised at the time as a costly distraction. In 2004 he started investing in "Cuda", a base software layer that enables such fine-tuning, and implanting it in all Nvidia chips.

A lot of these systems end up in servers, the powerful computers behind data centres' processing oomph. Sales to data centres contribute 36% of total revenues, up from 25% in early 2019 and nearly as much as gaming GPUs. As companies across industries adopt AI, the share of Nvidia's data-centre sales going to the big cloud providers has declined from 100% to half.

Today its AI hardware-software combo is designed to work seamlessly with the machine-learning algorithms collected in libraries such as TensorFlow, kept by Google, and Facebook's PyTorch. The firm has created programs to hook its hardware and software up to the IT systems of big business clients with AI projects of their own. This makes the job of AI developers immeasurably easier, says a former Nvidia executive. Nvidia is also getting into "inference": running AI models, hitherto the preserve of CPUs, not merely training them. Huge, real-time models like those used for speech recognition or content recommendation increasingly need specialised GPUs to perform well, says Ian Buck, head of Nvidia's accelerated-computing business.

Armed and dangerous

This is where Arm comes in. Owning it would give Nvidia the CPU chops to complement those in GPUs, as well as its new abilities in network-interface cards needed in server farms (in 2019 it bought Mellanox, a specialist in the field). In April Nvidia unveiled plans for its first data-centre CPU, Grace, a high-end chip based on an Arm design. Arm's energy-efficient chips may go into AI wares for "edge computing"—in self-driving cars, factory robots and other uses far from data centres, where power-hungry GPUs may not be ideal.

Transistors in microprocessors are already the size of a few atoms, so have little room to shrink. Tricks such as outsourcing computing to the cloud or using software to split a physical computer into several virtual machines may run their course. So businesses are expected to turn to accelerated computing as a way to gain processing power without splurging on ever more CPUs. Over the next 5-10 years, as AI becomes more common, up to half of the $80bn-90bn that is spent annually on servers could shift to Nvidia's accelerated-computing model, reckons Stacy Rasgon of Bernstein, a broker. Of that, half could go on accelerated chips, a market which Nvidia's GPUs dominate, he says. Nvidia thinks the global market for accelerated computing, including data centres and the edge, will be more than $100bn a year.

Nvidia is not the only one to spy an opportunity. Competitors are proliferating, from startups to other chipmakers and the tech giants. Firms such as Tenstorrent, Untether AI, Cerebras and Groq are all trying to make chips even better suited to AI than Nvidia's GPUs, which for all their virtues can use lots of power and be fiddly to program. Graphcore, a British firm, is promoting its "intelligence-processing unit".

In 2019 Intel bought an Israeli AI-chip startup called Habana Labs. Amazon Web Services (AWS), the e-emporium's cloud division, will soon start offering Habana's Gaudi accelerators to its customers. It claims that the Gaudi chips, though slower than Nvidia's GPUs, are nevertheless 40% cheaper relative to performance. Advanced Micro Devices (AMD), a veteran chipmaker that is Nvidia's main rival in the gaming market and Intel's in CPUs, is finalising a $35bn purchase of Xilinx, which makes another kind of accelerator chip called field programmable gate arrays (FPGAs).

A bigger threat comes from Nvidia's biggest clients. The cloud giants are all designing their own custom silicon. Google was the first, with its "tensor-processing unit". Microsoft's Azure cloud division opted for FPGAs. Baidu, China's search giant, has "Kunlun" chips for AI and Alibaba, its e-commerce titan, has Hanguang 800. AWS already has a chip designed for inference, called Inferentia, and one coming for training. "The risk is that in ten years' time AWS will offer a cheap AI box with all AWS-made components," says the former Nvidia executive. Mark Lipacis at Jefferies, an investment bank, notes that since mid-2020 AWS has put Inferentia into an ever-greater share of its offering to customers, potentially at Nvidia's expense.

As for the Arm acquisition, it is far from a done deal. Arm's customers include all the world's chipmakers as well as AWS and Apple, which uses Arm chips in iPhones. Some have complained that Nvidia could restrict access to the chip designer's blueprints. The Graviton2, AWS's tailor-made server chip, is based on an Arm design. Nvidia says it has no plans to change Arm's business model. Western regulators have yet to decide whether to approve the deal. Britain's competition authority, which had until July 30th to scrutinise it, is expected to be among the first to issue a ruling. China is unlikely to welcome an American takeover of an important supplier to its own tech firms, which is currently owned by SoftBank, a Japanese tech group.

Even if one of the antitrust watchdogs puts paid to the deal, however, Nvidia's prospects look bright. Intel has overpromised many things, including accelerated computing, for years, and has mostly not delivered. Venture capitalists have become markedly less enthusiastic about backing startups that are taking on Nvidia and its software, and the tech giants investing in accelerated computing, observes Paul Teich of Equinix, an American data-centre operator. As for AWS and the rest of big tech, they have other things on their plates and lack Nvidia's clear focus on accelerated computing. Nvidia says that, measured by actual use by businesses, it has not ceded market share to AWS's Inferentia.

Mr Huang says that it is the expense of training and running AI applications that matters, not the cost of hardware components. And on that measure, he insists, "we are unrivalled on price-for-performance." None of Nvidia's rivals possesses its software ecosystem. And it has a proven ability to switch gears and capitalise on good luck. "They're always looking around at what's out there," enthuses another former executive. And with an entrenched position, Mr Lipacis says, it also benefits from inertia.

Investors have not forgotten the plunge in Nvidia's share price in 2018. It may still be partly tied to the fortunes of the crypto market. Holding Nvidia stock requires a strong stomach, says Mr Rasgon of Bernstein. Nvidia may present itself as a pillar of the computing industry, but it remains an aggressive, founder-led firm that behaves like a startup. Sprinkle in some paranoia, and it will be hard to disrupt. ■

Carmakers and semiconductors

Pinned by chips

Carmakers are rethinking supply chains for the electric era

THE SUDDEN unavailability a decade ago of cars in "tuxedo black", "rugged brown" or "royal red" highlighted the vulnerability of the industry's global supply chain. The abrupt closure of the only factory making a vital pigment because of its proximity to the tsunami-hit Fukushima nuclear plant in Japan affected most of the world's big carmakers. A side-effect of a global pandemic has denied carmakers a more vital component.

A shortage of semiconductors has left car firms unable to install the electronics that control entertainment systems, safety features and driving aids. Many have cut assembly-line shifts. Some have temporarily closed factories. Ferdinand Dudenhöffer of the Center Automotive Research, a German think-tank, reckons the bottlenecks will dent forecast worldwide production in 2021 by 5.2m cars, to 74.8m.

Ford's net profit fell by half in the second quarter, year on year, mainly owing to the chip crunch. Jaguar Land Rover expects sales in the three months to September to be 50% lower than planned. On August 3rd Stellantis, created by the merger of Fiat Chrysler and PSA, which owns Peugeot and Citroën, said it would make 1.4m fewer cars in 2021 than expected. (A big Stellantis shareholder is a part-owner of *The Economist*'s parent company.) The next day General Motors warned the chip crunch will weigh on results in coming quarters. Though car bosses agree the worst is over, shortages are likely to dent output in 2022.

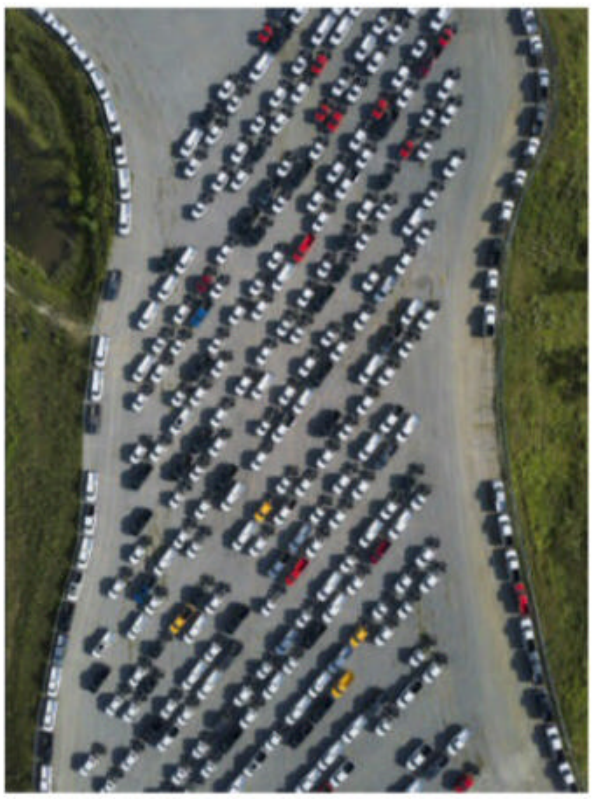
Expecting weak sales, in 2020 carmakers pared back orders of electronics, and then underestimated the rapidity of recovery this year. When the pandemic boosted demand from makers of electronic devices for those locked down at home, car firms found themselves low in the semiconductor pecking order: although they spent $40bn or so on chips in 2019, that accounted for only a tenth of global demand.

Established car firms also long ago outsourced development of most technology, including electronic subunits, to big suppliers. These "tier 1" suppliers, such as Germany's Bosch or Denso of Japan, buy circuit boards and microcontrollers to make components from suppliers in the next tier down, which in turn buy semiconductors from chipmakers. This has kept chip firms and car firms at arm's length. Deloitte, a consultancy, talks of a "lack of visibility up and down the value chain".

Carmakers' initial response has been to make more vehicles that require fewer chips, or to use the scarce resources to build their most profitable models. In the long run, the changing nature of the car will force them to think more creatively. Fully electric cars are packed with twice as many chips by value than fossil-fuelled ones, says KPMG, another consultancy. As Pedro Pacheco of Gartner, yet another firm of consultants, points out, software will become a significant source of profits as cars move from a disparate collection of chips to a centralised "brain" connected to the internet that can be updated remotely. In 2019 Tesla made an average of nearly $1,200 per vehicle from selling software updates, Mr Pacheco notes.

To ensure that the hardware woes don't stymie this ambition, carmakers may need to take another leaf from Tesla's book. The Californian firm has been designing its own chips since 2016, which lets it launch new software-enabled features quickly. Volkswagen's boss, Herbert Diess, has said that the German giant will develop its own chips and software for autonomous driving: "Software and hardware have to come out of one hand."

For now Volkswagen would like closer relations with chipmakers. So would its rivals. Few have the resources—or inclination—to design chips. Some will still need help developing their own software. Big suppliers, fearful of losing out as carmakers cosy up to chip firms, are being forced to up their game. Bosch, the world's biggest car-parts maker, has invested €1bn ($1.2bn) in a factory that will start to produce advanced chips for cars later this year. A hiccup over paintwork is one thing. As the industry braces for a more electric and electronic future, it can ill afford to leave its fate in someone else's hands. ■



Stuck without silicon

European industry

A green and level field

Europe's firms size up the prospect of a carbon tariff

SINCE THE EU launched its emissions trading system in 2005, industries have followed divergent greenhouse-gas trajectories. The power sector has cut them by half. Among cement- and steelmakers, which got free allowances for four-fifths of their exhausts to stop the shift of production abroad, they have barely budged.

The European Commission wants to end this handout. Last month the EU's executive arm proposed new rules to help the bloc meet its goal of cutting emissions by 55% from levels in 1990 by 2030. One proposal would withdraw free allowances for producers of aluminium, cement, fertiliser, iron and steel, and levy import tariffs on these products based on their carbon content. This "carbon border adjustment mechanism" (CBAM) aims to level the playing field. If Europe's steel mills must pay for the carbon they spew, so will their Chinese rivals selling to the EU.

The EU plan is just that for now. It needs the nod from the European Parliament and member states. China says it violates World Trade Organisation rules; others may challenge it. If enacted, CBAM would not start until 2026 and take a decade to roll out. Still, it is a test case that governments and firms elsewhere will study.

ICIS, a research firm, predicts that by 2030 CBAM-covered companies will receive 145m fewer tonnes of annual allowances than they would have done. That adds up to about €12bn ($14.2bn) a year, or 2% of the newly covered sectors' sales, according to the commission's forecasts. Four-fifths of the burden will fall on steel and cement.

Heavy industry may pass the costs of CBAM to EU firms that use the carbon-intensive inputs. The commission estimates this impact to be modest, with a slight dip in employment. Not everyone agrees. Farmers and unions are furious. Pekka Pesonen, head of Copa Cogeca, a farmers' lobby, says that fertilisers account for about 35% of the cost of crops such as wheat. The CBAM would thus make it harder to compete with cheaper foreign grain. And the costs will be hard to pass on, because consumers are reluctant to pay more for low-carbon products, says Mr Pesonen. ▸▸

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Firms' reaction has been mixed. Many profess to support the energy transition but gripe about the rules. Others, including LafargeHolcim, a Swiss cement giant, say they welcome them. Still, Cédric de Meeûs of LafargeHolcim notes that although cement-makers do not now pay for all their pollution, the rising price of carbon in Europe makes EU-made cement pricier than foreign stuff. As a result, the bloc imported 25% more cement in 2020 than in 2019.

Some trade groups are responding by lobbying lawmakers. With some success: in March the European Parliament passed a non-binding vote to keep the free allowances. Others will hedge by buying extra allowances when carbon prices are low, as power companies now do routinely.

A few are reacting as the plan intended: by trying to decarbonise. In May Thyssenkrupp of Germany teamed up with the Port of Rotterdam to import renewable hydrogen to make green steel. Antoine Vagneur-Jones of BloombergNEF, a research firm, identifies 24 small-scale hydrogen projects in the CBAMed sectors.

Decarbonisation is costly. Mr de Meeûs says that making cement with a third less carbon adds some 15% to the cost. ArcelorMittal, the world's biggest steelmaker and one of Europe's largest emitters, expects to invest an extra $10bn to cut carbon by 2030. That could raise its capital spending by a third. But the firm also expects governments to cough up a similar amount. Its boss, Aditya Mittal, noted recently that renewable-energy firms enjoyed support from politicians. Other executives call for infrastructure, such as pipelines to funnel captured carbon dioxide from factories, as well as financial aid. The EU may need more carrots to go with its new stick. ■

Bartleby The new monarchs

How chief executives behave like medieval kings

In the early 15th century many of the Portuguese voyages of discovery around Africa and into Asia were financed by Prince Henry of Portugal, whom historians dubbed "Henry the Navigator". When Christopher Columbus sought finance for his planned westward voyage to the "Indies", he first turned to the king of Portugal before achieving success with Ferdinand and Isabella of Spain. Monarchs financed explorations because they believed such trips would boost their power and their treasuries.

In the 21st century corporate executives have become deeply involved in adventure and exploration. Sir Richard Branson of Virgin and Jeff Bezos of Amazon have just travelled to the edge of space. Elon Musk of Tesla has developed the SpaceX programme and is talking of the eventual colonisation of Mars. Messrs Musk and Bezos competed for the contract to operate future Moon landings. Mr Bezos even offered to part-finance the project.

In itself, this is a remarkable development. Sixty years ago, when the space race was between America and the Soviet Union, few could have imagined that individual businessmen would ever have the resources to enter the fray. The shift says something about the extremes of wealth in the 21st century.

The resemblance to absolute monarchs does not stop with exploration. Like past rulers, modern tycoons build their own monuments in the form of corporate headquarters, not just skyscrapers in London and New York but the vast, low-rise campuses in Silicon Valley. Whereas the ancient dynasts travelled in horse-driven coaches, modern CEOs separate themselves from the public in chauffeur-driven limos and private jets.

Like monarchs of old, executives have to deal with rival sources of power. They face the equivalent of feudal barons, in the form of boards of directors who may try to unseat them. And they need to contend with ambitious princelings, who in the modern era are younger executives who would like their job. The good news is that whereas an unseated monarch was likely to be executed, a dethroned boss can enjoy a generous pay-off.

Then there is their ability to control time. At the court of Louis XIV, France's "Sun King", the rhythm of the day was entirely devoted to the monarch's habits, with the luckiest courtiers watching him get dressed, have lunch and go to bed. Modern CEOs also have the ability to change the schedules of those around them. If he or she gets up at 5am to send messages, someone on the staff will feel obliged to rise early and answer them. Similarly, if the CEO likes to hold Zoom conferences on weekends, or have working dinners on a Friday night, the family life of subordinates will suffer.

Another parallel with monarchs is a tendency towards arrogance. In his book "Fall", John Preston recounts that when Robert Maxwell, the publishing tycoon, was dissatisfied with his food, he would sometimes sweep the plate on to the floor and leave others to clear it up. Maxwell also bugged the phones of his staff and listened to their conversations, which also recalls Louis XIV, who intercepted the mail of his courtiers.

Lavish entertainment is a further common denominator. Monarchs held elaborate balls and competed to show off their wealth. Modern tycoons pay rock stars to perform at their birthdays. Carlos Ghosn, the boss of Nissan, even held an extravagant party at the Sun King's former digs in Versailles.

Royal dynasties added to their empires through both military conquest and strategic marriages. Modern executives achieve the same effect through mergers and acquisitions, using their financial clout to buy smaller rivals and reduce the threat of disruptive competition. In effect, ancient monarchs were monopoly providers of security services, who received payment in the form of taxation and conscription. Their abiding sin was too much ambition; Philip II of Spain's military overreach in battling England and the Netherlands was followed by the country's steady decline as a global power, for example.

The same trap awaits modern tycoons. Often they make the mistake of taking on too much debt by acquiring businesses that do not mesh with the rest of the enterprise. Or, like many an ancient ruler, they make the mistake of fighting on two fronts. Space-obsessed Mr Bezos is still executive chairman of Amazon. Mr Musk is trying to make both rockets and Tesla cars. The greatest danger to monarchs may come when they seem at the height of their powers.

Schumpeter | India's other A-lister

The many sides to Gautam Adani

ONCE UPON a time, long before the hoodie was invented, pioneers of business preferred to call themselves self-made men rather than entrepreneurs. They built hard assets like ports, railways and oil terminals. They cajoled—and canoodled with—governments. They built vast conglomerates. In America, such men made history in the Gilded Age. In India, one of their modern-day avatars is Gautam Adani, a trader who started his career haggling for diamonds, and now controls more ports, power stations, solar farms and airports than almost any other private tycoon. A thick-set 59-year-old of few words, a strong political antenna and a stomach for debt, he could not be further removed from the elfin founder-CEOs of the digital age. And yet as recently as June, the value of his companies had more than quintupled in 12 months, to $133bn. That is tech-like growth from what is normally one of the stodgiest parts of the old economy—infrastructure.

In India's "Billionaire Raj", Mr Adani is usually overshadowed by the other "A", Mukesh Ambani, India's richest man, who controls Reliance Industries, a petrochemicals-to-phones conglomerate. Yet Mr Adani, whose personal net worth almost caught up with Mr Ambani's in June, is just as intriguing—not least for some of the contradictions he embodies. In a country whose banks have lost fortunes lending to infrastructure projects, his debt-fuelled acquisition spree has gone from strength to strength. He is a champion of Prime Minister Narendra Modi's drive for self-reliance, yet relatively few of his firms' shares are owned by Indian institutional investors. And he courts environmental, social and governance (ESG) funds from around the world, yet parts of his empire are knee-deep in coal. Anyone who can sustain such a precarious juggling act probably deserves to make history, too.

The Adani Group's interests have dovetailed with the economic ambitions of Mr Modi's government. For instance, since listing in 2018, the share price of Adani Green Energy (AGEL), its renewables company, has soared by over 2,700%. As well as building what it reckons is the world's biggest solar-power company, it is helping Mr Modi achieve his clean-energy ambitions. And Mr Adani is not afraid of bold bets to win government contracts. Take Adani Enterprises (AEL), another listed entity, for instance. In 2018-19 it scooped up six privatised Indian airports, despite no previous experience in the industry. Since then (and despite the blight on air travel caused by the covid-19 pandemic) its stockmarket value has eclipsed that of Adani Ports, historically the group's crown jewel.

This expansion is not as reckless as it seems. Adani Group touts an "adjacency model" in which it moves into complementary areas: from ports to power to logistics to data storage, for example. Its debts are backed by rising cashflows. It has stepped up reliance on bond markets, rather than India's ropy banks. And it has brought foreign groups, such as TotalEnergies, the French supermajor, and Qatar's sovereign-wealth fund, into joint ventures. The government, not overly keen on foreign competition in India, welcomes these sorts of capital inflows as much as Mr Adani does.

Its financing creates a paradox, though. While the group attracts foreign funding for businesses that are focused squarely on India, ordinary Indian investors barely get a look-in. Besides the flagship ports business, domestic mutual funds hold minuscule amounts of its other listed entities, including those whose share prices have shot up of late, such as AGEL and AEL. The group says such shareholdings should widen "in the near future", explaining that the small free floats are a result of relatively recent listings.

But in the meantime, questions about the group's arcane shareholding structure have helped wipe tens of billions of dollars off the combined value of its six listed entities since mid-June. Besides Mr Adani, who has huge stakes in all his listed companies, most of the remaining large investors are offshore funds, including some based in Mauritius. Some have almost all of their investments in Adani Group companies, and questions about their ownership have been raised in parliament. In response, a government minister said last month that the Securities and Exchange Board of India, the capital-markets regulator, was investigating some of the group's companies. Adani Group said it had always been transparent with its regulators, and had received no information requests recently.

The group's hunger for capital creates a further conundrum. Increasingly it is peddling its clean-energy businesses to ESG fund managers. Yet AEL owns Carmichael, an Australian thermal-coal mine that has been the target of a grassroots "Stop Adani" campaign, and has been shunned by banks and insurers worried about the climate implications of funding coal projects. Tim Buckley of the Institute for Energy Economics and Financial Analysis, a pro-renewables think-tank, reckons that the coal exposure could cause an ESG backlash hurting other parts of the Adani empire. He argues that to bolster its ESG reputation, the conglomerate should commit to phasing out coal power.

Nice present, bleak future

Mr Adani appears to have no plans for that yet. He believes a developing country like India cannot give up coal overnight. The group still intends to produce 30% of the gross operating profit of its utility businesses from thermal power generation in 2025 (it was 52% last year). When Carmichael produced its first lump of coal in time for Mr Adani's birthday on June 24th, he tweeted: "There couldn't be a better birthday gift."

Perhaps he recognises that foreigners, sustainable pretensions notwithstanding, find India irresistible, especially with investment in China in the doldrums. Perhaps he hopes that they will flock to giants like Adani, not least because of its knack for coping with India's bureaucracy. Yet if they do, the group faces a problem. The stronger it becomes, the more unsavoury it will seem that few ordinary Indian shareholders are sharing in the upside. ■

A crypto stress test

The disaster scenario

What if bitcoin went to zero?

THE RECENT expansion of the crypto-universe is a thing of wonder. Only a year ago there were about 6,000 currencies listed on CoinMarketCap, a website. Today there are 11,145. Their combined market capitalisation has exploded from $330bn to $1.6trn today—roughly equivalent to the nominal GDP of Canada. More than 100m unique digital wallets hold them, about three times the number in 2018.

Holders have become more sophisticated and deep-pocketed, too. Institutions account for 63% of trading, up from 10% in 2017 (see chart 1 on next page). SkyBridge Capital, a hedge fund run by Anthony Scaramucci, provides an illustration. Its diversified $3.5bn fund began investing in crypto in November, and it launched a $500m bitcoin fund in January. The exposure of its 26,000 clients, which range from rich individuals to sovereign funds, is rising. Bitcoin now accounts for 9% of the value of its main vehicle, up from 5%, and the dedicated fund is worth around $700m.

This maturing, however, has failed to tame the wild gyrations that characterise crypto markets. Bitcoin sank from $64,000 in April to $30,000 in May. Today it hovers around $40,000, having dipped to $29,000 as recently as July 29th. Every downward lurch raises the question of how bad the fallout might be. Too much seems at stake for the cryptocurrency to collapse—and not just for the die-hards who see bitcoin as the future of finance. Algorithmic traders now conduct a hefty share of transactions and have automatic "buy" orders when bitcoin falls below certain thresholds. Still, in order to grasp the growing links between the crypto-sphere and mainstream markets, imagine that the price of bitcoin crashes all the way to zero.

A rout could be triggered either by shocks originating within the system, say through a technical failure, or a serious hack of a big cryptocurrency exchange. Or they could come from outside: a clampdown by regulators, for instance, or an abrupt end to the "everything rally" in markets, say in response to central banks raising interest rates.

There are three types of crypto investors, says Mohamed El-Erian of Allianz, an insurer and asset manager: "fundamentalists", who believe bitcoin will replace government-issued currencies one day; "tacticians", who reckon its value will rise as more people invest in it; and "speculators", who want to gamble. Though a crash would come as a monumental upset to the first group, it is least likely to sell out; the third, meanwhile, will flee at the first sign of trouble. To avoid a terminal stampede, the second group must be persuaded to stay. It is unlikely to do so if the price falls to zero.

A crash would puncture the crypto economy. Bitcoin miners—who compete to validate transactions and are rewarded with new coins—would have less incentive to carry on, bringing the verification process, and the supply of bitcoin, to a halt. Investors would probably also dump other cryptocurrencies. Recent tantrums have shown that where bitcoin goes, other digital monies follow, says Philip Gradwell of Chainalysis, a data firm.

The result would be the destruction of a significant amount of wealth. Long-term holders would suffer small losses relative to the price they paid, but cede huge unre-

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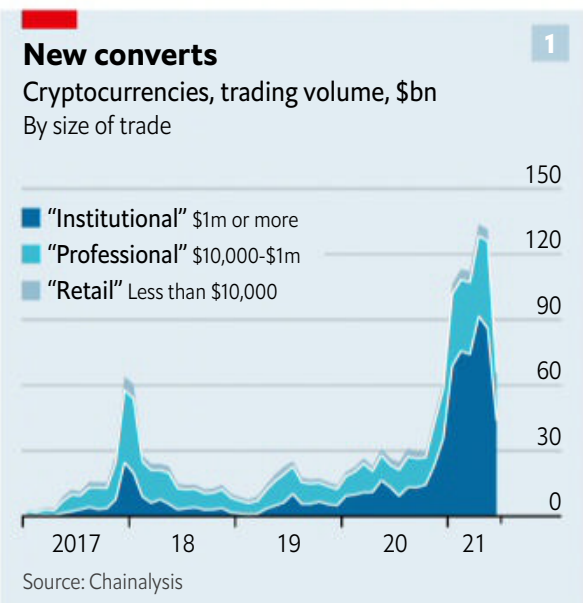
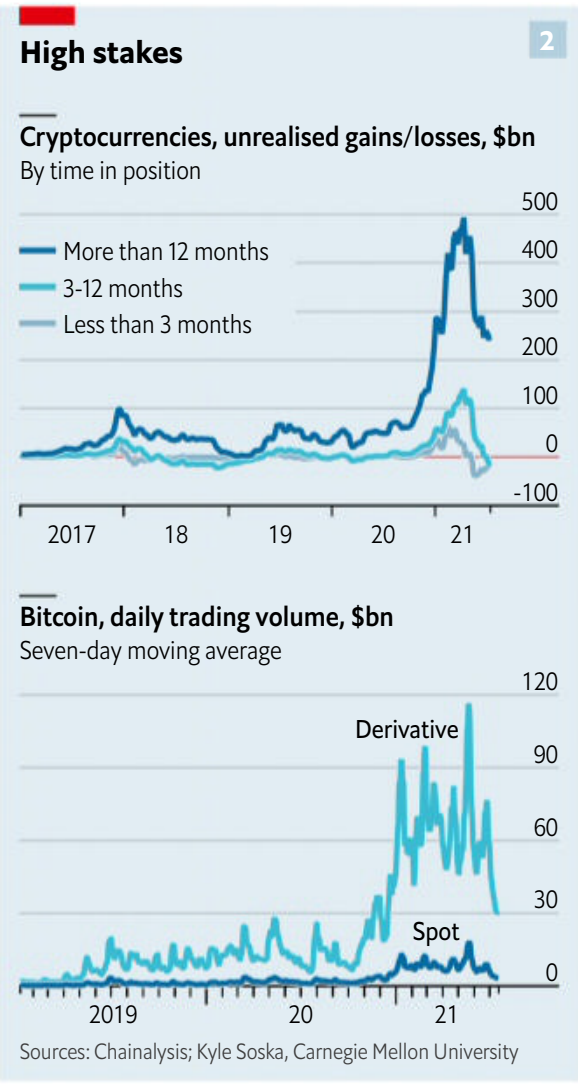
alised gains (see chart 2). The biggest losses relative to the purchase price would fall on those who bought less than a year ago, at an average price of $37,000. That would include most institutional investors exposed to crypto, including hedge funds, university endowments, mutual funds and some companies.

The total value erased would go beyond the market capitalisation of digital assets. A crash would also wipe out private investments in crypto firms such as exchanges ($37bn since 2010, reckons PitchBook, a data provider) as well as the value of listed crypto firms (worth about $90bn). Payments companies like PayPal, Revolut and Visa would lose a chunk of growing, juicy business, which would dent their valuations. Others that have ridden the crypto boom, such as Nvidia, a microchip-maker (see Business section), would also take a hit. All in all, perhaps $2trn might be lost from this first shockwave, a little more than the market capitalisation of Amazon.

Contagion could spread through several channels to other assets, both crypto and mainstream. One channel is leverage. Fully 90% of the money invested in bitcoin is spent on derivatives like "perpetual" swaps—bets on future price fluctuations that never expire. Most of these are traded on unregulated exchanges, such as FTX and Binance, from which customers borrow to make bets even bigger. Modest price swings can trigger big margin calls; when they are not met, the exchanges are quick to liquidate their customers' holdings, turbocharging falls in crypto prices. Exchanges would have to swallow big losses on defaulted debt.

The rush to meet margin calls in cryptocurrency—the collateral of choice for leveraged derivatives—could force punters to dump conventional assets to free up cash. Alternatively, they might give up trying to meet those calls since their crypto holdings would no longer be worth much, triggering liquidations. Meanwhile, other types of leverage exist, where regulated exchanges or even banks have lent dollars to investors who then bought bitcoin. Some have lent dollars against crypto collateral. In both cases borrowers nearing default might seek to liquidate other assets.





The extent of leverage in the system is hard to gauge; the dozen exchanges that list perpetual swaps are all unregulated. But "open interest", the total amount in derivatives contracts outstanding at any one time, provides an idea of the direction of travel, says Kyle Soska of Carnegie Mellon University. It has grown from $1.6bn in March 2020 to $24bn today. This is not a perfect proxy for total leverage, as it is not clear how much collateral stands behind the various contracts. But forced liquidations of leveraged positions in past downturns give a sense of how much is at risk. On May 18th alone, as bitcoin lost nearly a third of its value, they came to $9bn.

A second channel of transmission comes from the "stablecoins" that oil the wheels of crypto trading. Because changing dollars for bitcoin is slow and costly, traders wanting to realise gains and reinvest proceeds often transact in stablecoins, which are pegged to the dollar or the euro. Such coins, the largest of which are Tether and USD coin, are now worth more than $100bn. On some crypto platforms they are the main means of exchange.

Issuers back their stablecoins with piles of assets, rather like money-market funds. But these are not solely, or even mainly, held in cash. Tether, for instance, says 50% of its assets were held in commercial paper, 12% in secured loans and 10% in corporate bonds, funds and precious metals at the end of March. A cryptocrash could lead to a run on stablecoins, forcing issuers to dump their assets to make redemptions. In July Fitch, a rating agency, warned that a sudden mass redemption of tethers could "affect the stability of short-term credit markets". Officials from America's Securities and Exchange Commission and the Federal Reserve are paying closer attention to the risks from cryptocurrencies, and stablecoins in particular (see next story).

A cryptocalypse could affect broader sentiment even beyond fire sales. The extent of this is unclear: more entities are now exposed to cryptocurrencies, but few have staked big shares of their wealth on them, so losses would be widespread but shallow. Crucially, banks are immune; and most will not rush to hold bitcoin on their balance-sheets any time soon. The Basel club of supervisors recently proposed making banks fund their bitcoin holdings with only capital, not debt.

But a worse case is not hard to imagine. Low interest rates have led investors to take more risk. A crypto collapse could cause them to cool on other exotic assets. In recent months the correlation between bitcoin prices and meme stocks, and even stocks at large, has risen. That is partly because punters reinvest gains made on faddish stocks into crypto, and vice versa.

A sell-off would begin with the most leveraged punters—typically individuals and hedge funds—in high-risk areas: meme stocks, junk bonds, special-purpose acquisition vehicles. Investors exposed to these, facing questions from their investment committees, would follow in turn, making risky assets less liquid, and perhaps provoking a general slump. If that sounds improbable, remember that the S&P 500, America's main stock index, fell by 2.5% in a day after retail punters' infatuation with GameStop, a video-game retailer, wrong-footed a few hedge funds.

For general market turmoil to ensue, then, you would need a lot of things to go wrong, including the price of bitcoin to fall all the way to zero. Still, our extreme scenario suggests that leverage, stablecoins, and sentiment are the main channels through which any crypto-downturn, big or small, will spread more widely. And crypto is only becoming more entwined with conventional finance. Goldman Sachs plans to launch a crypto exchange-traded fund; Visa now offers a debit card that pays customer rewards in bitcoin. As the crypto-sphere expands, so too will its potential to cause wider market disruption. ■

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Policing crypto

Here comes the sheriff

The SEC sets its sights on the crypto "Wild West"

When Gary Gensler took over as the head of America's Securities and Exchange Commission (SEC) in April, he might have seemed pretty crypto-friendly. Only months before he had taught a course on cryptocurrencies at the Massachusetts Institute of Technology; he has said that the innovation associated with bitcoin will be a "catalyst for change" in finance. Yet, speaking at the Aspen Security Forum on August 3rd, he probably dashed the hopes of crypto buffs. He signalled that he would seek tougher policing of the crypto-sphere, which he described as "rife with fraud, scams and abuse".

Mr Gensler offered the most fleshed-out vision yet for how the SEC might regulate cryptocurrencies. These tokens, he said, were not a means of exchange but "highly speculative stores of value". That in itself was not a problem—investors should be left to gamble should they wish to. But punters often could not access "rigorous, balanced and complete information", meaning a lot of them could be hurt.

That calls for greater investor protections, which fall into three broad buckets. The first relates to what the SEC already does. The regulator claims jurisdiction over the crypto assets that it defines as securities; issuers of these must provide disclosures and abide by other rules. The SEC's definition uses a number of criteria, including the "Howey Test", which asks whether investors have a stake in a common enterprise and are led to expect profits from the efforts of a third party. Bitcoin and ether, the two biggest cryptocurrencies, do not meet this criterion (they are commodities, under American law). But Mr Gensler thinks that, among the 1,600 tokens with at least $1m in market capitalisation, a fair few probably count as securities—and do not follow the rules. These, he said, may include stablecoins, virtual monies pegged to conventional money, some of which may represent a stake in a crypto platform. Mr Gensler asked Congress for more staff to police them.

The second bucket covers work in progress: areas where Mr Gensler's team is considering how to treat new products being brought to market. For months the SEC has sat on applications for bitcoin ETFs and related products, filed by big Wall Street names like Goldman Sachs and Fidelity. Mr Gensler hinted that, in order to be approved, these may have to comply with the stricter laws governing mutual funds. The strictures could prove too costly and rigid for firms hoping to list vehicles. (Mr Gensler did signal openness to narrower ETFs focused on bitcoin futures that trade on the Chicago Mercantile Exchange.)

The last bucket comprises new powers that the SEC will seek from Congress so as to prevent transactions and products "falling between regulatory cracks". Mr Gensler is chiefly concerned with platforms engaged in crypto trading or lending as well as in decentralised finance (DeFi), where smart contracts replicate financial transactions without a trusted intermediary. Some of these, he said, may host tokens that should be regulated as securities; others could be riddled with scams.

Mr Gensler is not the first to toughen up on crypto, though his attack is perhaps the most comprehensive. Other officials have focused mainly on stablecoins, which back their issuance with heaps of conventional assets. Jerome Powell, the chairman of the Federal Reserve, has hinted that these should be regulated as money-market funds or even banks. Janet Yellen, America's treasury secretary, has urged the quick adoption of rules. The sheriff may be out in front, but the cavalry is not far behind. ■

Perishable e-money

Temporary income hypothesis

HONG KONG

Will Hong Kongers use it or lose it?

"If you want to see how the free market really works this is the place to come," said Milton Friedman in "Free to Choose", his 1980s TV series. He was sitting on a cross-harbour ferry in Hong Kong. The city, he said, was an "almost laboratory experiment in what happens when government...leaves people free to pursue their own objectives".

This week the same city began another experiment: not merely leaving people free to pursue their own objectives, but giving them free money to pursue their own purchases. On August 1st Hong Kongers received the first instalment of the government's consumption voucher, an effort to revive the city's hard-hit retail industry. The amounts are generous (HK$5,000 or $640) and the distribution is slick. The money is added to a person's Octopus card (widely used in shops and on public transport) or paid into e-payment apps, such as Alipay. Shops are now vying for their customers' unearned dollars. The Mira hotel, where Edward Snowden revealed America's secrets to the world, is offering 75% off a romantic "staycay". Unlike ordinary cash handouts, these e-vouchers must be spent within a few months. Otherwise they will "expire".

Milton's paradise

So will Hong Kongers use it or lose it? Similar experiments have had mixed results. After South Korea provided perishable vouchers in May 2020, only 36% of households said they had raised their retail spending (and some of them cut spending of other kinds). After Taiwan distributed physical vouchers in 2009, most people spent them on things they would have bought anyway, according to Kamhon Kan of Academia Sinica in Taipei and his co-authors. Only about a quarter used them for unplanned purchases, making them no more effective than America's more conventional tax rebates in 2008.

These shortcomings would not surprise proponents of the "permanent-income hypothesis", who argue that households will try to smooth their consumption over time, spending a fraction of their estimated lifetime wealth. In these models, windfall gains are largely squirrelled away. Hong Kongers cannot set aside their voucher money without losing it. But the windfall nonetheless lets them save more of their ordinary money because they do not have to spend it on the stuff they are buying with their vouchers.

The originator of the permanent-income hypothesis was none other than Milton Friedman. If Hong Kong's new experiment is to work as well as the government hopes, one of his most cherished cities will have to overcome one of his most celebrated theories.

China's capital markets

Evergrave

HONG KONG

As more big firms flirt with default, financial regulators face a dilemma

A DOCUMENT CIRCULATING among Chinese banks in early July has caused unease among investors and local officials. Known as "Document No. 15", the regulatory directive says that banks should stop lending to heavily indebted local-government financing vehicles (LGFVs), companies set up by city or provincial governments to finance building projects and public works. The groups, which have not so far been allowed to default, have about 48.7trn yuan ($7.5trn) in debts, 11.9trn yuan of which is held in fixed-income securities. They routinely use bank loans to pay interest on bonds. Ending the steady stream of credit is a recipe for turmoil. "If banks don't give them a blood transfusion", a local investor told Chinese media, "LGFVs will face a default crisis."

Then the circular vanished, along with most references to it in state media. Some investors believe it may have been released prematurely and that another, less severe version will eventually replace it. Others say banks are carrying out the orders, but fear that the first LGFV default will unleash chaos in the bond market, of which securities issued by LGFVs make up about 10%.

Such is the dilemma China's financial regulators face. They must stop poorly managed groups from hogging capital and allow the worst of them to fail. But they must do so without causing panic or cutting off healthy companies' access to finance. LGFVs are just one of many cases testing their resolve.

Defaults in China's onshore bond market have climbed to a record, with companies missing payments on about 97bn yuan in principal in the first half of 2021, up by almost 50% compared with the same period last year, according to Wind, a data provider. China Fortune Land defaulted on a $530m bond in February, in what was the country's largest-ever default by a property developer; Chongqing Energy Investment, a state-run firm that produces most of the city of Chongqing's coal, defaulted in March, denting confidence in local authorities' support for state-owned groups.

More worrying, however, are the size and profile of some struggling companies. Defaulting groups had on average about 1bn yuan in outstanding onshore bonds in 2015, a year after China experienced its first default in recent times. That figure has climbed to nearly 9bn yuan this year, reckons S&P, a rating agency. Evergrande, a troubled property giant, is on the hook for more than $100bn in interest-bearing offshore and onshore debt. A series of missteps and growing regulatory pressure has led to a collapse in investor confidence. Its offshore bonds have traded at less than 50 cents on the dollar, indicating that many investors expect a default.

Groups controlled by the central government used not to be allowed to face collapse. But now Huarong, a state asset manager with more than $40bn in offshore and onshore debt, seems to be in trouble. Once among the most powerful financial conglomerates in China, it has not published its results for 2020, leading investors to guess at the poor shape of its books and bet on its demise.

These risks threaten to shatter the calm portrayed by technocrats in Beijing. But regulators may be more willing to countenance defaults than they were in the past. They have seized control in two key areas that make defaults easier. One is a tighter grip over unruly companies owned by municipal and provincial governments. Upon defaulting these groups were often allowed to make inside deals that benefited well-connected creditors but excluded others. Investors involved in such situations say that this is changing.

Take, for instance, the default of Yongcheng Coal in November. A probe after the default showed that the company had shifted assets round in an attempt to pay less to some creditors. Regulators promptly stepped in to make clear to all investors, including foreign ones, that accounting tricks would not stop the company from paying out as much as it could. That lessened investors' concerns about how they might be treated in a default and, crucially, kept markets liquid even as more firms face distress.

Regulators have also grabbed more control over the restructuring process. State-backed restructurings used to be mired in opacity. That has changed; after Peking University Founder Group (PUFG), a conglomerate linked to China's top university, defaulted in 2019, many of the terms of its restructuring were made public. A deal was worked out in just 581 days, compared with an average of 679 in China, noted S&P. After a court-led restructuring, the recovery rate on PUFG's assets was 31.4%, beating the average recovery rate of 23.7% in 50 other Chinese restructuring deals. Such efficiencies are attracting more market-based investments and reducing the need for state-mandated ones, says Charles Chang of S&P.

These cases will guide officials as they take on more daunting problems. If Evergrande's woes persist, many investors believe it could be allowed to default and move into restructuring. Huarong, with its sprawling business, is seen as carrying more systemic risk than Evergrande, says Edmund Goh of Aberdeen Standard Investments. This means a state-brokered bailout, as opposed to a market-based one, could lie ahead.

LGFVs may pose the biggest risk of all. The first default "is going to cause a lot of market turbulence", says Larry Hu of Macquarie, an investment bank. If regulators enforce Document No. 15, a bellwether default could take place in the coming months. A softer stance, by contrast, would suggest that they are not quite ready to face up to the challenge. ■

Getting the house in order

Free exchange | Something ventured

America's roaring recovery might teach economists more about recessions

A COMMITTEE OF eight prominent economists made it official on July 19th. The covid-19 recession, America's deepest since the Depression, was also its shortest, spanning just March and April 2020. That tests the very definition of a recession, which the National Bureau of Economic Research describes as "a significant decline in economic activity that is spread across the economy and lasts more than a few months". A recession it was judged nonetheless, given its breadth and extraordinary depth. The plunge in output in the second quarter of 2020 was more than three times the second-largest quarterly drop in America's post-war history.

The rebound in GDP, thankfully, has been comparably dramatic. The 33.8% annualised rate of growth notched in the third quarter of 2020 was about twice as fast as the second-best quarterly performance in the post-war era. As the Bureau of Economic Analysis reported on July 29th, output overtook its pre-pandemic level in the second quarter of this year. Though unique in some ways, this unfolding recovery resembles past recoveries in other important respects. It may prove similar enough to help economists gain a better understanding of what policy can achieve in the face of hardship.

Recent American recoveries have tended to be "jobless", meaning that labour markets have taken far longer to regain lost ground than has overall production. During the seven recessions from 1948 to 1980, it took an average of about five quarters for GDP to surpass its previous peak. Employment took only a little longer to recover: six quarters on average. From the 1980s onwards, however, the recovery in employment began to lag behind that in output. Across the four downturns preceding the covid-19 crisis, GDP regained its peak in just six quarters, on average. But employment did not pass its previous high for a full 15 quarters.

It is not quite right, of course, to call today's recovery jobless. About 22m jobs were lost between February and April 2020, and 15.6m have since been added back. (Payroll figures for the month of July were due to be released on August 6th, after *The Economist* went to press.) Still, hiring is once again lagging behind GDP. Though output reached a new high in the second quarter, employment remained more than 4% below its pre-pandemic level. Moreover, the resulting jump in the level of output per worker over the course of this recovery looks remarkably similar to that which followed the global financial crisis (see chart). At present, America is producing more output than it managed just a year and a half ago, with roughly 7m fewer workers.

This would seem to suggest that productivity has leapt across the economy. It may well have done. The pandemic has forced many firms to experiment with new technologies and working patterns and favoured some business models over others. The effect on output per worker in some sectors has been dramatic: labour productivity in retail trade jumped by nearly 8% in 2020, for example. The surge in output per worker also reflects the changing mix of the workforce. Employment in the leisure and hospitality industries, where productivity tends to be low, remains about 13% below the pre-pandemic level, compared to a 4% shortfall in the higher-productivity manufacturing sector.

That productivity-boosting restructuring might accompany a period of economic stress is hardly surprising. In work published in 2012, for instance, Nir Jaimovich of the University of Zurich and Henry Siu of the University of British Columbia analysed the destruction of "routine" jobs—work that follows simple procedures and is thus highly susceptible to automation or outsourcing—and found its incidence to be concentrated around recessions. Furthermore, the researchers noted, the destruction of routine work in recessions seems to account for much of the joblessness of economic recoveries since the mid-1980s. But output per worker eventually stagnated over these plodding recoveries, perhaps because low-wage service-sector work only slowly expanded to absorb the lingering pool of unemployed labour.

The present recovery might reveal whether a more forceful policy response can yield a different outcome. By contrast with past recoveries, this one has been positively blistering, thanks to a burst of deficit spending rivalled only by that during the second world war. Over the first four quarters of the recovery, output rose by just over 12%. Rapid growth is expected to continue; the IMF, for instance, projects that GDP will rise by an impressive 7% in 2021 as a whole, and by a further 5% in 2022.

Push it

How might the future path of jobs and productivity evolve as a result? One scenario is that, powered by stimulus, the economic expansion remains rapid, but that early gains in productivity fail to be preserved. Consumer demand would shift back towards labour-intensive services, leading to frantic hiring. The result would be a jobs-rich recovery, but a productivity-poor one. Were the economy to grow as projected by the IMF and output per worker to fall back to pre-pandemic levels, then employment would rise towards 166m by the end of 2022, compared with 146m today. That would mean there were some 14m more jobs than in February 2020, when the unemployment rate stood at 3.5%.

Another possibility looms, however. Perhaps growth in expanding, high-productivity industries, which can afford to pay higher wages, will continue, leaving fewer people willing to fill low-productivity, low-wage service-sector jobs. Where past jobless recoveries might have encouraged the creation of more low-wage services jobs, a faster expansion today might break the link, perhaps forcing employers in these industries to automate instead. America would enjoy a jobs-rich recovery while also emerging from the pandemic structurally changed, with a permanent increase in its level of productivity.

Wishful thinking, perhaps. But whatever the outcome, America's spending will have purchased a faster recovery and new information about how best to ease the pain of a recession. And it might just have gained a productivity boost. ■

Cells and how to run them

Layers of power

Cells are the basic units of life, and provide it with the mechanisms through which food and sunlight are turned into usable energy

THE CHEMICAL reactions on which life depends need a place to happen. That place is the cell. All the things which biology recognises as indisputably alive are either cells or conglomerations of cells (viruses fall into disputable territory). Since the middle of the 19th century the cell has been seen as the basic unit of life.

A cell requires something to keep its insides in and the outside out. That is the role of the cell membrane, a flexible film made largely of lipids. These are smallish tadpole-shaped molecules with heads that are comfortable in water and twin tails that shun it. When put into a watery solution they naturally form double layers in which the water-tolerant heads are on the outside and the water-wary bits on the inside. Some plant, fungal and bacterial cells employ more rigid structures, called cell walls, as further fortifications beyond their membranes. But it is the membrane which defines the cell.

What is more, the disposition of membranes determines what sort of cell it is. Some creatures use membranes chiefly to define their perimeters. These are called prokaryotes, and come in two varieties, bacteria and archaea. In others they are also used to create structures within cells, notably a nucleus to contain the DNA on which genes are written. Such cells may have ten or 20 times more membrane within them than they have defining their surfaces. They are called eukaryotic, Greek for truly nucleated. Creatures made from them are eukaryotes.

The world's prokaryotic cells vastly outnumber their eukaryotic cousins. Your own body has roughly as many single-celled prokaryotes living on and inside it (mostly in the gut) as it has eukaryotic cells making up muscles, nerves, bones, blood and so on. Some parts of Earth's biosphere, such as the ocean floors, contain more or less nothing but prokaryotic life.

But almost everything you have ever looked at and recognised as alive—all the animals, plants, fungi and algae—has been composed of eukaryotic cells. Such cells are typically a lot larger than almost all prokaryotic ones and are capable of a far greater diversity in both form and function. Their versatility is seen in the wide range of shapes they take, from the conjoined starbursts of nerve cells to the creeping mutable blobbiness of amoebae.

Even prokaryotic cells, though, are big compared with the molecules they contain. A bacterium two millionths of a metre long encompasses around 3m protein molecules as well as the DNA which describes them, the RNA necessary to make use of those descriptions and the various smaller molecules that proteins stick together and break apart in the course of their duties (see previous Biology brief). The membrane of such a bacterium, moreover, contains around 20m lipid molecules.

But if you were to synthesise all the molecules found in that bacterium in a laboratory (quite possible, in theory) and pop them into a bacterium-sized bag you would not get a bacterium. You would get an itsy bitsy mess. A cell is not just a set of contents. It is also a set of processes running alongside each other. The only way to create a cell in which all the necessary processes are up and running is to start off with another such cell in which they are already doing so.

Feed a bacterium with the nutrients it needs and as it grows it will synthesise a copy of the DNA molecule on which its genome is stored. When it is big enough to have made a complete copy of that DNA it will split into two, with one DNA ending up in one cell, and the other in the other.

As it is for bacteria, so it is, *mutatis mutandis*, for all other life, for ever and ever, amen. Life is made of cells, and cells from pre-existing cells. The 30 trillion cells of which a human body is composed can in almost every case be traced back to the single fertilised egg which started it all (the exception is a condition known as chimerism in which two embryos fuse in the womb early on in development).

Of all the processes that continue from cell to cell as life goes on, none is more fundamental than those which provide life's ▸▸

→ In this series on the levels of life
1 Biology's big molecules
2 Cells and how to power them
3 Making organs
4 The story of a life
5 What is a species, anyway?
6 Finding living planets

energy. These are completely dependent on the membranes in cells. Conditions on the two sides of a membrane will almost always be different; different molecules will be present in different concentrations. The laws of thermodynamics, though, take a dim view of different concentrations of something being next to each other. Small molecules and ions that are more frequent on one side of that membrane than the other will diffuse across it in an attempt to even things up. Proteins embedded in such membranes pump molecules in the opposite direction to maintain the distinction between inside and out.

It is by setting up a gradient of hydrogen ions—hydrogen atoms with their electrons pulled off—across a membrane that living things put energy into a chemical form which they can use. This process depends on sets of proteins called electron-transport chains. These proteins are embedded in the membrane.

Electron-transport-chain proteins pass electrons to each other in a way that causes hydrogen ions on the inside of the membrane to get moved to the outside. The ions thus build up outside, which means that nature's tendency to even out concentrations requires some of them to get back inside. This they do by means of a magnificent protein called ATP synthase, or just ATPase. Molecules of ATPase provide channels through the membrane which it is easy for the hydrogen ions to flow through. This flow yields usable energy, like the flow of water through a watermill.

That is not an idle metaphor. ATPase has several parts, one of which can rotate with respect to the others. As the ions flow through the protein they spin this rotor at a speed of 6,000rpm. If you could hear them at work they would be humming at something like the G two octaves below middle C. Another part of the molecule uses the kinetic energy of this spinning rotor to affix phosphate ions to a molecule called adenosine diphosphate (ADP), thus making adenosine triphosphate, or ATP—cell biology's near-universal energy carrier.

In almost all instances where a cellular process requires energy, that energy is provided by breaking ATP back down into ADP. Adding an amino acid to a growing protein uses up roughly five ATPs. Synthesising membrane lipids costs about one ATP for every two carbon atoms used. A bacterium doubling in size uses about 10bn ATPs to build all the molecules it needs, meaning every one of the 10m or so ADP molecules the bacterium contains is turned into ATP and broken back down again 1,000 times during the process.

To keep the ATPase whirring, the cell requires a constant flow of electrons along its membrane-bound electron-transfer chains. There are two ways of creating such flows: respiration and photosynthesis.

Respiration breaks molecules of glucose down into carbon dioxide and water through a suite of reactions called the citric-acid cycle. A glucose-molecule's worth of electrons typically pushes ten hydrogen ions across the membrane in which the respiratory electron-transfer chain is embedded. As they flow back through the ATPase they can generate 20 ATPs.

Photosynthesis uses the energy of sunlight to liberate electrons from water molecules, thus creating oxygen and also hydrogen ions ready for pushing across the membrane. Some of the ATP made this way powers a process that combines those ions with carbon-dioxide. A few more chemical reactions produce a sugar such as glucose, which then goes on to be built into all the other molecules from which life is made. Photosynthesis builds up the world's biomass; respiration breaks it down.

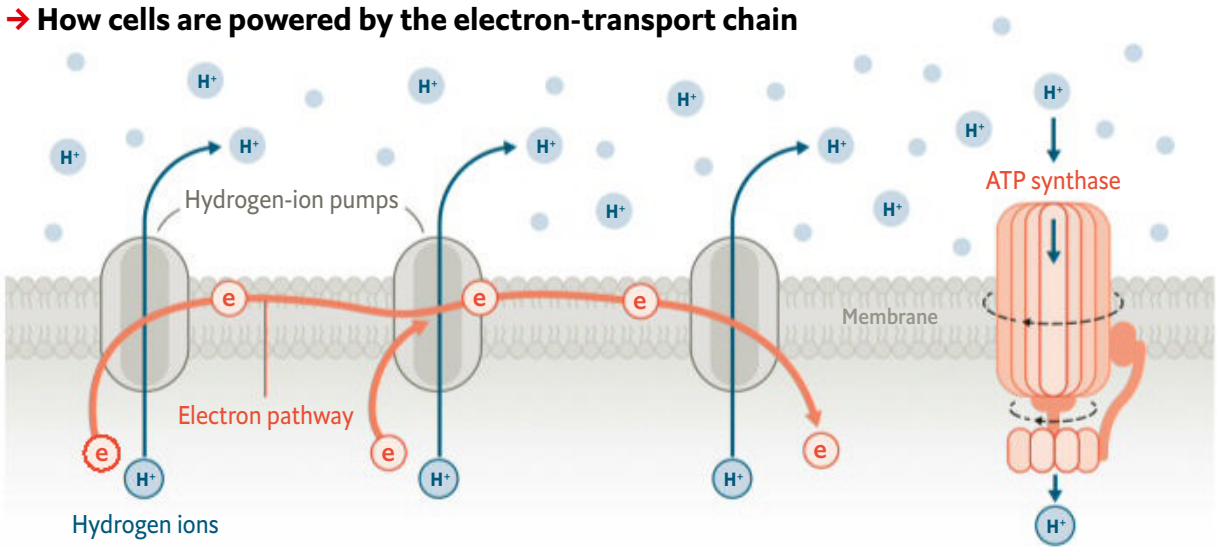
Once upon a time

In a prokaryotic cell the membrane in which electron-transfer proteins sit is that which surrounds the cell. In eukaryotic cells respiration takes place in intracellular structures—organelles—called mitochondria. These consist of folded-up membranes rich in electron-transport chains. Containing lots of mitochondria (in humans, hundreds or thousands per cell is not uncommon) means such cells can generate a great deal of ATP. If all the membranes in your body's mitochondria were joined and spread out flat they would cover several football fields.

Under a microscope, some mitochondria look a lot like bacteria. This is not a coincidence, it is a family resemblance. When Earth was a bit more than half its present age, which is to say around 2bn years ago, two prokaryotes, one from the archaea and one from the bacteria, contrived to merge. How, exactly, they did so is far from clear. But that merger created something truly novel: the first eukaryotic cell. Mitochondria are descendants of the bacterium involved, a descent demonstrated incontrovertibly by the fact they still have remnant genomes of their own which are distinctively bacterial. In human beings these little mitochondrial genomes are the only DNA not sequestered on chromosomes in the nucleus.

All the mitochondria in all the eukaryotes in the world date back to that merger. Similarly, chloroplasts—the organelles of photosynthesis found in plants and algae—date back to a later event in which a eukaryote engulfed a photosynthetic bacterium. Many eukaryotes remained single-celled, and do so to this day. But others began forming colonies which permitted division of labour between cells and encouraged the development of specialised body parts called organs. Which are the subject of next week's Biology brief. ■

→ How cells are powered by the electron-transport chain

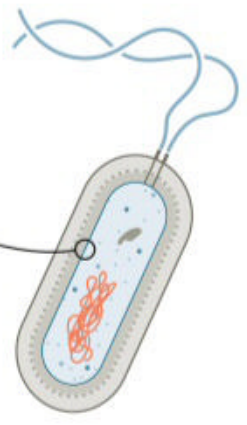


Electrons (e) derived from the citric-acid cycle power a series of proteins that pump hydrogen ions (H+) from one side of a membrane to the other.

The hydrogen ions then re-cross the membrane via ATP synthase, causing part of that molecule to rotate. This drives the process of ATP manufacture.

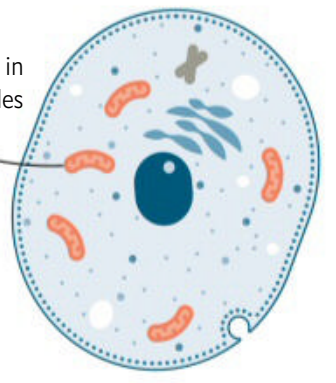
Prokaryotic cell
eg, bacterium

In prokaryotes this process happens in a membrane surrounding the cell



Eukaryotic cell
eg, animal

In eukaryotes this happens in the membranes of organelles called mitochondria



Combating future viruses

Predict and survive

By anticipating how pathogens will evolve, vaccines and therapies to deal with them can be prepared in advance

GENERALLY, IMMUNE systems mount responses only against pathogens that have already infected the bodies they are protecting. Science, though, can shorten the path to immunity by vaccination. This involves presenting the immune system with harmless or lookalike versions of dangerous pathogens so that it may create antibodies and killer cells hostile to the real thing in advance of any actual infection, thereby reducing its danger.

Like immune responses themselves, however, vaccination generally has to wait for the appearance of the pathogen in question before it can do its stuff. There is therefore a delay between a pathogen's arrival on the scene and the deployment of a vaccine against it. That delay costs lives. Even in the case of covid-19, which has prompted the fastest vaccine-development programme the world has ever witnessed, millions are reckoned to have died by the time vaccinations began to be given in the rich world at the end of 2020.

But, just as vaccination introduces immune systems to pathogens that are remote from them in space, new techniques which have come to the fore during the current pandemic offer the possibility of introducing them to pathogens that are remote from them in time—pathogens, indeed, that have not yet evolved, but which are likely to do so in the future. Thanks to a combination of high-throughput DNA-sequencing technologies and modern machine-learning it is now possible not merely to observe which variants of a virus are circulating, but also to suggest how they are likely to change. Understanding in this way what a virus might look like in the months and years to come gives those designing vaccines and therapies a leg up, enabling them to prime more immune systems sooner, so that fewer people die.

The starting point for these predictions is the sort of work going on in the laboratory of Jesse Bloom, a virologist at the Fred Hutchinson Cancer Research Centre, in Seattle. Dr Bloom and his colleagues grow variants of coronavirus spike protein (the molecule which such viruses use to attach themselves to cells they are about to infect) in Petri dishes. They then scan through these to discern which mutations have what effects.

They have named this technique deep mutational scanning. It uses an array of yeast cells that have been genetically modified to express a part of the spike protein called the receptor-binding domain (RBD). As the yeast cells churn out their RBDs, many emerge, thanks to errors inherent in their production, with slight deviations in their structures from that of the original wild-type virus. Dr Bloom's team then test the RBDs from each yeast cell to see how tightly they bind to ACE2, a receptor protein found on the surfaces of some human cells, to which the coronavirus attaches itself before entering those cells. RBDs that bind tightly have their underlying genomes sequenced, to determine which mutations are present.

When Dr Bloom's team ran this scan in ▸▸

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66 Robots that unload lorries

the summer of 2020, on spike from a version of the virus then circulating, they spotted a mutation called N501Y which appeared to confer a binding advantage. A few months later, that mutation appeared in the Alpha variant, which for several months was dominant across much of the world. Dr Bloom says it would be "charitable" to say that he and his colleagues had predicted the emergence of N501Y. It was by no means the only mutation of interest to turn up. But even so, having a limited set of such mutations to focus on is useful for narrowing the field of research.

Getting the message across

One firm taking advantage of that narrowing is Flagship Labs 77, a company based in Boston that has until recently been working in secret. FL77, as it is known for short, is a spin out from Flagship Pioneering, a biotechnology incubator run by Noubar Afeyan, a venture capitalist. Moderna, a trailblazer of the messenger-RNA-based technology that helped speed up the production of coronavirus vaccines, was also a Flagship Pioneering company, and Mr Afeyan is its chairman.

FL77's researchers are trying to combine experimental data of the sort Dr Bloom is collecting with computation, in order to predict how viruses may evolve. That information could be used to develop vaccines and therapeutic antibodies pre-emptively. Whereas Dr Bloom's laboratory predicts only single mutational hops, FL77 can currently manage five or six. The firm calls its system "Global Pathogen Shield". The details remain confidential, but in June it published a paper outlining the project's goals. This described the scale of the challenge involved in keeping pace with viral evolution—namely that biology is so diverse that even looking at a small slice of possible mutations leads to a problem which rapidly grows beyond the plausible limits of observation, to one on the scale of counting and categorising all of the atoms of which Earth is composed.

The conventional response to such overwhelming odds has been observation rather than experimentation. The World Health Organisation's Global Influenza Surveillance and Response System does this for flu. It monitors which viruses are circulating in the southern hemisphere when it is winter there, in order to focus attention on which strains will be relevant during the next northern-hemisphere winter, and vice versa. During the coronavirus pandemic, organisations such as Nextstrain and GISAID have kept track of variants of SARS-CoV-2 in a similar way.

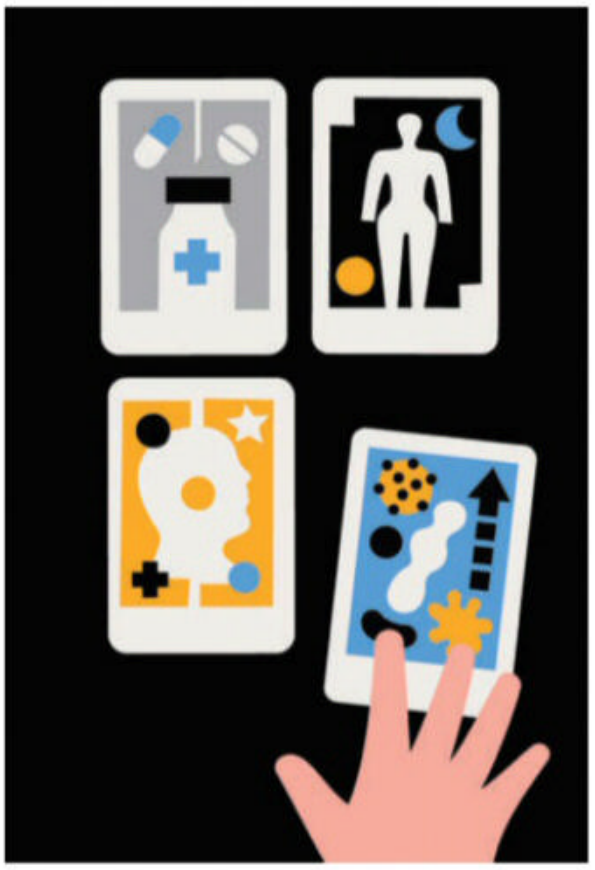
FL77 aims to take this much further—not only tracking which variants of a virus are where, but also predicting how they will evolve. It does this by feeding into a piece of software called Octavia data from a scaled-up version of Dr Bloom's deep mutational scanning that runs assays on between 1m and 10m variants.

Octavia's job is to recognise patterns in the Petri-dish data—for example, which of the millions of mutations tend to lead to tighter binding, and also which lead to poorer neutralisation by antibodies—and then to extrapolate those across all possible variants of spike. This leads to predictions about which mutations will defeat antibodies, and which will spread more easily. That, says the paper, "makes it possible to define a protective antibody repertoire", whether through vaccination or manufacturing of antibody proteins themselves. FL77 calls this an "antibody net".

Dr Bloom, who is advising FL77, and who holds patents on deep mutational scanning, says the value of these kinds of predictions has become clear with the development of messenger-RNA vaccines. These are not just quick to make, but quick to update. Their manufacturing process starts with the gene for the viral protein that the immune system is desired to attack, and ends with a strand of RNA which encodes that specific protein.

In covid-19 vaccines, the protein in question is spike. Updating vaccines to take account of predicted variants of spike is merely a matter of inserting the relevant genetic code at the start of the manufacturing process. At the least, such predictions would permit a library of candidate vaccines to be held ready, in anticipation of rapid manufacturing. At its most ambitious, FL77 imagines vaccinating people against variants of a pathogen that are not yet circulating, but are likely to.

Deep mutational scanning may have other uses, too. Gabriel Victora, an immunologist at Rockefeller University in New York, thinks predicting the evolution of a pathogen in this way will be useful not just for designing antibodies and vaccines, but also for detecting parts of the virus which change only rarely, and aiming antibodies at what would thus be reliable targets.



This, though, is difficult. The shape of any given segment of a protein depends on the rest of the molecule of which it is a part. Yet, for the immune system, the shape of its target is a crucial feature that it needs to learn in order to recognise its foe. So, though predictive approaches like FL77's might spot segments of viral proteins which are unlikely to change, getting the immune system to look at them specifically is difficult, because expressing an isolated protein segment in a way that makes it the same shape as it is when it is part of a bigger structure is tricky.

A more brute-force approach is simply to show the immune system all of the protein structures that are likely to emerge in future, so that it makes antibodies against the lot. Dr Victora says that immune systems have no known limit to their capacity to absorb information about pathogens. Instead, the problem with this approach may come if the system preferentially makes antibodies to some of the predicted variant proteins, but not others.

Strain gauge

Seasonal flu vaccines already grapple with this problem when updating immune systems with information about the strain predicted to be circulating in the coming winter. Even after vaccination, immune systems may tend to make antibodies against the old virus instead. It is not clear whether the same thing will happen with updated messenger-RNA vaccines.

No programme will ever be able to predict the evolution of the entire array of pathogens which can plausibly infect human beings. But for those already known to pose a threat, systems like Octavia may be able to see far enough into the future to offer benefits. "We don't have to be able to predict arbitrarily," says Dr Bloom. "We don't need to predict mutation in a decade. Just a radius of five to six mutations from where we are now. That's good enough."

FL77 is already doing this. The most radical version of the firm's vision—vaccinating against variants and strains of pathogens that are yet to emerge—is some way off, if it ever happens. Protecting people by programming their immune systems against future pathogens, not just those already circulating, would be a fundamental shift in the meaning, purpose and ethics of vaccination. But even in the absence of that, pathogen prediction should soon serve to speed existing sorts of vaccination programmes. And every increase in the speed of vaccine development means thousands of saved lives. ■

A non-binary burial

Antiquated thinking

An intriguing reinterpretation of an interment from the past

In 1968 a grave dating from about 1100 was uncovered near Hattula, in Finland. Little remained of the occupant's skeleton, but the inhumation included two swords and a sheathed knife. Such grave goods would normally suggest said occupant was a man. The skeleton was, however, also adorned with brooches and woollen clothing of types more usually worn at the time by women. This led to speculation that the burial was actually of a powerful woman, possibly a local ruler in her own right rather than just the wife of a male monarch.

This would be noteworthy enough. But a re-examination of the remains, just published in the *European Journal of Archaeology* by Ulla Moilanen of the University of Turku and Elina Salmela of the University of Helsinki, suggests the truth may be yet more intriguing. Ms Moilanen and Dr Salmela suspect that the individual in question may have had outward characteristics of both a man and a woman.

In 1968 working out the sex of a skeleton in an ancient grave was tricky. After years of deterioration, the bones of men and women look pretty-much alike. But that was before the use of DNA became possible. So Ms Moilanen and Dr Salmela thought it worth trying again.

Most people have two sex chromosomes: XX in women and XY in men. Find DNA from a Y-chromosome in a skeleton and the chances are the body in question was male. And, looking at a fragment of femur brought to her by Ms Moilanen, who is the archaeologist in the collaboration, Dr Salmela, who is the geneticist, did indeed find such DNA. But not much of it. That led her to wonder about contamination, but also to consider whether the individual in the grave had had an extra X-chromosome that was swamping the signal from the Y.

Having an anomalous number of sex chromosomes is rare, but not vanishingly so. The particular combination XXY leads to what is known as Klinefelter's syndrome. People with this karyotype are male, but may have small genitals and reduced body hair. Some also develop breasts, a female secondary sexual characteristic, during puberty.

To determine the occupant's karyotype from the meagre amount of DNA available, Dr Salmela drew comparisons with living people. The grave yielded 8,329 sequenceable fragments, so she used a computer to draw samples of similar size from the genomes of living people with various karyotypes, including XXY, and also from mixtures of both sexes, to mimic contamination. She then compared these with the DNA from the grave and concluded it was 99.75% probable the individual concerned had indeed had Klinefelter's syndrome.

While Dr Salmela was working all this out, Ms Moilanen and her team had another look at the grave. They confirmed that it was a high-status burial. For instance, they discovered traces of feathers below the spot where the skull had been, hinting that the deceased individual's head had rested on a feather pillow. They also found evidence of fine furs, probably from foxes.

Clearly, this was a venerated human being, but what led to that veneration in a world then dominated by masculine values is a matter of speculation. Perhaps the person in question came from a family powerful enough for such things not to matter. But perhaps those who did not fit easily into sexual categories nevertheless had honoured roles in society. Across the Gulf of Bothnia in Sweden a near-contemporary grave found last century contained a man buried in women's clothes and jewels, but otherwise with masculine grave goods. Stereotyping can work in many ways. And one is to accept, unthinkingly, modern stereotypes about the past. ■

Ancient geometry

No need for a protractor

The Babylonians used Pythagorean ideas long before Pythagoras

Most readers will have encountered Pythagoras's theorem about right-angled triangles—that the square on the hypotenuse is equal to the sum of the squares on the other two sides—at school. But the less-mathematically inclined might have been tempted to ask when such knowledge would ever be useful in real life. One answer, predating Pythagoras by over 1,000 years, is in land surveying.

Lurking in a museum in Istanbul is a 3,700-year-old clay tablet known as Si.427. It has been there since it was dug up in the 19th century in Sippar, an ancient Babylonian city in what is now Iraq. Only this year, however, has its significance been revealed—by Daniel Mansfield, a mathematician at the University of New South Wales, in Australia. As he describes in *Foundations of Science*, Dr Mansfield has shown that Si.427 is inscribed with the world's oldest known example of applied geometry.

Si.427 seems to have been created by a surveyor defining land boundaries after part of a field was sold. This is, of itself, unremarkable. What is remarkable is that its text describes the use of what are now called Pythagorean triples to draw accurate right angles.

Pythagorean triples are special cases of Pythagoras's theorem. They are sets of whole numbers that correspond to the lengths of the sides of particular right-angled triangles. Three, four and five for example, or five, 12 and 13. Another tablet, Plimpton 322, showed many decades ago that the Babylonians knew about these triples. What researchers could not agree on was why they were interested.

Dr Mansfield's answer is surveying, for this was a period when agriculture was developing, and with it the idea of land ownership. One way to measure the size of a field is to divide it into rectangles and right-angled triangles, both of which have easily calculated areas. Knowing Pythagorean triples makes drawing the right angles needed to construct these figures easier, and so is useful information. QED.

Automatic goods handling

Heave-ho!

One of the last pieces of warehouse automation will soon be in place

UNLOADING LORRIES is wearisome for people, but hardly an intellectual challenge. For robots it is the reverse. Robots never tire. They do, however, have problems interpreting the data streaming in from the cameras and laser scanners that are their eyes. Seeing where one box in the back of a crowded lorry ends and another begins is second nature to a human being. But even the best artificial-vision systems struggle to cope.

And that is just the start. The next question is what the robot should do with what it sees. The less tidy the contents, the greater the problem. Shrink-wrapped pallets of packages are one thing, the miscellaneous jumbles of objects handled by parcel-delivery businesses quite another. Cases may get wedged, or be fumbled. Or the robot may need to work out how to lift an irregular consignment like a set of skis. People learn how to do such things gradually, as they grow up. And machines have to learn, too. That takes time and a lot of training.

Unloading lorries is therefore one of the few parts of operating a warehouse that has resisted automation. But not for much longer. A new generation of cargo-handling robots is poised to take on the task.

A lorry-load of ideas

The robotics division of Honeywell, a large American technology company, has come up with a vehicle-sized unit (see picture) that fits onto the back of a lorry. It has a large arm fitted with suction cups which can pick up several boxes at a time and then feed them onto a conveyor belt, or knock down a wall of boxes and sweep them onto the conveyor. An individual human worker can unload between 600 and 1,200 boxes an hour. Honeywell hopes that, once its robot is perfected, a single crew chief will be able to supervise the simultaneous unloading of three or four lorries, each at rates of up to 1,500 boxes an hour.

Thomas Evans, chief technology officer of Honeywell's robotics operation, says the robot does not need to be as precise as the pick-and-place robots that work on assembly lines. But it is still a challenge for it to distinguish between individual boxes and to recognise and identify anomalous objects such as loose pallets and the pallet jacks used to move stacked pallets around. At the moment, therefore, it works best with boxes of uniform size and shape.

Changing that will need a lot of training, which, in turn, means designing and assembling a variety of dummy loads inside a variety of vehicles. This is both time-consuming and labour-intensive. Dr Evans says his team can put together about four such test loads a day. Ideally, that number would be nearer 100—but running tests at this scale would be expensive. Digital simulations can help. They are, though, Dr Evans says, no substitute for the real thing. He is therefore negotiating with one of the potential customers for the robot, a company that already handles this volume of business, to do the training there.

In Massachusetts, a firm called Boston Dynamics takes a different approach from Honeywell's. Boston Dynamics is famous in the wider world for an acrobatic humanoid robot called Atlas, and for Spot, a robot that resembles a dog and is now on sale as a device for monitoring what is happening in factories and other large spaces. The firm's good-handling system, Stretch, is, however, the first it has custom-built for a particular task.

Stretch is smaller and more mobile than Honeywell's robot, and is able, according to Kevin Blankespoor, Boston Dynamics' general manager of warehouse robotics, to move easily from one lorry to another, or to a different part of a site altogether. It sports a single arm festooned with sensors and a suction gripper able to handle boxes weighing up to about 25kg. Unlike Honeywell's system, Stretch can already manage the trick of examining a wall of boxes, working out their sizes and shapes, and choosing which to pick up first. It is, though, slower. The aim is that it will be able to handle 800 cases an hour.

A third contender, Dill, is made by the Pickle Robot Company, also based in Massachusetts. Andrew Meyer, Pickle's boss, believes Dill has an edge over the competition because Pickle's engineers have focused on the robot's ability to handle messy trailers with irregular loads. This is not just a matter of machine vision and an ability to work out where boxes are, but also of understanding the laws of physics, and therefore how particular objects will behave. That helps Dill decide which is the best box to pick up next, and how to deal with it as speedily as possible without dropping it.

Keep on trucking

In particular, Dill is designed for what Mr Meyer terms "centaur operation", in which human and robot collaborate, rather than the human's role being merely supervisory. Dill is skilled at spotting problems it cannot deal with and then calling in human assistance. It can handle 98% of cases on its own, Mr Meyer claims—though it has problems with things like damaged goods and unexpected objects. The upshot is an arrangement which, he says, has a maximum capacity of 1,600 packages an hour, with a realistic average of 1,000.

The next task, which all three companies are now engaged in, is to run the unloading process in reverse by using robots to load lorries in the first place. Besides simply lugging boxes around, this also involves working out how to stack them efficiently. Solving that problem, and doing so at the speed which commerce requires, would allow warehouses to be almost completely automated. The firm that perfects this trick may not be popular with unions. But managers will love it. ■

Stack overflow. Loader initialisation required

Sport

The pursuit of greatness

Two new books examine the extraordinary careers of Roger Federer and Lionel Messi and find they have much in common

As two of the most stylish and successful athletes of all time, Roger Federer and Lionel Messi naturally invite comparison. Mr Federer has won 20 men's singles titles, a record he shares with Rafael Nadal and Novak Djokovic, and reached more Grand Slam finals than any other male player. Mr Messi has won 34 trophies with Barcelona and been awarded the Ballon d'Or, a prize for the world's best football player, six times. Mr Federer praises the Argentine forward's abilities in the same language that many pundits use to describe his tennis: "There's always three options for him. He's one of the few who's got that."

In recent years the similarities between the two sporting stars have deepened. Mr Federer won three of his major titles after turning 35; aged 34, Mr Messi has just won an international tournament—hitherto the one prize to elude him. Sport was once considered the sole career in which, after 30, you were fated to know only professional decline. Mr Federer and Mr Messi are both showing that no longer needs to be the case.

The Barcelona Complex. By Simon Kuper. *Penguin; 416 pages; $27. Published in Britain as "Barça"; Short Books; £20*
The Master. By Christopher Clarey. *Twelve; 432 pages; $30. John Murray; £20*

It is fitting, then, that two books about the athletes have been released at the same time. In "The Barcelona Complex" Simon Kuper, a journalist at the *Financial Times*, analyses how the Spanish football club became a behemoth, with Mr Messi its "engine and standard-bearer". "The Master" by Christopher Clarey, a journalist at the *New York Times*, is a more conventional biography, based on interviews with the tennis player and his inner circle. Both books offer valuable insight into how sporting greatness is achieved.

Modern athletes are more disciplined than their forebears, who often lived like rock stars and expected their bodies to give out before they reached middle age. In the early 1970s Johan Cruyff, another Barcelona footballing legend, was a chain-smoker. He was so unfit that, during his time at Ajax, Cruyff would hide in the woods while his teammates did running training, only rejoining them for the last lap. Mr Messi, by contrast, credits a mostly vegetarian diet with prolonging his career and has benefited from his club's focus on the science of nutrition, sleep and psychology.

By far the longest-serving member of Mr Federer's team is Pierre Paganini, a former decathlete who has been his fitness coach since 2000. "A big part of the reason that I'm here where I am today is definitely because of Pierre," Mr Federer has said. Modern tennis players need "explosive endurance": ie, the acceleration of a sprinter and the stamina of a marathon runner. A favourite drill of Mr Paganini's is to make Mr Federer sprint between four numbered posts while holding a heavy medicine ball above his head.

The story of Barcelona in recent years is, in many ways, the tale of Mr Messi. In everything from player signings to the team's tactics, Barcelona "handed Messi the keys to the club", Mr Kuper writes. Sandro Rosell, the club's former president, ▸▸

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says: "If you have the possibility to be the best player in every match, you have to be a bit of a dictator, as Messi is."

For many years, it worked. Between 2006 and 2015, Barcelona played dazzling football and won four Champions League titles (they had won only one before in their history). Yet the years since have been of slight on-field decline and huge gross debt, which reached more than €1bn ($1.2bn) this year. While he has remained an extraordinary player, Mr Messi may partly be to blame. His astronomical fee—$674m over four seasons from 2017 to 2021, according to reports—exhausts club funds and leads teammates to demand higher salaries, leaving less cash to sign new players. Rivals have also mimicked Barcelona's tactics, refining the sophisticated passing style developed by Cruyff.

Both "The Barcelona Complex" and "The Master" emphasise the decision-making that helps set superlative athletes apart. Mr Messi is renowned, rightly, for his balletic dribbling, pinpoint passing and clinical finishing in front of goal. But underpinning all these qualities, Mr Kuper shows, is what sports scientists call "scanning": looking around to take visual snapshots of play. An illuminating passage deconstructing Mr Messi's art documents how he spends much of each match walking about—during the World Cup in 2014, only one outfield player covered less ground. Yet though his movement is economical, Mr Messi "is moving his head, right, left, right, left," as his former coach, Pep Guardiola, observed. The best footballers in the world scan the pitch about 50 times per minute.

The finest tennis players also use visual cues, such as the positions of their opponents' torso and hips, and the way they go to strike the ball, to deduce where the ball is likely to land even before it is touched. "It happens so fast that you have to hit the shot almost without thinking," Mr Federer explains. With the best contenders, says Marc Rosset, a former Swiss tennis player who mentored Mr Federer, it is "as if they have more time for their brains to process it all". The impression of effortlessness that this creates is a brilliant illusion.

Both authors reject the notion that Mr Messi or Mr Federer was fated to prevail. Mr Clarey highlights the fortune—particularly the decision of Peter Carter, an Australian tennis coach, to accept a job in Basel—and hard work that made Mr Federer's story possible. Mr Messi could also conceivably have been lost to football: the sport long had a dogma about height, and he needed a growth hormone, funded by Barcelona when he moved from Argentina, even to reach a modest 1.7 metres. If Mr Federer's success "has been a long-running act of will, not destiny", as Mr Clarey argues, the same is true of Mr Messi's. ■

The Berlin Wall

An underground operation

Tunnel 29. By Helena Merriman. *PublicAffairs; 352 pages; $28. Hodder & Stoughton; £20*

THE PLAQUE at 7 Schönholzer Strasse, in the trendy Prenzlauer Berg district of east Berlin, is easy to miss. Yet it marks one of the most astonishing episodes in the grim history of communist East Germany. For it was from here, in September 1962, that 29 East Berliners escaped to freedom via a narrow, 120-metre tunnel underneath the wall that had cleaved their city in two a year earlier. "Tunnel 29", by Helena Merriman, a British journalist and broadcaster, began as a popular podcast, aired by the BBC in 2019 to mark the 30th anniversary of the fall of the wall. Happily, the written account is no less captivating.

The hero of the tale is Joachim Rudolph, whom Ms Merriman interviewed extensively in 2018. A young engineering student with a tragic family history, Mr Rudolph flees East Berlin less than two months after the wall's construction—before concrete reinforcements, trigger-happy guards and wide strips of no-man's-land were to render it almost unbreachable (at least 140 people were killed trying to escape from East Berlin before the wall came down in 1989). Safely ensconced at West Berlin's Technical University, Mr Rudolph joins forces with a network of students and other activists aiming to smuggle out East Berliners. Yet unlike most of them, he is not seeking to bring loved ones over to the West. The motivations for his courage are hard to discern; he is not sure he understands them himself.

How the other half lives

The narrative focuses on the escapades of the gang of young men who sought to burrow into the east from a plastic-straw factory in West Berlin's Bernauer Strasse, which ran adjacent to the wall. Early enthusiasm soon yields to sagging spirits and abandoned attempts as the group confront a battery of obstacles, from water leakage and equipment shortages to the ever-present threat of Stasi infiltration. Well-justified paranoia drives them to rough up a well-meaning *Ossi* escapee who offers to help. A secret cash-for-footage deal with NBC, an American television network hungry for *verité* tales of cold-war Berlin, pays for vehicles and tools, though this later causes ructions within the team.

Politics hums in the background. John F. Kennedy, who became obsessed with the divided city, makes an appearance; so do Nikita Khrushchev, who enjoyed squeezing West Berlin, the "testicles" of the West, and Erich Mielke, the sadistic Stasi chief. The East German workers' uprising of 1953—the first crack in the German Democratic Republic's edifice—is also evoked, as is the Soviet-sanctioned construction of the wall itself, characterised by Walter Ulbricht's communist regime as an "anti-fascist protection barrier".

Ms Merriman weaves these strands together skilfully, offering enough context to explain her characters' actions without distracting from their adventures. Smells, sounds and tastes give texture to the story. The ecstasy that Mr Rudolph, brought up on flavourless eastern swill, finds in the pineapple jam he is served on reaching the West is a particular delight. The dusty claustrophobia of the dig, conducted in night-time shifts over months, is palpable.

The supporting cast is richly drawn, ranging from Siegfried Uhse, a gay, closeted hairdresser in West Berlin blackmailed by the Stasi into collaboration, to Reuven Frank, an NBC executive who threatens to resign when the Kennedy administration blocks the network from airing the film. (The politicians relent, and the documentary, available today on YouTube, is a triumph.) Most of the players find some sort of redemption in the happy denouement; the family reunions described in a late scene are moving. Ms Merriman's well-crafted book does justice to the extraordinary bravery of her characters. ■

Horological history

A matter of time

About Time: A History of Civilisation in Twelve Clocks. By David Rooney. *W.W. Norton; 288 pages; $28.95. Viking; £16.99*

In 2015 Kim Jong Un, North Korea's supreme leader, decreed that every clock in his country must move back by half an hour. The idea was to right what he saw as a historical wrong. Japan ruled Korea between 1910 and 1945 and, during that period, it replaced Korea's existing time zone with a new one set half an hour forward. "The wicked Japanese imperialists committed such unpardonable crimes as depriving Korea of even its standard time," explained North Korea's news agency.

But the restoration proved short-lived. In 2018, in a more emollient mood, Mr Kim spoke of his sadness at seeing clocks display different times for Pyongyang and Seoul, the capitals of North and South Korea respectively. As a result, all the North's clocks were dutifully moved half an hour forward again.

Time, as David Rooney argues in his new book, is often a political subject—as well as a technological, cultural, imperial or religious one. Armed with that insight, Mr Rooney—a former curator of timekeeping at the Royal Observatory in Greenwich—is the latest author to try his hand at a fashionable style of writing that uses everyday objects as a means to analyse the twists and turns of history. As Mr Rooney observes, clocks are rarely ever built simply to measure time; like any other technology, they are built with some human goal in mind. So although the book is organised around 12 clocks, and starts with the ancient world and finishes with the modern one, it is more a collection of historical, horological ruminations than a systematic, linear history of timekeeping.

The result is a book that is often fascinating, but just as often frustratingly uneven. Tales of clocks serve as jumping-off points for discursive discussions of other things. A segment on a gigantic sundial and observatory completed in 1734 at Jantar Mantar (pictured), near Jaipur, for instance, sets up a discussion on the contributions of Christian, Hindu and Islamic scientists to Indian astronomy in the 18th century. Satellite-navigation services like GPS are collections of super-accurate, space-going clocks that provide location and timekeeping data for everyone from high-frequency financial traders and electricity grids to mountaineers and lorry-drivers. But they were invented to wage war, providing reliable position fixes for American soldiers and allowing what one official describes as "a humanitarian bombing system". Knowing the time, in other words, permits you to "hit what you're trying to hit and not hit what you aren't trying to hit"—in theory, at least.

Sometimes Mr Rooney's piecemeal approach is captivating. A chapter on how time came to be standardised is particularly illuminating. Before electricity and radio offered a convenient way to synchronise timekeeping, the time in one town could be noticeably different from the time in the next. The commonly accepted version of the story holds that it was the spread of railways, with their need to synchronise schedules, that forced countries to settle on a single time. But Mr Rooney recounts how he and a friend unearthed evidence suggesting that, in Britain at least, Victorian licensing laws that regulated pub opening hours were just as important in putting paid to "local time" as they required every pub in the land to know when to bring the evening's drinking to a halt.

A running theme of the book is resentment of the order imposed on ordinary people's lives by clocks erected by their rulers. The sentiment dates back to at least the Romans, who complained about how the easy, natural rhythms of the body and the natural world were being usurped by newfangled, tyrannical sundials and water clocks. Two millennia later, residents of industrialising Europe, whose lives were ruled by the factory clocks that marked out their working hours, made almost exactly the same complaints.

At other times, though, Mr Rooney's approach misfires. A discussion of Jodrell Bank, a British radio observatory, and its role in the cold war, is interesting but rather disconnected from the theme of clocks and timekeeping. Segments on imperial China or the Mongol empire feel rushed and too short. And the writing might have benefited from a firmer editor, as the book feels padded in places. A steady stream of superlatives, especially in the first half, serves mostly to weaken their impact on the reader. But those are minor flaws in what is, otherwise, a diverting way to spend a few hours of precious time. ■

Elif Shafak's new novel

Star-crossed lovers

The Island of Missing Trees. By Elif Shafak. *Viking; 368 pages; £14.99. To be published in America in September by Bloomsbury; $27*

Elif Shafak's novels are read and celebrated around the world, yet she remains controversial in Turkey, where her parents were born. In 2006 she faced trial in Ankara, accused of "insulting Turkishness" on the grounds that characters in "The Bastard of Istanbul" discuss the Armenian genocide, which the Turkish government denies (Ms Shafak was acquitted of the charges before the trial began). The saga did not deter her from using fiction for social criticism. Published in 2019, and also set in Istanbul, "10 Minutes and 38 Seconds in this Strange World" is narrated by a murdered sex worker. The harrowing story draws attention to the ills of misogyny and religious hypocrisy in the country.

If Ms Shafak's subjects are sombre, her ▸▸

magical-realist style is anything but. Her new novel, which addresses the turbulent history of Cyprus, is partly narrated by a fig tree. The story opens in London, where the teenage Ada is mourning the death of her mother Defne, a Muslim Turkish-Cypriot who had become prone to drink. Ada suspects that Defne's decision to emigrate and to marry her father, Kostas—a Christian Greek-Cypriot—was a difficult one. She learns just how incendiary it was only after talking to Defne's sister Meryem, who vowed never again to speak to Defne as long as their own parents were alive.

Cutting between past and present, the novel tells the story of Defne's and Kostas's romance. Teenagers in Cyprus in the 1970s, their courtship takes place against a backdrop of rising violence between Turkish and Greek paramilitaries in the wake of Cyprus's independence from Britain (Turkey would invade the island in 1974). When Kostas's mother sends him to London for safety, having already lost one son to the bloodshed, his estrangement from Defne has grave consequences—not least for a Turkish-Greek couple who had sympathetically provided them with a haven.

The transformative role played by the fig tree is unlikely to surprise readers of Ms Shafak's previous novels, or Ovid's "Metamorphoses". Its presence affords bittersweet relief, not to mention an outlet for digressions on a range of subjects, from Cyprus's illegal trade in songbirds to its eradication of malaria in the 1940s. The overlapping timelines produce a busy and fast-moving narrative focused on healing as well as grief. Ms Shafak does not shrink from the reality of violence, but she salvages tenderness—even joy—from the wreckage of 20th-century history. ■

Johnson The terms that bind

A new book explores how "cultish" language ties people to organisations

"DRINKING THE Kool-Aid", meaning to unquestioningly adhere to a belief or system, is often used jokingly by people unaware of its awful origin in Peoples Temple, a 20th-century religious community. (Jim Jones's followers in Guyana in fact committed suicide by putting cyanide into Flavor Aid, a different drink.) The cult had its own internal lexicon, too. The Temple's acolytes celebrated the birthday of one man, Jones himself, on "Father's Day". "Churchianity" was a term for the Christianity observed by America's middle class. "Revolutionary suicide" was the group's final act. Heaven's Gate, another cult that ended with a mass suicide in 1997, used similarly bizarre jargon.

A new book, "Cultish" by Amanda Montell, examines the role of language in binding people to organisations of all kinds. The group may be an ordinary workplace, a fan club or a circle of friends, but it can also include institutions that make it hard to escape their orbit and, at worst, that inflict grievous harm on members. What the organisations have in common is passionate adherents, charismatic leaders and a unique use of language that helps join everyone together. The vocabulary of tight-knit organisations gives people a powerful sense of belonging.

Ms Montell briefly addresses a core question: whether being made to use a certain lexicon subsequently makes people manipulable. The much-debated Sapir-Whorf hypothesis in linguistics posits a causal connection between language and thought. In its strongest form it suggests that ideas that lack a linguistic label are unthinkable—much as the very concept of being "free" is destroyed in George Orwell's "Nineteen Eighty-Four"—while the regular use of other labels forces people's thinking into approved patterns.

But, like most modern scholars of the hypothesis, Ms Montell dismisses such notions. After years of being steeped in insular language, some people do muster the thought that they should leave a group or a job. A weaker and more plausible form of the idea is that constant repetition of cultish vocabulary merely pushes thoughts in certain directions and away from others. This makes it harder, though far from impossible, to flee.

More interesting is her discussion of "thought-terminating clichés" in cults and religious groups. These are circular or distracting mantras designed to head off doubt. Believers in QAnon, a conspiracy theory, constantly told doubters to "trust the plan" that President Donald Trump would apprehend a global ring of Satanic paedophiles. Shambhala, a controversial Tibetan Buddhist offshoot, would tell people with concerns, "Why don't you sit with that?" rather than talk about it. "You pulled it in" is Scientology's response to a bad event in someone's life. Such calamities shouldn't happen to adherents, so if misfortune arises, you are doing Scientology wrong.

"Cultish" will raise eyebrows as it moves through modern belief systems to multilevel marketing (MLM) organisations, whose members are often put under pressure not only to sell products but to recruit new associates. Amway, the biggest and most powerful MLM, once called its members "independent business owners"; its own thought-terminating cliché is, "A good system always works." Modern beauty schemes often target young women, as Ms Montell says, using the "faux-spirational lingo of commodified fourth-wave feminism". These "boss babes" are motivated with rhetoric associated with independence.

Ms Montell also scrutinises fitness trends such as CrossFit, a kind of high-intensity training, where gyms are "boxes" and trainers are "coaches". "Uncle Rhabdo" is the nickname for rhabdomyolysis, a potentially life-threatening result of over-exercising, and nearly everything else is given an acronym. She examines online wellness gurus spouting pseudoscientific terminology such as "quantum transformation" and "upgrading your DNA". Most of these ministrations are harmless, but some of them suggest deleterious treatments.

In the end Ms Montell's net is so broad that it may leave many readers wondering if a group they belong to is manipulating them somehow. It may not be a cult (though it would certainly deny being one if it were). But being aware of how language is used to reroute or shut down thought within organisations is a powerful tool in itself. There is nothing wrong with joining a team and gladly adopting its lingo—so long as it remains freely chosen.

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Tenders

European Parliament

CONTRACT NOTICE

The European Parliament has launched a public procurement procedure with a view to concluding a contract for the full operational management of its childcare facility in Brussels, located on Rue Wayenberg. The childcare facility has a capacity of 320 children.

The contract notice (**No 2021/S 141-371596**) is available on the TED website:
ted.europa.eu/udl?uri=TED:NOTICE:371596-2021:TEXT:EN:HTML

If you are interested in taking part in this tender procedure, we invite you to download the documents available free of charge at the following address:
etendering.ted.europa.eu/cft/cft-display.html?cftId=8772

All requests for information should be sent to:
etendering.ted.europa.eu/cft/cft-display.html?cftId=8772

Reference: PE PERS 2021 027

Deadline for the submission of tenders:
17 September 2021 at **12:00**.

A compulsory visit of the Wayenberg premises will take place on **4 September 2021** at **10:00**.

Economic data

	Gross domestic product, % change on year ago: latest		quarter*	2021†	Consumer prices, % change on year ago: latest		2021†	Unemployment rate, %		Current-account balance, % of GDP, 2021†	Budget balance, % of GDP, 2021†	Interest rates, 10-yr gov't bonds: latest,%		change on year ago, bp	Currency units, per $ Aug 4th	% change on year ago
United States	12.2	Q2	6.5	6.0	5.4	Jun	3.6	5.9	Jun	-2.7	-12.7	1.2		67.0	-	
China	7.9	Q2	5.3	8.5	1.1	Jun	1.3	5.0	Jun‡§	2.8	-4.9	2.7	§§	nil	6.46	8.1
Japan	-1.6	Q1	-3.9	2.2	0.2	Jun	0.1	2.9	Jun	3.8	-9.0	nil		-8.0	110	-3.3
Britain	-6.1	Q1	-6.2	5.7	2.5	Jun	3.1	4.8	Apr††	-4.5	-10.8	0.6		45.0	0.72	6.9
Canada	0.3	Q1	5.6	5.4	3.1	Jun	2.3	7.8	Jun	-2.0	-8.8	1.1		70.0	1.25	7.2
Euro area	13.7	Q2	8.3	4.4	2.2	Jul	1.8	7.7	Jun	3.3	-7.1	-0.5		6.0	0.84	1.2
Austria	-5.5	Q1	-12.6	3.5	2.7	Jul	2.7	6.4	Jun	3.4	-8.0	-0.3		8.0	0.84	1.2
Belgium	14.5	Q2	5.7	4.3	2.3	Jul	1.5	6.2	Jun	-0.7	-6.6	-0.2		6.0	0.84	1.2
France	18.7	Q2	3.8	5.5	1.2	Jul	1.6	7.3	Jun	-1.3	-8.7	-0.1		7.0	0.84	1.2
Germany	9.2	Q2	6.1	3.5	3.8	Jul	2.5	3.7	Jun	6.8	-5.4	-0.5		6.0	0.84	1.2
Greece	-1.4	Q1	18.9	5.4	1.0	Jun	nil	15.1	Jun	-3.7	-5.8	0.6		-47.0	0.84	1.2
Italy	17.3	Q2	11.1	5.0	1.8	Jul	1.3	9.7	Jun	3.4	-11.8	0.6		-44.0	0.84	1.2
Netherlands	-2.4	Q1	-3.1	3.4	2.0	Jun	2.1	3.2	Jun	10.3	-1.7	-0.5		-6.0	0.84	1.2
Spain	19.8	Q2	11.5	6.1	2.9	Jul	2.0	15.1	Jun	0.9	-8.6	0.2		-6.0	0.84	1.2
Czech Republic	-2.6	Q1	2.4	3.8	2.8	Jun	2.7	2.9	Jun‡	3.0	-8.5	1.7		91.0	21.5	3.7
Denmark	-0.9	Q1	-3.9	2.8	1.7	Jun	1.4	3.8	Jun	7.8	-0.5	-0.2		23.0	6.28	1.0
Norway	-1.4	Q1	-2.5	2.6	2.9	Jun	2.9	4.9	Apr‡‡	2.5	-1.0	1.4		76.0	8.84	3.2
Poland	-1.3	Q1	4.5	4.6	5.0	Jul	4.1	5.9	Jun§	2.2	-6.9	1.8		50.0	3.84	-2.6
Russia	-0.7	Q1	na	3.4	6.5	Jun	5.7	4.8	Jun§	3.8	-1.8	7.0		105	73.1	0.8
Sweden	9.3	Q2	3.6	3.9	1.3	Jun	1.9	10.3	Jun§	4.8	-2.2	0.1		16.0	8.60	1.7
Switzerland	-0.5	Q1	-2.0	3.4	0.7	Jul	0.3	3.1	Jun	7.1	-3.8	-0.4		6.0	0.91	1.1
Turkey	7.0	Q1	na	5.6	19.0	Jul	16.6	12.4	May§	-2.7	-2.8	16.7		368	8.47	-17.7
Australia	1.1	Q1	7.3	4.3	3.8	Q2	2.6	4.9	Jun	1.9	-6.1	1.1		28.0	1.36	2.9
Hong Kong	7.5	Q2	-3.9	4.9	0.7	Jun	1.6	5.5	Jun‡‡	3.2	-4.1	0.9		46.0	7.78	-0.4
India	1.6	Q1	6.0	10.4	6.3	Jun	5.2	7.0	Jul	-0.9	-7.2	6.2		37.0	74.2	1.1
Indonesia	-0.7	Q1	na	3.9	1.5	Jul	2.4	6.3	Q1§	-0.1	-5.7	6.2		-58.0	14,313	2.2
Malaysia	-0.5	Q1	na	4.4	3.4	Jun	2.4	4.5	May§	4.4	-5.8	3.2		60.0	4.22	nil
Pakistan	4.7	2021**	na	3.8	8.4	Jul	9.2	5.8	2018	-1.8	-7.2	9.8	†††	61.0	164	2.4
Philippines	-4.2	Q1	1.2	5.1	4.0	Jul	4.2	8.7	Q2§	-1.1	-7.5	3.9		109	49.8	-1.3
Singapore	14.3	Q2	-7.7	5.4	2.4	Jun	1.8	2.7	Q2	17.3	-4.4	1.3		44.0	1.35	2.2
South Korea	5.9	Q2	2.7	3.8	2.6	Jul	2.0	3.8	Jun§	4.6	-3.2	1.9		56.0	1,144	4.4
Taiwan	7.5	Q2	-7.9	5.9	1.9	Jun	1.7	4.8	Jun	15.6	-0.7	0.4		-3.0	27.8	5.8
Thailand	-2.6	Q1	0.7	2.8	1.2	Jun	1.5	1.5	Dec§	3.7	-6.5	1.2		19.0	33.1	-6.2
Argentina	2.5	Q1	11.0	7.0	50.2	Jun	47.3	10.2	Q1§	1.6	-5.9	na		na	96.8	-25.1
Brazil	1.0	Q1	4.9	5.5	8.3	Jun	7.2	14.6	May§‡‡	nil	-5.9	9.6		326	5.22	1.9
Chile	0.3	Q1	13.4	7.5	3.8	Jun	3.6	9.5	Jun§‡‡	-0.4	-7.1	4.4		202	779	-1.9
Colombia	2.0	Q1	11.9	7.8	3.6	Jun	3.1	14.4	Jun§	-3.6	-8.9	6.9		182	3,917	-3.1
Mexico	19.7	Q2	6.1	6.4	5.9	Jun	5.1	4.0	Jun	1.6	-2.8	6.9		122	19.9	14.3
Peru	3.8	Q1	8.3	10.8	3.8	Jul	3.5	8.8	Jun§	-0.5	-5.7	5.9		267	4.07	-12.8
Egypt	2.9	Q1	na	3.3	4.9	Jun	5.6	7.4	Q1§	-3.8	-8.0	na		na	15.7	1.9
Israel	-1.0	Q1	-5.8	4.2	1.7	Jun	1.8	5.2	Jun	3.9	-7.6	0.9		28.0	3.21	6.5
Saudi Arabia	-4.1	2020	na	2.2	6.2	Jun	2.9	6.5	Q1	3.4	-2.1	na		na	3.75	nil
South Africa	-3.2	Q1	4.6	3.0	5.1	Jun	4.0	32.6	Q1§	1.2	-9.4	8.9		-47.0	14.4	21.3

Source: Haver Analytics. *% change on previous quarter, annual rate. †The Economist Intelligence Unit estimate/forecast. §Not seasonally adjusted. ‡New series. **Year ending June. ††Latest 3 months. ‡‡3-month moving average. §§5-year yield. †††Dollar-denominated bonds.

Markets

In local currency	Index Aug 4th	% change on: one week	Dec 31st 2020
United States S&P 500	4,402.7	nil	17.2
United States NAScomp	14,780.5	0.1	14.7
China Shanghai Comp	3,477.2	3.4	0.1
China Shenzhen Comp	2,465.6	6.6	5.8
Japan Nikkei 225	27,584.1	nil	0.5
Japan Topix	1,921.4	0.1	6.5
Britain FTSE 100	7,123.9	1.5	10.3
Canada S&P TSX	20,329.7	0.5	16.6
Euro area EURO STOXX 50	4,144.9	1.0	16.7
France CAC 40	6,746.2	2.1	21.5
Germany DAX*	15,692.1	0.8	14.4
Italy FTSE/MIB	25,490.2	0.9	14.7
Netherlands AEX	766.2	2.5	22.7
Spain IBEX 35	8,792.9	0.7	8.9
Poland WIG	68,170.8	1.2	19.5
Russia RTS, $ terms	1,640.3	1.5	18.2
Switzerland SMI	12,178.7	0.9	13.8
Turkey BIST	1,413.8	3.9	-4.3
Australia All Ord.	7,778.7	1.7	13.5
Hong Kong Hang Seng	26,426.6	3.7	-3.0
India BSE	54,369.8	3.7	13.9
Indonesia IDX	6,159.0	1.2	3.0
Malaysia KLSE	1,491.3	-1.6	-8.4

	index Aug 4th	% change on: one week	Dec 31st 2020
Pakistan KSE	47,789.9	1.0	9.2
Singapore STI	3,182.9	1.3	11.9
South Korea KOSPI	3,280.4	1.3	14.2
Taiwan TWI	17,623.9	2.9	19.6
Thailand SET	1,545.9	0.5	6.7
Argentina MERV	65,088.1	-2.2	27.1
Brazil BVSP	121,801.2	-3.6	2.3
Mexico IPC	51,195.4	-0.3	16.2
Egypt EGX 30	10,718.9	-0.5	-1.2
Israel TA-125	1,758.7	0.2	12.2
Saudi Arabia Tadawul	11,162.4	2.1	28.5
South Africa JSE AS	68,898.1	0.5	16.0
World, dev'd MSCI	3,085.8	0.5	14.7
Emerging markets MSCI	1,304.0	2.8	1.0

US corporate bonds, spread over Treasuries

Basis points	latest	Dec 31st 2020
Investment grade	117	136
High-yield	358	429

Sources: Refinitiv Datastream; Standard & Poor's Global Fixed Income Research. *Total return index.

Commodities

***The Economist* commodity-price index**

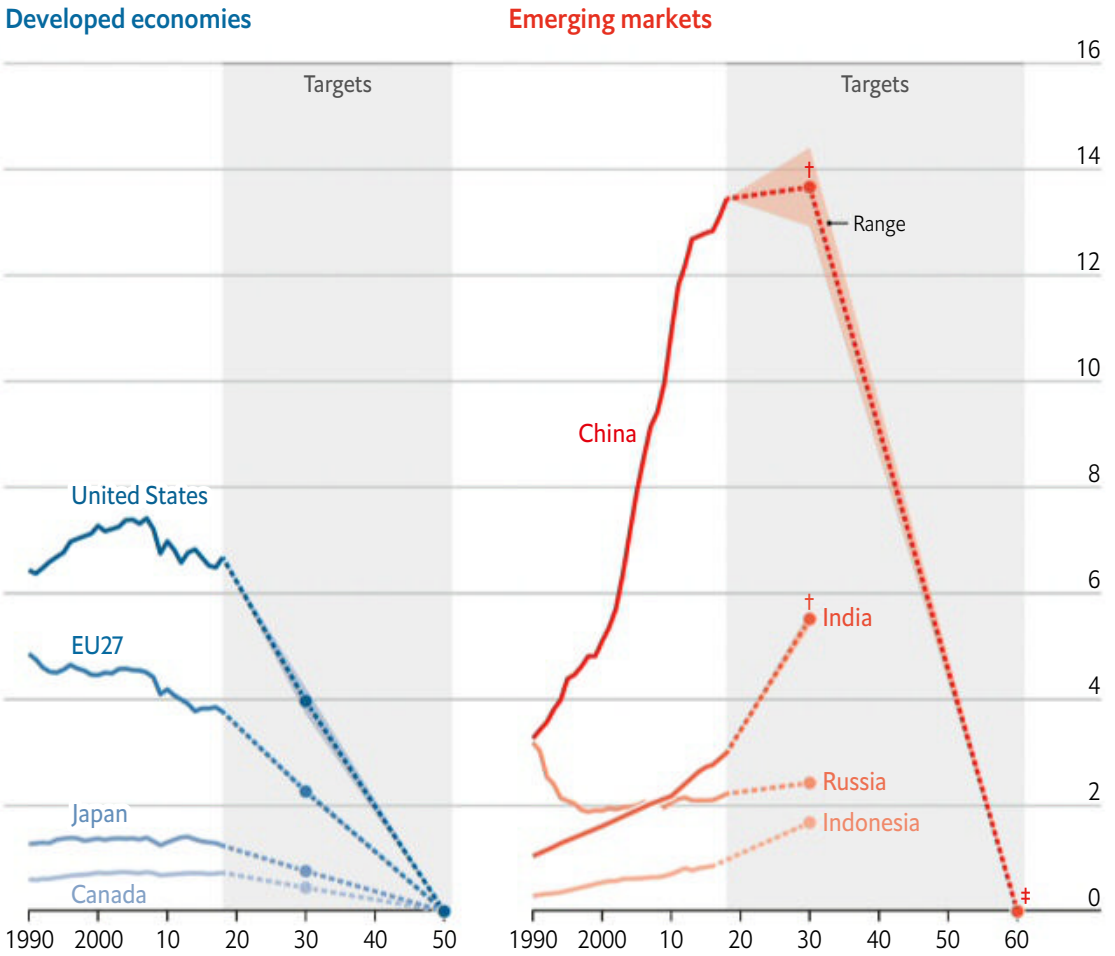
2015=100	Jul 27th	Aug 3rd*	% change on month	year
Dollar Index				
All Items	179.3	173.4	-6.4	44.5
Food	129.8	128.6	0.5	38.7
Industrials				
All	225.5	215.3	-9.9	48.0
Non-food agriculturals	144.8	143.5	-6.3	43.6
Metals	249.4	236.6	-10.6	48.9
Sterling Index				
All items	197.1	190.5	-7.0	35.7
Euro Index				
All items	168.1	162.2	-6.7	43.3
Gold				
$ per oz	1,797.5	1,808.9	0.3	-9.3
Brent				
$ per barrel	74.6	72.5	-2.9	63.1

Sources: Bloomberg; CME Group; Cotlook; Refinitiv Datastream; Fastmarkets; FT; ICCO; ICO; ISO; Live Rice Index; LME; NZ Wool Services; Thompson Lloyd & Ewart; Urner Barry; WSJ. *Provisional.

For more countries and additional data, visit **Economist.com/indicators**

→ **Emerging-market countries' climate goals leave a lot of room for them to emit more greenhouse gases**

Greenhouse-gas emissions*, tonnes of CO_2 equivalent, bn
Four largest emitters in each group



Annual change in emissions allowed by targets
From 2018 or latest available, % points

*Excluding forestry and other land use, except net-zero targets which include emissions removals from these sources †Multiple targets ‡Unclear whether this targets CO_2 or all greenhouse gases §Assuming any conditions are met. Where target is a range, the average is used **Not yet official Sources: Climate Action Tracker; World Resources Institute

Green goals

Certain sorts of pledge are far less bold than they first appear

NEW CLIMATE announcements are coming thick and fast. In recent weeks dozens of countries, including Nigeria and Malaysia, updated the mitigation plans known as "nationally determined contributions" (NDCs) required under the Paris climate agreement of 2015. The deal obliges its signatories to increase the ambition of their NDCs every five years. The original deadline for the first round of updates was COP26, the UN climate summit in Glasgow in 2020. However, because of the covid-19 pandemic, the shindig's start was delayed until October this year. So far, 58% of the 191 signatories have submitted new NDCs.

Countries' climate targets come in many shapes and sizes. Around two-thirds of the global economy is now covered by a pledge to achieve "net-zero" emissions by around mid-century. The array of different benchmarks and definitions can obscure how ambitious each country actually plans to be. To obtain a clearer picture, *The Economist* has crunched data from Climate Action Tracker, a research group.

The world's 20 biggest polluters account for four-fifths of global emissions. About half of them have climate targets that provide for their emissions to grow over the next decade—all of those are emerging economies. Their justification is that the West was allowed to spew greenhouse gases as it grew rich and that they have the right to do so, too.

Offering relative pledges connected to the intensity of future pollution, or measured against scenarios without any reductions, are popular ways to cloak meagre green ambitions and continue polluting. Tweaking statistics is another.

Consider China, the world's biggest emitter with roughly a quarter of total emissions. It says it will cut the carbon-dioxide intensity of its GDP by over 65% by 2030, compared with 2005 levels. As economies grow, however, they automatically tend to become more energy efficient and so burn less fossil fuel to produce each unit of GDP. Carbon intensity drops, even as the country pollutes more overall. China's target allows it to emit slightly more by the end of the decade than it does today.

Another type of climate goal involves promising to cut emissions compared with a business-as-usual scenario. Pakistan pledges a cut of 20% by 2030, compared with a pathway where no climate action is taken whatsoever. Yet this goal means its emissions could surge threefold by 2030.

Fiddling with baselines is another wheeze. Brazil submitted its updated NDC in December. A major percentage in the pledge was the same: a reduction of 43% below 2005 levels by 2030. But tweaks to its carbon accounting meant the level of emissions booked in 2005 increased from the equivalent of 2.1bn tonnes of carbon dioxide to 2.8bn tonnes. As a result, the amount Brazil can emit in 2030 has risen by about a third.

Rebasing climate targets changes the relative ambition of rich countries, too. On the face of it, the European Union's target of lowering emissions by 55% by 2030 is more ambitious than America's 52% cut. But the EU's goal is based on 1990 levels and its emissions have already fallen from that point. By contrast, America's plan is based on 2005 levels, and its emissions have fallen by less since. Once put on the same basis, America's goal appears more laudable.

Rich countries should not feel smug about their efforts, however. If Brazil's emissions rise in line with its pledge and America's fall to meet its goal, by 2030 the average carbon footprint of an American will still be twice as large as that of a Brazilian. Not enough is being done to combat climate change in either the rich world or in emerging markets. ■

The weed of paradise

Frenchy Cannoli (born Didier Camilleri), master of hashish, died on July 18th, aged 64

MANY, MANY times in the early 1980s, in the Parvati Valley in the foothills of the Himalayas, a young man wandered slowly through a thicket of wild cannabis plants. As he went he removed the fan leaves from each plant and caressed the small green flowers, the resin glands. On his palm they left a thin layer, clear at first, then thickening and darkening until he could press the sticky brown mass with his thumb, and snap it off. He did not hurry. This was a communion between man and plant, a divine thing. The terpenes the flowers released were so intense that they almost overwhelmed him; his body seemed to float in the very essence of the valley. He could well believe that cannabis was born in a drop of the elixir of life, shaken down when the gods and the demons were struggling to create it.

So the locals said. But one look at this young man—his gangliness, and especially the whiteness of his skin—showed that he was not one of them. He was a Frenchman, brought up in Nice, and destined for a nine-to-five life before, on his 18th birthday, he ran away. His head was full of Marco Polo, Lawrence of Arabia and wild, tripping tales of survival in hard places. Now it was he who was wearing native clothes and living on society's margins, in a shack at the mouth of a cave. He was searching for the best hashish ever made, and he had found it in this valley, where the cannabis plants were protected by the beautiful goddess Parvati: *charas*, or Indian hashish, harvested as humans had probably done since the glimmering dawn of time.

What he absorbed there, in the seven or eight seasons he spent stroking and smoking the resinous flowers, turned him into a master of hashish. It was not a skill he could easily use back in so-called civilisation. First in Japan, then in California, hashish was still a scary and dangerous pleasure, one he hid from everyone except his dealer and his wife. It took the legalisation of cannabis in California for medical use in 1996, and for recreational use in 2016, to bring his passion and expertise as a *hashishin* into public view.

At first he sold his hashish only to Californian dispensaries. Then in looser times, in seminars, workshops and videos and in gravelly French tones, he showed all "home gardeners" how to make it properly. This was not by violent extraction but by gently sieving the cured flowers, pressing and rolling them with a bottle of boiling water to release their resin, then shaping it, like a pastry chef, into *cannoli*. Hence his *ganja* name. With much folding and pressing he could also make giant hashish balls, sleek and brown as bread, to show off with artist's pride. In video interviews he would writhe with delight as he described the tiny resin samples he had brought along, before both parties disappeared in ecstatic clouds of smoke. The interviewer might get noisy then, gasping "Holy Moly!" and needing to take a break; but he would stay serious, almost impassive, letting his mouth fill with the smoke, savouring each complexity and every moment.

He might have been drinking wine. The comparison was new but, to a Frenchman, obvious. Like vines, cannabis plants reflected their *terroir*; the tiniest variations in life-giving soil and life-shaping climate produced different terpenes, hence different strains. (He once found a patch in a field of wild strawberries, with a unique berry aroma; another, under nut bushes, tasted of nuts; each cultivar he used for hashish swept him off to a new reality.) In America's best cannabis country, the Emerald Triangle of northern California, the rolling hills produced dozens of strains. Each had been nurtured, like a vineyard, by the love and unhurried dedication of three generations of small, often hippie, farmers. To his mind, the Triangle was ripe for the French Appellation d'Origine Contrôlée (AOC), which tied a wine officially to its place by reputation, genetics and traditional ways of work. There was no reason why Purple Kush, Blackwater, Desert Diesel and Trainwreck should not attract the same reverence as a Montrachet or a Châteauneuf du Pape.

He reinforced the thought in two ways. First he made sure his own brand of hashish, marketed as Frenchy Cannoli 100% Ouh La La, looked as exclusive as fine wine. His best resin came in small black jars; his Royal Nepalese Temple Balls, a revival of a lost art, nestled in them singly like glossy dark-brown pearls. The lids were stamped, in the manner of Cognac, with V.S.O.P., for Very Special Olde Press. His second tactic was to produce a scoring system by which strains could be graded for, among other things, appearance, stability, smoothness, bouquet, intensity and sheer pleasure, turning unruly aficionados into solemn connoisseurs.

The AOC idea caught on, but slowly and not officially. It was hard to get the classification accurate enough. During prohibition, for almost 100 years, the farmers of the Triangle had learned to keep their methods secret, much like the Indian farmers he knew. They had no records to prove legacy or constancy, and disliked the sound of any regulation. Even legalisation was a threat, because it might force down the price. He wanted to protect and promote them by making the Triangle the Bordeaux or Champagne of hashish; but they were wary.

He was on surer ground when he compared hashish to wine as another gift of the gods. For so it was, and as he lit up he would often dedicate the smoke and the joy to Shiva. The cannabis plant, he claimed, could remove toxins, radioactivity, pesticides and solvents from the planet. It was also powerful medicine, as governments now realised and as he knew from experience. Hashish had soothed the traumas of his childhood and filled him with immense, positive energy—energy to become its chief ambassador.

The long stigma of smoking it still stayed with him. But eventually even that would heal. In the Parvati Valley he had once cut his index finger to the bone, hampering his apprenticeship. But he had dressed it with the best salve he knew, and the only sort he had: white hashish ashes from a chillum pipe, wrapped round with a rolling paper. And then he had set off again on his wanderings, to caress the waiting flowers. ■

The Economist EVENTS

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