

The Economist

The end of the social network

Bidenomics in a second term

Why charter schools work

Inside the Zelensky v Zaluzhny feud

FEBRUARY 3RD-9TH 2024

**HOW TO END
THE MIDDLE
EAST'S AGONY**





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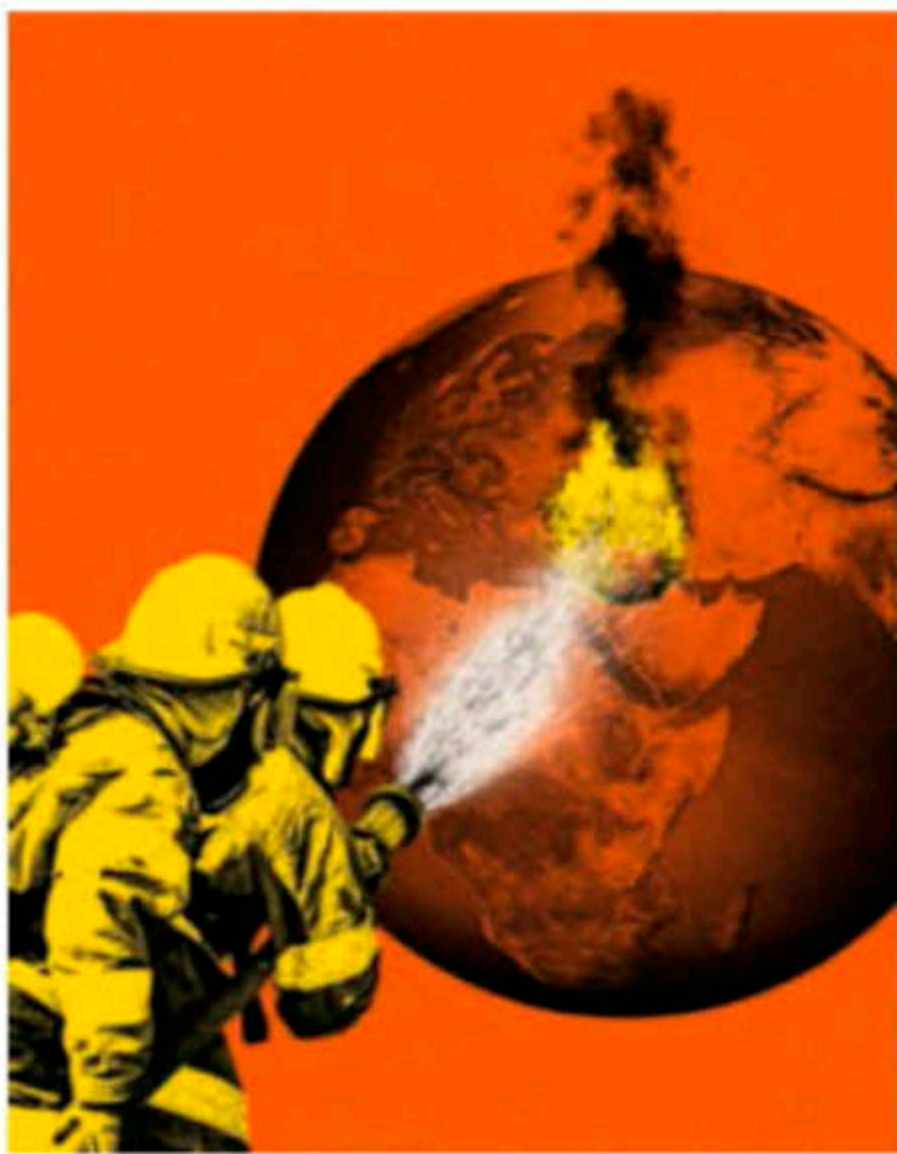
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On the cover

War is spreading across the Middle East. There is an alternative: leader, *page 9*. America makes a big push to end the war in Gaza. And maybe bring a lasting peace too, *page 35*. The case for bailing out Egypt: leader, *page 11*, and analysis, *page 38*. Despite a threat to one of its main trade routes, China prefers to sit out the Red Sea's security crisis, *page 31*

The end of the social network
A new social-media landscape is solving some problems—and creating new ones: leader, *page 10*. As Facebook turns 20, politics is out; impersonal video feeds are in: briefing, *page 14*

Bidenomics in a second term
What four more years of Joe Biden would mean for America's economy, *page 61*

Why charter schools work
The evidence for them has strengthened, just as both parties have run away from them: leader, *page 11*. Charter schools do things that all Democrats say they support, *page 17*

Inside the Zelensky v Zaluzhny feud
Ukraine's army chief faces the sack, *page 41*

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The world this week

7 A summary of political and business news

Leaders

- 9 **Gaza and beyond**
Ending the agony
- 10 **Online media**
Less network, more social
- 11 **Egypt's financial crisis**
Pyramid scheme
- 11 **American schools**
A charter for change
- 12 **The British armed forces**
Beating retreat

Letters

- 13 On Europe's single market, Israel and genocide, the death penalty, shipping sanctions, lawn bowls

Briefing

- 14 **Social media**
Not posting, but watching

Technology Quarterly: Where the internet lives

The foundations of the cloud
After page 40



Bartleby From football managers to CEOs, energy is a superpower, *page 58*



United States

- 17 New school
- 18 The Nevada GOP mess
- 20 The Arizona GOP mess
- 20 Lactose laws
- 21 Trump's defamations
- 22 Impeaching Mayorkas
- 23 **Lexington** EV politics



The Americas

- 24 Venezuelan politics
- 25 Spies in Canada
- 26 Brazil's fiscal mess



Asia

- 27 Kishida on the rocks
- 28 Indonesia's TikTok election
- 29 India's stray cows...
- 29 ...and its wayward opposition
- 30 **Banyan** Asia and sanctions



China

- 31 Security in the Red Sea
- 33 Repression in Hong Kong
- 33 "Shawshank" on stage
- 34 **Chaguan** Lessons from bicycle-makers



Middle East & Africa

- 35 America's push for peace
- 38 Egypt's broken economy
- 38 The UN in Gaza
- 39 Hunger in Ethiopia
- 40 "Brexit" in the Sahel



Europe

- 41 Ukraine's army chief faces the sack
- 42 Putin's challenger
- 43 Meet the Knights of Malta
- 43 F-16s for Turkey
- 44 Ukraine's Black Sea victory
- 45 **Charlemagne** Pitchfork protests

**Britain**

- 46 The armed forces
- 48 Europe's view of Labour
- 49 **Bagehot** Tory unity

**International**

- 50 War in space looms

**Business**

- 53 After the iPhone
- 54 Can AMD beat Nvidia?
- 56 Heirless family firms
- 57 Rolls-Royce goes electric
- 57 Biden's gas gaffe
- 58 **Bartleby** CEOs' superpower
- 59 **Schumpeter** Trump v TikTok

**Finance & economics**

- 61 Bidenomics round two
- 63 **Buttonwood** Bitcoin ETFs
- 64 China's policy muddle
- 64 Evergrande's liquidation
- 65 Fighting inflation
- 66 **Free exchange** Biden's electoral chances

**Science & technology**

- 67 Prosthetic tentacles
- 68 Is Alzheimer's catching?
- 69 The risks of AI in science
- 70 How whales smell

**Culture**

- 71 Collaborative writing
- 72 A museum in Hong Kong
- 73 Slap fighting
- 73 Art buying, exposed
- 74 Modern dance
- 75 **Back Story** "Mr & Mrs Smith" returns

**Economic & financial indicators**

- 77 Statistics on 42 economies

Obituary

- 78 Peter Schickele and P.D.Q. Bach, two sides of the same coin

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American, Egyptian, Israeli and Qatari negotiators met in Paris to discuss the framework for a long humanitarian pause in the fighting in Gaza. It would allow for the exchange of hostages still being held in **Gaza** with Palestinian prisoners in **Israel**. Binyamin Netanyahu, Israel's prime minister, said he would not accept a deal that required Israeli troops to leave Gaza permanently without Israel's "total victory" over Hamas. Nonetheless Ismail Haniyeh, a senior Hamas leader, said the group was considering the proposal.

Three **American soldiers** were killed and 40 others wounded in a strike on a base in Jordan known as Tower 22, which supports American operations in Iraq and Syria. Kataib Hezbollah, an Iranian-backed Iraqi militia, is believed to have been responsible. America hinted that its response might come in waves.

Israel said it had evidence that at least a dozen of the 13,000 Gaza-based staff members of **UNRWA**, the UN agency that helps Palestinians, were involved in Hamas's attack on Israel on October 7th. In response more than ten countries, including America and Germany, UNRWA's two largest funders, said they would freeze donations. UNRWA says that without the money it will be forced to cease operations at the end of February amid the humanitarian crisis in Gaza.

Israeli troops disguised as medics and other civilian roles killed three members of Palestinian armed groups in a hospital in the **West Bank**. Israel says the raid prevented a major imminent attack. A doctor at

the hospital said one of the men was receiving medical treatment. Experts believe Israel's ruse probably violated the laws of war.

The Iranian-backed **Houthis** attacked more merchant ships linked to America and Britain off the coast of Yemen. America carried out more air strikes on Houthi targets, including the destruction of a fleet of drones that were being prepared to attack vessels.

The African National Congress, **South Africa's** ruling party, suspended Jacob Zuma, a former president, after he said he would campaign for a newly formed rival party. The split makes it more likely that the ANC will lose its majority for the first time in national elections, which are due to be held later this year.

Burkina Faso, Mali and Niger, three west African countries run by military juntas, said they would withdraw from **ECOWAS**, the regional bloc, which has been pressing for a return to civilian rule.

The quid pro quo

The Biden administration confirmed that it would sell 40 **F-16s to Turkey**. The confirmation of the arms deal came the day after Turkey officially approved Sweden's membership of NATO. America had linked the sale of the fighter jets to Turkey's ratification of Sweden's application.

After intense negotiations, the European Union agreed to release €50bn (\$54bn) in aid to **Ukraine**. Because the money is coming from the EU budget it required unanimous approval. Viktor Orban, the prime minister of Hungary, had been blocking the deal until this week's summit.

Meanwhile **Volodymyr Zelensky**, Ukraine's president, was reported to have asked Valery Zaluzhny, the country's most senior general, to resign. Tensions between the two men are running high after General

Zaluzhny said that the war was at a stalemate, contradicting the official line that Ukraine is making advances.

The **Spanish government's** amnesty bill for Catalan nationalists was surprisingly defeated in a parliamentary vote. The Junts per Catalunya party withdrew its support, claiming the amnesty would not cover Catalan politicians who are being investigated on terrorism charges. Last year huge protests were held throughout Spain against the amnesty, the centrepiece of a deal that allowed the Socialists to continue in government. The bill could be resubmitted with revisions.

The Democratic Unionist Party in **Northern Ireland** announced its return to the power-sharing executive that it walked out of two years ago. Sir Jeffrey Donaldson, the DUP leader, agreed to a deal with the government in Westminster that will reduce checks and paperwork on goods moving from the British mainland to the province and staying there. But the Brexit-imposed Irish sea border is not going away entirely.



Imran Khan was handed two more prison sentences: 14 years for selling state gifts for personal profit and ten years for leaking classified documents. His wife was also imprisoned. Mr Khan, who has been in prison since August in the state-gifts case and barred from political office, says all the charges against him are politically motivated. His party has faced restrictions in campaigning ahead of a general election scheduled for February 8th.

In **Thailand** the Constitutional Court ruled that the reformist Move Forward party had broken the law by wanting to change the country's *lèse-majesté* legal code, which outlaws any criticism of the monarchy. The court ordered the party to ditch its policy. Though no MPs will be punished by the court's decision, it gives ammunition to Move Forward's enemies, who want to abolish the party.

The Philippines and Vietnam signed an agreement to co-operate on maritime security in the **South China Sea**. Chinese state media said the deal "will only irritate the situation" and increase the risk of conflict.

Brazil's president, Luiz Inácio Lula da Silva, sacked the deputy head of Abin, the country's intelligence agency, and four other officials, amid claims that Abin spied on critics of Jair Bolsonaro during his presidency. Police raided properties associated with Carlos Bolsonaro, one of the former president's sons, who is suspected of being at the heart of the spying ring. He has denied any wrongdoing.

America's House of Representatives came closer to impeaching Alejandro Mayorkas, the **secretary of homeland security**, for, Republicans say, failing to stop the surge of migrants crossing the Mexican border. Voting along party lines a committee approved two articles of impeachment, which will be put to the full House.

It's pay-back time

E. Jean Carroll pledged to use the \$83m that **Donald Trump** was ordered to pay her in damages on something he hates. A jury awarded the \$83m for defamatory remarks made by Mr Trump against Ms Carroll, whom he sexually abused according to another court jury. After coming face-to-face with him in court, she described Mr Trump as "just something in a suit".

The **Federal Reserve** kept its main interest rate on hold at a range of 5.25% to 5.5%. It was the fourth consecutive time the central bank has held rates. With inflation on the wane, investors are impatient for a rate cut; the Fed offered little information about when it expects to do that. It did issue a more neutral outlook by saying that it was “moving into better balance” on jobs and inflation, but it all but ruled out a rate cut in March. Stockmarkets swooned.

Boeing withheld its usual forward guidance for the year when it presented its quarterly earnings. The planemaker’s 737 Max 9 aircraft were grounded when a panel fell from an airliner soon after take-off. The 737 Max 9s have started flying again, though the Federal Aviation Administration has limited Boeing’s production of the plane.

Microsoft reported a big jump in revenues, boosted in large part by artificial intelligence, which it is now applying “across every layer of our tech stack”, according to Satya Nadella, its chief executive. The company pointed to the success of its Azure AI cloud service, which provides access to large and small language models integrated with infrastructure, data and tools. But Microsoft’s share price dipped, as investors fretted about the increasing costs of keeping up with AI developments.

A “notably larger” rise in spending on AI at **Alphabet** also weighed on market sentiment after it announced its results, even though revenue grew more than expected at Google’s cloud-services business.

Amazon withdrew its proposed acquisition of **iRobot**, following objections from the European Union. IRobot makes the Roomba autonomous vacuum cleaner; the EU claimed the deal would have allowed Amazon to Hoover up competition in the market. After Amazon’s announcement

iRobot said it would shed a third of its staff, after sales fell by 25% last year.

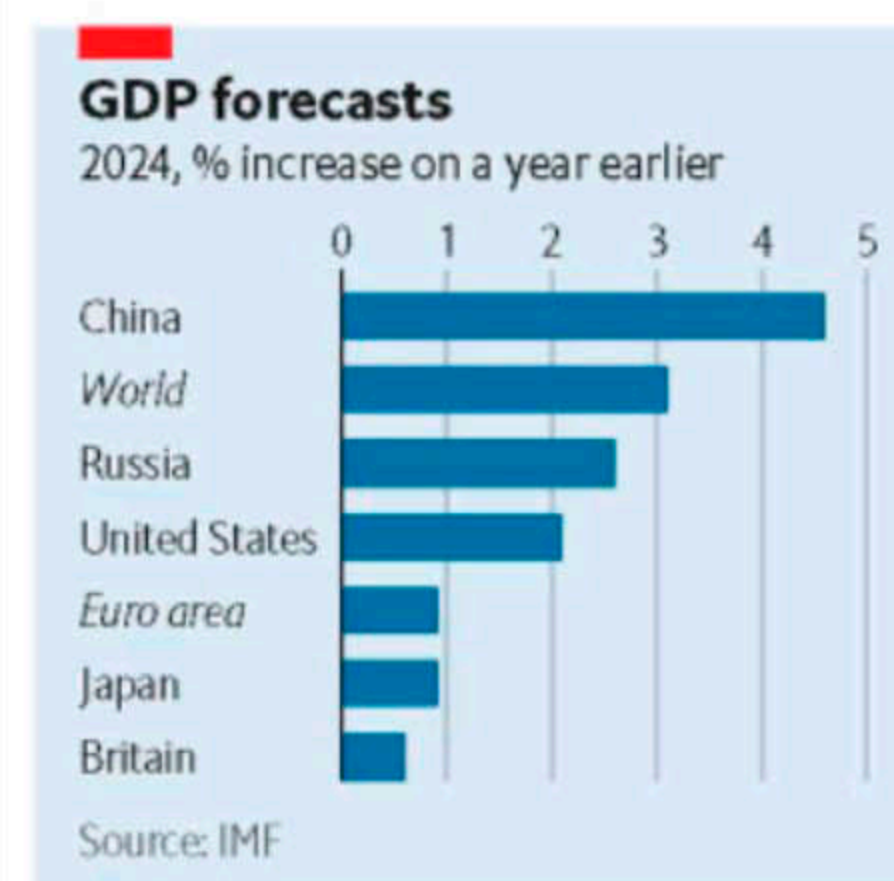
Bumps in the road

After becoming the world’s biggest seller of electric vehicles, **BYD** said it expects its profit last year will have grown by up to 86%. But it also warned of increasing competition from Chinese rivals. Meanwhile Renault called off its planned IPO of **Ampere**, its EV division, because of “current equity-market conditions”; in other words, souring investor sentiment on growth in the EV industry.

“It’s true the pace of EV growth has slowed,” **General Motors** said in its earnings, but it pointed out that EV sales are still rising, and should account for 10% of all car sales in America this year. The weak spot in the carmaker’s otherwise positive outlook remains China; it sold 2.1m vehicles there in 2023, down from a peak of 4m in 2017.

Although it is a laggard in EVs, **Toyota** retained its crown as the world’s biggest seller of vehicles in total, notching up 11.2m in sales last year. Volkswagen parked in the number-two spot again, selling 9.2m.

In a surprising change to its strategy, **Saudi Aramco**, under the direction of the Saudi government, abandoned an aim of increasing its maximum oil output and is to stick to current targets. Some industry watchers wondered if this was a response to a possible slowing of demand, whereas others said it was a reaction to spare capacity.



The IMF said it now expects the **world economy** to grow by 3.1% this year, up from the 2.9% it forecast last October. This is in part because of “greater-than-expected resilience” in the American economy, which expanded at an annual rate of 3.3% in the last three months of 2023. But the fund’s biggest upward revision was to **Russian GDP**, which it now thinks will grow by 2.6%. Despite sanctions by the West, Russia has been able to sell its oil elsewhere. Exports of Rus-

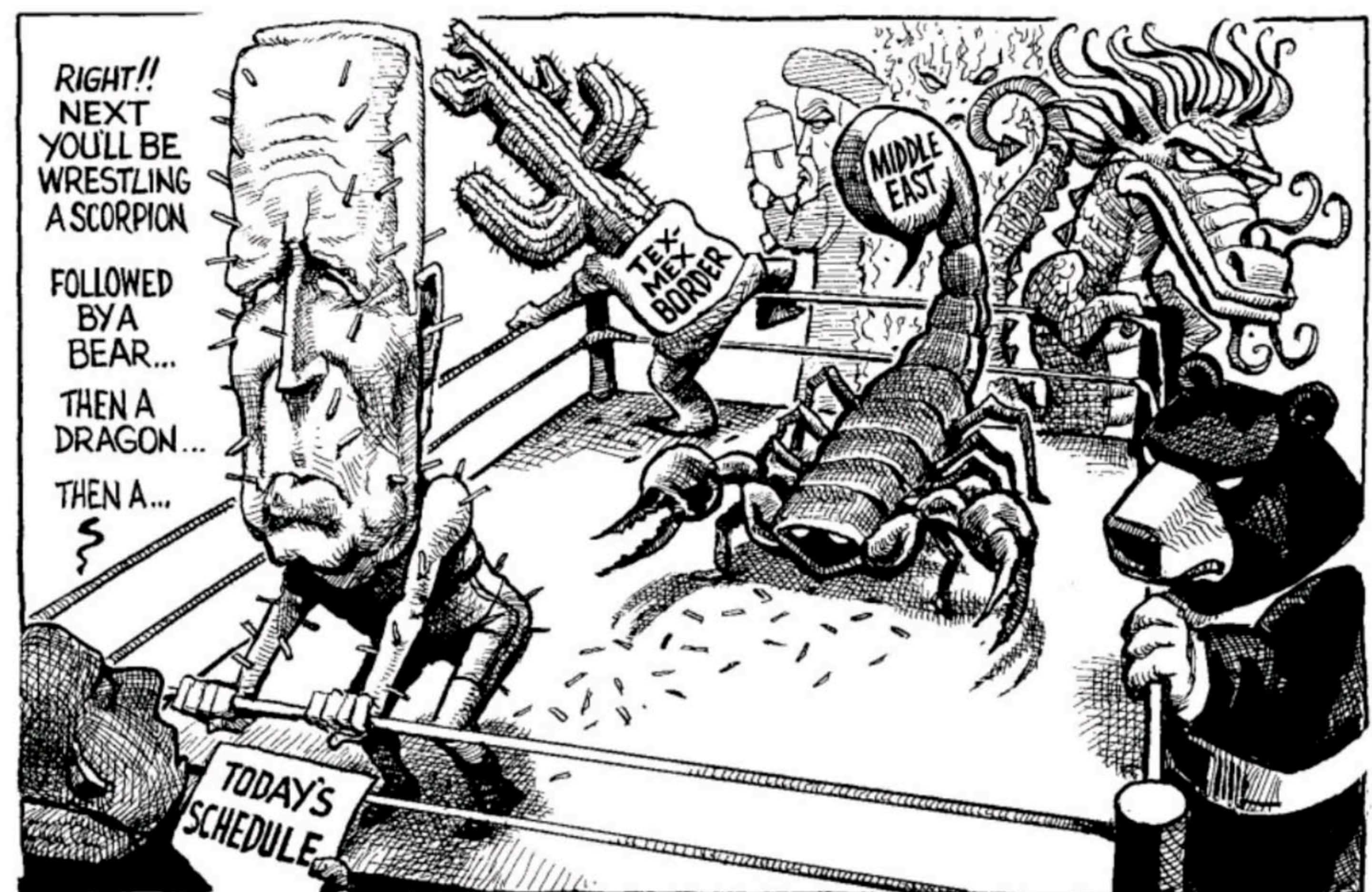
sian diesel to Brazil, for instance, have soared over the past year.

The **euro zone’s economy** registered zero growth in the final quarter of 2023, narrowly avoiding a recession (GDP fell by 0.1% in the previous three months). The economy grew by just 0.5% for the whole year.

A judge in Hong Kong ruled that **Evergrande** be put into liquidation. Saddled with over \$300bn in liabilities, the developer is at the heart of China’s property crisis. The ruling applies to its Hong Kong-based holding company, part of a sprawling financial network. Enforcing the order will depend on courts and officials in mainland China, where most of Evergrande’s assets are held.

Rich man, poor man

A judge in Delaware struck down the \$55.8bn pay package awarded by Tesla to **Elon Musk** in 2018, finding that as the “superstar CEO”, he had “dominated the process” that led to the deal. “Never incorporate your company in the state of Delaware,” Mr Musk retorted on X. He is going to ask Tesla’s shareholders “immediately” to transfer the company’s incorporation base to Texas.



Ending the Middle East's agony

War is spreading across the region. There is an alternative

IN THE MONTHS after Hamas committed the worst atrocity against Jews since the Holocaust, conflict has spread across the Middle East. In all, ten countries are now caught up in fighting. In Gaza Israeli soldiers and Hamas are still killing each other, even as 2m people face famine. Across the border with Lebanon, Hizbullah and Israel are in a low-grade war. The Houthis in Yemen are attacking cargo ships, aggravating a financial crisis in Egypt (see leader) and triggering retaliation by America and Britain. The killing of three GIs in Jordan on January 28th by militias in Iraq could spark a clash between America and Iran, which sponsors the “axis of resistance”.

It is easy to despair, but there is a way out. Amid intense diplomacy, led by America and Saudi Arabia, a transformative deal is taking shape. Its novelty, we have learned, is to use a proposed hostage-release to reset Israeli politics; to use that reset to open a path to a Palestinian state; and then to use Israel's commitment to that as the basis for a deal between it and Saudi Arabia, in which mutual recognition is underpinned by American security guarantees. Officials say the odds of a hostage deal may be 50% and, with that in place, the odds of a Saudi-Israeli deal could also be 50%. The prize is far from certain, obviously, but it promises a new economic and security architecture in the Middle East.

One reason for hope is that Israel may wish to pause the campaign. Many Israelis are desperate to get their hostages home, and fighting won't free them. Israel has advanced towards its military goals. Hamas has lost half its territory, half its fighters (says Israel's army), possibly a third of its tunnels and many of its leaders (but not the most senior). From now, Israel faces diminishing returns, plus an ever higher civilian toll in Gaza and corresponding harm to its reputation.

Another reason for hope is that America, Egypt, the Gulf states and Saudi Arabia also have good cause to work together. As the war has spread, all those countries have seen the full extent of Iran's malign influence. Through its regional proxies, armed with drones and missiles, Iran is attempting to sow regional chaos even as it seeks to avoid a direct war with Israel or America. All want to stop Iran's scavenger regime from emerging as the regional power, capable of threatening Israel and the Gulf and holding world trade to ransom. That would make a mockery of American deterrence. None wants to see a ruinous war pitting America and Israel against Iran. Peace is the only way out.

The plan begins with a humanitarian pause brokered by America, Qatar and Egypt (see Middle East & Africa section). The first truce, in November, lasted just seven days; this one could endure for one or two months and free many or all of the remaining 100 or more Israeli hostages in stages. That could reset Israeli politics and help the Israeli public look beyond the horror of October 7th. America and Saudi Arabia are asking Israel to commit itself to a Palestinian state, and prove its resolve by, for example, freezing settlements on the West Bank.

The next step, our reporting reveals, involves Muhammad bin Salman, Saudi Arabia's autocratic but modernising leader. Before October 7th he was working on a deal that recognised Is-

rael in return for a Saudi-American defence treaty. Indeed, one probable motive behind Hamas's assault was to sabotage his plans. Against the odds, Saudi Arabia is still striving for this vision. A deal would mark the biggest Arab commitment to peace in three decades. It would also bind in Israel and offer Palestinians a concrete commitment to statehood. In time, this could evolve into a regional American-led alliance to contain Iran.

Two big obstacles stand in the way: Binyamin Netanyahu, Israel's prime minister, and Yahya Sinwar, Hamas's leader in Gaza and the terrorist-architect of October 7th. Mr Netanyahu is a life-long sceptic about a Palestinian state. He has indulged the violent aims of extremist settlers. However, polling suggests that only 15% of Israelis think he should remain in power after the war. A long ceasefire and hostage release may create an opening for rivals. Benny Gantz, say, could free himself from the war cabinet with honour. Israel's next leader may be someone who can tell his people that the best foundation for their security is not unending war, but strong alliances and a path to peace.

President Joe Biden should speed up this transition by appealing over Mr Netanyahu's head—just as Mr Netanyahu has sometimes spoken over the head of American presidents. He should open an embassy in Jerusalem for the Palestinians, to match the one Donald Trump opened for Israel. He should also set out how America sees the parameters for a Palestinian state and, if Israel doggedly refuses to engage, be ready to recognise one himself.

What about the other obstacle, Mr Sinwar? He is thought to be holed up beneath south Gaza, with Israeli troops overhead. Although he has unleashed a catastrophe upon Gaza, he will claim a great victory simply by surviving. It is possible that Hamas's armed and most fanatical

wing would emerge after a ceasefire as the dominant force in Gaza and lay claim to broader Palestinian leadership. With Iran's encouragement, Mr Sinwar may well attack Israel, provoke reprisals and thereby sabotage any progress towards peace.

To deter such attacks and continue dismantling tunnels, Israel will retain a military presence in Gaza for some time. That will disappoint those wanting an immediate withdrawal. But Israel should be clear that, if its security is guaranteed and Hamas remains out of power, then it will withdraw. Mr Sinwar may be asked to leave Gaza for a country such as Qatar—as Yasser Arafat left Lebanon for Tunisia. He is likely to insist on staying. That would underline the value of international peacekeepers, including from Arab states, tasked with providing security in Gaza so as to create the space for a moderate government to emerge.

For that to be possible, momentum is urgently needed. The more Israel curbs its West Bank settlers and the more credibly it commits itself to a Palestinian state, the more leeway it will have to contain the rump of Hamas fighters. The more Arab states are willing to spend money and provide security, the more confident ordinary Israelis and Palestinians will be of change. And the more America pushes all sides the better. Peace and stability in the Middle East will always be hard-won. But the world must seize this chance, because the pull towards war is unrelenting. ■



Online media

The end of the social network

A new set-up for social media is solving some problems—and creating others

FACEBOOK MAY be turning 20 on February 4th, but it is just as much of a magnet for controversy and cash today as when it was a brash, break-everything teenager. On January 31st Mark Zuckerberg, the social network's founder, was harangued by American senators over the spread of harmful material. The next day, as we published this, he was poised to announce another set of glittering results for Meta, Facebook's parent company, which is now valued at \$1trn. Yet even as social media reliably draw vast amounts of attention from addicts and critics alike, they are undergoing a profound but little-noticed transformation.

The weird magic of online social networks was to combine personal interactions with mass communication. Now this amalgam is splitting in two again (see Briefing). Status updates from friends have given way to videos from strangers that resembles a hyperactive TV. Public posting is increasingly migrating to closed groups, rather like email. What Mr Zuckerberg calls the digital "town square" is being rebuilt—and posing problems.

This matters, because social media are how people experience the internet. Facebook itself counts more than 3bn users. Social apps take up nearly half of mobile screen time, which in turn consumes more than a quarter of waking hours. They gobble up 40% more time than they did in 2020, as the world has gone online. As well as being fun, social media are the crucible of online debate and a catapult for political campaigns. In a year when half the world heads to the polls, politicians from Donald Trump to Narendra Modi will be busy online.

The striking feature of the new social media is that they are no longer very social. Inspired by TikTok, apps like Facebook increasingly serve a diet of clips selected by artificial intelligence according to a user's viewing behaviour,

not their social connections. Meanwhile, people are posting less. The share of Americans who say they enjoy documenting their life online has fallen from 40% to 28% since 2020. Debate is moving to closed platforms, such as WhatsApp and Telegram.

The lights have gone out in the town square. Social media have always been opaque, since every feed is different. But TikTok, a Chinese-owned video phenomenon, is a black box to researchers. Twitter, rebranded as X, has published some of its code but tightened access to data about which tweets are seen. Private messaging groups are often fully encrypted.

Some of the consequences of this are welcome. Political campaigners say they have to tone down their messages to win over private groups. A provocative post that attracts "likes" in the X bear pit may alienate the school parents' WhatsApp group. Posts on messaging apps are ordered chronologically, not by an engagement-maximising algorithm, reducing the incentive to sensationalise. In particular, closed groups may be better for the mental health of teenagers, who struggled when their private lives were dissected in public.

In the hyperactive half of social media, behaviour-based algorithms will bring you posts from beyond your community. Social networks can still act as "echo chambers" of self-reinforcing material. But a feed that takes content from anywhere at least

has the potential to spread the best ideas farthest.

Yet this new world of social-media brings its own problems. Messaging apps are largely unmoderated. For small groups, that is good: platforms should no more police direct messages than phone companies should monitor calls. In dictatorships encrypted chats save lives. But Telegram's groups of 200,000 are more like unregulated broadcasts than conversations. Politicians in India have used WhatsApp to spread lies that would surely have been removed from an open network like Facebook.

As people move to closed groups, the open networks left behind are less useful because of the decline in public posting. During the covid-19 pandemic, scientists and doctors contributed to an online debate which contained real insight as well as misinformation. Open-source intelligence flowed when Russia invaded Ukraine. Today those conversations are disappearing or moving to closed channels, slowing the spread of ideas. The people still weighing in on the public networks, meanwhile, are disproportionately male and likely to describe themselves as very left- or right-wing: bores, in plain English.

What's more, the open-network algorithms driven by users' behaviour seem primed to spread the spiciest videos. For something to go viral on a social network, people had to choose to share it. Now they endorse it simply by watching, as the algo-

rithm rewards content that attracts the most engagement. Deliberate curation has been replaced by a system that taps straight into the id. Provocateurs like Mr Trump or Nayib Bukele, the favourite in this week's election in El Salvador, stand to benefit, as do misinformation merchants. Platforms say they are better at weeding out fakes. Taylor Swift, the latest high-profile victim of a deepfake, might disagree.

More urgent even than the rise of fake news is a lack of the real sort. Mr Zuckerberg once said he wanted Facebook to be like a personalised newspaper. But since the network's pivot to entertainment, news makes up only 3% of what people see on it. Across social media only 19% of adults share news stories weekly, down from 26% in 2018. Publications like BuzzFeed News, which relied on social distribution, have perished. That is their lookout (and ours). But it is everyone's problem when nearly half of young people say that, just as the platforms decide news is no longer interesting, social media are their main source of news.

WhatsApp and WhatsDown

Some people argue that social networks' defects can be fixed by better governance, clever coding or a different business model. Such things can help. But the problems raised by the new generation of apps suggest that social media's flaws are also the result of the trade-offs built into human communication. When platforms swing back towards private groups, they inevitably have less oversight. When people escape their echo chambers, they may well face more extreme content. When users embrace harmless entertainment, they see less news. As social networks wither, platform operators and users should devote less time to the old battles and more to grappling with the new. ■



Egypt's financial crisis

Pyramid scheme

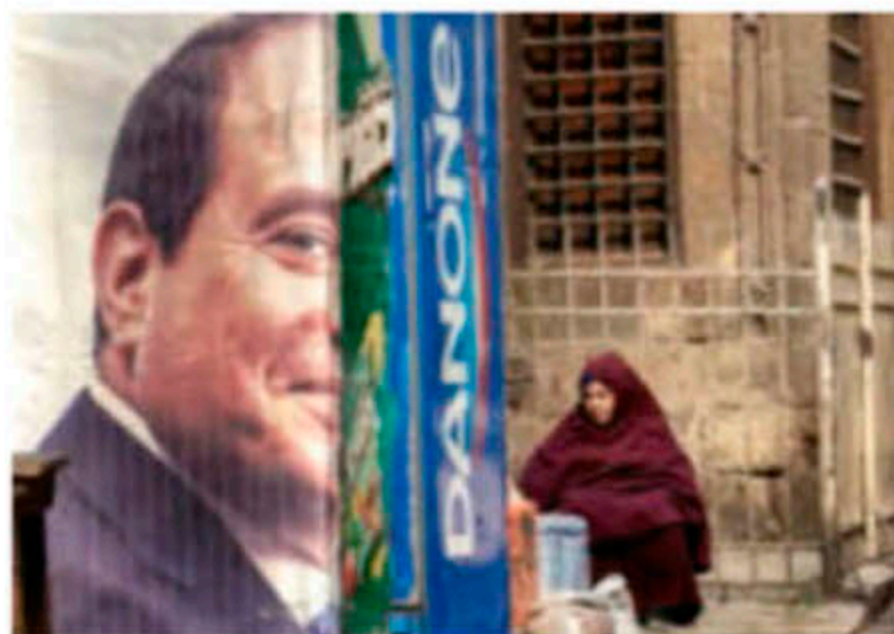
Bail out Egypt to give the Middle East a shot at stability

THE PROSPECTS for war or peace in the Middle East depend on many actors: America, the Houthis, Iran, Israel, the Palestinians, Saudi Arabia and others. But one country is more important than most people realise: Egypt.

It is huge, with 110m people. It runs the Suez canal, shares a land border with Gaza, maintains a peace treaty with Israel and has helped to broker peace talks. Egypt could yet play a vital role to help underwrite statehood for the Palestinians and provide security in the Gaza Strip. Were the country to collapse, however, it could further destabilise the entire Middle East. And such a collapse is terrifyingly plausible, as the country faces a mounting financial crisis. Its feckless regime does not deserve a bail-out. But Egypt should receive one nonetheless.

Its leader, Abdel-Fattah al-Sisi, is a strongman who led a coup in 2013 and assumed the presidency the next year. He has proved to be an atrocious economic manager. In the past decade monopolies run by the army and its cronies have tightened their chokehold on Egypt's already feeble economy. Spending has served the generals. Foreign investors have fled. The fiscal and balance-of-payments deficits are persistent. Mr Sisi has borrowed far too much: public debt is 89% of GDP; external debt is 37%. The IMF has bailed out his government four times. Mr Sisi always promises economic reforms, and then does very little (see Middle East & Africa section).

The fallout from the war between Israel and Hamas has made everything worse for Egypt. In a normal year the country earns hard-currency revenues worth 2% of GDP from operating the Suez canal, and receipts from foreign tourists add a further 3% of GDP. Both sources of cash have shrunk dramatically. The official exchange rate of 30 Egyptian pounds to the dollar is a mirage. The black-market rate, reflecting what willing buyers will pay, is



70. The country needs to devalue its currency formally, but doing so would mean the value of its dollar debts would surge relative to its GDP. It would also raise the price of food, particularly grains, which Egypt mostly imports.

If economic logic was the only consideration, Egypt would be prescribed some bitter medicine. Any further lending by the IMF or foreign governments would be contingent on it restructuring its debts, living within its means and getting the army out of business. However, such austerity would be highly dangerous. Egypt could spend years in default, a financial no-man's-land: China, its third-biggest bilateral creditor, typically tries to block debt restructuring. Mr Sisi would struggle to feed his people or pay his civil servants. Egypt's young, frustrated population might launch mass protests, which would meet with violent repression.

Any disorder would be hard to contain. Jihadism is already a grave problem in Egypt's Sinai peninsula, which abuts Israel and Gaza. It could spread to cities, threatening Mr Sisi's government. The wider Middle East, already burning, cannot afford a conflagration in Egypt, too. At a minimum, it would render Egypt incapable of helping broker or implement a peace deal between Israel and the Palestinians.

So the world should hold its nose and bail Egypt out yet again. The country probably needs at least \$10bn of short-term funding to roll over its debts and ease the shock of a huge devaluation. Western countries, the IMF and wealthy Gulf Arab states should all pitch in. In return, they should publicly press the army to give up its grip over the economy. They will do so in the full knowledge that the army is unlikely to comply, especially because Mr Sisi is himself an ex-general. However, Egypt will never prosper until the men in uniform make way for everyone else, and ordinary Egyptians need to hear it. ■

American schools

A charter for change

The evidence for charter schools has strengthened, just as both parties have run away from them

IMPROVING SCHOOLS is hard. Evidence of success or failure can take a decade to collect. What works in one place may flop in another. This explains why school reformers are excited about an authoritative study from Stanford University which shows that charter schools really do help children learn (see United States section). That should settle an argument over how to arrange America's schools that has been raging for 30 years.

The theory underpinning charters is that schools should be freed from the bureaucracy of the public-schools system and be able to hire and fire teachers based on merit. If they have these freedoms and are held accountable, then the benefits will show up in better results. That idea attracted Republican support, but it was controversial on the left. Although technocratic-minded

Democrats, such as Bill Clinton and Barack Obama, supported charters, teachers' unions opposed them, arguing that they drew resources away from other public schools. When charters succeeded, the unions said, it was only because they attracted the brightest pupils or the most motivated parents.

Although fine-grained studies were encouraging, the broad evidence for charters was disappointing. In 2009 the group at Stanford published an influential study showing that their pupils did slightly worse in maths and reading than students in conventional public schools. In 2013 the study was updated and the team found that charter pupils did better in reading and worse in maths. Partly as a result, the unions won the argument on the left. When he was running for office in 2020, Joe Biden de-▶▶

scribed himself as “not a charter-school fan”. Meanwhile, the right has turned away from charters and fixated instead on “wokeness” and on giving parents vouchers so that they have more choice over where their children go to school.

Despite all this, charter networks have quietly expanded and experimented. Although some have failed (deservedly), more have thrived. The latest study, from Stanford’s Centre for Research on Education Outcomes, compared 1.9m charter-school students with a control sample in 2014-19. They found that in maths the average charter student advanced by an extra six days each year compared with one at a traditional public school, and by 16 days in reading. Over time, that adds up to a big difference.

What is more, these averages obscure important details. Charters do much better in cities and with Hispanic and African-American students. Charters in cities advanced their pupils by almost a whole month each year in reading and maths compared with the control group. Black and Hispanic students did better on those measures “by large margins” compared with their peers at traditional public schools. These are the very children the Democratic Party says it especially wants to help.

And the researchers rejected the notion that this was achieved by creaming off motivated pupils or parents. If anything, charter schools take in students who are doing worse than their classmates in public schools.

The Stanford study also points to something larger. Since the Supreme Court overturned affirmative action in college admissions and firms began backing away from diversity, equity and inclusion schemes, Democrats have become unsure about how to deal with the racial disparities they focused on in 2020. They thought the way to fix black-white achievement gaps was to attack standardised tests and gifted and talented programmes. That was unpopular, and left the underlying problem unsolved.

America would do more to cut racial disparities by pursuing race-blind policies that focus on those who most need help. That sounds like a paradox, but it is not. Just as tax credits for poor families narrow racial disparities in income, so charter schools in cities do the same for reading and maths. Republicans should rekindle their enthusiasm for charters. Mr Biden should tell his education secretary that he is now a fan of charter schools. And he should set about helping them flourish. ■

The British armed forces

Beating retreat

Fixing British defence requires money, muscle and fresh thinking

BRITAIN’S ARMED forces have much to be proud of. The Royal Navy is engaged in some of the most intense naval skirmishing since the Falklands war, knocking Houthi missiles out of the sky above the Red Sea. The Royal Air Force (RAF) is still flying over Iraq and Syria to keep Islamic State in check. The army has trained more than 60,000 Ukrainian soldiers in the past ten years and helps guard Estonia.

Yet something is rotten in British defence. Even though the country is the sixth-largest military spender in the world and the largest in Europe, it is not always clear where the money goes. The navy’s fleet operates fewer frigates and destroyers than Japan, South Korea or France. The army, at its smallest in centuries, would struggle to deploy a single heavy division. Britain has admirably emptied its cupboard to arm Ukraine, but its meagre ammunition holdings are now a matter of grave concern. What has gone wrong?

The first problem is cash. In 2020 the government boasted of the biggest sustained increase in defence spending for 30 years. It spends just over £50bn (\$64bn) on defence, a sum that crosses NATO’s threshold of 2% of GDP. But a fifth of the budget goes on nuclear weapons. The conventional forces that Britain needs are being cannibalised to pay for nuclear cost-overruns. Strip out the nuclear bits and defence spending stands at around 1.75% of GDP, in the middle of the European pack.

The second problem is a lack of manpower. In 2010, when the Conservative Party entered government, the British Army was over 100,000-strong. It is now due to fall to 72,500. The government says that technology means fewer people are needed than in the past. This is casuistry. The Royal Navy is decommissioning ships for want of sailors. New technology often requires more personnel to maintain and operate it, not fewer. Even at its

reduced scale, the army is struggling to recruit; beefing up the army reserve would be one way to help.

British defence cannot be fixed without more money and more people. But the country’s defence woes are also rooted in deeper problems of culture, outlook and process. Far too often, penny-pinching and short-termism have resulted in Britain buying high-end kit and then economising on the things that make it work properly (see Britain section).

The Treasury bears some responsibility for this state of affairs. It has incentivised services to delay expensive projects. That balances the books in the short run but causes costs to balloon overall. Its strictures can have absurd results. Reducing an order of Wedgetail airborne command aircraft from five to three means that the RAF may not have one available in a crisis.

Yet the services also deserve much of the blame, having repeatedly botched major projects. That is hardly unique to the armed forces or to Britain. But if Britain is serious about rearming, it may have to buy more foreign equipment off the shelf rather than demanding new

features and insisting on domestic design and manufacturing. The ill-fated Ajax armoured vehicle—whose excessive vibration deafened crew—was supposed to be based on a pre-existing Austrian-Spanish platform. After the army unwisely added 1,200 requirements, it was essentially bespoke.

The Tories have had 13 years in office and four defence reviews. They will not, as an election approaches, solve problems that have festered for years. But with Ukraine in peril and Russia rearming fast, defence is once again too important to suffer from neglect. Like one of Britain’s ageing fleet of armoured vehicles, the country’s defence system is no longer good enough. The next government should act quickly and boldly to fix it. ■



Doing business in Europe

Charlemagne rightly criticised the European Commission for a lack of rigour in overseeing the national enforcement of European Union rules that are designed to provide a level playing-field for Europe's citizens and businesses (January 13th). Our recent business survey found enduring barriers to businesses seeking to trade in other EU member states. These include differing contractual and legal practices, varying national rules for service providers and non-intuitive tools that are supposed to help firms understand and comply with these divergent requirements.

Nearly three-quarters of the entrepreneurs at a Eurochambres gathering last November said that the single market is not sufficiently integrated for them to operate and compete freely across the bloc. Meanwhile, the EU continues to churn out legislation without adequately considering the specific and cumulative effect on European businesses trying to remain competitive in extremely challenging times.

While gathering input for his forthcoming high-level report for the European Council, Enrico Letta, a former Italian prime minister, has detected a sense of single-market fatigue among senior politicians and officials. When it comes to entrepreneurs, it is more a matter of single-market fatalism, as they have become resigned to accepting the frustrating obstacles to doing business in neighbouring countries. These frustrations are felt more by smaller companies without the in-house capacity to understand and adapt to differing national rules and requirements.

Jacques Delors famously said that "nobody falls in love with a common market" and indeed, technocratic discussions over how to ensure that member states stick to EU rules are not going to get voters rushing to the polling stations in June's European elections. Nonetheless, imple-

menting the details are critical to reviving the single market, an EU achievement that we take for granted at our peril.

VLADIMIR DLOUHY
President
Eurochambres
Brussels

Israel and Gaza

You set out arguments against South Africa's case accusing Israel of genocide ("Show trial", January 20th). But you did not tackle one large question regarding intent. What does the Israeli government want to happen to Palestinians when it finishes its war on Gaza? Binyamin Netanyahu, the prime minister, has rejected a Palestinian state. Offering Israeli citizenship to the Palestinians is not likely, because they would then have the same rights as Israelis to lease land, and could claim protection against harassment and the confiscation of their land by other Israeli citizens. If Israel occupied Gaza it would be responsible for rebuilding the territory, paying for food, medicine, shelter, education and so on. Either full citizenship or full implementation of the responsibilities of an occupying state would require great generosity on the part of the Israeli government.

Or is it the unstated hope of the government that, in the name of humanitarian concerns, the Palestinians in Gaza and the occupied territories should be "voluntarily" moved to other countries? This would appear to breach Article 2 of the Genocide convention, which forbids "deliberately inflicting on the group conditions of life calculated to bring about its physical destruction in whole or in part".

JANE SIMPSON
Canberra

Your leader was strangely schizophrenic. On the one hand, it casts doubt about South Africa's allegations by asserting that Israel "is targeting Hamas fighters" rather than ordinary Gazans. On the other hand, it states that the death toll in Gaza "raises grave

doubts" over whether Israel is complying with its obligation to "distinguish between civilians and combatants". Make up your mind. Which is it?

ALAIN DECKERS
Brussels

Alabama's execution method

Nitrogen hypoxia per se is not an inherently painful or stressful experience (*The Economist* explains, January 27th). In fact what makes pure nitrogen so dangerous is that a leak which displaces enough breathable air can cause death with virtually no perceptible symptoms as the victims lapse into unconsciousness. For this reason, facilities using gases like nitrogen or helium are required to install alarms that warn of dangerously low oxygen levels in the event of a leak.

The problem with Alabama's execution method is that the active participation of the prisoner, in the form of volitional breathing, is required to administer the lethal agent. This is worse than ordering the condemned prisoner to push a button that will initiate his own death. It is more akin to the plight of a drowning person, who will hold his breath knowing a rapid death will ensue when he can no longer do so.

The intense and primal drive to breathe, which makes suicidal hypoxia by breath-holding physiologically impossible, is presumably one of the reasons why waterboarding was considered by the CIA to be such a compelling threat during sessions of "enhanced interrogation".

Notwithstanding the near universal condemnation of capital punishment in democracies, the experience of a prisoner during the initial minutes of this procedure can be expected to resemble that of being waterboarded, or forced to maintain a painful stress position under threat of death.

RICK HOGE
Associate professor in
neurology and neurosurgery
McGill University
Montreal

The Panama connection

Some mention of the ongoing abuse by foreign-flagged vessels to aid rogue countries breaking the law was warranted in an otherwise excellent article on illicit global maritime activity ("Ghost ships", January 6th). A bipartisan group comprising members of the US Senate Committee on Armed Services recently sent a letter to the Panama Maritime Authority asking it to investigate the scores of Panamanian-flagged vessels that are suspected of transporting Iranian oil in violation of American sanctions. The sanctions imposed on Iranian oil in 2018 and 2019 were designed to cut off a significant source of revenue that the regime uses to fund terrorist organisations, such as Hizbullah and Hamas, cartel activity, nuclear proliferation, and other nefarious activity.

PATRICK BURNSON
Former executive editor
Supply Chain Management
Review
San Francisco

No one wants to bowl alone

Regarding your article on the decline of lawn bowls ("Bowling over?", January 6th) one of the pleasures of my last job was visiting many bowling clubs in south-east England. Although these clubs lack diversity in terms of ethnicity and demography, they do provide an important place for the elderly to socially interact. Bowling clubs provide a secure place for older people to meet up, be it a green work party, a formal county game or a simple roll up (an informal game of bowls, not a hand-rolled cigarette).

Bowls England needs to jack up its game.

MICHAEL COOK
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Not posting, but watching

As Facebook turns 20, politics is out; impersonal video feeds are in

I'M A LITTLE intoxicated, not gonna lie. So what if it's not even 10pm and it's a Tuesday night?...Let the hacking begin." So typed a 19-year-old Mark Zuckerberg, live-blogging from his Harvard dormitory as he began work on a website called Facemash. The site displayed randomly selected pairs of students' mugshots, harvested from the university's intranet, and allowed users to vote on who was hotter. It caused a stir and was promptly shut down. But before long, a successor was in the making. On February 4th 2004 Mr Zuckerberg launched a new site: TheFacebook.com.

Facebook, as it later became, quickly overtook established social networks such

as Friendster and MySpace to become the world's largest, a position it still holds on its 20th birthday. Today 3bn people—about 60% of all internet users—scroll its infinite feed every month (see chart 1 on next page). It has outwitted its rivals, or swallowed them, as it did Instagram and WhatsApp. Six of the ten most-downloaded mobile apps last year belonged to Meta, Facebook's holding company, which is now the world's largest seller of advertising after Google. Meta's market value has surpassed \$1trn; in the third quarter of last year it reported revenue of \$34bn.

Facebook and its imitators have done more than make money. Social media have

become the main way that people experience the internet—and a substantial part of how they experience life. Last year nearly half of mobile screen-time worldwide was spent on social apps (and more than a quarter of waking hours were spent on phones), according to Data.ai, a research company. The networks have become what Mr Zuckerberg and others call a digital "town square", in which the arguments of the day are thrashed out and public opinion is shaped. Social media have fomented social movements, from #MeToo and #BlackLivesMatter to the Arab spring and the Capitol riot.

Feedster

Now, after two decades of evolution, the town square is being dug up and rebuilt. Following the arrival of competitors such as TikTok, powered by artificial intelligence, Facebook and other incumbents have been forced to reinvent themselves. Platforms that began as places for friends to interact and share their own content are turning into television-like feeds of entertainment, for passive consumption. At the same time, users are moving their conversations and arguments off the open networks and into closed, private groups on platforms like WhatsApp and Telegram. That migration, in turn, will have big implications for politics, in a year when countries with more than half the world's population are heading to the polls.

Social media are more popular than ever. The average internet user spent nearly two and a half hours a day on social platforms last year, according to GWI, another data company. Usage ticked up during the pandemic and has not returned to pre-covid levels. As more people go online, more are signing up. Total time spent using social apps on Android devices, which account for about 70% of the world's phones and tablets, has risen by 42% since 2020, to 2.3trn hours last year, according to Data.ai.

But the sort of social networking that Facebook pioneered is disappearing. The most obvious change is the shift to video on today's networks. The explosive success of TikTok, a Chinese-owned short-video app which launched in 2017 and quickly had young people hooked, has sparked a wave of copycats. Meta has added a video feature called Reels to Facebook and Instagram. Similar products have been bolted onto Pinterest (Watch), Snapchat (Spotlight) and YouTube (Shorts). Elon Musk, who bought Twitter in 2022 and renamed it X, now claims it is a "video-first" platform. Of the 64 minutes per day that the average American spent on social media last year, 40 were spent watching video, up from 28 minutes three years earlier, estimates Bernstein, a broker.

The bigger change to social feeds is un-▶▶

der the bonnet. At first, social networks showed chronological updates from users' contacts: their friend just got engaged, their uncle was storming the Capitol and so on. As the volume of posts grew, the networks employed algorithms to prioritise posts that had proved popular among the user's friends. Now a new phase has begun. TikTok decided that, rather than guessing what people would like based on their "social graph"—that is, what their family and friends liked—it would use their "interest graph", which it inferred from the videos they and people like them lingered on. And rather than show content created by people they followed, it would serve up anything it thought they might like.

Every other big platform has followed suit. In 2022 Mr Zuckerberg announced that Facebook's feed would become a "discovery engine" to seek out engaging content from around the internet. Since last year half of the posts X shows its users come from outside the network of people they follow. Threads, Meta's Twitter-clone, launched last year with a similar approach. The resulting feeds of unrelated content from strangers can be jarring: "Here's a healthy breakfast option! You should kill your mom!" quipped Bo Burnham, a YouTube comedian, in a satirical song. But users seem to like it. Time spent on Instagram has risen by 40% since Meta launched Reels. Even the geriatric Facebook somehow added 5m new users in America and Canada last year.

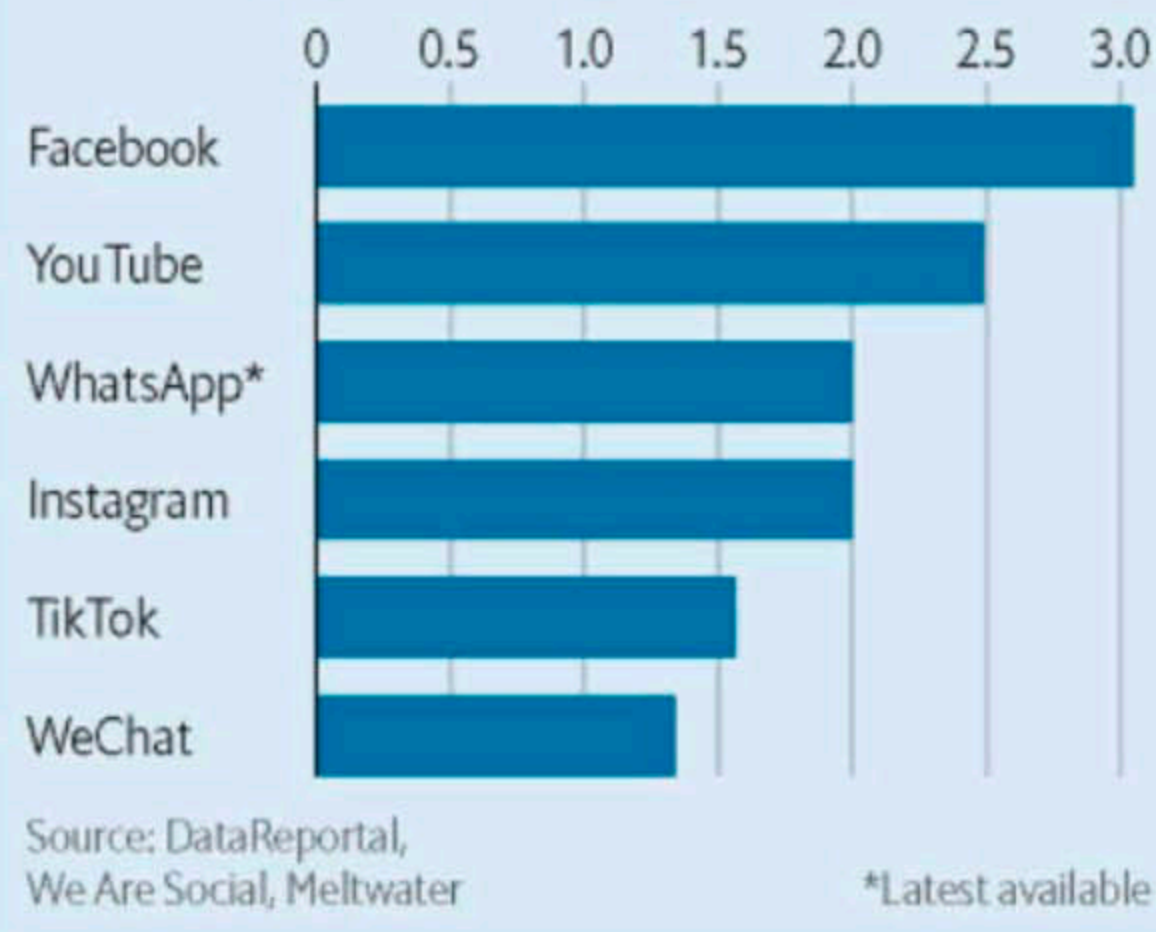
Google -

As users' newsfeeds become unmoored from their network of friends and family, they are posting less about themselves. "The average user is now more of a consumer," says Michael Bossetta of Lund University. In a survey last year by Gartner, a market-research company, only 28% of Americans said they liked documenting their life online, down from 40% in 2020. Some 61% say they have become more selective about what they post, finds Morning Consult, another research firm, which speculates that an influx of "influencer" content may have made users think "their everyday life is too mundane to justify frequent posts". Video, the new format of choice, is harder to create than dashing off a quick status update. And some platforms, such as X, prioritise posts by users who pay, reducing incentives for the rest.

Instead, conversations have been moving for some time to private groups. In 2021 Mr Zuckerberg wrote that, as well as debating in the "town square" of Facebook and Instagram, "People increasingly also want to connect privately in the digital equivalent of the living room." Adam Mosseri, head of Instagram, said last year that more photos and videos were being shared in direct messages than on the app's main feed.

Billions of likes

World, social-media platforms, active users, January 2024, bn



"All the friends-sharing is moving in that direction," he concluded. Morning Consult asked people how they would be most likely to recommend a movie. Only 30% said they would post on social media, behind the 43% who chose text or email and the 35% who opted for group chats.

At the same time, in the digital town square, fun is in and politics is out. Although (and perhaps because) social networks are accused of driving political polarisation, they seem increasingly eager to steer users away from news and current affairs. A study by Joshua Tucker of the Centre for Social Media and Politics at New York University (NYU) and colleagues compared a group of Facebook and Instagram users who were on chronological newsfeeds in the run-up to America's election in 2020 with another group who used the platforms' recommendation algorithm. Those using the chronological feed saw 15% more political content on Facebook and 5% more on Instagram than those who were fed by the algorithm. (They also saw a lot more information from what Meta classified as untrustworthy sources: 69% more on Facebook and 22% more on Instagram, albeit from low bases.)

Since then, the platforms have shied even further from news. The U-turn has been sharpest at Meta, whose boss said ten

News you can lose

People who share news stories on social media % of respondents



years ago that he wanted Facebook's newsfeed to be a "perfect personalised newspaper for every person in the world". The firm now says that news makes up less than 3% of what people see on the platform. Mr Mosseri, who is also in charge of Threads, wrote at its launch last year, "Politics and hard news are inevitably going to show up on Threads...but we're not going to do anything to encourage those verticals." A week later he added, "From a platform's perspective, any incremental engagement or revenue they might drive is not at all worth the scrutiny, negativity (let's be honest), or integrity risks that come along with them."

A campaign by some publishers to make social-media firms pay to share their content has reinforced the networks' view that news is more trouble than it is worth. In Canada, which will hold a general election this year or next, Facebook and Instagram are blocking all news content, in response to a demand by the government that Meta pay publishers for hosting links to their stories. Under Mr Musk, who is scathing about what he calls the "legacy media", X has removed headlines from posted news articles, and appeared to throttle traffic to out-of-favour publications such as the *New York Times*.

The squeezing of news has been felt by publishers, some of which had built their business around the platforms. Last year the amount of internet traffic sent from Facebook to media companies fell by 48%, and from X by 27%, according to Chartbeat, which measures such things. Former kings of the viral social-post have struggled: last year BuzzFeed News shut down and Vice News drastically cut back.

As they see less news in their feed, people are becoming less likely to share or comment on the news in public (see chart 2). Whereas in 2018 some 26% of people reported sharing news articles on social media at least weekly, last year only 19% did, according to a 36-country study by the Reuters Institute at Oxford University. The decline in sharing seems to affect the amount of political content in particular. Mr Tucker and colleagues found that removing shared content from users' Facebook feeds reduced the amount of political news they saw by more than half. (Again, it also reduced the amount of content from suspect sources, by nearly a third.) The authors found that this left the users less knowledgeable about the news—though they did not find evidence that it had changed their minds about anything much.

The decline of sharing and posting has given rise to what the Reuters Institute calls the "passive news consumer", who sees the news but doesn't comment, share or otherwise engage with it. This trend is most advanced in rich countries: in Britain 68% of adults are "passive" consumers of news, with only one in ten posting about it

▶ in a typical week. The remaining hard core of “active” participants in the online public square are disproportionately male, and highly opinionated. A third of those who call themselves “very” right or left-wing still take part, whereas only 22% of centrists bother weighing in.

For political strategists, “the job has totally changed”, says Teddy Goff, who ran Barack Obama’s digital campaign in 2012 before co-founding Precision Strategies, a consultancy. In the past the dominance of a handful of mega-platforms meant there was “a sort of political monoculture”, he argues. “At least in major moments, like an election campaign, something could happen and the whole country could hear about it pretty quickly... It doesn’t work that way any more.” Today different groups lurk in different places. Young people are on Snapchat. Journalists cling to X (while claiming to hate it). LinkedIn is the best place to reach parliamentary aides, says an activist in Britain. So politicians need to be everywhere. Joe Biden has even joined Truth Social, the social network owned by his Republican rival, Donald Trump.

“It’s a lot, lot, lot harder for us to reach the same number of people as we used to,” says Matthew McGregor, another former Obama staffer who runs 38 Degrees, a British campaigning outfit. Social networks’ algorithms serve up less political content, he finds, and the way they optimise for engagement incentivises provocative posts. “We need to make people laugh, make people cry, or make people angry,” he laments. He admits to wrestling with how far to push this. “It’s a simple fact that you can get more numbers by being a bit more vitriolic, by being a bit more critical, by being a bit more personal...There is a tension and it is hard.” Candidates with uncompromising messages seem to travel furthest.

The surest way to win attention, of course, is to pay for it. American candidates and their backers will spend nearly

\$16bn on advertising in the run-up to November’s elections. Television will take the lion’s share: its ageing audience puts off some advertisers, but not politicians, who know that the elderly vote. TV ads are still believed to be the best when it comes to persuasion; those on social media are mainly about fundraising. Still, more than a quarter of American political-ad spending in this cycle will be on digital platforms, forecasts Insider Intelligence, a research firm. In the past week alone, Mr Biden has spent more than \$750,000 on ads just on Facebook and Instagram.

But even candidates willing to pay are finding it harder to get their message out in the new public square. For one thing, some of the new digital platforms don’t want their money. TikTok bans political advertising altogether. Threads, less than a year old, does not yet sell ads at all. Streaming services, which make up a bigger share of TV viewing in America than either broadcast or cable, are also wary: Netflix, Amazon Prime Video and Disney+, the biggest streamers, all refuse to take political ads for now, though that may change.

The bigger problem is that political ads on social media don’t work as well as they used to. Anti-tracking changes introduced by Apple in 2021 have made it harder to target ads and so reduced the return on investments in them. Spending on Facebook ads will be lower in this election cycle than in 2020, predicts AdImpact, a consultancy, even though total political ad spending is expected to be up by 30% or so.

In the past six months politicians spent \$244m on ads on Facebook and Instagram in America, down from \$320m during the same period in the 2020 cycle, according to our analysis of data collected by Andrew Arengé, a researcher at the University of Pennsylvania. Meta’s ad library shows that in the 90 days before the Iowa caucuses last month, Donald Trump spent only about \$400,000 on the two platforms. “These are

pretty startling numbers compared with what we’ve seen in years past,” says Reid Vineis of Majority Strategies, a Republican consultancy. His explanation: “The platform is less effective.”

As social networks bury political posts, email is proving a useful way of sidestepping Silicon Valley’s algorithms. “There isn’t some big, bad Mark Zuckerberg or Nick Clegg [another Meta executive] sitting in California deciding whether or not we get to email people, and whether people get to open those e-mails,” says Mr McGregor. The most effective way to make something go viral on Facebook, 38 Degrees finds, is to email its members and ask them to post it there. Morning Consult argues that, given the wilting of online sharing, brands will need to come up with messages simple enough to be remembered and passed on in person, rather than creating memes designed to be shared.

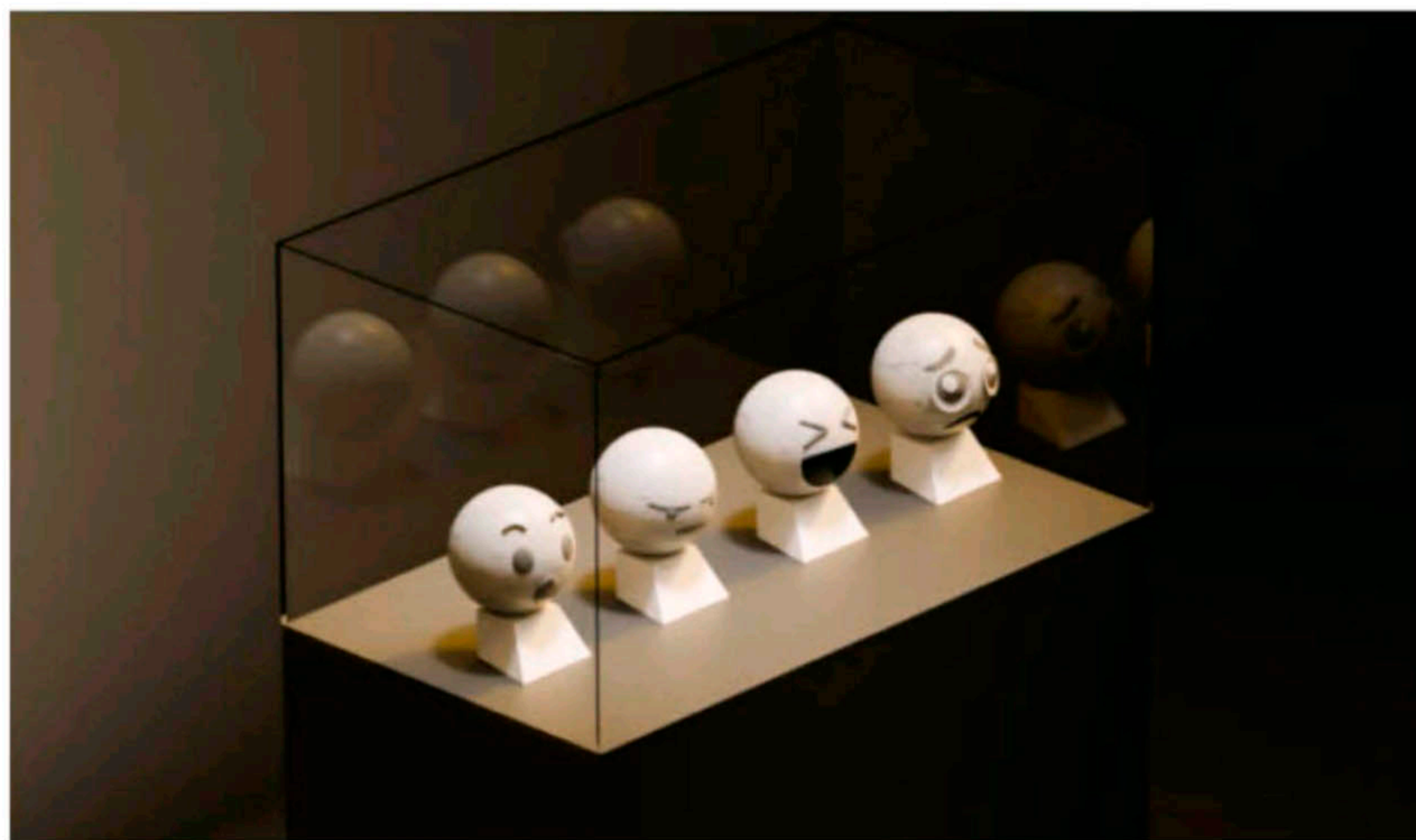
NotYourSpace

Hardest of all is infiltrating the millions of small group-chats into which the public square has splintered. What goes on in these encrypted spaces is opaque, even to the platforms that operate them. But the groups seem to be picking up some of the slack in terms of news-sharing. The proportion of adults posting news articles weekly via instant-messaging platforms rose from 17% to 22% in the five years to 2023, the Reuters Institute found.

Getting into the group chats pays dividends for campaigners. A recent petition by 38 Degrees to strip a bungling former boss of Britain’s Post Office of a medal—the kind of campaign that in the past would have relied on Facebook—got the most traffic from its email list, and the second-most from WhatsApp.

Elections were easier to fight when there were just a few big social-media platforms, acknowledges Mr Goff. However, he says, “I don’t think it was altogether good when it was more of a public square...These are channels that put their thumbs on the scale for certain kinds of content over other kinds of content.” The design of the platform is such that, “You’re going to have a laugh about a stupid gaff, or a hot-mic moment or something like that, and not have good-faith, in-depth conversations about what we ought to do about Gaza.”

Good-faith debate can be hard to find online. But campaigners report that getting people to share something in a group chat calls for a calmer tone than grabbing their attention on the open platforms. “They don’t want their friends to think, ‘Oh God, here he goes again...why is he always whanging on at us about this annoying issue?’” says Mr McGregor. As debate shifts from open platforms to small groups, he says, “Maybe we’re going back to the coffeehouse from the public square.” ■





Schools

What works

WASHINGTON, DC

Charter schools do things that all Democrats say they support. And yet the party has turned against them

A YEAR AGO New York's governor, Kathy Hochul, a Democrat, proposed to adjust a state cap on charter schools, the publicly funded but privately run schools that have become a locus of innovation and controversy in American education. Ms Hochul's plan was not ambitious, but it would have allowed dozens of new charter schools to open in New York City, where they already attract about 15% of public-school students and where thousands of families languish on waiting lists. But the governor's plan drew fervent protests from fellow Democrats, including state legislators aligned with teachers' unions. After a bruising fight, the governor had to settle last autumn for a small increase.

The row reflected a discouraging change in the politics of charter schools. Once a topic of unusual bipartisan enthusiasm, the schools have become divisive, particularly among Democrats. Barack Obama campaigned on charter-school expansion in 2008, but Joe Biden declared in 2020 that he was not enamoured of them. (His administration has nonetheless maintained federal funding for charters.)

Republicans are more favourably inclined overall, and Donald Trump increased support during his presidency. But Republican priorities have shifted since George W. Bush, as president, and his brother Jeb, as governor of Florida, championed charters as beacons of racial equity. These days Republicans prioritise vouchers that allow parents to use taxpayer funds to enroll children in religious schools.

The relative neglect of charters comes just as fresh evidence has arisen that they are successful. Last June a comprehensive new study emerged from Stanford University. It is the latest of three national studies

carried out over two decades by the Centre for Research on Education Outcomes (CREDO). The first study analysed 13 states and three big cities between 2000 and 2008 by comparing charter pupils with peers in other public schools. On average charter pupils performed worse in reading and maths. This was hardly inspiring. Four years later, a follow-up study had mixed results: charter pupils performed better in reading but worse in maths.

Fast forward to June's study, which used data from 2014 to 2019. Its results show a positive trajectory over time (see chart on next page). In all 31 geographic locations studied (29 states, New York City and the District of Columbia), pupils in charters outperformed their traditional public-school peers, on average. Pupils gained the equivalent of six days of learning in maths and 16 days in reading each year. "We don't see a revolution," says Macke Raymond, the lead researcher of the Stanford studies. "We are seeing thousands of [charter] schools getting a little bit better every year." Other recent studies, such as research by Douglas Harris at Tulane University and investigators at the University of Arkansas, also report positive results.

This is a departure not just from past findings of CREDO but also from the broader patterns of past research. During the 1990s and early 2000s, as the charter movement gathered momentum, Democrats and Republicans promoted the innovation more from instinct or a preference for parental choice than on the basis of evidence. ▶▶

→ Also in this section

18 The Nevada GOP mess

20 The Arizona GOP mess

20 Lactose laws

21 Donald Trump's defamations

22 Impeaching Alejandro Mayorkas

23 Lexington: EV politics

It can be hard to study how particular schools shape educational outcomes, since so many other factors—economic circumstance and parental educational attainment, for example—are influential. Early studies often delivered mixed results. Research was like a Rorschach test: stakeholders interpreted new studies according to their own biases.

The latest CREDO report provides clear evidence of success and also describes which types of charter schools seem to be working best. Larger charter management organisations (CMOs in the jargon), which run multiple schools at a time, have stronger results on average than stand-alone charters. There were also hundreds of successful charters where disadvantaged pupils (black, Hispanic, poor pupils or English-learners) performed similarly to or better than their more advantaged peers.

Charter enrolment is growing and the schools' impact on American children is substantial. In 2021 about 4m public-school pupils studied in charters, more than double the number enrolled back in 2010. Forty-five states and the District of Columbia allow them. In Chicago, where 15% of public-school students enroll, black and Hispanic families are disproportionately represented, as is typical in cities that offer them. In poverty-stricken Philadelphia, a third of public-school children are educated in charters.

Republican support for charters reflected a preference for parental choice among right-leaning politicians, but the policy did not pay clear dividends at election time, since the schools had the most impact in big cities, which are often dominated by Democrats. Vouchers offer political benefits because they are attractive to religious, home-schooling and suburban voters. Amid great fanfare, Arizona, Arkansas, Florida and other Republican-led states have passed laws allowing parents to use vouchers to direct public dollars to private schools they choose, including religious ones, or for other educational assistance. "Republicans have long been sup-

portive of charter schools even though most of their constituents do not attend," says Michael Petrilli of the Fordham Institute, a think-tank. However, school-choice plans "can result in money actually in the pockets of Republican constituents...and so I think that has obvious appeal."

Mr Trump has seized on school choice as a campaign issue for 2024. He hopes to tap into the emotional "parents' rights" movement visible in the form of shouting matches at school-board meetings, as conservative parents have lately battled teaching about DEI and trans rights while their liberal opponents seek curriculums they regard as inclusive and essential.

Democrats have no obvious parent-friendly education policy to promote now they have turned away from charter-school expansion. According to a survey by *Education Next*, a journal, while 55% of Republicans support charter schools, only 38% of Democrats do. More white Democratic voters oppose charters than do non-white Democratic voters. Many of the white respondents say they fear charters undermine racial equity, which may surprise the black and Hispanic voters whose children are flourishing in them. ■

The swinging six: Nevada

Fear and voting in Las Vegas

LAS VEGAS

How Nevada's Republicans made their primary irrelevant

PARTICIPATING IN Nevada's Republican primary this year is a bit like playing a choose-your-own-adventure game. Your first choice is between voting in the state-run primary election or the caucus put on by Nevada's Republican Party. You pick the February 6th primary, since the state has kindly mailed you a ballot. But wait: Donald Trump, your preferred candidate, isn't listed. Instead you can choose between Nikki Haley, two people who are no longer running and four others you have never heard of. What if you picked the caucus on February 8th? Well, then you can vote for Mr Trump or Ryan Binkley, a pastor from Texas. Fans of Ms Haley are out of luck.

How did Nevada end up with duelling Republican primaries? In 2021 the state legislature passed a law replacing the caucuses run by the Democratic and Republican parties with state-run primaries on the first Tuesday of February. The move was intended to boost Nevada's importance in presidential-primary elections by holding them earlier and making them more representative of the electorate. President Joe Biden and the Democratic National Com-

mittee endorsed the change. Nevada and New Hampshire would vote on the same day, behind only South Carolina.

The bill was bipartisan, but the Nevada Republican Party revolted. Michael McDonald, its chairman and an ardent supporter of Mr Trump, argues that the party objected to the primary because it didn't require voter-ID. He feared that Democrats, and specifically members of the powerful culinary union, would change their party preference on the day of the poll to skew the results of the Republican primary. To exert control, Republicans decided to put on a caucus. The result is two votes in three days and utter confusion.

If a candidate is on the primary ballot they are barred from participating in the caucus, which is the only way to win any of the state's delegates. Ms Haley has suggested that Mr Trump's allies in Nevada pushed for a caucus to help his chances. When she was asked why she decided to participate in the meaningless primary instead, she said her campaign would "focus on the states that are fair". Mr McDonald—who along with several other high-profile Nevada Republicans recently pleaded not guilty to charges alleging that they tried to falsely pledge Nevada's electoral votes to Mr Trump in 2020—denies that the party put its thumb on the scale.

The duelling primaries have probably not changed the outcome of the contest. But they have changed politics in the Silver State in two ways. First, voters are miffed that they are being denied an actual choice between the top two candidates. While waiting in line to enter a Trump rally in Las Vegas on January 27th, several said they were baffled when they opened their primary ballot and didn't see Mr Trump's name. Karen Marrs, a Las Vegas, says she does not trust the party. "I'm going to do what Trump tells me to do," she explains.

Nevada is not the only important swing state where a chaotic Republican Party could be a liability in November. Republicans in Michigan mutinied against their MAGA party chair, and Arizona's party chairman resigned on January 24th after a recording revealed that he had tried to bribe Kari Lake, a Trumpian provocateur, to stay out of politics (see next story).

Second, caucuses are less likely than primaries to reveal how voters will act in November because fewer people take part. Queuing for hours in churches and schools requires more time from voters than posting a ballot. Because Nevada is one of just six states that will in effect decide the presidential election, the opinions of voters there have outsize importance.

Mr Trump encouraged Nevadans to caucus during his rally. But in his remarks he revealed the vote's irrelevance. "Don't waste your time on primary," he urged. "Waste all of your time on caucus." ■

The charter chart

US, charter schools, days of learning lost/gained compared with traditional public schools
Average per student per year



Source: Centre for Research on Education Outcomes



**TWO LEGENDS.
60 ICONIC YEARS.
THE RACE NEVER STOPS**



PORSCHE

The swinging six: Arizona

The Lake tape

SCOTTSDALE

A leaked recording shakes up the Republicans in the Grand Canyon State

“WE’D LIKE to share with you that we have a brand-new AZGOP chair, Jeff DeWit,” said the recorded greeting on the voicemail of the Arizona Republican Party. “He is wonderful to work for, and I know you will be happy getting to know him.” But the recording, still playing on January 25th, was doubly outdated. Mr DeWit was hardly “brand-new”: he had taken over as party chair a year before (with Donald Trump’s backing), promising to unite the party’s feuding factions. More important, he had resigned the previous day, after what amounted to a coup orchestrated by the party’s likely candidate for Senate, Kari Lake—amid drama worthy of reality TV.

Arizona will be a critical state in the elections in November. “There’s no path to the White House that doesn’t run through Arizona,” says Caroline Wren, an adviser to Ms Lake. “And Arizona might well be the 51st Senate seat,” determining whether or not Republicans can wrest back control.

Republican bigwigs were keen to field a Senate candidate with the best chance of winning. The lesson from the midterms was that strident Trump-backed candidates tend to lose. Ms Lake’s own defeat in the Arizona governor’s contest was a prime example: the former TV news anchor was a vocal supporter of Mr Trump’s false claim that the 2020 election was stolen. About 11 months ago Mr DeWit approached Ms Lake with a message from “very powerful people” back east and an offer he hoped she would not refuse: an inducement to sit out the coming election cycle.

Unfortunately for Mr DeWit, she not only refused, but recorded the conversation—and last week was leaked to *Daily-Mail.com*, a British news website. In the ten-minute tape Mr DeWit is heard suggesting that Ms Lake “pause” her electoral ambitions for two years. “Is there a number” that would persuade her to do so, he asks? An offended Ms Lake rejects the attempt to buy her off: “They’re going to have to fucking kill me to stop me,” she says.

Mr DeWit claims that the tape was selectively edited. Yet he felt compelled to go.

Why did Ms Lake wait nearly 11 months to release the recording? Some Arizona Republicans had grown frustrated with Mr DeWit (among his sins, apparently, was being seen at several events of Ron DeSantis, the Florida governor who until recently was competing for the Republican presidential nomination) and were preparing to



Lactose law

Intolerance

NEW YORK

Is a class-action lawsuit against Dunkin' Donuts udderly silly, or compelling?

DUNKIN' SELLS about 60 cups of coffee every second. That works out to be about 2bn cups a year. The coffee-and-doughnut chain brags there are 25,000 ways to order coffee in its shops. A recently filed class-action lawsuit claims that customers ordering plant-based or lactose-free milk with theirs are charged \$0.50-2.15 more than those ordering cow's milk. This amounts to discrimination under the Americans with Disabilities Act (ADA), the plaintiffs argue.

The ADA became law in 1990. Its aim was to give disabled people equal access to places of business, and expanded it in 2008 to broaden the definition of disability. The suit asserts that lactose intolerance (the gastronomical symptoms of which are not at all pleasant) is a disability and that the plaintiffs are entitled to damages from Dunkin'.

Some are sceptical that this violates the ADA. Many consuming plant-based drinks are doing so because of taste or because they think cows' burps are bad for the planet. The lawsuit also asserts there is no material difference in cost between milk and non-dairy alterna-

tives. But Ben Pierce, an analyst at the Good Food Institute, says that “gallon for gallon, plant-based milk prices were 87% higher than conventional milk in 2022.”

Arlene Kanter, head of the disability law and policy programme at Syracuse University, says the plaintiffs have a strong case. Lactose intolerance meets the definition of disability as it is a substantial limitation on a life activity (the right to drink supersized takeaway coffee). If a wheelchair-bound driver needs help filling their car with petrol, petrol stations legally cannot charge them extra. Keith Gibson, the lawyer who represents the plaintiffs, says that “Dunkin' Donuts does not have to offer soy, almond or oat milk for its coffee or lattes. But once they do, the surcharge then is discriminatory.”

Dunkin' has until March 4th to respond to the complaint. Some chains, such as Tim Hortons, do not charge for non-dairy milk. Starbucks was sued in 2022 for charging more for plant-based milk. That case is still pending. Meanwhile, even the lawsuit's named plaintiffs intend to continue going to Dunkin'.

challenge his leadership at a meeting of the state party on January 27th. Ms Lake's leak was exquisitely timed to bring about Mr DeWit's resignation and enable that meeting to elect a new leader, Gina Swoboda, a Trump-endorsed conservative praised by her fans for her knowledge of election law.

In a text to a local political journalist, Dennis Welch, Mr DeWit complained about “the total mess that Kari caused”,

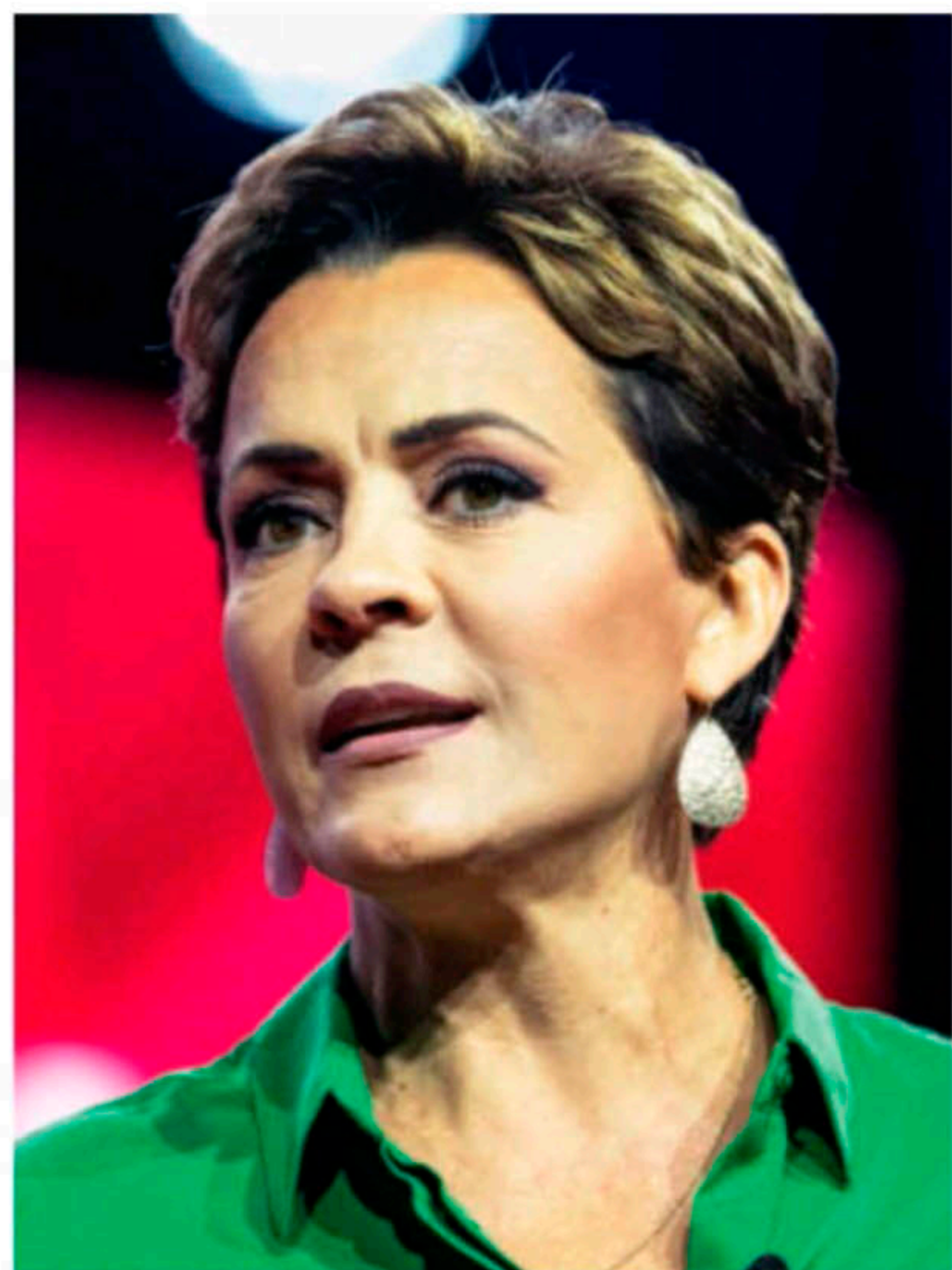
which had brought “divisiveness and chaos”. Ms Lake now faces a backlash. At the party meeting “she was literally booed off the stage,” says Sandra Dowling, a retired school superintendent who has been a Republican Party member since 1981. “What you hear in these boos was, Kari, we're really mad at you, and we're mad at you for taking out someone we loved.” Ms Dowling reckons Ms Lake has a lot of damage con- ▶▶

► trol to do even to win the Senate primary.

The coup leaves Arizona's Republican leadership, which was already MAGA-aligned, looking Trumpier than ever, and that could be a problem come November 5th. Republicans enjoy an advantage of about five percentage points over Democrats among registered voters in Arizona, and should win statewide elections, points out Samara Klar, a political scientist at the University of Arizona. But more than a third of voters here identify as independents, and many seem put off by Mr Trump. The party badly needs to raise money to help woo them. Democrats achieved surprising wins not only in the presidential election (Joe Biden won narrowly in 2020) but also the race for governor and both Senate seats: a trifecta not seen in Arizona for over 70 years.

In office, those Democrats tend to behave like independents—and often to sound like Republicans, notes Professor Klar. In the case of Senator Kyrsten Sinema, that has involved actually leaving the Democratic Party to become an independent. Whether she opts to run for re-election is one of the uncertainties hanging over this year's contest. Some doubt that she could muster the required number of signatures in time to get on the ballot.

Arizona will be getting a lot more attention from people "back east". Mr Trump cancelled an appearance at what was to have been a big fund-raiser for the Arizona Republican Party in Phoenix last week. But he is expected to visit soon. Two other former presidents did make it to Arizona: George W. Bush and Bill Clinton took the stage jointly on January 31st at a conference in Scottsdale organised by TIGER 21, a network of rich people. It was a demonstration of civility in stark contrast to the strife within parties—let alone between them. ■



Lake leaked

Defamation

Grab him by the purse

NEW YORK

Punitive damages ought to moderate Donald Trump's speech a bit

IF ORDERED TO pay millions of dollars for defaming someone, most people would learn their lesson and zip it. Not so Donald Trump. Last May a jury in Manhattan determined that he owed E. Jean Carroll, an advice columnist, \$5m in damages for sexually assaulting her nearly 30 years ago and then, in 2022, accusing her of making it up. Unbowed by the judgment, he called her a "whack job" on CNN the next day and denied ever having met her (even though they were photographed together). "I have no idea who the hell she is," he protested.

Mr Trump now has a big new incentive to restrain himself, thanks to a whopping judgment in a separate but related defamation trial. On January 26th a different jury awarded Ms Carroll \$83m for another set of insults and denials over the assault, these ones made by Mr Trump in 2019. Punitive damages represented four-fifths of the total—a sum clearly intended to deter the presumptive Republican nominee for president from defaming Ms Carroll again. Her lawyers had asked for \$24m in compensatory damages and "an unusually high punitive award". Mr Trump called the verdict "absolutely ridiculous!" in a social-media post, and vowed to appeal. The sum may well be reduced: calculating reputational harm is inherently subjective. But at least for now the lesson appears to have sunk in. Mr Trump made no reference to Ms Carroll after the trial.

The case stems from an encounter at Bergdorf Goodman, a department store in New York, in the mid-1990s. Ms Carroll alleges that, while they shopped in the lingerie department, Mr Trump pushed her against a dressing-room wall and raped her. In 2019 she published a book describing publicly the attack for the first time. Mr Trump said it never happened and accused her of trying to juice book sales, adding, "she's not my type." In 2022 Ms Carroll sued him under a law that allowed sexual-assault victims a one-year window to bring claims outside the statute of limitations. At last year's civil trial a jury determined that Mr Trump had "sexually abused" Ms Carroll but that he had not raped her. Those findings were not being re-litigated in this case. Lewis Kaplan, the judge who presided over both trials, said there would be no "do-overs by disappointed litigants".

Mr Trump stayed away from the first trial, but he attended this one and testified, albeit for less than five minutes. Those ap-

pearances marked an effort to bring the campaign trail to the courthouse, to underscore the supposed lawfare being waged against him by Democrats (Reid Hoffman, a co-founder of LinkedIn and Democratic donor, helped finance Ms Carroll's first case). Before Mr Trump's testimony Judge Kaplan demanded to know exactly what he would say, lest he suggest that the attack never happened.

Sure enough when Mr Trump called Ms Carroll's account "false" under oath, Judge Kaplan ordered it struck from the record. The defendant's huffing and puffing—he stormed out during closing arguments—no doubt helped Ms Carroll's case. "You saw how he has behaved through this trial," her lawyer told the jury. "Rules don't apply to Donald Trump." Judge Kaplan also sparred with Mr Trump's pugnacious lawyer, Alina Habba, who he warned might spend "some time in the lockup".

Ms Carroll will not receive the full damages while Mr Trump is appealing against the decision, which may take months. If he has the amount in cash he could pay it to the court, which will hold it during the appeals process (as he did with the previous award to Ms Carroll). Or he could try to secure a loan against his other assets. Much of his money is tied up in property. Mr Trump likes to brag about his wealth—one of the reasons the jury opted to award such a thumping sum in damages.

More legal peril awaits Mr Trump, who stands accused of 91 felonies in four criminal cases. The first, a federal trial over his election interference in 2020, was scheduled to begin in March. But it is on hold until an appellate court rules on Mr Trump's claim of immunity from prosecution for crimes committed in office.

In the meantime he can expect an even bigger penalty in yet another civil lawsuit in New York related to his real-estate business. In September Arthur Engoron, the judge overseeing that case, agreed with prosecutors that Mr Trump and his firm committed fraud by inflating the value of property to secure better loan terms. Letitia James, the state attorney-general, wants Mr Trump and his co-defendants to be fined \$370m and barred from serving as a corporate director in the state of New York.

Judge Engoron will also have to clarify what he intended when he ordered the cancellation of corporate charters that enable the Trump Organisation to operate in the state. His initial ruling was unclear about whether he really meant for Mr Trump's properties to be sold off and the business wound down. That would be a rare punishment: only a dozen companies in the state have been subjected to it in nearly 70 years. Whatever the penalty, it will probably be paused until Mr Trump appeals against it and the underlying fraud judgment, which will take months. ■

Immigration politics

Why not impeach everyone?

WASHINGTON, DC

House Republicans pursue an impeachment full of sound and fury

WILLIAM BELKNAP is the only cabinet official in American history to have suffered the indignity of a congressional impeachment. In the case of Belknep, the secretary of war to Ulysses S. Grant, it was richly deserved: to maintain his reputation for enormous, raucous parties and well-dressed wives, the war secretary awarded trade monopolies at a military fort to a friend who gave him generous kickbacks. For “basely prostituting his high office to his lust for private gain”, the House of Representatives voted to impeach him in 1876.

Nearly 150 years later, Alejandro Mayorkas, the secretary of homeland security, may become the second cabinet official to be impeached—if Republicans were to have their way, that is. Compare the two charge sheets, and the travesty of the latter becomes clear. Mr Mayorkas does not stand accused of grand corruption or treason but of a political crime: he has overseen immigration policy.

It should be noted that there is no chance of Mr Mayorkas actually being ousted from office. Articles of impeachment must first be passed with a majority of the House, which Republicans might even struggle to do because they retain control by the barest of margins. Passing those articles would trigger the spectacle of a trial to be held in the Senate. And the chances of securing a conviction there, which would require a two-thirds majority and so at least 18 Democratic voters, are lower than the odds that Mexico would ever pay for the construction of a border wall. So, why bother at all?

The southern border is indeed in a bad way, as Republicans point out. In December 2023 American immigration authorities reported more than 300,000 encounters with migrants—the most of any month on record. Those who arrive and claim asylum cannot be kept in custody because of a shortage of detention beds and immigration judges; many are released into the country with a court date years into the future, which is sometimes skipped. Even if the severity of the crisis is at its highest level, the problem of illegal migration over the US-Mexico border is decades old. Presidents like Dwight Eisenhower and Ronald Reagan struggled with it.

But in their articles of impeachment, the Republicans lay all of the blame at the feet of Mr Mayorkas. “In large part because of his unlawful conduct, millions of aliens

have illegally entered the United States on an annual basis with many unlawfully remaining,” they accuse in their first article. The second article says he breached the public trust by testifying to Congress that the border was secure, when, they argue, he should have known that it was not.

On closer inspection, the allegations are even more flimsy than they first appear. One complaint is that Mr Mayorkas overturned the Migration Policy Protocols, put into place by President Donald Trump, requiring asylum-seekers to remain in Mexico while they waited for their cases to be considered. The complaint cites language from a federal appeals court that Mr Mayorkas appears to have ignored. That only looks damning because it omits the fact that the court ruling was appealed to the Supreme Court, which sanctioned the policy change.

Rock and parole

Another gripe is over the administration’s use of “parole authority”, which allows it to grant reprieve from deportation on a case-by-case basis. Republican arguments that this has been applied over-generously (by allowing in 30,000 Cubans, Haitians, Nicaraguans and Venezuelans each month) are certainly plausible. But complaints about governmental inaction do not usually rely on empirical evidence showing increased action. The articles of impeachment, by

contrast, argue that Mr Mayorkas has not done enough to curtail the smuggling of fentanyl by pointing to the increasing amounts impounded by the authorities; that he is not doing enough to stop migrants by pointing to increased apprehensions at the border; and that he is not deporting enough illegal migrants by pointing to record-breaking deportation-case backlogs. At their core, the Republican allegations are about competence in office and the appropriate use of executive powers, which are usually addressed through court cases, not impeachment.

The irony is that House Republicans are pursuing this course of action when, on the other side of the Capitol, more serious Senate Republicans are trying to negotiate with Democrats to craft a bill that would alleviate the pressure on the Mexican border. Among the mooted provisions are limits on the president’s parole authority, an increase in the number of border-patrol officers and immigration judges, and tougher criteria for judging whether those seeking asylum actually have credible cases.

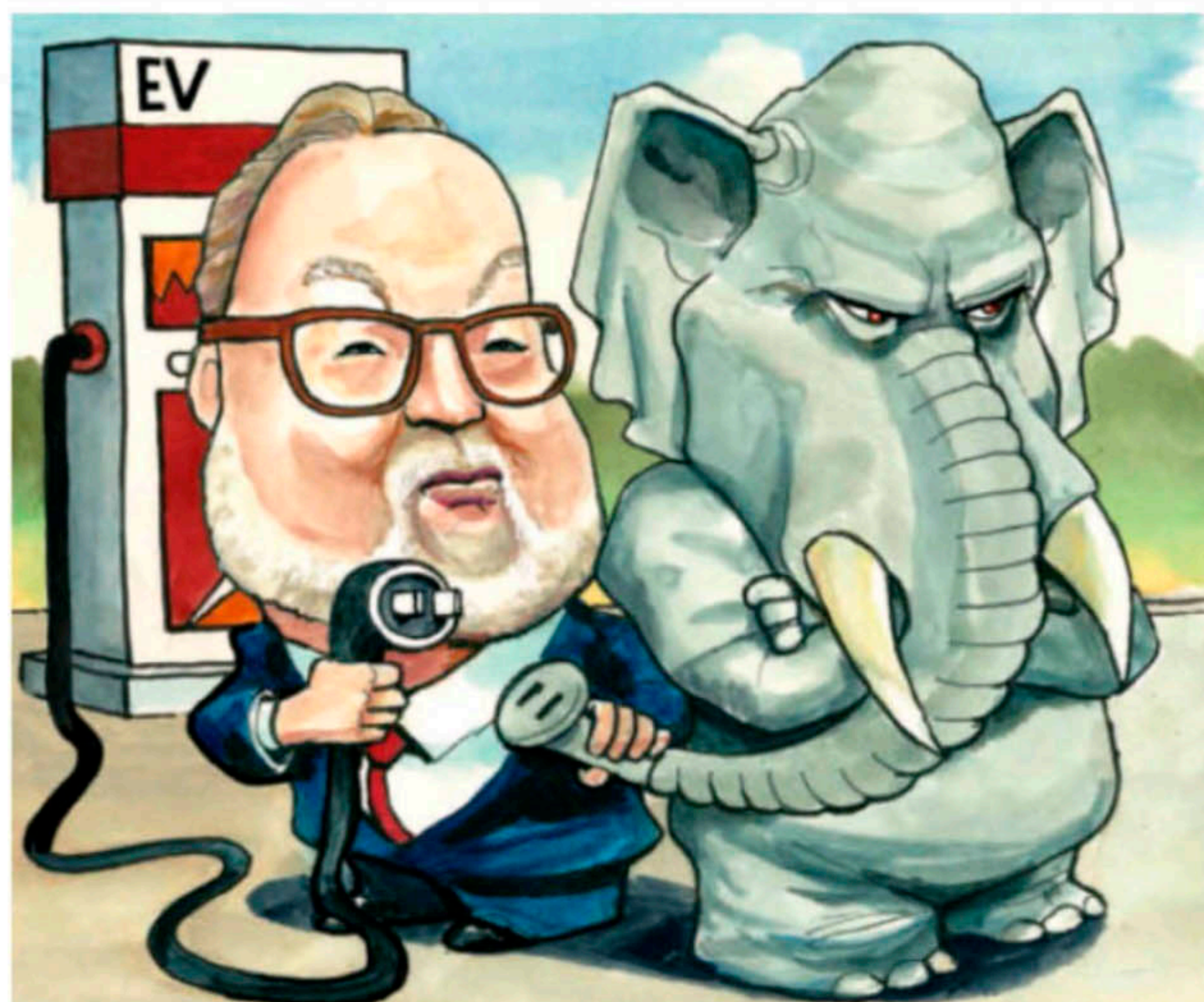
The bill matters for more than just the border: Democrats hope that a border deal would placate Republicans enough for them to agree to send more aid to Ukraine as part of a combined spending package. If accomplished, it would be a rare triumph of pragmatism over partisanship. Unsurprisingly, Mr Trump has taken to whipping against any forthcoming border compromise, following the cynical logic that border chaos is better for his election prospects than improvement. Pursuing an impeachment trial to protest about the border, in lieu of the legislation that might actually fix it, would be to prefer empty spectacle over governing. Alas, that seems an apt summary of the House Republicans’ mission statement. ■



The insecure security secretary

Lexington | EV rider

A Republican politico wants to save electrification from politics



PACKING EVER more ions into ever smaller batteries, spangling the landscape with charging stations, lowering the cost to make electric cars and trucks: these are complex, exciting challenges that engineers, regulators and others will probably solve. The tougher problem, the one that may define the limit of the American market for electric vehicles, is much stupider. It is polarisation, the stuff that makes an EV go but in its metaphorical incarnation is cursing not only America's politics but, increasingly, its culture and marketplace.

Three researchers who studied the adoption of electric and plug-in hybrid vehicles between 2012 and 2022 discovered that fully half of them went to Americans living in the 10% of counties with the highest proportion of Democratic voters. A third went to just the top 5% of such places. The pattern held even when the researchers controlled for income and population density.

Lucas Davis, a professor at Berkeley's Haas School of Business who was an author of the study, was startled that the correlation with ideology did not subside over the period under review, a decade during which the electric-vehicle market diversified with scores of models. "The market has matured in many ways, and I expected to see more of a broadening of EVs across the political spectrum," he says. "I think the results suggest that it may be harder than previously believed to achieve widespread EV adoption."

From the popularity of what the researchers called "conspicuous" EVs, they tentatively concluded that many purchases were driven by "extrinsic" motivations—a desire to advertise one's concern about climate change. That is a signal many Republican drivers are eager not to send.

This problem has caught the attention of one of America's most experienced Republican campaign operatives, Mike Murphy. A past devotee of internal combustion, Mr Murphy grew up in Detroit and boasts he has averaged about eight miles per gallon over the years. But when he traded in his Porsche for an electric BMW he became entranced by both the superior performance and the community of engineers and enthusiasts trying to overcome the obstacles to electrification. "It's like the Apollo programme," he says. "They're full of joy. They're solving really tough engineering problems and have a purpose to that. And that's a bit infectious."

Mr Murphy decided to apply his skills to knocking down the barrier that the boffins were less equipped to defeat. In January he launched an outfit, the EV Politics Project, to advise automakers on how to overcome Republican resistance and also to counter what he expects, in the 2024 campaign, to be an intensifying barrage of attacks on electrification.

Mr Murphy undertook a poll to gauge the problem. He discovered that Democrats and Republicans had similar attitudes toward car brands in general but split radically over electric-only carmakers. Democrats approved of them by a net margin of 15 points, whereas Republicans disapproved by 40 points—"an Osama bin Laden number," Mr Murphy says. While 61% of Democrats said their friends and relatives would praise them for a "smart move" if they bought an EV, only 19% of Republicans said that.

The son of a labour lawyer and grandson of carworkers, Mr Murphy fears the American auto industry will not survive if electrification falters. "If half the American market is ruling this stuff out based on bullshit and tribalism—and on marketing that doesn't understand that—that's a gift to the People's Republic of China," he says. Mr Murphy is a Reagan Republican who advised the likes of John McCain, Jeb Bush and Mitt Romney. The toughest adversary he confronts over the politics of electrification is the same one he has been tilting against for years, unsuccessfully, over the direction of his party: Donald Trump.

Mr Trump has identified in the polarisation over electric vehicles the kind of energy that has powered his politics since 2016. "MAY THEY ROT IN HELL", he wished of EV supporters, among others, on Christmas Day. He owned a Tesla, according to his aides, but he has claimed electric vehicles are bad for the environment, require charging every 15 minutes and will cause 40% of American auto jobs to disappear in a year or two. Some Republican-led states have begun imposing fees on EVs, restrictions on how they can be sold and even new taxes, purportedly to make up for lost fuel-tax revenue, though Republican leaders, starting with Mr Trump, do not habitually object to tax avoidance.

Yet some Republican leaders have embraced the possibilities of electrification. It has taken ridiculously long for states to begin opening new charging stations with the \$7.5bn fund created by President Joe Biden's 2021 infrastructure law. But the first governor to do so, in December, was Mike DeWine of Ohio, a Republican. Brian Kemp, the Republican governor of Georgia, is busy recruiting battery manufacturers.

The body electric

Mr Murphy sees other openings. He notes that five of the top ten states for EV investment, including Georgia and Michigan, are swing states in presidential elections. He intends to aim his pro-EV messages at them. Whereas 66% of Democrats think Elon Musk is a bad ambassador for EVs, 61% of Republicans disagree. "So is he Nixon to China?" Mr Murphy wonders.

Mr Murphy's polling also suggests, hopefully, that regardless of party most Americans share important sentiments about EVs. They have the same anxieties about price and range, and they are drawn to some of the same advantages: never paying for petrol, cashing in on government rebates. Mr Murphy thinks carmakers need to shut up about how EVs help the environment—those who care are already sold on the vehicles—and talk instead about how they benefit their owners. "If we want to move iron, we gotta make it about cars, not about luxury opinions," he says. There may be a lesson in there for Mr Biden's re-election campaign, too. ■



Venezuelan politics

Autocratic tactics

CARACAS

Nicolás Maduro bars his main opponent from office, defying the United States

IN THE UNLIKELY event that a free and fair election were to be held in Venezuela this year, Nicolás Maduro, its autocratic president, would almost certainly be voted out of office. That is especially true were he to face María Corina Machado, a popular conservative leader who won the opposition primary last October with 92% of the vote. One poll in November found that 70% of those surveyed said they would elect her, with just 9% supporting Mr Maduro. So it came as little surprise when, on January 27th, a Supreme Court stuffed with his cronies ratified a ban on Ms Machado seeking any political office for 15 years.

The move was swiftly justified by spokesmen spouting the regime's twisted logic. Prohibiting the country's most popular politician from being on the ballot papers was nothing other than a valiant defence of democracy, they insisted. "We want elections which are competitive for everyone, free for all," claimed Jorge Rodríguez, the head of the government's rubber-

stamp National Assembly. He then added that there was no way "that woman" would ever be a candidate.

It is just the latest example of Mr Maduro thumbing his nose at the United States. In October President Joe Biden's administration lifted sanctions for six months on most of the country's oil, mining and gold sectors in exchange for the regime agreeing, with members of the opposition, to a deal signed in Barbados which includes releasing political prisoners and holding broadly democratic elections this year.

Since then a handful of prisoners have been freed. But democracy remains elusive in the rogue state. In December Mr Maduro held a dodgy referendum which he claimed gave him the remit to annex two-

thirds of neighbouring Guyana, a move designed to create geopolitical headaches.

On January 29th, in response to Ms Machado's ban, the US Department of the Treasury announced the reimposition of one sanction. American companies transacting with Venezuela's state-owned mining company, Minerven, would have until February 13th to disentangle themselves from it. The big question now is: will Mr Biden have the mettle to impose more noteworthy sanctions, such as on the oil sector, on April 18th, the deadline for Mr Maduro to play ball?

Ms Machado believes in free markets and calls Margaret Thatcher a hero. That makes her unusual in Venezuela, a socialist state which has been ruled by Mr Maduro since 2013 and, before that, by Hugo Chávez, his political mentor. She used to be seen as the hardline fringe of the opposition, and as recently as 2018 tweeted that the only way to rid the country of Mr Maduro's regime was not via the ballot, but "by force". She now argues that elections can bring about change. She has also repeatedly said that Mr Maduro runs a "terrorist regime" and should "face justice" for crimes he has committed against humanity.

Even before the Supreme Court decision, Ms Machado was banned from office on the grounds that she failed to declare some assets when she was a congresswoman (an allegation she says is baseless). Jus- ▶▶

→ Also in this section

25 Foreign spies in Canada

26 Fixing Brazil's fiscal mess

tifying its latest ruling, the Supreme Court cited various reasons, including the fact that she had expressed support for American sanctions. The court also confirmed a similar ban on Henrique Capriles, another opposition politician.

Indeed, despite the Barbados deal, the regime is taking a harder-line stance against its perceived enemies. On January 22nd it announced that 32 people had been arrested for allegedly plotting to assassinate Mr Maduro and Vladímir Padrino, the defence minister. Detention warrants were issued for a further 14 “suspects” including Tamara Sujú, a human-rights activist, and Sebastiana Barráez, a journalist, both of whom live abroad. Three of Ms Machado’s campaign directors were detained earlier this month. The government has said it is unleashing what it has described as “Furia Bolivariana”: a “fury” in the name of the country’s 19th-century independence hero, Simón Bolívar.

Others see it as sheer pragmatism. “Allowing Machado to stand was never a possibility in this situation, where the government sets the rules,” says Luis Vicente León, a pollster. He thinks that Ms Machado’s past threats of retaliation meant her candidacy was a non-starter. Given that Mr Maduro’s regime survived an escalation in sanctions under Donald Trump (see chart), it seems it is calculating that it can withstand sanctions once more.

Mr Maduro has used the past few months to consolidate his power further. His regime has more leverage over the United States. On January 30th Delcy Rodríguez, the vice-president, tweeted that if America snapped back an embargo, Venezuela would stop taking repatriated Venezuelan migrants, record numbers of whom arrived in the United States last year.

Meanwhile the deal in Barbados led to a prisoner swap whereby an ally of Mr Maduro, Alex Saab, a Colombian businessman who faced charges in the United States for allegedly helping the regime launder \$350m, was granted clemency by Mr Biden and returned to Venezuela. He now runs

Venezuela’s international investment centre. Mr Saab was arrested in 2020 in Cape Verde, during a refuelling pit-stop when on the way to Iran. The Iranian regime has helped Venezuela’s, by buying gold, and it could do so again.

Even so, the return of sanctions on Venezuela’s oil sector would still be a big financial hit. It would mean that the regime would again have to resort to selling its oil at as much as a 40% discount on the black market, at an estimated loss of \$500m per

month in a country where GDP was just \$92bn last year.

One possible compromise being suggested in Caracas, the capital, is that Ms Machado withdraws her candidacy and supports a non-banned candidate. But the opposition leader, whose political mantra is *Hasta el final* (Until the end), emphatically dismissed that option on January 29th. “There is no retreat,” she said. “We have a mandate. And we will complete it.” Venezuela is set on a collision course. ■

Canada

All eyes on Five Eyes

OTTAWA

Did Chinese, Indian and Russian spies meddle in Canada’s elections?

JUSTIN TRUDEAU, Canada’s beleaguered prime minister, has had a tough few months. In September the Liberal Party leader made the explosive allegation that India was linked to the assassination of Hardeep Singh Nijjar, a Canadian citizen and Sikh separatist activist, on his country’s soil. India angrily denies this and diplomatic relations have soured.

Now Mr Trudeau faces another test. On January 29th a public inquiry began probing the extent of foreign interference in the country’s last two elections. If it finds that Canada, a member of the “Five Eyes” intelligence pact, has been a playground for foreign spies, Mr Trudeau will have to answer accusations that his government failed to take threats to Canada’s democracy seriously.

The probe is overseen by Marie-Josée Hogue, a judge appointed to the bench by Stephen Harper, a former Conservative prime minister. The initial part of the inquiry will look at the role China, Russia and other countries attempted to play in the elections in 2019 and 2021 that returned Mr Trudeau to power in a minority government. Ms Hogue has also asked to see state documents that might point to meddling in those campaigns by India. Russian and Chinese officials have thunderously denied any interference in Canada’s elections. (India has not yet responded to the allegations.)

Reporting by the *Globe and Mail*, a newspaper, suggests that China attempted to use a network of diplomats, spies and proxies to invest money and political muscle to try and influence the election in 2021 in order for the Liberals to win a minority mandate. The implication appears to be that a weak Liberal government was more likely to serve Chinese interests than a more hawkish Conservative one.

An earlier official inquiry also suggested there was a “well-grounded suspi-

cion” that Han Dong, an MP in Toronto, may have unwittingly benefited from the support of the local Chinese consulate in 2019, when he won the Liberal Party’s nomination. Meanwhile Michael Chong, a Conservative MP, is thought to have been targeted by China, along with his family in Hong Kong, after condemning China’s treatment of Uyghurs.

Security officials say few should be surprised that there are foreign spies in Canada. The country’s generous immigration policies have created large diaspora populations. Canada’s proximity to the United States also makes it an attractive stomping ground for spooks. The two countries’ armed forces work closely together. “You can spy here and get intelligence benefits from the United States,” says Ward Elcock, a former director of Canada’s intelligence service. The inquiry’s final report is due before the end of the year.



Warning signs

The Donald Trump effect

United States, number of individuals in Venezuela with active sanctions



Sources: CRS; OFAC; WOLA

*To January 31st

Brazil

A red-tape hellscape

SÃO PAULO

Can Lula and Fernando Haddad, the finance minister, fix Brazil's fiscal mess?

AN OVERHAUL OF consumption taxes passed by Brazil's Congress in December has been called "historic", "revolutionary" and a "miracle". "Nobody believed this would be possible," boasted President Luiz Inácio Lula da Silva, known as Lula, to a standing ovation in Congress. For once, the superlatives are not misplaced. More than 30 years in the making, the reform will simplify the world's most complicated tax system. But can Lula's government withstand the pressure from special-interest groups in order to implement it fully?

The tax overhaul is the latest and most telling in a series of structural reforms in Brazil. In 2017 labour laws were modernised under Michel Temer, a centre-right president. Under Mr Temer's right-wing populist successor, Jair Bolsonaro, Congress approved a pension reform that raised the retirement age. The flurry of reforms is happening because "frankly, the state ran out of money," says Tatiana Ribeiro of the Competitive Brazil Movement, a research and advocacy group. A deep recession in 2014 was made worse by fiscal profligacy and prompted giant protests in Brazil's biggest cities.

To understand why the tax reform is considered revolutionary, consider the current system. The constitution, enacted in 1988, gave all three levels of government—federal, state and municipal—the power to levy consumption taxes. This makes Brazil an outlier. Of the 174 countries that have value-added taxes (VAT), the most common consumption tax, the vast majority collect them at the national level. Brazil is unique in allocating responsibility for taxation of services to municipalities and giving them a high degree of freedom in how to do it. As Brazil has a grand total of 27 states and 5,570 municipalities, the country became "a madhouse for taxes", says Máilson da Nóbrega, a former finance minister.

This chaotic system has generated copious litigation. In 2019 the World Bank estimated that it took companies 1,501 hours a year to comply with Brazilian tax law, compared with a global average of 234. Many businesses are unsure which taxes they must pay, and to which entity. The value of current cases in Brazilian courts involving tax credits is over 5trn reais (\$1trn), equivalent to 75% of the country's GDP.

Many companies go to court to have their products reclassified in order to avoid



Taxing times for Mr Haddad

taxes. Crocs, a maker of plastic clogs, has been in a legal battle since 2015 to have its flagship product recognised as "slippers", which are exempt from certain taxes, rather than "footwear with outer soles and uppers of rubber or plastics", which are not.

The tax system also introduces distortions. Unusually Brazil charges VAT where a good is produced, rather than where it is consumed. This has led states and cities to offer tax breaks to attract companies. It is impossible to quantify their cost, since most local governments do not tally them. But the IMF has estimated that such breaks amount to lost revenue of more than 5% of GDP every year.

Stop suffocating us

The system also raises the cost of production and harms investment. Many of Brazil's taxes are cumulative. This means that companies producing goods have to pay tax on each input that is bought without securing refunds, as happens elsewhere. Products which are more complex to produce, requiring more technology and inputs, are disproportionately burdened.

Under the new system the five main consumption taxes will turn into two VAT rates: one collected by the federal government, the other by a steering committee with representatives from states and municipalities. Firms will now have to register only with the committee, rather than

register and file tax returns in each state and municipality in which they operate.

The committee will harmonise taxes across regions, ending the discretion of states and municipalities. Taxes will no longer be cumulative, credits for inputs will be automatic and taxes will be charged where products are bought. The simplification means that the standard VAT rate may end up at 27.5% by the end of 2033. By then the reform is due to be fully in force.

That rate would still be the highest of any big economy, but a step down from the 34% which can apply today. EY, a professional-services firm, calculates that the typical number of hours needed to comply with consumption taxes alone will fall from 885 per year to 285.

But the battle is not yet over. Though the reform will sharply reduce the number of "special tax regimes", many exemptions will remain. Congress will define limits for these in the coming months. Lobbies have been hard at work. Tax benefits for Manaus, a manufacturing hub, will remain untouched. Agribusiness has wangled a 60% reduction from the general rate for its inputs. The "intellectual professions" will get a 30% reduction. This includes accountants, lawyers and journalists, many of whose jobs depend on tax chaos.

Lula and Fernando Haddad, the finance minister, are fighting an uphill battle. In November Lula vetoed a bill extending payroll-tax exemptions for 17 sectors, including construction and retail. This exemption was introduced on a temporary basis in 2012. Instead of paying a 20% tax on payrolls for social security, companies in this scheme must pay only between 1% and 4.5% on their gross revenue.

Studies have shown that the fiscal costs of the exemption far outweigh any benefits to job creation. Even so, the exemption has continually been renewed. Mr Haddad has pushed to scrap it, saying it is too expensive. But in December Congress overturned Lula's veto. The exemption will now remain for another four years.

It can sometimes feel as if Mr Haddad has to fight against his own boss, too. Mr Haddad has been repeatedly criticised by his party for trying to keep fiscal accounts in order. On January 22nd Lula announced a new industrial policy that will involve deploying 300bn reais in grants and subsidised loans to national companies between now and 2026. As part of the announcement, the government mentioned it could introduce import-tax exemptions for inputs. Such moves undermine the idea of a simplified tax system.

"Brazil's elites are in favour of reform as long as it maintains their privileges," says Mr Nóbrega. For the tax reform to be considered truly revolutionary, Congress will have to resist the lobbies that have helped sustain the current morass. ■



Japanese politics

Kishida on the rocks

TOKYO

A financial scandal threatens Japan's prime minister and ruling party

THE NEWSPAPER *Mainichi* has polled approval of the Japanese government regularly since July 1947. During that time the country has had 34 prime ministers, including plenty of forgettable faces and reviled figures. But according to the newspaper's surveys none has been more unpopular than Japan's current leader, Kishida Fumio. In December disapproval of his administration reached a record high of 79%, up from under 50% in June.

This historic nadir comes as Mr Kishida's Liberal Democratic Party (LDP), which has held power almost continuously ever since its formation in 1955, faces its biggest financial scandal in decades. The party's "factions", or institutionalised groupings of lawmakers, have been accused of systematically under-reporting ticket sales at fundraisers and kicking back the proceeds to members.

Since news of the wrongdoing broke in November, ten people associated with the LDP, including three lower-level parliamentarians, have been indicted in a wide-ranging criminal probe. Four cabinet min-

isters have been sacked. In late January four of the LDP's six factions—including Seiwakai, once led by the late prime minister Abe Shinzo, and Kochikai, which Mr Kishida heads—were formally disbanded. During an appearance at Japan's new Diet session on January 29th Mr Kishida bowed and asked for forgiveness.

He was never particularly popular. Mr Kishida was elected president of the LDP—and thus became prime minister—in October 2021 thanks largely to the backing of the faction bosses. Minor scandals and unpopularity have since dogged his government, even as he has pursued ambitious policies, including major reforms to Japanese security policy. Apparently unfazed

→ Also in this section

28 TikTok and Indonesia's election

29 Stray cows in India

29 India's struggling opposition

30 Banyan: Sanctions against Russia

by his worsening ratings, Mr Kishida defied the many sceptics who questioned his staying power.

The latest troubles are more serious, however. With the opposition parties in disarray, the LDP's grip on power is probably secure. But Mr Kishida's leadership is creaking. He has called for an end to factional politics and launched a taskforce on internal reform.

Such moves have improved his image, but only a little: in *Mainichi's* January survey, disapproval of his government had dropped slightly to 72%. Mr Kishida's chances of a further boost may hinge on good news emerging from Japan's annual wage negotiations in March, a state visit to the White House in April and a package of tax cuts due to take effect in June.

Yet Mr Kishida will still struggle to win re-election as LDP president when his term ends in September. Although challengers have yet to step forward, many party members will be looking for new leadership as the deadline for the next general election looms in 2025. The contest will be unpredictable in part because of the weakening of the factions, which used to be able to direct their members' votes. "Now I can choose the candidate whom I truly believe in—before it was just a set menu from the faction," says one LDP parliamentarian.

Even if Mr Kishida hangs on, the LDP faces a new era of instability. The turmoil will at the very least distract from other priorities. The government may also find it

► harder to fulfil big promises, especially those that require the public to shell out, such as Mr Kishida's pledge to increase the defence budget by two-thirds by 2027. His government's plans to finance the increase by raising corporate, income and tobacco taxes have already been delayed once.

The balance of power inside the LDP may also shift appreciably on several big policy debates. "It's still the LDP, so it's only within a range, but there may be changes," the LDP lawmaker says. The wing of the party that belonged to Seiwakai, the largest faction and the one at the centre of the financial misdeeds, is likely to see its influence diminished. That faction has been a staunch advocate of strengthening Japan's defences. "We lose that engine," says Mutai Shunsuke, an LDP lower-house member.

Seiwakai has also been a brake on social reforms, such as legalising gay marriage, allowing married couples to have separate surnames and opening the imperial family to female succession. *Nikkei*, a business daily, has speculated that Seiwakai's decline may open political space to relax Japan's stringent immigration policy.

The LDP's legal troubles are unlikely to fade quickly. At issue is how the party raises funds from supporters and distributes money to its members, rather than the outright bribery of an earlier political era. The dollar amounts may seem trifling to those accustomed to American political contests: Seiwakai is accused of amassing a slush fund of ¥500m (\$3.5m) over a period of five years.

Yet the revelations come just as the government has been pushing for greater transparency in the private sector, through a strict new tax-invoicing system and corporate-governance reforms. Learning that politicians were stuffing their pockets meanwhile has enraged the public. The prosecutors handling the affair want to take the case as far as possible, says Toshikawa Takao, editor of *Insideline*, a political journal: "They are motivated by the idea of standing up to power."

The internal LDP reforms may nonetheless amount to little more than cosmetic changes. Some in the party would like to see the factional structure evolve. Mr Mutai compares the process to the *haihanchiken*, the abolition of feudal domains and establishment of prefectures in the late 19th century: "We need to get rid of archaic ways of doing politics...and instead introduce modern governance."

But talk of abolishing factions is nearly as old as the LDP itself. The party formed through the merger of two conservative parties that maintained distinct identities; past promises of change have amounted to little. "They are likely to change the name or shape, but remain intact in terms of content," says Uchiyama Yu, a political scientist at the University of Tokyo.

The LDP might feel more pressure to undertake deeper reform if other parties posed a bigger threat. But the opposition is split between disparate wings: the Constitutional Democratic Party of Japan, made up of remnants of the Democratic Party of Japan (DPJ), a liberal challenger that held power between 2009 and 2012; the Japan Communist Party, an old-school left-wing outfit; and the Japan Innovation Party, a newer right-wing one.

For many voters, memories of mismanagement during the DPJ era are still too fresh to eject the LDP again. "For the LDP to lose, someone else has to win, and there's nobody who can gain," notes Gerald Curtis of Columbia University. Though Japan's democracy has so far avoided the ills of populism and polarisation that vex others, it is far from healthy. ■

Indonesian politics

Dancing to victory

JAKARTA

TikTok has become a key battleground in Indonesia's election

PRABOWO SUBIANTO used to crack heads; now he busts moves. The favourite to win Indonesia's presidential election on February 14th stands accused of many past abuses. As a special-forces commander under Suharto, a dictator, he allegedly permitted atrocities in Timor-Leste in the 1980s. In the late 1990s, he ordered the kidnapping of more than 20 democracy activists, of whom 13 remain missing. (Mr Prabowo denies wrongdoing.) This record got him barred from America and Australia for a time. His strongman reputation has



Will he go viral?

blighted his political prospects; Mr Prabowo has twice tried and failed to become president. So he has lately undergone a startling makeover.

Social media have been flooded with videos of the portly former general dancing terribly. Young internet users, who mostly do not know or care about his past, seem to find them cute. This is not a trivial advance. More than half of Indonesia's 204m voters are millennials or younger, and Mr Prabowo is especially popular with them. It helps that he is backed by Joko Widodo (known as Jokowi), the current president, who is beloved and also obsessively curates his image on social media. Nearly four-fifths of Indonesians own smartphones, so politicians can reach even those on the remotest of the 13,000 inhabited islands that make up the world's third-biggest democracy.

TikTok is proving especially important as a place where politicians compete for votes from the young. Indonesia has more TikTok users than any country except America. A typical user scrolls for 29 hours a month, making it one of the country's most popular social-media platforms.

It is making politics more fun, too. Unlike X (formerly Twitter), which is used by people who take an interest in candidates' policies, TikTok is reducing the election to memes, songs and dances, notes Rustika Herlambang, a social-media expert at Indonesia Indicator, a consultancy.

Mr Prabowo's popularity on TikTok is buoyed by his running-mate, Gibran Rakabuming, the 36-year-old son of Jokowi. Mr Gibran posts clips of himself embracing TikTok's most popular trends, such as silly dances and videos of young Indonesians pretending to talk to their future children. His most popular TikTok videos have been viewed over 20m times, putting him on a par with Taylor Swift on an average day.

TikTok has taken the appeal of personality over policy to another level. A rival candidate, Ganjar Pranowo, complains that young voters aren't interested in his policies but are "more into gimmicks" that go viral on social media. Anies Baswedan, the third presidential candidate, has pulled ahead of Mr Ganjar in the polls, in part due to a social-media campaign that appeals to Indonesia's many K-pop fans. His newfound admirers have given Mr Anies a Korean nickname: Park Ahn Nice.

This marks more bad news for Indonesian democracy, which has retreated under Jokowi. TikTok says it is working with Indonesia's election oversight agency to stop fake news and hoaxes. Yet it has a bad record in this regard. According to a study by New York University and Global Witness, an NGO, TikTok approved the highest percentage of false political advertisements among websites, including YouTube and Facebook, in America's midterm election ►►

Cows in India

Suffering herds

NOIDA

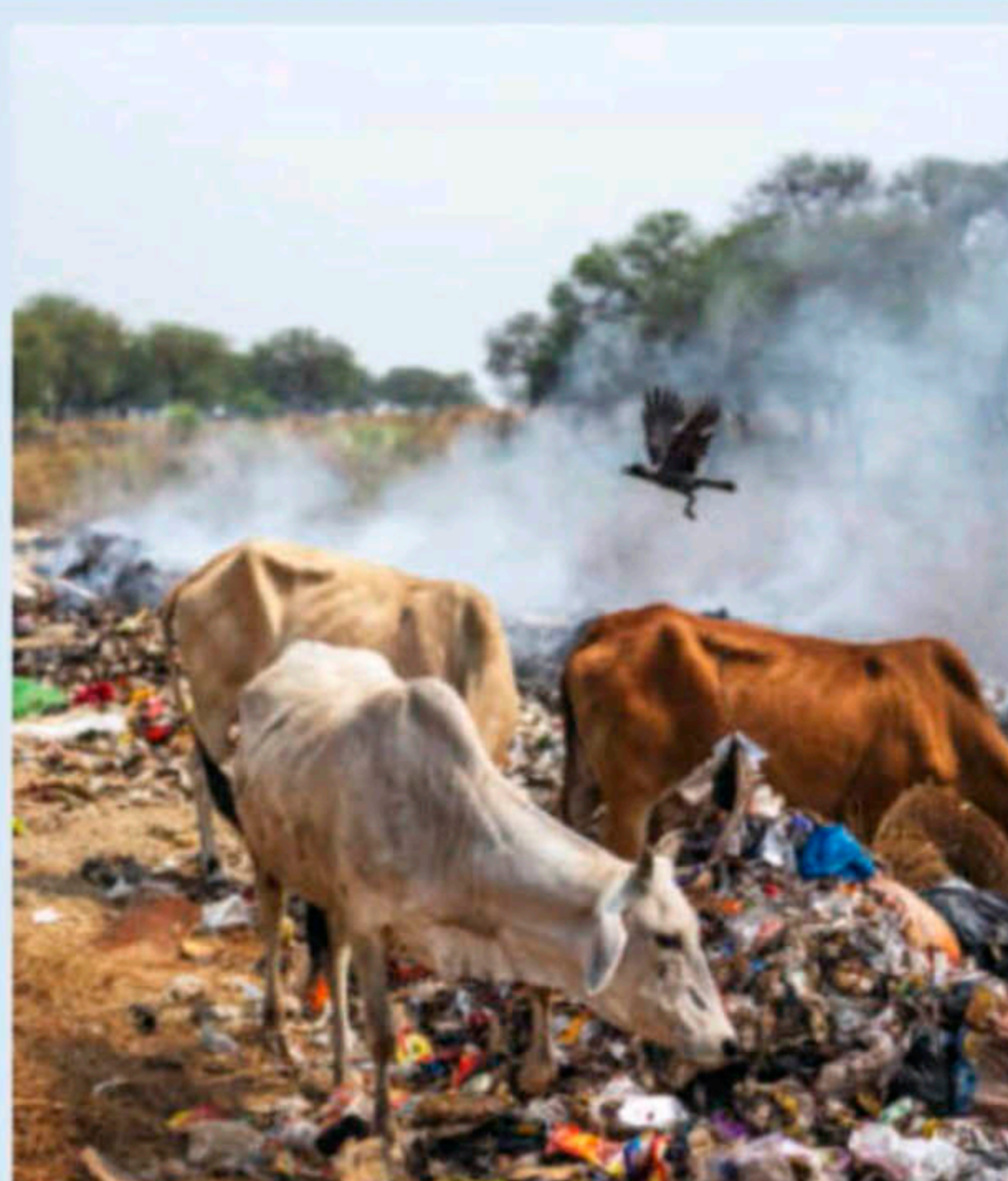
The Hindu right's pro-cow policies are terrible for India's cows

THE INDIAN government is not terribly keen on counting people. The country's census, conducted every ten years between 1881 and 2011, was postponed in 2021 owing to the covid-19 pandemic. It has yet to be rescheduled. Counting cows, for the ruling Bharatiya Janata Party (BJP), is a different matter. The BJP government of the big northern state of Uttar Pradesh (UP), home to an estimated 240m people and perhaps 20m cattle, is conducting a new bovine census. The point of this, says the government, is better cow protection.

The effort highlights a glaring cow-related contradiction in the BJP's Hindu nationalist ideology. The party says it wants to protect cows, which are associated with divine beneficence and venerated by Hindus. Yet its pro-cow policies, including bans on cow slaughter, appear to be detrimental to cattle welfare. They are thought to be causing an increase in stray cows, typically male calves and aged milkers which, having little commercial value, are let loose by their owners. Abandoned, they feed on plastic bags and other rubbish, cause car crashes and raid farmers' crops. There were an estimated 5m stray cattle in India in 2019, including 1.2m in UP. The government reckons the number has since increased.

Stray cattle have long been a menace in India, given the Hindu taboo on cow slaughter. Anti-slaughter laws such as the one introduced by the UP government in 2017 have further reduced the options for farmers to dispose of unwanted animals. Almost all of India's 28 states now have laws banning cow slaughter, many of which have grown stricter in recent years. So has the taboo, thanks to thuggish Hindu activists—so-called cow vigilantes—who attack traders, particularly Muslims, whom they suspect of transporting cattle. They operate largely with impunity and in some states alongside the police.

To mitigate the problem in UP, its BJP



government, which has been in power since 2017, promised to care for ageing livestock. The government set up its own shelters and doled out subsidies to private ones. At a shelter in Noida, a city in UP across the Yamuna river from Delhi, around 160 cows are housed in a crowded neighbourhood beside a busy road.

The men who run it say they are using time off from their jobs as estate agents and bank clerks to serve "mother cow". As leaders of the local branch of the Bajrang Dal, a militant Hindu group, they also have non-bovine interests. They scan the neighbourhood for signs of "love jihad" (a conspiracy theory that alleges Muslim men seduce Hindu girls in order to convert them and produce Muslim children), "land jihad" (alleged attempts by Muslims to take over Hindu-owned land) and Christian missionaries. They claim to press local police to prosecute such "crimes".

If the census finds, as is expected, that the number of stray cows has grown, operations like the one in Noida are sure to proliferate. That will be another boost to the Hindu right. It might not do much for UP's legions of famished cows.

India's opposition

A doomed alliance

DELHI

Nitish Kumar's defection is a disaster for Narendra Modi's opponents

LATE IN THE afternoon of January 28th Nitish Kumar was sworn in as chief minister of the east Indian state of Bihar for the ninth time. He had resigned from the job only a few hours earlier, after announcing that he would ditch his coalition partner and rejoin forces with Narendra Modi's Bharatiya Janata Party (BJP). Less than three months before Indians are due to start voting in a general election, this is a big boost to the prime minister's hopes of securing a third term.

A serial turncoat, Mr Kumar exemplifies the efforts of India's regional parties to play the two national giants, the BJP and Congress party, off against each other. He last walked out of a state-level coalition with the BJP 18 months ago, after accusing the Hindu nationalists of trying to split his Janata Dal (United) party (JDU).

This latest flip-flop is a huge blow to Mr Modi's opponents, including Congress, who have clubbed together in the heroically named Indian National Developmental Inclusive Alliance (INDIA). Indeed, Mr Kumar's decision is only the latest bad news for Congress: two other powerful regional leaders recently spurned its offers of an electoral pact in order to contest the poll independently. Taken together, these moves leave the opposition in potentially terminal disarray.

The INDIA alliance had been creaking ever since Congress lost three important state elections to the BJP in the populous Hindi heartland late last year. The defeats weakened Congress's claim to leadership of the opposition and undermined its efforts to institute seat-sharing deals with beefy regional parties such as Mr Kumar's. In recent weeks Arvind Kejriwal of the Aam Aadmi Party (AAP), which runs Delhi and Punjab, and Mamata Banerjee of the Trinamool Congress (TMC), which controls West Bengal, said that they would spurn Congress and campaign alone in Punjab and West Bengal. Though Congress has some support in Punjab it has almost none in West Bengal. This means it is now unlikely to win many of their combined total of 55 parliamentary seats.

Mr Kumar's defection is a bigger blow. The BJP has a lot of support in Bihar, India's poorest state, so an election pact with Mr Kumar should help it secure most of its 40 seats. Mr Kumar's decision is also a powerful sign to other regional leaders of where the political wind is blowing. He briefly

► campaign in 2022 (in response, TikTok said it prohibited misinformation and welcomed feedback to improve).

Another low trick, paying individuals to praise a politician online and castigate his rivals, is also common on TikTok and hard to police. Such social-media hacks are known in Indonesia as "buzzers" and are allegedly being used in all the campaigns. A typical buzzer is a young, well-educated

man, operating up to several hundred fake social-media accounts, says Wija Wijayanto of Diponegoro University in Java, the country's most populous island. A buzzer's pay might start at a few hundred dollars a month, but can be much more. When it comes to ruling on TikTok, the fact that Mr Prabowo's campaign is estimated to have up to 30 times more cash than its rivals looks like a big advantage. ■

▶ put the BJP on the back foot in Bihar last year, by rallying low-caste Hindus behind his demands for more generous affirmative-action measures in their favour. Mr Kumar was also instrumental in persuading other regional leaders to set aside their longstanding wariness of Congress and join INDIA. Others are now much likelier to go it alone or follow Mr Kumar to the BJP.

The chief minister has managed to stay in power in Bihar almost continuously since 2005, by joining forces with whichever partner seemed most opportune at the time. He has switched allegiance five times

in the past decade, earning him the nickname “Kursi Kumar” (“Chair Kumar”). Before he became chief minister in 2005, he held several posts in the BJP-led government of Atal Bihari Vajpayee, including control of the powerful railway ministry.

Underlining the sense that he believes the national mood is now with Mr Modi, Mr Kumar was re-sworn in as chief minister to chants of “Jai Shri Ram” (“Victory to Lord Ram”). This pointed to the Hindu nationalist fervour that has swept much of the country since the consecration on January 22nd of a long-awaited temple to the

Hindu god Ram in Ayodhya, in the next-door state of Uttar Pradesh. Mr Modi immediately congratulated Mr Kumar and the BJP’s leaders in Bihar on the state’s new government. The prime minister said he was confident they would “leave no stone unturned” in developing Bihar for the benefit of its 130m people.

The remaining INDIA leaders lambasted Mr Kumar’s “betrayal”. Much good that will do them. Ms Banerjee, Mr Kejriwal and Mr Kumar were the opposition alliance’s most powerful non-Congress members. Without them, it looks doomed. ■

Banyan Unsanctioned behaviour



Asia’s undermining of sanctions against Russia carries lessons for the future

FOLLOWING VLADIMIR PUTIN’S invasion of Ukraine two years ago, more than three dozen countries, led by the West, slapped economic sanctions on Russia. They were unprecedented in their scope for a target of its size, covering energy and other commodities, finance, technology, travel, shipping and more. Their aim was to raise the cost to Russia of continuing the war.

The reorganisation of trade that has followed highlights the relentless eastward shift in the world’s economic centre of gravity. Asia accounts for two-fifths of the world’s GDP. Its ever-increasing commercial pull is diverting much trade that Russia previously conducted with the West, undermining sanctions. That is despite the fact that three of the six Asian countries which have joined the sanctions—Japan, Australia and South Korea—number among the region’s five biggest economies. America should bear this in mind if it ever considers slapping similar sanctions on China.

Of course China itself, under Mr Putin’s pal, Xi Jinping, has done the most to undermine the West’s sanctions. Trade between Russia and China jumped by 29% in 2022 and probably by more last year. China and Hong Kong are now Russia’s chief suppliers of microchips, frustrating Western efforts to starve Russia of the integrated circuits essential to the war effort. China has also swiftly become the top supplier to Russia of cars and smartphones.

Chinese support is far from the only factor, however. The *Insider*, an online newspaper, recently revealed how Russian military enterprises are getting hold of sophisticated machine tools from Taiwan, despite sweeping sanctions there: middlemen in Turkey and elsewhere are sourcing what Russia needs. In

Central Asia, Kazakhstan and Kyrgyzstan are key conduits for shady “parallel imports” into Russia: their trade with neighbouring Russia has boomed.

From the start sanctions had to be designed around Asia’s apathy. The alternative was for the West to compel its involvement by imposing massive and indiscriminate “secondary” sanctions: that is, measures targeting third parties who help Russia. But Asia is too important, economically and geopolitically, for the West to issue such threats.

Another important example is oil. On the eve of the invasion, Europe bought three-fifths of Russia’s oil exports; that has fallen sharply because Europe has banned those that come via sea. Russia’s oil exports to Asia, meanwhile, have leapt to more than half its total, with India the biggest buyer. Singapore is one odd case. It condemned Russia’s aggression and was the only member of ASEAN to sanction Russia. Oil, though, is not covered. Singapore is a refining and oil-trading giant, as well as the world’s busiest bunkering port. In the year to May 2023 its imports of

Russian oil nearly doubled. Demand for storage has also risen, suggesting that Russian oil products are being blended and sold on as non-Russian oil with a juicy mark-up.

In part Asia’s appetite for Russian oil is helpful to the West. America and Europe have tried to use their control of maritime insurance and vessels to cap the price of Russian oil while ensuring it still flows, thereby avoiding a global supply crunch that would hurt their own consumers. Yet Russia’s sales to Asia also highlight that even if the West had wanted to stop Russia’s oil exports, it could not have done so. The price cap is leaky, too, because a “shadow fleet” accounting for roughly 10% of all tankers ignores it. Today Russia earns more from oil exports than before the invasion.

Now the speculation in Asia is about how much America might ratchet up secondary sanctions aimed at Asian entities deemed to be supporting Russia’s war economy. In December President Joe Biden issued an executive order detailing secondary measures against foreign firms and banks. Asian banks appear keen to be seen as compliant.

Even if the West successfully uses secondary sanctions to coerce Asian countries, says Nicholas Mulder, a sanctions scholar at Cornell University, the long-term risk is that economic warfare undermines both the primacy of the dollar-based financial system and America’s influence in Asia. And if America is having this much trouble getting Asians to support a sanctions regime against a (for them) relatively unimportant country such as Russia, think how much more trouble it would have with China’s neighbours should it ever attempt to impose a similar regime on the region’s military and economic colossus.





China and the Red Sea

Operation Sit Tight

Despite a threat to one of its main trade routes, China prefers to sit out the Red Sea's security crisis, while reaping political benefits

SIX YEARS ago a film titled "Operation Red Sea" became a huge hit in China. It was touted as the first in Chinese cinemas to focus on the exploits of the modern Chinese navy, which in recent years has overtaken America's to become the world's largest. The plot revolves around a naval special-forces operation to rescue a Chinese citizen taken hostage by terrorists in a Yemen-like Red Sea country. "This mission is a message to all terrorists that you will never harm a Chinese citizen," intones the commanding officer. The Communist Party organised showings to whip up patriotic fervour. Officials said the film showed a China that was "taking on its responsibilities as a great power".

America is wary of China's growing global reach. But since mid-November, when Houthi rebels in Yemen began attacking shipping in the Red Sea with missiles and drones, American officials have been prodding China to show some of that great-

power spirit by helping to resolve a real-life crisis in the region. During 12 hours of meetings on January 26th and 27th in Bangkok, America's national security adviser, Jake Sullivan, tried to persuade China's foreign-affairs chief, Wang Yi, that China's influence could be used to stop the threat to a major artery of global trade. China, however, views its responsibilities differently. It does not want to flex muscle in the Middle East. China sees the region's security as a quagmire of America's making. It is exploiting an opportunity to talk up solidarity with the Arab world.

Security in the area is certainly impor-

→ Also in this section

33 Repression in Hong Kong

33 "Shawshank" on stage

34 Chaguan: Heroic bicycle-makers

tant to China. In 2021, when a container ship blocked the Suez Canal for six days near its entrance to the Red Sea, China's Ministry of Commerce estimated that 60% of the country's exports of goods to Europe were using that route (last year about 17% of China's goods exports worldwide were to the European Union and Britain).

The Houthis claim their dozens of attacks have been aimed at vessels linked to countries that support Israel in the Gaza conflict (China does not). But there are risks for all. On December 3rd a container ship chartered by OOCL, a Hong Kong-based firm owned by COSCO, a state-controlled Chinese shipping giant, was hit by a drone-fired rocket. There has been speculation that the Houthis had outdated information about the vessel, which previously had been chartered by an Israeli firm. On January 19th the Houthis said Chinese and Russian ships would enjoy safe passage through the Red Sea. But much of China's maritime trade involves ships registered in other countries. Many of these are now playing safe by going around the Cape of Good Hope (see map on next page).

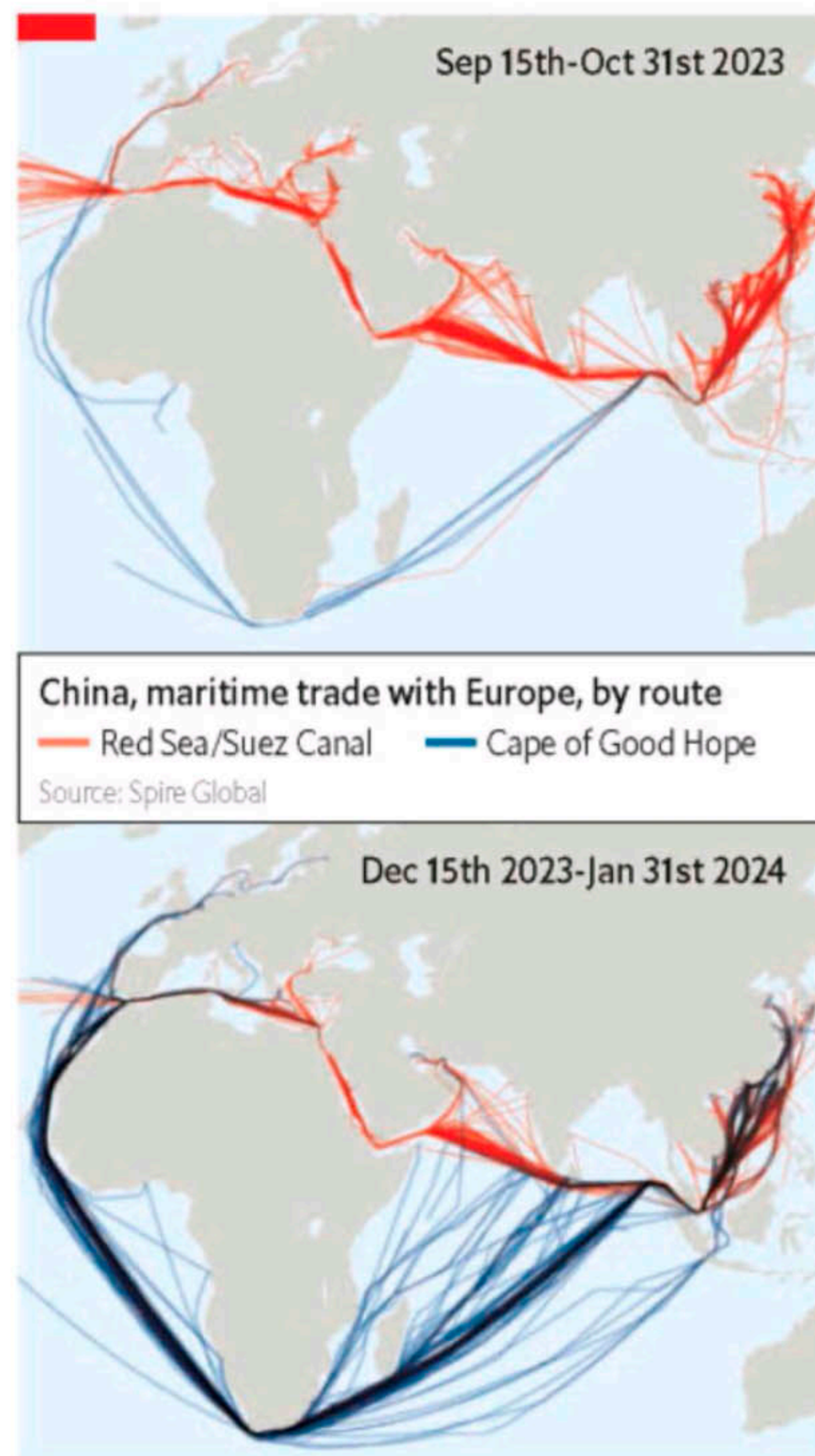
Data provided to *The Economist* by Spire Global, an analytics firm, shows that before December, 99% of container ships sailing between Europe and China went through the Suez Canal. By the second week of January, fewer than half were do- ▶▶

ing so. The Cape route can add about two weeks to the journey—avoiding the high premiums now demanded by insurers for Red Sea transits, but adding to transportation costs. The China Containerised Freight Index, a measure of container prices at major Chinese ports, has more than doubled since late 2023 for shipping to Europe (see chart 1).

Your problem

The Chinese government, however, prefers to stay on the sidelines. The country’s only overseas military base is close by, in Djibouti. Yet the Chinese navy has been keeping a low profile. It has avoided involvement in an American-led military coalition, known as Operation Prosperity Guardian, which has been formed in response to the Houthi attacks. China’s state media do say a Chinese shipping line, Sea Legend, is offering to carry freight through the area with the help of Chinese navy escorts. Its website displays a schedule for such escorts in the Gulf of Aden, which adjoins the Red Sea. China has much experience of such missions: since 2009 its warships have been helping to protect commercial shipping in the Gulf of Aden from attacks by Somali pirates.

America believes that Iran is encouraging the Houthis and that China, which has close ties with the government in Tehran, could help persuade the country to stop the Red Sea attacks. According to a senior American official, Mr Sullivan stressed this during his meeting with Mr Wang in Bangkok. Reuters says that during several recent encounters in Beijing and Tehran, Chinese officials have indeed asked their Iranian counterparts to rein in the Houthis. The Chinese message has been that: “If our interests are harmed in any way, it will impact our business with Tehran,” the news agency quoted an Iranian official as saying. The American official said China had confirmed it was talking to Iran about the attacks. “But we’re certainly going to wait to see results before we comment further,” he said, seeming unsure of “whether



we think they’re actually raising it”.

China likes to present itself as a benign big power that can help spread peace in the Middle East and elsewhere. In 2022 China’s leader, Xi Jinping, unveiled a “Global Security Initiative” (GSI) that was clearly aimed at rallying support for China, especially among countries resentful of American hegemony. It called for resistance to “cold war” thinking and opposition to “the pursuit of one’s own security at the cost of others’ security”. These are standard Chinese descriptions of American behaviour. The idea was that conflicts would ebb if countries focused on building their economies (hint: we can help with that if you subscribe to our worldview).

There was nothing new in this, but the GSI was much trumpeted in Beijing. In March last year, China claimed a victory for it in the Middle East, brokering a deal that saw Saudi Arabia and Iran restore diplomatic relations after a seven-year rupture. In reality it was low-hanging fruit. “They went to China, I think, to get that great-power stamp of approval at the very end of the process,” says Jonathan Fulton of the Atlantic Council, an American think-tank. In the Red Sea, China cannot be expected to work GSI magic. American hopes that China might help end the crisis face several obstacles. One is China’s willingness to use what the American official called its “substantial leverage” in Iran, which exports about 90% of its oil to China. China welcomes this cheap supply of energy—it accounts for about 10% of its crude oil imports. It relishes friendship

with a country that shares its misgivings about American power.

Another difficulty is that Iran supplies the Houthis with weapons and intelligence, but its ability to control them may be limited. “They are strengthened by Iran, which gives Iran a little bit of sway over their actions,” says Dina Esfandiary of Crisis Group, a Brussels-based think-tank. “But if what they want to do goes against what Iran wants to do, they usually don’t hesitate to go ahead and do it.” Meanwhile, China is expending little energy on trying to secure peace in Gaza—it lacks the clout to achieve much there. Its state media have been pumping out coverage accusing America of fanning the flames. Mr Wang has pointedly remarked that the UN Security Council has not given approval for American and British strikes in Yemen.

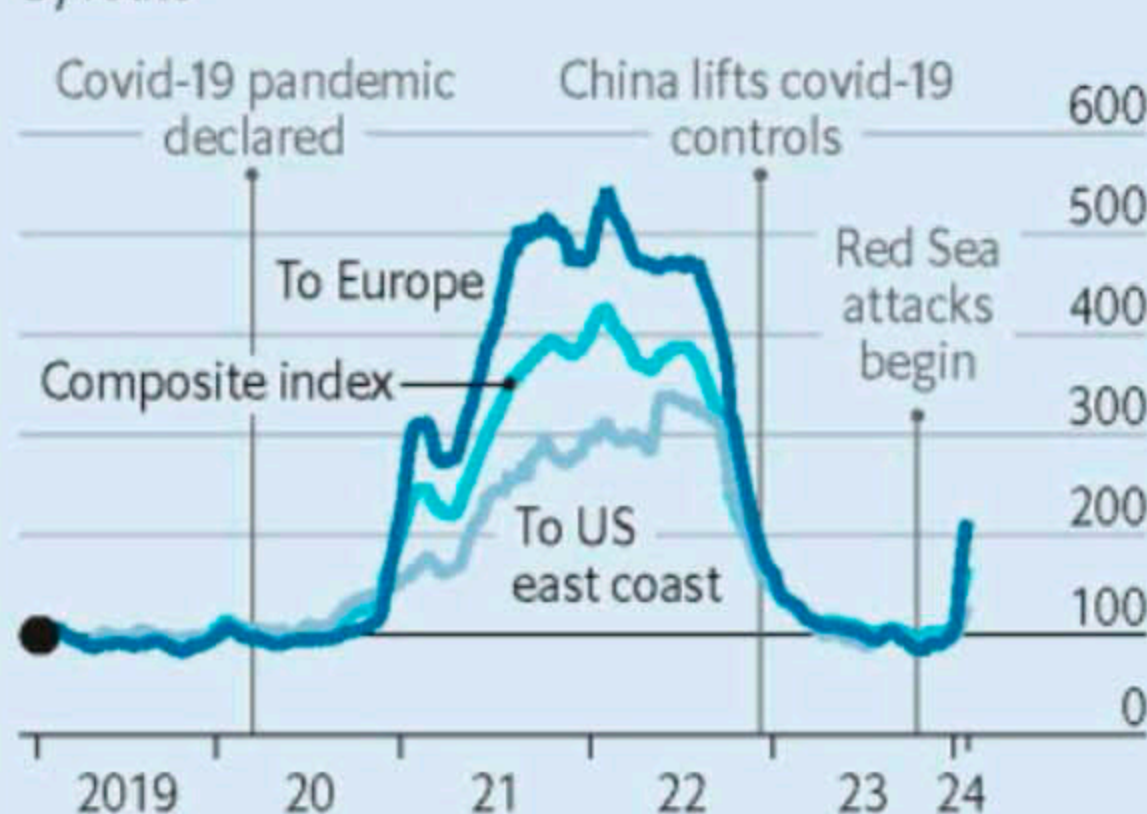
China would have much to fear from a wider conflict in the region. Its companies have invested more than \$20bn in countries around the Red Sea, mainly in Egypt and Saudi Arabia, according to the American Enterprise Institute, a think-tank in Washington. More than 70% of the oil that China consumes is imported; about half of it comes from the Middle East.

But at present China appears to believe that the threat from the Houthis is bearable. COSCO has said it would re-route its ships around the Cape of Good Hope and stop delivering to Israel. But some of its vessels have continued to ply the Red Sea. Ships try to protect themselves from Houthi attacks by making clear a link with China in their automated identification systems—transponders that are fitted on ships above a certain tonnage on international voyages. By late January, more than 30 vessels per day in the Red Sea were advertising such a connection, Spire Global’s analysts found (see chart 2).

In China movie fans have been more focused on when a much-anticipated sequel to “Operation Red Sea” might be released (this year, many reckon). Expect it to feature an alternative universe, with China in the thick of Middle Eastern action. ■

The price of fighting

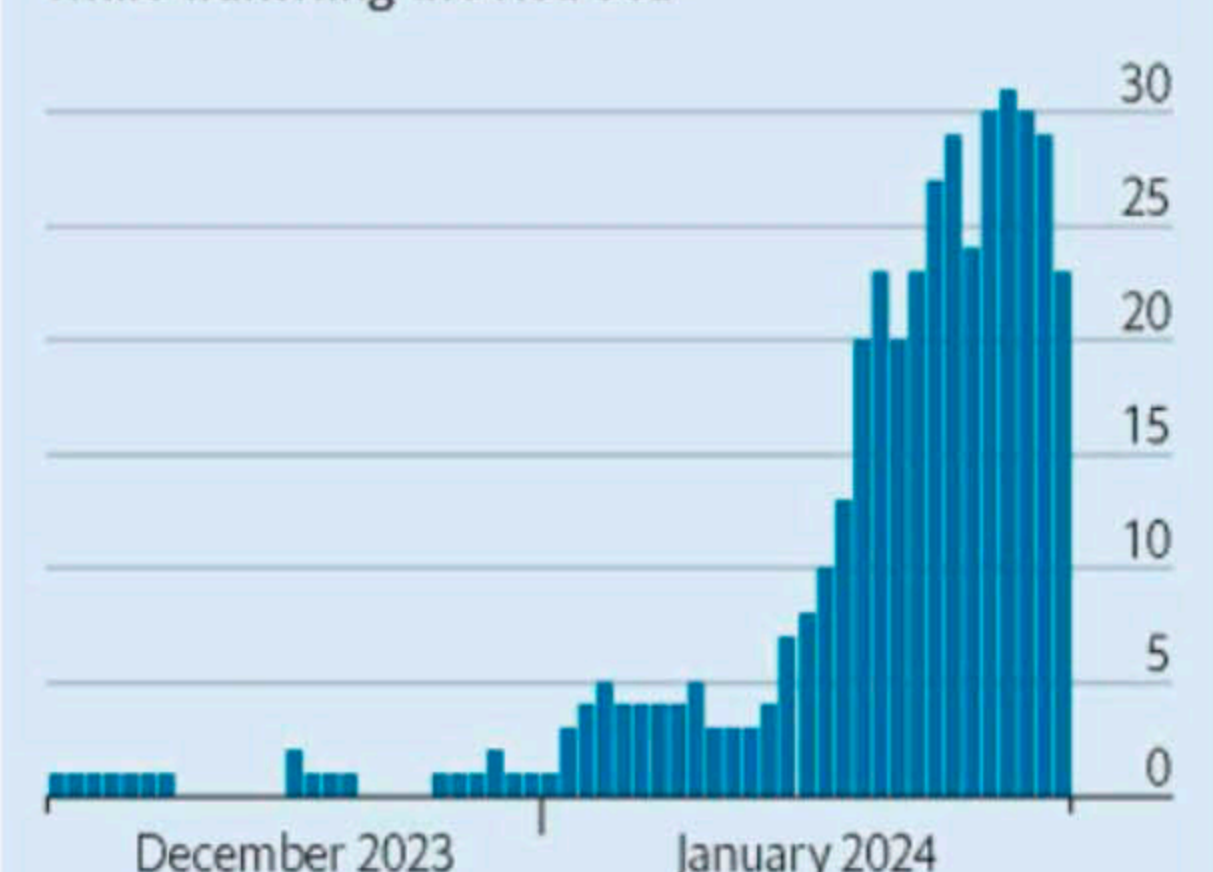
China, container freight costs*, Jan 4th 2019=100
By route



*Based on prices from ten major ports
Source: Shanghai Shipping Exchange, Wind

Ni hao mateys

Vessels reporting Chinese crew members while transiting the Red Sea



Source: Spire Global

Repression in Hong Kong

One draconian law is not enough

HONG KONG

John Lee thinks foreign powers are still trying to overthrow his government

HONG KONG has a constitutional duty to implement its own national-security law, as well as a practical need to do so. So said John Lee, the city's chief executive, on January 30th, as he unveiled new legislation aimed at thwarting subversive types.

Mr Lee was half right. Hong Kong is indeed required to pass national-security legislation under Article 23 of the Basic Law, the mini-constitution enacted after Britain handed back the city to China in 1997. Its practical need is debatable. Hong Kongers, at least, seem to prefer living without it. When the government last tried to push through such a measure, in 2003, it sparked enormous protests and the city's leaders backed down.

Since then, Article 23 has loomed over Hong Kong. Everyone knew it had to be dealt with; the question was when and how. The central government in Beijing moved first. In 2019 it was spooked by big pro-democracy protests in Hong Kong. A year later, after the pandemic cleared the streets, it foisted its own suffocating national-security law on the territory. The success of that legislation in suppressing even mild criticism of the authorities allowed Hong Kong's government to at last put forward its own version of the law. No big protests are likely.

After a four-week public consultation, the new measure is expected to be swiftly passed by the city's legislature, which is packed with Communist Party supporters. The statute will cover acts such as treason, insurrection and sabotage. The government says it will complement the one imposed by the central government. Some of the acts the new law will proscribe are distinct, such as espionage. Nevertheless, given that the existing law is so broad and ill-defined, it is difficult to conceive of an activity that would fall foul of the new law and not already be covered by the old one, says a barrister in the city.

The idea of Western powers meddling in Hong Kong seems to be part of what is motivating Mr Lee, a tough former policeman and security chief. The new legisla-

We are hiring a correspondent to strengthen our China coverage. Candidates should be willing to be based in mainland China. A knowledge of geopolitics and economics is helpful. Applicants should send a cv, a cover letter and an unpublished article of 600 words suitable for publication in *The Economist* to chinawriter@economist.com. The deadline is February 23rd 2024.

IS HOPE A dangerous thing in China? Theatregoers in Beijing have been mulling that question, with two new stage adaptations exploring themes of injustice, freedom and renewal. "The Shawshank Redemption" (pictured) is set in mid-20th-century America, while "Les Misérables" takes place in 19th-century France. Both feature characters who are unjustly imprisoned and suffer under cruel jailers and corrupt systems.

The plays, performed in Mandarin, might seem a bit too on the nose for Chinese censors. After all, the Communist Party has been known to play the role of cruel jailer in real life. The party also disputes the notion that freedom and human rights are universal values.

"The Shawshank Redemption", based on a novella by Stephen King, was made into an award-winning film in 1994. Though it was not shown in Chinese



Ready for a little escape?

tion would outlaw "external interference" in Hong Kong's affairs. Mr Lee has come round to the view, popular in Beijing, that forces from abroad were behind the protests in 2019. "Foreign agents and advocates of Hong Kong independence are still lurking in our society," he warned on January 30th. His words have sent a chill through foreign NGOs working in the city. Mr Lee "has a track record of throwing wild and completely false allegations at people who simply advocate for democracy and human rights", says Ben Rogers of Hong Kong Watch, a monitoring group. He expects a crackdown on foreign organisations.

Theatre

Salvation lies within

BEIJING

Two plays that touch on sensitive topics

cinemas, it became hugely popular with locals who bought bootleg VHS or DVD copies. It also caught the attention of censors. In 2012 a blind human-rights lawyer called Chen Guangcheng pulled off a daring night-time escape from house arrest in the village of Dongshigu. (He ended up in America.) This gave rise to chatter about the "Dongshigu Redemption"—and led the government to block online searches for "Shawshank".

In 2019 "Les Misérables", which is based on a novel by Victor Hugo, got similar treatment. This came after pro-democracy demonstrators in Hong Kong adopted as their anthem a tune from the musical version of the story. The song, "Do You Hear the People Sing?", was subsequently censored.

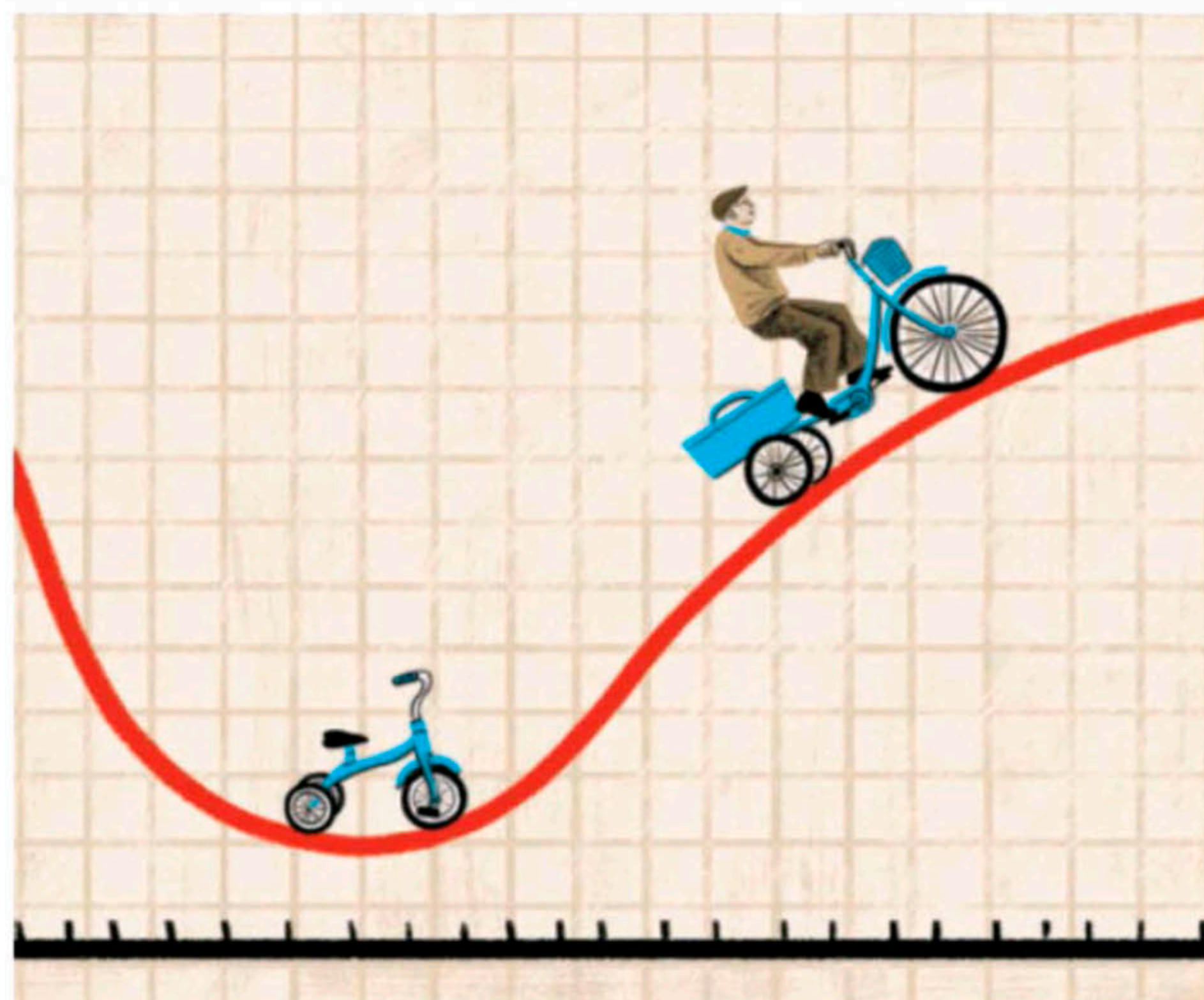
Yet people involved in the Chinese stage productions of "Shawshank" and "Les Misérables" report no problems gaining approval. This is not all that surprising. Censors worry less about plays than films or online content, which can be shared widely. Another factor is the foreign settings of the works, which make their messages easier to dismiss by Chinese officials. The production of "Shawshank" even has a foreign cast (all of whom speak Mandarin).

But Chinese theatregoers are not being obtuse. "Of course you start to think China is a bit like the prison," says an audience member at the Beijing premiere of "Shawshank". One of its stars is Mark Rowswell, a Canadian who has enjoyed fame in China under the stage name Da Shan. He admits that the play veers into sensitive territory. "Sure, it's about a corrupt system that makes you think you're trapped and you'll never get out," he says. "But really, it's mostly about hope. What's wrong with that?"

Few believe Mr Lee when he says that freedoms and rights will be "respected and safeguarded" under the new measure. The existing national-security law has been used to lock up scores of opposition politicians, shut down independent newspapers and effectively outlaw vigils for the victims of the Tiananmen Square massacre. Mr Lee was keen to explain how his proposed legislation is not so different from laws which have been enacted in Western countries. That may be true, says the barrister, but "it is one thing to legislate as part of a democracy, another when you are effectively a one-party state." ■

Chaguan | China's heroic micro-industrialists

A rural hub for children's bicycle-making adjusts to a world with fewer kids



THERE ARE lots of upsides to making bikes for kids, explains Mr Li, a young entrepreneur from Pingxiang, a scruffy county in northern China that has become a centre for the children's bicycle industry. For one thing, they are easy to build, he says, nodding at a toddler-sized machine parked near his desk, held upright by tiny stabilisers. Teenage mountain bikes are a bit fiddly, but smaller ones "need no special machinery at all". Also, he grins, children grow. Sell a three-year-old their first ride and two years later their parents have to buy a bigger one, and so it goes on for years to come. The downside? China is running out of children.

Pingxiang, in the province of Hebei some 400km south of Beijing, is a revealing place to see the country's demographic future playing out today. Like many industrial clusters in China, it grew over decades as businesspeople forged networks, helped by local officials offering tax breaks and other subsidies. Initially, small firms assembled frames, pedals and other parts bought from established manufacturers in coastal cities. Over time complete supply chains were created in Pingxiang. Today, the county is a sprawl of large industrial plants linked to smaller suppliers, many of them tucked away in rural sheds and barns. There are traffic jams as lorries and three-wheelers piled high with bicycle cartons inch down narrow village lanes.

County officials report that 10m bicycles a year are built there, by thousands of firms. Official media credit Pingxiang with supplying 40% of the children's bicycles sold worldwide. It also produces half the wheeled toys sold inside China, including bicycles, tricycles, scooters and ride-along toy cars. This targeted approach to globalisation made Pingxiang prosperous, if not lovely. The county is a drab, dusty spot, though officials have painted cycling-themed murals on walls and erected a giant sculpture of a bicycle wheel in a public square. Then came China's fertility crash.

In 2023 the number of Chinese newborns hit a record low of just over 9m, after falling for seven years in a row. That compares with nearly 19m babies born in 2016. Mr Li quit his job as a quality controller in a big factory a few years ago, and began selling hand-assembled bikes in street markets. Today he rents a small factory with a former colleague. He employs 15 people who can make hundreds of bicycles a day, when orders are good. Orders are not good

right now and his staff are on short hours. Huddled in a freezing office in one corner of their steel-walled factory, he and his business partner look anxious. This is understandable, given that their main customer base—namely, Chinese toddlers—has shrunk by half over the past decade. The change "started slowly, a few years ago", he recalls. Now the impact on sales is unmistakable.

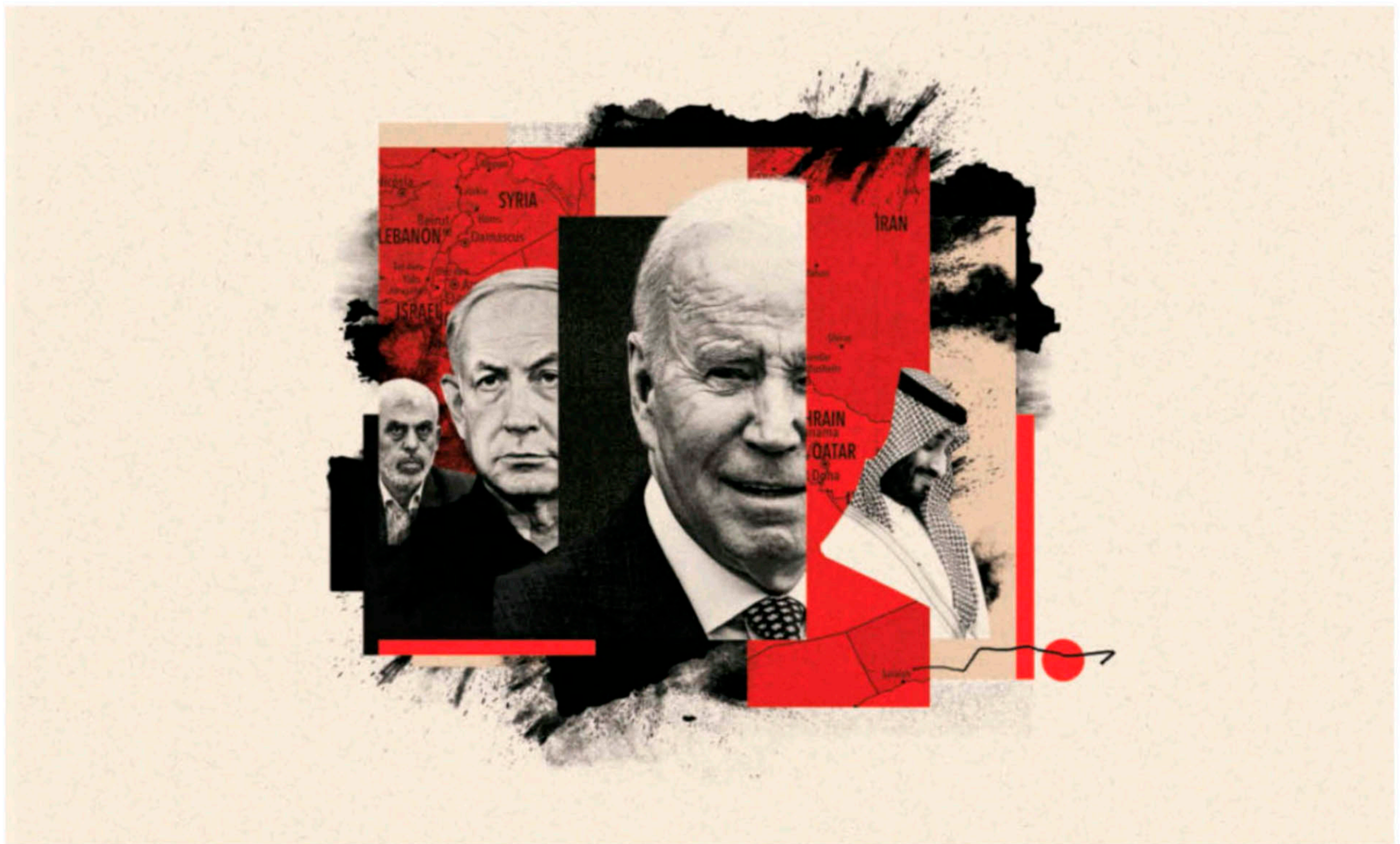
Mr Li's plight reveals a lot about the large forces that are battering China's private sector, and about the solutions being proposed by officials in both the local and central governments. Coverage of China's economy often focuses on a handful of national champions making world-class products, from smartphones to electric vehicles. But small firms with fewer than 300 employees accounted for 79% of China's job creation and 68% of exports, the OECD, a club of mostly rich countries, reported in 2022. Though the Communist Party puts great stock in large state-owned enterprises and groundbreaking technology, China needs its backyard entrepreneurs, too. The supreme leader, Xi Jinping, calls China's mastery of the complete array of industrial sectors a source of national strength. Last year he urged officials to upgrade, not eliminate, industries deemed "low-end".

Sluggish domestic demand, notably since the end of the covid-19 pandemic, has led officials to urge manufacturers of all types to seek new markets abroad. Still, exports are not a cure-all. A bicycle-industry veteran in Beijing notes that China's manufacturers saw roaring domestic and foreign sales during the pandemic, as people abandoned public transport for their own two wheels. The industry now faces a hangover, as inventories are cleared and many covid-era riders lose interest. In ageing societies, e-bikes for adults are selling well. But even in markets that still have children, many want to play video games, not play outdoors. Chinese consumers lack the confidence to spend but demand is weak in many foreign markets too, says the veteran. "In some of our enterprises, production is down by a third."

A slowing China bets on exports

Back in Pingxiang, Mr Li is struggling to survive. During pandemic lockdowns, many Chinese consumers had bills to pay but no income. They have not yet shaken the fear that they felt then, he says. Compared with last year, his firm's sales are down by more than half. Local officials urge businesses like his to look abroad, with a focus on countries signed up to China's Belt and Road Initiative. In 2020 less than a tenth of the firm's sales went abroad. Now exports account for 40-50% of turnover, with customers in Russia, Malaysia and Indonesia. He is grateful to county officials who subsidised his stand at a trade fair in Shanghai, where he met foreign buyers. But exports are hard work. The Russians are from that country's far east near the Chinese border, he thinks. They ask for more time to pay when the rouble is weak, though helpfully they settle their bills in Chinese yuan. Europe and America are richer markets, but the firm cannot meet their product standards.

After lunch, Chaguan is taken to a nearby village to see Plan B. In a farmyard workshop guarded by honking geese, Mr Li's business partner has a team assembling pedal tricycles for old people. These are built to order in batches of 50, which middlemen sell to domestic customers online. Compared with children, who need new bikes as they grow, the disadvantage is that pensioners "stop riding" when they get older, says the partner earnestly. But at least China will have more and more of them. A larger tricycle-assembly line is planned for next year. These are grim times for China's micro-industrialists. Their resilience is a wonder to behold. ■



Gaza and its reverberations

The new shuttle diplomacy

DUBAI, JERUSALEM AND WASHINGTON, DC

America makes a big push to end the war in Gaza. And maybe bring a lasting peace too

MASSACRE, RAPE, war, hunger, disease, regional escalation, disruption of global trade: the Middle East is living through apocalyptic times. But after death and hell, might peace come? To hear American officials talk about the four-month war between Israel and Hamas, and its reverberations that claimed the lives of three American soldiers in Jordan on January 28th, there is a modest but growing chance of turning catastrophe into opportunity. President Joe Biden's administration is working hard to bring it about, with senior figures shuttling between Washington, European and Middle Eastern capitals.

Their immediate aim is to secure a long humanitarian pause in the fighting, lasting a month or two, that allows for the exchange of Israeli hostages and Palestinian prisoners. A parallel and more ambitious objective is to turn that pause into a permanent ceasefire and secure a regional peace deal. This package would comprise Israel's acceptance of a Palestinian state, Saudi Arabia's recognition of Israel, Pales-

tinian reform and American measures to sweeten the deal.

American officials give even odds on securing the hostage deal in the coming weeks. If it succeeds, they reckon the broader agreement then has a similar chance. They are operating under two clocks. First, they want to calm the situation before Ramadan, the Muslim month of fasting. It starts around March 10th and is often a time of heightened religious passion and violence. Second, they think the best opportunity to secure regional peace is before America's presidential election in November. They also know that the danger of uncontrolled escalation is ever present.

→ Also in this section

38 Egypt's economy on the brink

38 The UN in Gaza

39 Hunger in Ethiopia

40 "Brexit" in the Sahel

All this helps to explain why Mr Biden is taking his time in retaliating "at a time and in a manner our choosing" against a drone strike that killed three American soldiers and wounded 40 others at Tower 22, a base in Jordan which supports US operations in Syria and Iraq. Republicans demand retribution against Iran and its proxies in the "axis of resistance", responsible for the latest of about 160 attacks on American forces (see map on next page) in the region since the start of the Gaza war. "Hit them hard," said Lindsey Graham, a hawkish Republican senator. Instead Antony Blinken, the secretary of state, promises a response that "could be multi-levelled, come in stages, and be sustained over time".

Mr Blinken warns of "an incredibly volatile time" in the Middle East: "We've not seen a situation as dangerous as the one we're facing now across the region since at least 1973, and arguably even before that." The crisis began on October 7th with Hamas's assault on Israeli communities that killed around 1,150 people. About 250 hostages were seized. Israel's military campaign to crush Hamas has destroyed much of Gaza and killed almost 27,000 Palestinians (including fighters). Some 2m people are displaced within the narrow territory. The UN warns of spreading disease and possible famine. The International Court of Justice has been hearing accusations of genocide by Israel.

A worsening conflict with Iran and its ►►

allies is under way across the region. Amid daily cross-border strikes, some in Israel want to go to war in Lebanon against Hizbullah, a Shia militia. America and Britain have also started bombing the Houthis, who control much of Yemen and have been attacking ships passing nearby.

Senior Americans have been running a diplomatic relay. Brett McGurk, Mr Biden's Middle East adviser, was in the region last week. William Burns, the CIA director, was in Paris on January 28th to consult spooks from Israel, Egypt and Qatar and co-ordinate the hostage deal. Mr Blinken is expected in the Middle East once again in the coming days. Jake Sullivan, the national security adviser, has been working the phones with Saudi and other leaders.

Think of the problem as a set of nested boxes. The key to ending the Israeli-Palestinian conflict is a "two-state solution", with a Palestinian state alongside Israel; the key to a two-state solution is the Saudi normalisation deal; the key to Saudi normalisation is ending the war in Gaza; and the key to ending the war in Gaza is the hostage agreement.

Let my people go

Begin with the hostages. Both sides seem closer to a deal that, like the previous exchange in November, would see hostages freed in return for the release of Palestinian prisoners. Binyamin "Bibi" Netanyahu, Israel's prime minister, faces street protests and demands to do more to bring back the captives. And Yahya Sinwar, the Hamas leader in Gaza, is under military pressure now that the Israel Defence Forces (IDF) are operating in Khan Younis, in southern Gaza, above the tunnels where he is thought to be hiding.

It would be a phased process involving the release of different categories of hostages: the wounded, women, children and the elderly. There is a particular urgency to get young female Israeli soldiers out. Male soldiers will be last.

The main hold-up is that Hamas insists on a cessation of hostilities and the complete withdrawal of Israeli forces; Israel is offering only a temporary pause. On January 30th Mr Netanyahu proclaimed: "We will not remove the IDF from the Gaza Strip and we will not release thousands of terrorists. None of this will happen." Instead, Israel would seek "absolute victory".

The pause, if it happens, may be Mr Netanyahu's moment of truth. His far-right cabinet members reject a long truce. But pragmatic members of the smaller war cabinet, among them the former defence minister, Benny Gantz, demand that priority be given to freeing the hostages, even if it means accepting a long or permanent ceasefire. If abandoned by either wing, Mr Netanyahu could face the dissolution of his cabinet and the countdown to an early

election. In those circumstances polls indicate he would lose to Mr Gantz.

The signs are that Israel's war in Gaza is reaching a point of diminishing returns. The dismantling of Hamas is proving difficult. The IDF reckons it has destroyed 60-70% of the group's battalions. But the intense fighting in Khan Younis is evidence that it is far from defeated. The fact that Hamas can still fire the odd rocket at Israeli cities from northern Gaza, where the IDF has thinned out its forces, suggests it can reconstitute itself. It is not just Mr Netanyahu, but much of the war cabinet that has pleaded for more time to deal with Hamas.

But some figures are starting to shift. Gadi Eisenkot, a member of the war cabinet and a former IDF chief of staff whose son and nephew were killed fighting in Gaza, has said that talk of total victory and rescuing the hostages by military means amounted to "tall tales"; securing the release of captives was more important than continuing the fight. "The enemy can be killed afterwards," he said. Yair Lapid, leader of the opposition Yesh Atid party, says he would be ready to join the government in place of the far right "to save the hostages".

An extended period of calm would allow more aid to enter Gaza, and permit planning for reconstruction. America is pushing to get a UN assessment team into northern Gaza, where conditions have so far proven too perilous. Above all, American envoys will be hoping a pause will help Israel turn its mind to the "day after".

Lost in transition

The two-state solution has been the holy grail of peace mediators since the Oslo accords of 1993, which gave Palestinians interim autonomy in parts of the occupied West Bank and Gaza Strip. The main population centres were run by the Palestinian Authority (PA). Israel and the Palestinians were then meant to negotiate "final status issues" such as statehood, borders, the return of refugees, water and the status of Jerusalem, ie, how it might be shared. The temporary became permanent as security collapsed during the second intifada of

2000-05. Israel left Gaza, and Hamas expelled the PA from the enclave in 2007. Divided and weak, the Palestinians were largely ignored. Instead America promoted the Abraham accords, instigated by the Trump administration, under which Bahrain and the United Arab Emirates (UAE), then Morocco and Sudan, established diplomatic ties with Israel in 2020-23.

The Biden administration has tried to finalise a similar Saudi-Israeli accord, with commitments from America such as a US-Saudi defence treaty and an American-supplied civil nuclear programme (including uranium enrichment) for the Saudis.

But then came the cataclysm of October 7th. The Biden administration talks more pointedly now about the need for a "credible, irreversible and time-bound" Israeli commitment to a Palestinian state. It also wants an early down-payment—perhaps a withdrawal from some West Bank territory or a real halt to settlements in the West Bank. David Cameron, the British foreign secretary, says Britain would consider recognising a provisional Palestinian state before a final deal. Mr Blinken is said to be contemplating such an option.

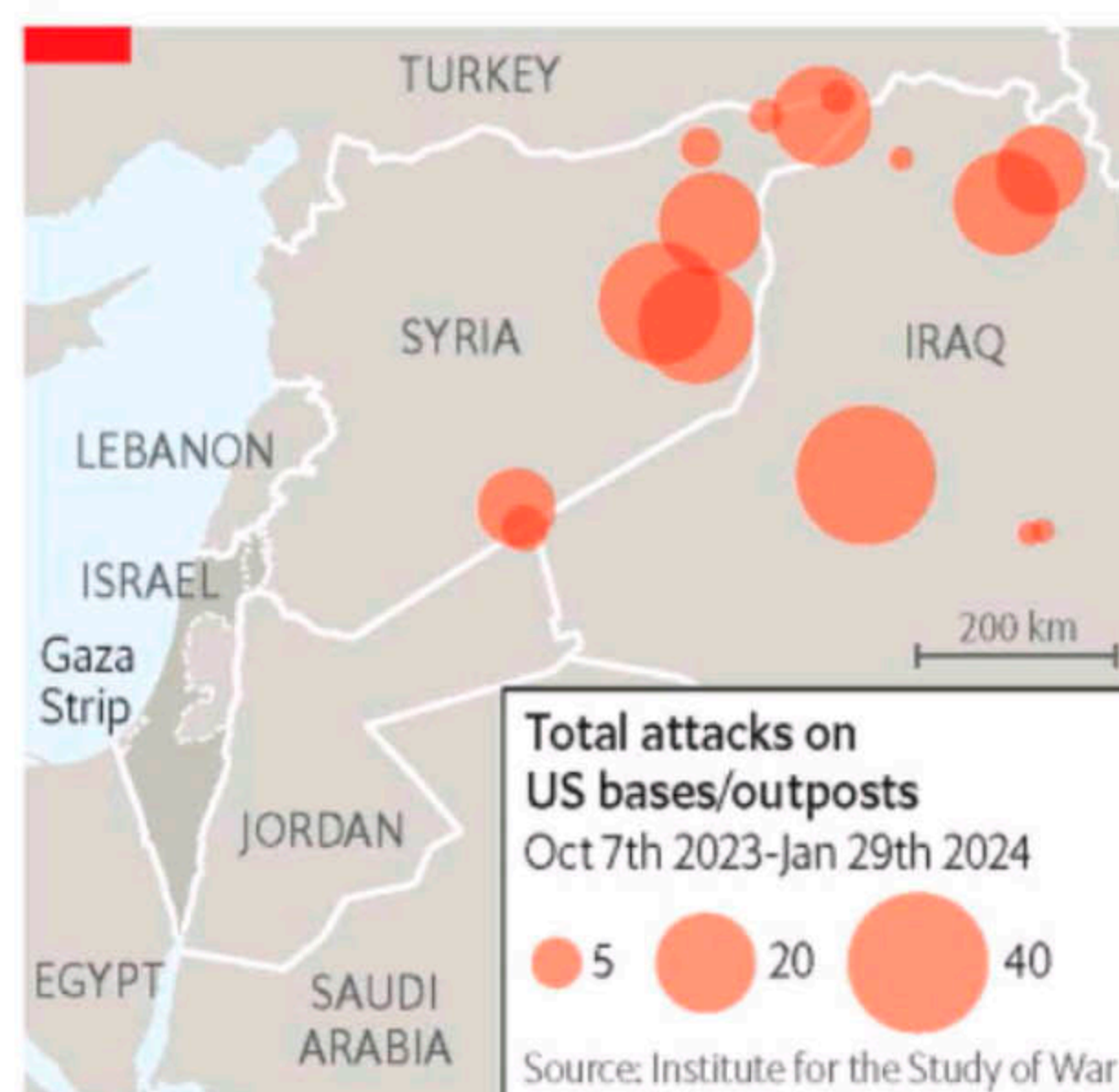
Despite the ordeal of Gazans playing nightly on Arab television and social-media channels, Saudi Arabia remains keen on an agreement. Indeed, Muhammad bin Salman, the crown prince and de facto ruler, seems to be a man in a hurry.

For one thing, he is aware of the American political calendar. A defence treaty would require ratification by a two-thirds majority in the Senate—this in a Congress that struggles to agree on anything, notably Mr Biden's request for more money to help Ukraine, Israel and others. Nonetheless, a deal done this year under Mr Biden ought to secure bipartisan support, even if some left-wing Democrats and isolationist Republicans oppose it. Were Mr Trump to win a second term, Democrats would probably vote en masse against a defence treaty.

An agreement would allow Prince Muhammad to claim credit for ending the Gaza war and giving Palestinians their state. He could show up Iran and outdo the UAE, which has been unable to use its ties with Israel to advance any diplomatic solution.

All that said, Saudi Arabia's price for peace with Israel is now steeper: not just a vague "Palestinian dimension", as previously discussed, but a firm commitment to Palestinian statehood, with unambiguous steps and a clear timetable. "We are going for gold," says one Saudi source.

There are countless obstacles to such a plan. The two biggest are Mr Netanyahu and Mr Sinwar. The Israeli prime minister has ruled out a Palestinian state, saying Israel must have security control over all lands between the Jordan river and the Mediterranean. Mr Netanyahu may be deeply unpopular, but he scarcely faces de-



► demands for “peace now”. His far-right allies are recycling ideas of the “transfer” of Gazans to other countries, or at least a return of Jewish settlements to Gaza. Centrists such as Mr Gantz are careful not to mention two states. Indeed he tells foreigners to stop talking about Palestinian statehood, as “you are only helping Bibi”.

Mr Netanyahu is said to be signalling his interest in a deal—in private. He has bowed to American pressure to restore the flow of tax revenues to the PA (indirectly and partially). Israeli officials do not exclude the possibility that Mr Netanyahu may be more forthcoming than he sounds. Few world leaders trust him, though.

Hamas, for its part, has a history of undermining peace efforts through violence. Its revised charter rejects the Oslo accords and commits itself to “armed resistance” against Zionism. Some diplomats reckon exiled Hamas leaders in Qatar might be biddable. But Mr Sinwar is a hardliner and has become a heroic resistance figure to many Arabs. Israeli officials say he ultimately has only two options: die fighting or go into exile. It seems unlikely that he would emulate Yasser Arafat, the late Palestinian father-figure, who went to Tunis after Israel besieged him in Beirut in 1982.

Mr Sinwar is said to be signalling via Egypt that Hamas is not interested in retaking administrative control of the Gaza Strip. Perhaps, think some Israelis, he now wants to emulate Hizbullah, letting a hollowed-out government run civilian life while retaining military capacity. Some talk of a transitional council in Gaza that could be set up with a formal mandate by the PA, or from Arab states.

All of which raises the question of “revitalising” the PA, which America has been demanding. Nothing suggests that Mahmoud Abbas, the Palestinian president, is serious about reforming an authority widely reviled as corrupt and ineffective. He may appoint a new prime minister—whether it will be another lackey or a credible figure remains to be seen.

America is considering the creation of a “contact group” to press for reform, involving Egypt, Jordan, Saudi Arabia, the UAE and maybe Turkey and Qatar. Arab officials say Jordan could oversee security-sector training, while Gulf states could help with administrative reforms. In Gaza the hope is that eventually enough Gazan ex-police-men—currently on the PA’s payroll—can be retrained to take over. But the process will take many months.

For now, Israel says it is not interested in allowing the return of the PA to Gaza. The authority is “incapable” of taking over the area, says one Israeli official. “We have not shed blood in Gaza to give it to this corrupt entity.” Others privately disagree.

Instead, Israel has been hoping that Arab states would rebuild Gaza and send a



peacekeeping force to control it. Without progress towards Palestinian statehood, it looks like a delusion. “No Arab country is going to come and save the day,” says one Arab diplomat bluntly. At most, they will provide short-term humanitarian aid.

Some speculate about the possibility of bringing private Western military contractors for narrowly defined tasks such as protecting a reconstruction project. In the meantime Israel is telling the Americans it can get by with local potentates—clan leaders or businessmen, say—running particular districts under overall Israeli control. The danger is that, if there is no progress towards statehood, this may lead to anarchy.

Biden their time

Nevertheless, America and Saudi Arabia are trying to agree on the details of a normalisation deal to present to Israel at the right moment. If Mr Netanyahu turns it down, as he might, Mr Biden will have to decide whether to turn the screws on his government. In an election year, Mr Biden must balance two political dangers: one is that supporting Israel’s war turns off progressives, young voters and Muslim Americans, particularly in swing states like Michigan. The other is that pressure on Israel pushes centrists and independents towards the loudly pro-Israeli Republicans.

Despite his dislike of Mr Netanyahu, the president’s instinct has been to embrace Israel. It has won him popularity there, which he has used to mitigate the damage done by the war, for example pushing Israel to permit more humanitarian supplies to reach Gaza.

America has many more means of exerting pressure on Israel. Beyond private suasion, Mr Biden could go public with his criticism, suspend or halt military supplies and deny Israel protection from hos-

tile resolutions at the United Nations.

For all the special bond between America and Israel—home to the world’s two largest Jewish communities—there have been many moments of tension. Dwight Eisenhower threatened economic sanctions against Israel if it did not withdraw its forces from Sinai during the Suez crisis of 1956, when it plotted with France and Britain to overthrow Egypt’s nationalist leader, Gamal Abdel Nasser. Ronald Reagan allowed many UN Security Council resolutions critical of Israel and repeatedly interrupted (temporarily) the delivery of F-15 and F-16 jets to Israel because of its actions in Lebanon and the bombing of an Iraqi nuclear reactor in 1981. George Bush senior blocked loan guarantees over the construction of Jewish settlements.

Mr Biden, in contrast, has twice vetoed Security Council resolutions related to the latest war and has hastened the delivery of weapons. Many Arab diplomats long for America to act once more as a “big power”—perhaps by summoning regional leaders to Washington for a conference, or by going to Jerusalem to appeal over the head Mr Netanyahu (as Mr Netanyahu did to Barack Obama, in a speech to Congress urging it to block a nuclear deal with Iran).

Many pine for a new James Baker, secretary of state to the elder Mr Bush, who orchestrated a coalition that expelled Iraq from Kuwait in 1991 and then summoned Israeli and Arab leaders to a peace conference the same year in Madrid. Admittedly Mr Baker did not bring peace. But the conference set the ground for progress after the Israeli election of 1992. Yitzhak Shamir, an obdurate Likud prime minister, lost power in part because he was seen to undermine relations with America. His successor, Yitzhak Rabin of the Labour Party, signed the Oslo accords on the White House lawn in 1993.

The Biden administration will no doubt bristle at such demands. It is also managing a war in Ukraine and a looming crisis with China over Taiwan. America will want to maintain influence on Mr Netanyahu for as long as he is in office. Mr Biden may part ways with him—but not yet.

American envoys will strive for the diplomatic prize, knowing it may be out of reach. “The Middle East is where America’s big ideas go to die,” cautions Aaron David Miller, a veteran Middle East peace negotiator now at the Carnegie Endowment for International Peace, a think-tank in Washington, DC. “That applies both in war—in Iraq and Afghanistan—and in peace.” Diplomacy has only two speeds in the region, “slow—and slower”. The best America can do this year, he says, is to set the parameters for a future peace. The chance for gold, if it ever comes, may have to wait for a new Israeli government, a new Palestinian Authority and a second Biden term. ■

Egypt's economy

On the brink

CAIRO

The war in Gaza threatens Egypt's economy while giving it leverage

HOW BETTER to boost the ego of a latter-day pharaoh than by rebuilding a pyramid? After almost a millennium bereft of its cladding, the third great pyramid of Giza is to be covered with granite tiles. The intent, say officials, is to link Egypt's imperial past with its illustrious present under the president, Abdel-Fattah al-Sisi.

For all Mr Sisi's pretensions, Egypt has been on the brink for some time. It was hit badly by a sharp rise in food prices from the war in Ukraine and its currency is one of the world's worst-performing (see chart). Repayments on its external debts are forecast to reach \$29bn (8% of GDP) this year. To stay afloat Egypt has relied on deposits from the Gulf and frequent infusions from the IMF: it is now the fund's second-biggest debtor. True to form, IMF officials are back in Cairo to stave off a default.

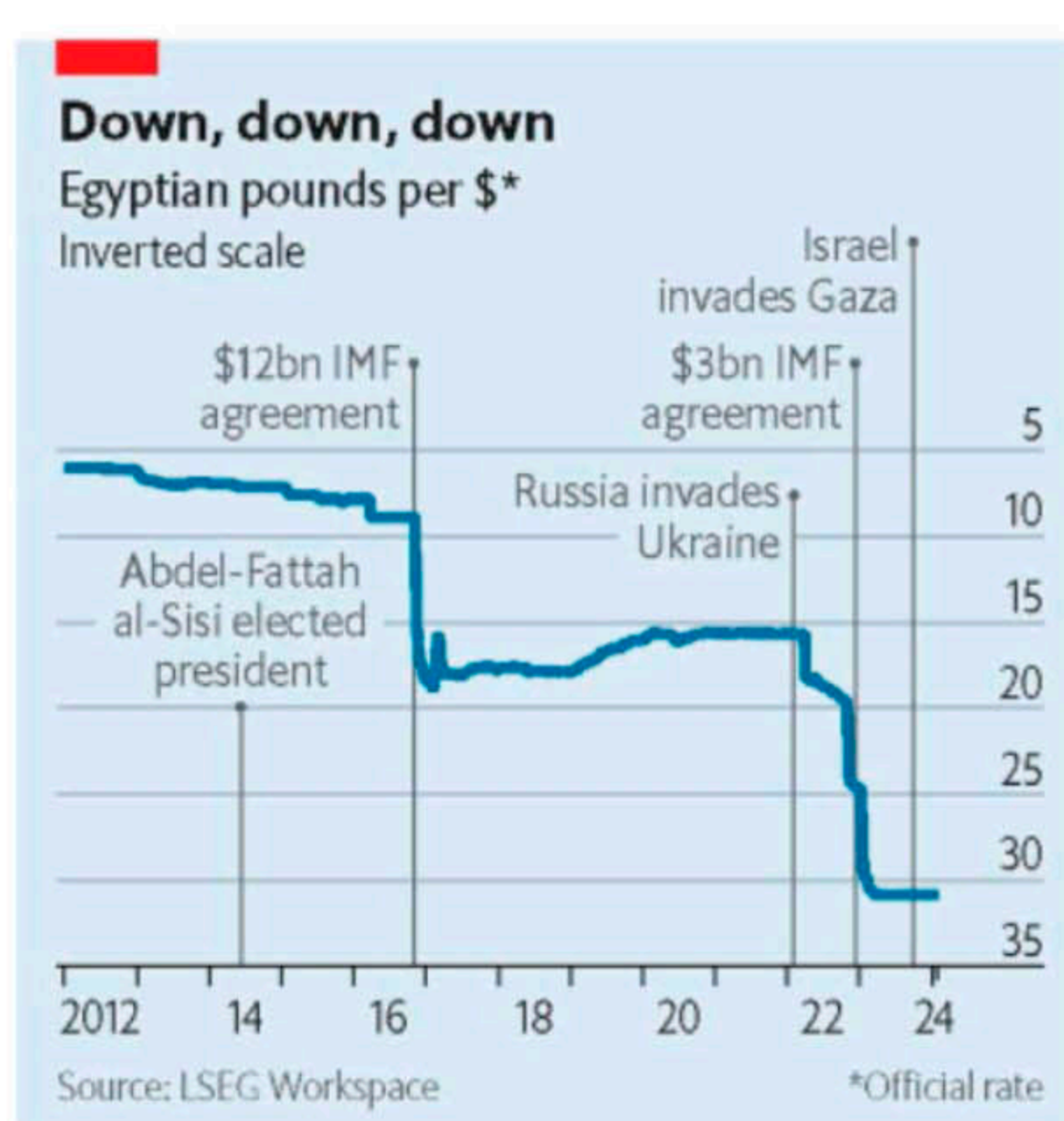
Egypt's economic problems predate the war in Gaza, but the conflict and its overflow in the Red Sea are threatening to tip it over the edge. At the same time, they are boosting its negotiating power.

Tourism revenues, which peaked last year at almost \$14bn (about 14% of Egypt's dollar inflows), have plummeted since the start of the war. The attacks on shipping in the Red Sea by the Houthis have cut traffic through the Suez Canal by about half. It usually carries some 30% of global container traffic and earned Egypt \$9.4bn in transit fees in the 12 months to June. Meanwhile a hot summer drove up electricity use, cutting Egypt's exports of oil and gas.

Egyptians abroad, nervous of transferring money into a tanking currency, are withholding remittances. In the third quarter of 2022 they fell by about 30% compared with a year earlier. Foreign investors are withdrawing their capital, or demanding high interest rates to keep it there.

Since wheat and oil prices spiked in 2022 after Russia invaded Ukraine, Mr Sisi has devalued the Egyptian pound three times. Officially the currency has fallen by about 50% over this period, but on the black market it is worth 70 to the dollar, less than a quarter of its former value. That is fuelling inflation, which reached an annual rate of 34% in December, up from 6% two years ago. The falling pound also means the government now spends 60% of its budget servicing its debts.

Since Mr Sisi took power in 2013, Egypt's external debt has quadrupled. That is partly because of the president's costly mega-



projects, which include a gleaming new capital, lots of other cities and highways. The capital, into which Mr Sisi has sunk \$60bn (15% of GDP), stands empty.

Some spending has slowed; work on a monorail to the new capital has stopped. But mostly the president continues to justify splashing his cash on the grounds of social stability, not economics. "I employ 5m-6m people...how could we shut all this down?" he asked in January. Without such jobs, the unemployment rate of 7% would soar, his officials insist. So new projects keep coming and handouts, such as the annual bread subsidy which eats up \$2.9bn, or 2.6% of the state budget, persist. "We're bankrupt but still spending like no tomorrow," says one financial analyst in Cairo.

The army is also to blame. Under Mr Sisi, Egypt's generals have tightened their grip on its economy. They hide away in compounds, ignoring the moans of poor Egyptians beyond their gates. Food prices rose by 72% in the year to September.

Mr Sisi seems unsympathetic. He recently suggested Egyptians were lucky not to be in Gaza: "Things are expensive and some things are not available? So what?" His security forces guard against trouble. Tens of thousands of suspected opponents languish in jail.

To judge by December's election, Mr Sisi remains popular. He won the poll, which was surely rigged, by almost 90%, with the highest turnout in years. But the streets heave with discontent. "May presidents fall," protesters chanted in January. Support for the army has faded since 2011, when it allowed a revolution to topple Hosni Mubarak. Then, as now, rising bread prices fuelled anger. But the economic crisis is far worse today.

Economic weakness also hampers the army's ability to project strength abroad. Qatar, a tiny but rich Gulf emirate, is supplanting Egypt as the main negotiator between Israel and Hamas. Despite the threat to the Suez Canal's revenues, Egypt has recoiled from joining America's coalition against the Houthis. Mr Sisi has been po-

werless to stop landlocked Ethiopia damming the Nile and leasing a Red Sea naval base in Somaliland, a breakaway enclave.

Still, strongmen can benefit from wars. The security forces prey on refugees. Palestinians pay them \$5,000 or more to escape Gaza. Egypt hopes to capitalise on fears of the crisis that would follow if conflict spilled over its borders or it defaulted on debt. After the election, the IMF had been expected to demand the economic reforms Mr Sisi had promised in late 2022 as a condition for the fund to release most of a \$3bn loan. Another devaluation of the pound was widely predicted, or even its free float, together with a shift in investment away from vanity megaprojects.

Instead Mr Sisi appears to have won a reprieve. When so much of the region is aflame, he reasons, its foreign allies will deem Egypt too big to fail. Neither its Western nor Gulf creditors are rushing to collect their debts. And as *The Economist* went to press, the IMF was expected to double or more its original \$3bn package, beginning with a \$3bn loan with few strings attached. "Dive deeply and you'll see Egypt has benefited a lot from war," says Ahmed Aboudouh, an Egyptian expert at Chatham House, a think-tank in London. That will bring short-term relief. But it will also further entrench the generals who have hollowed out the economy. "The same people who are benefiting from the system are asked to change it," says a former Egyptian finance official. "In the long term it will never work." ■

The UN in Gaza

A brewing crisis

RAMALLAH

The allegations against UNRWA threaten aid flows to Palestinians

THE UNITED Nations Relief and Works Agency (UNRWA) is almost as old as the conflict between the Israelis and Palestinians. It has often found itself at its heart. Countless Palestinians have sheltered in its buildings during the war in Gaza. Over 150 of its staff are among the near 27,000 people who have been killed.

The agency is now in crisis. On Friday January 26th Israel said it had evidence that at least a dozen of the organisation's 13,000 staff members based in Gaza were involved in Hamas's assault on Israel on October 7th. More than ten governments, including those of America and Germany—its two largest funders—have said they are freezing donations. UNRWA says that without the money it will be forced to cease operations at the end of February. ►►

Some of the evidence for Israel's allegations came from interrogations of Palestinians captured during and after the Hamas attack. Israeli officials said that intelligence was also gleaned from computers and documents that Israeli troops have found in Gaza. Israel said that UNRWA IDs were found on the bodies of some of the Palestinian militants killed in Israel. Phone intercepts place other employees inside Israel at the time of the attacks. Those implicated are accused of taking part in abducting a woman, distributing grenades and helping bring the body of a dead Israeli soldier back to Gaza.

Philippe Lazzarini, the head of UNRWA, sacked nine of them. One has been confirmed dead. The fate of the other two is unclear. On January 28th the United Nations said the UN's Office of Internal Oversight Services would investigate.

This is not the first controversy to beset UNRWA. In 2017 the head of one of its schools was fired after being elected to the Hamas politburo. Israel has long said the agency's school textbooks incite hatred against Jews; an investigation by UNRWA in 2017 found anti-Israel and other bias in 3% of the pages of the books examined. UNRWA has admitted in the past to finding Hamas weapons stored in its schools.

UNRWA is markedly different from other UN bodies. It was founded in the aftermath of Israel's war of independence in 1948 to care for the 700,000 Palestinians displaced from their homes. It now caters to their almost 6m descendants. It is the only UN agency that serves a specific group of refugees in a specific geographical area. Some of the controversy over it stems from the broadness of its definition of a refugee.

As a result, UNRWA's position is politically sensitive. Israeli officials have long thought of shutting it down. To many Israelis UNRWA's very title sustains the idea that the Palestinian refugees might return to their old homes in Israel, a right that Israel does not recognise. For Palestinians, UNRWA's perpetuation of their refugee status keeps alive the idea that they might one day return to the homes they fled in 1948.

UNRWA is also a lifeline for millions. Much of the aid going into Gaza is distributed by UNRWA. Its collapse would make the humanitarian crisis far worse. If the organisation went under, another outfit would have to take on its work.

It is hardly surprising that some members of an organisation that has been embedded in Gaza so deeply and for so long have links to Hamas. But that raises tricky questions about whether UNRWA is sufficiently neutral, transparent and accountable. UNRWA is probably essential in the short term in order to avoid an even deeper humanitarian crisis in Gaza. Whether it should be an essential part of Gaza's long-term future is far less clear. ■

Ethiopia

Hunger returns

YECHILA

Northern Ethiopia, ravaged by war, now faces drought

BULLET HOLES riddle the door and walls of Tedesse's grain shop in Yechila, a small town in the northern Ethiopian region of Tigray. During the recent civil war, Ethiopian and Eritrean soldiers looted his stores and emptied his cash box. Now peace has returned but buyers have not. He scoops up a handful of maize and lets it slide through his fingers. People cannot afford even to buy this much, he explains.

From 2020 until 2022 war raged across northern Ethiopia, pitting Tigrayan forces against the Ethiopian and Eritrean armies and regional militias. A land pillaged by soldiers is now parched by drought. Some farmers have harvested enough to last for a few months; others nothing at all. The next main harvest is still eight months away. Viewed from the crumbling hillsides, the barren terrain has the same sepia tint as an old photograph. On the maps drawn by aid workers, it is coloured in shades of red.

The Famine Early Warning Systems Network, which is funded by the American government, predicts that most of Tigray will experience "emergency" levels of hunger in the coming months, one notch below famine. The recent harvest was barely a third as big as expected. The situation is just as bad in parts of the neighbouring Afar and Amhara regions, which also saw fighting, and in southern grazing areas. Nearly 16m Ethiopians are short of food.

The rains are always fickle in the northern highlands, especially in years when the El Niño weather pattern appears. But marauding armies have robbed farmers of their assets and disrupted the economic

networks that might once have kept hunger at bay. When Eritrean soldiers first arrived in Yechila, they nabbed livestock so that they could eat, says an official. Then they killed the remaining animals so the locals would starve. Farmers talk of soldiers burning ploughs, stealing sickles and slaughtering oxen. The federal government and its allies obstructed aid deliveries, cut electricity and blocked banking transactions. A UN inquiry found that starvation was used as a weapon of war.

Although most services are now restored, a million people in Tigray are unable to return to their homes in areas still occupied by forces from Amhara or Eritrea. Gebremariam sleeps in a school classroom in Wukro town after fleeing from western Tigray, which is claimed by Amhara. "Many young people died and we were not allowed to bury them," she says. Eritrean soldiers kidnapped one of her adult sons, who has not been seen since; another escaped to Sudan. Her jewellery was taken at knife-point by Amhara militiamen. She gets by on sporadic handouts of wheat and on the generosity of the local townsfolk, which is starting to wear thin. A survey last year found that 30% of displaced children under five were acutely malnourished.

In normal times young people could follow the rains, finding seasonal farm work in the fertile lowlands of the west, where Gebremariam once lived. That is no longer an option. Migration to the Afar region has also dried up. Kifle (we have withheld full names of all those interviewed to protect them), a Tigrayan day-labourer, fled Afar during bitter fighting and dares not return. The landowners in his home village are no longer hiring farmhands, so he has sold all his sheep to buy food.

Hunger may be most severe in parts of Amhara, where 1.7m people are affected by the drought. The situation there is made worse by continuing war as the Ethiopian army battles a regional militia. Armed groups have attacked food trucks and some areas are hard for aid workers to reach. Parts of the region had already been devastated by Tigrayan forces in the war.

Elders in the worst-hit areas of the north draw comparisons with the catastrophe of 1983-85, when hundreds of thousands starved to death. So does the regional administration in Tigray, which warns of an "unfolding famine" and estimates that thousands have already died of hunger-related causes. The federal government considers such claims alarmist. Aid workers avoid "the F-word", as they coyly refer to famine, and think the number of deaths is overstated. Rainfall data indicate that this drought is not as extensive as in the worst historical episodes, but just as severe in places. The true picture is hard to establish because the federal government has not allowed an Integrated Food Security Phase



► Classification—the gold-standard analysis—since it disagreed with the conclusions of the previous one, in 2021.

It is clear, in any event, that more people will die if sufficient help does not arrive soon. The government's well-regarded Productive Safety Net Programme, which gives cash, food and work to about 8m needy people across the country, used to provide around a quarter of the calorific needs in the areas now blighted by drought. But it is so underfunded that transfers will stop entirely for two months this year.

International aid has also faltered. Last year the UN's World Food Programme and the American government suspended food handouts for eight months in Tigray and six months nationwide after uncovering what an American official describes as "multiple, concurrent schemes to divert humanitarian assistance away from its intended beneficiaries". Food aid was being stolen all over the country to feed soldiers or be sold for profit. Distribution has slowly resumed since December, at lower levels than before. Aid agencies and the government gave food to 6.5m people in January. It is not enough.

In the hills near Atsbi, in eastern Tigray, Meles is trying to feed his two cows on the thin grass beside a dry watering hole. Then he will sell them for whatever price he can get. During the war Eritrean soldiers killed and raped people here, camping for months at the village school. It is as though, he says, the drought has come to finish off the work the soldiers started. ■

West Africa

Block-busters

DAKAR AND NIAMEY

Three junta-led states are leaving west Africa's economic union

"IT'S A HISTORIC decision!" said Sido Ibrahim as he celebrated in the streets of Niamey, Niger's capital, after Burkina Faso, Mali and Niger declared their immediate withdrawal from the Economic Community of West African States (ECOWAS), the region's main bloc. "We are united and stronger than ever," claimed Mr Ibrahim. Others were less happy. "Things really are falling apart!" wrote Comfort Ero, the head of Crisis Group, an international think-tank, on X. "This looks like an earthquake!"

Founded in 1975, ECOWAS allows the free movement of its citizens between its 15 member countries and largely the free movement of goods. Yet it has been floundering since a spate of coups toppled the governments of Burkina Faso, Guinea, Mali and Niger. Each time, ECOWAS imposed



sanctions and demanded elections. Yet the juntas flagrantly broke promises and coddled up to Russia. A return to democracy in the Sahel is now a distant dream. The damage goes wider still.

The juntas claim they are taking their 75m people out of the bloc because it has not helped them fight terrorism. That is nonsense. ECOWAS sent thousands of soldiers to help Mali when it began to buckle under a jihadist onslaught in 2013. They were then the leading troop contributors to a UN peacekeeping mission, before the junta kicked it out last year.

The real reason is almost certainly to escape pressure to return to democracy. Mali and Burkina Faso had promised to hold elections this year, and ECOWAS had told Niger to provide a timetable for doing so.

The bloc deserves blame, too. After last year's coup in Niger, ECOWAS imposed economic sanctions and threatened to invade if it was not reversed. The junta instead stirred up crowds and the trio formed a mutual defence pact. ECOWAS backed down, though it kept sanctions in place.

Russia's backing matters, too. The three states believe they have enough foreign support to ditch ECOWAS, even though they have also severed ties with France, which had been helping them fight the jihadists. Russian mercenaries have operated in Mali since late 2021. About 100 Russian soldiers arrived in Burkina Faso last week—the first major deployment of Russians in the country—to prevent any counter-coup. Niger's prime minister recently visited Iran, Russia, Serbia and Turkey, looking for weapons and cash.

ECOWAS is struggling to respond. The bloc's rules say leaving takes a year. Nigeria's foreign ministry slammed unelected leaders who "engage in a public posturing to deny their people the sovereign right to make fundamental choices". But a highly-placed Nigerian official sounded more emollient, emphasising that every member country is "vital to our union...All avenues to engage members that are aggrieved will be explored". But it is unlikely that any of the juntas will reverse course. The real question is what sort of relations ECOWAS

will maintain with the leavers. If it is too soft, Guinea's junta might quit too.

The implications are many, large and bad. Though far from perfect, ECOWAS cares about democracy and human rights and carried some influence. Without its involvement there is little hope of restoring democracy. The juntas will also have a freer hand to fight jihadists and target dissidents without pesky complaints about human rights, says Crisis Group's Ibrahim Yahaya. Human rights are already widely abused. In just one massacre in Mali in 2022 soldiers and Wagner mercenaries killed about 500 people, almost all civilians. In Burkina Faso the junta rounds up critics and sends them to the front.

The exit from ECOWAS will make it harder to stop the jihadists in the Sahel and may threaten the security of the bloc's remaining members. The border areas between the three leavers and their southern neighbours are already hotspots for jihadists, who are also attacking Ivory Coast, Benin and Togo. Countries need to co-operate closely to beat them. The eviction of French troops and UN peacekeepers has already worsened security. Last year was the bloodiest ever in Mali, Burkina Faso and Niger. Almost 14,000 people, some 5,000 of them civilians, were killed in conflict.

It is also bad news for the trio's economies, which account for less than a tenth of the bloc's GDP, as they will lose free movement and preferential trade with Ghana and Nigeria, which account for about two-thirds of it, notes Charlie Robertson of FIM Partners, a fund manager.

Niger, with its tight links to Nigeria, stands to lose most. "This scares us," says Mahamadou Salifou, a market trader in Niamey. "I import all my products from Nigeria." Mali and Burkina Faso are more closely linked to Ivory Coast and Senegal, whose ports they rely on. Crucially, they will not yet lose trade and free movement to these countries because they (along with Niger) remain part of the West African Economic and Monetary Union, whose eight members share a common currency and allow free movement of people and goods.

Yet their next step could be to leave the monetary union, which has also imposed sanctions, says Ornella Moderan of the Clingendael Institute, a think-tank based in The Hague. That would be a savage economic blow, complicate access to ports and throw into question the status of millions of Sahelians who live in other countries of the union. The three juntas have already discussed launching their own currency and have talked to Morocco about ambitious plans to use its ports.

This year is meant to be a year of tighter integration across all of Africa, as the African Continental Free Trade Area expands beyond its pilot phase. Instead, west Africa's regional unity is splintering. ■

TQ

The Economist
Technology Quarterly:
The physical internet

→ February 3rd 2024

3 The foundations of the cloud

4 Cloud storage

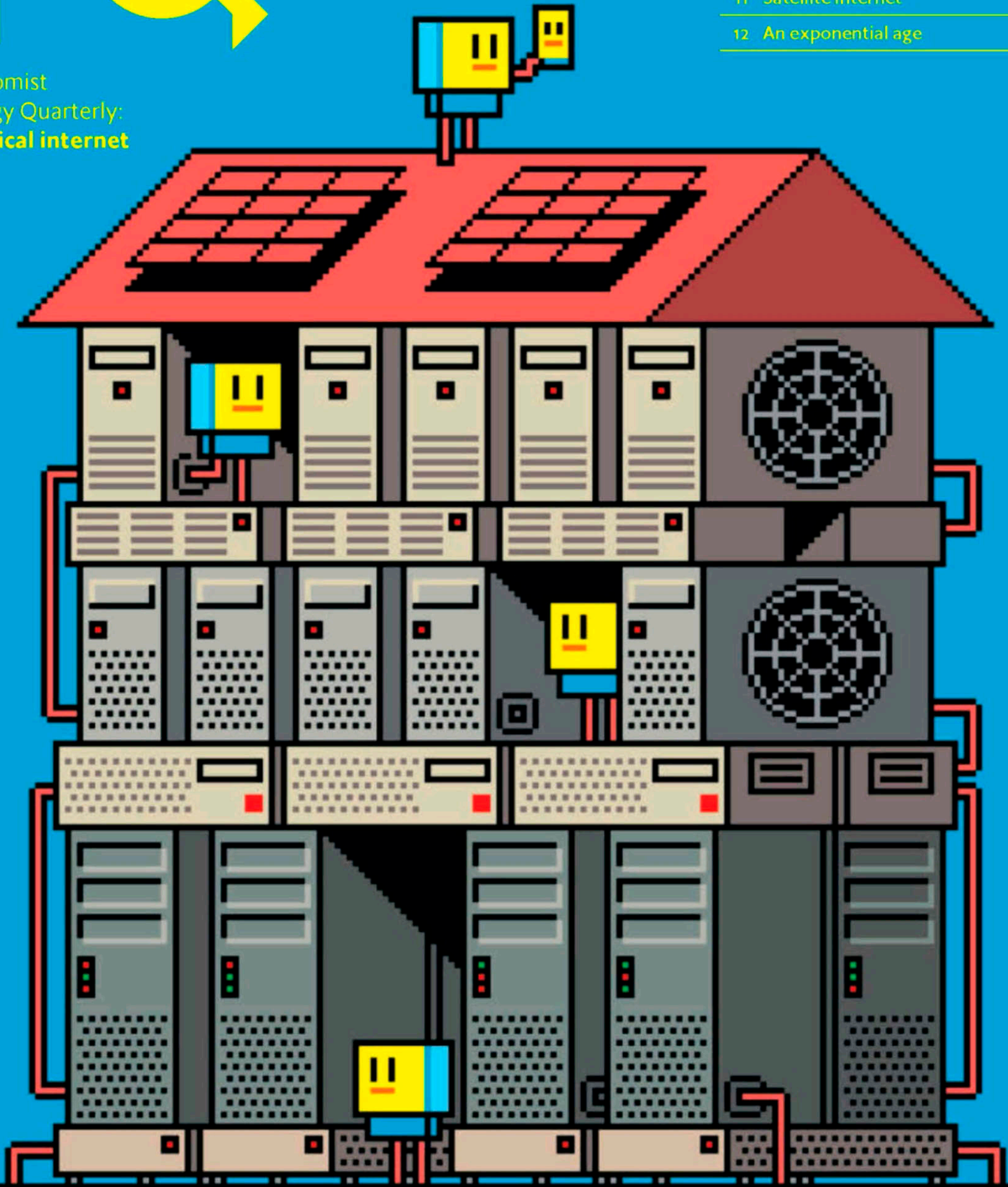
6 Edge computing

8 Data centres and climate

10 The geopolitics of connectivity

11 Satellite internet

12 An exponential age

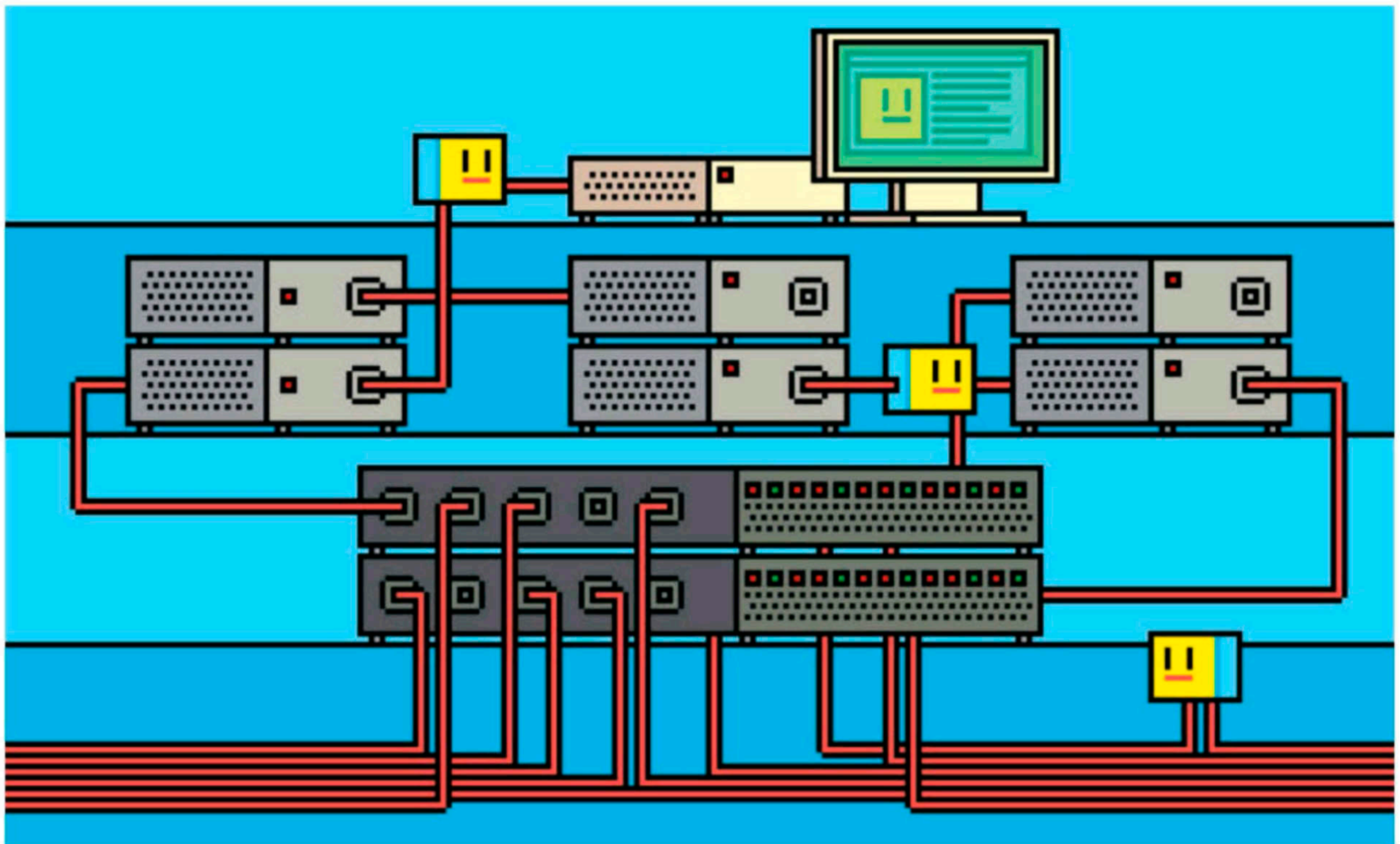


Where the internet lives



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The physical internet

The foundations of the cloud

Users of the internet can ignore its physical underpinnings. But for technologies like artificial intelligence and the metaverse to work, others need to pay attention, argues Abby Bertics

IN 1973 BOB METCALFE, a researcher for Xerox at Palo Alto Research Centre, helped think up a way for the company's computers to send information to each other via co-axial cables. He called this concept Ethernet after the medium by which, in 19th-century physics, electromagnetic forces were thought to be transmitted. Ethernet would become a cornerstone of the internet.

Despite his role in its foundations, Dr Metcalfe later doubted the hardness of the internet as it became a global phenomenon. In late 1995 he noticed that a quarter of internet traffic was getting lost on its way, and that the system did not seem to be responding well to that volume of loss. He predicted that the whole shebang would "go spectacularly supernova and, in 1996, catastrophically collapse". The collapse never happened, and Dr Metcalfe literally ate his words. At a conference in California, he produced a print-out of his prediction, pureed it in a blender and slurped it up with a spoon. "I learned my lesson," Dr Metcalfe says now. "The internet is more robust than I had estimated."

In its more than 40 years the internet as a whole has never completely stopped working. Parts of it break all the time, but resilience was built into the internet from day one. It is a decentralised, distributed network of billions of computers and billions of routers, connected to each other by perhaps billions of kilometres of cables. The network works seamlessly for end-users because of layers of software above this hardware that manage how the computers communicate, building in multiple redundancies and leav-

ing no single point of failure. This power of abstraction—the ability to create, transmit and consume digital artefacts without needing to think about the physical realities behind them—is the secret sauce of the internet. And, indeed, of all computer science.

Abstraction is also the key to why Dr Metcalfe's prediction ended up proving wrong. To see why, one has to grasp the internet's layered structure. Some engineers think of the internet as having five layers (though others say there are four or seven depending on whether certain functions get layers of their own). At the bottom is the most physical of layers, where photons and electrical signals whizz from one server to another via routers and cables. Just above the cables are local-network protocols like Ethernet, Dr Metcalfe's contribution, which allow computers and other devices near each other to interpret this traffic as groups of ones and zeros.

So many layers to this

Above the cables and local-network protocols are two communications layers, "transmission control protocol" and "internet protocol" (TCP/IP), which enable computers to interpret messages as "packets": short strings of data with a tag at one end which describes their destination. TCP/IP interacts with Ethernet but needs not know about the cables at the very bottom. Sitting above TCP/IP is the application layer of software and language that users will begin to find more familiar, like "HTTP" (as seen on the world wide web). That allows webby stuff to interact with TCP/IP without wor- ▶▶

► rying about Ethernet, cables and the like.

These levels of abstraction made the internet flexible and allowed it to scale beyond what many—including Dr Metcalfe—imagined. Each intermediate layer is designed to manage disruptions below and to present a clean image above. A well-designed layered system like the internet dampens chaos caused by errors, rather than spiralling out of control with them. And it didn't hurt that, all the while, the physical foundation itself was strengthening. Optical fibre became increasingly available throughout the 1990s, which increased bandwidth to send more packets faster, losing fewer of them. The problem Dr Metcalfe was worried about got resolved without the rest of the internet really noticing. And as applications became more data-intensive, the plumbing below continued to hold up admirably.

To take an example, originally the internet was designed to carry text—a restricted set of 128 different characters—at a rate of 50 kilobits per second. Now video makes up more than 65% of traffic, travelling at hundreds of megabits per second, without gumming up the pipes. Changing web protocols from HTTP to the more secure HTTPS did not affect lower layers. As copper wire is upgraded to fibre-optic cable, applications do not have to change. The internet's seemingly limitless adaptability has been enabled by those layers of abstraction between the user and the cables.

But Dr Metcalfe was not entirely wrong. The benefits of abstraction are still ultimately limited by infrastructure. In its early days Google was able to beat its competitors in part because it kept things simple. Others tried loading huge pages with lots of adverts. But they misjudged how much modems could handle at a reasonable speed. Since no one wants to wait for a web page to load, you now “google” things rather than “AltaVista-ing” them.

AltaVista learned the hard way that abstraction comes at a cost: it can obscure the frailties of hardware. Tech visionaries of today should take notice. Their most ambitious schemes will not work without the appropriate infrastructure to deliver them. From autonomous cars to augmented reality, from artificial intelligence (AI) to the metaverse, decisions at the physical layer constrain or expand what is digitally possible. Underneath all the layers of abstraction, the physical infrastructure of the internet is the foundation of the digital future. Without it, the internet is just an idea.

This special report will demystify the physical building blocks of the internet in order to explain how they constrain what is possible in the abstractions which sit on top of them. It will explore what about the physical layer must change for the internet to remain sustainable—in the physical sense, but also environmentally—as the internet's uses multiply far beyond its original remit.

Fantastic voyage

A good place to start would be to explain how this article reached your screen (if you are reading the print edition, it is a different story). Each digital article starts somewhere in the “cloud”. To users this is the infinite attic where they toss their digital stuff—articles, photos, videos. But the cloud is actually composed of tens of millions of computers connected to the internet.

Your click on a mouse or tap on a screen created packets that were turned into signals which travelled tens or thousands of kilometres through metal, glass and air to a machine in a data centre.

Depending on where you are in the world, the data centre that your article will have come from will be different. This is because *The Economist*, along with most content providers on the internet, gets to users via something called a content-delivery network (CDN). This stores ready-to-read articles in data centres across the world, rather than having our main servers in northern Virginia put all the components together every time. This spreads out the load so that the main servers do not get overwhelmed. And it helps

**The internet's
seemingly limitless
adaptability has been
enabled by layers
of abstraction**



an article get to your screen faster because memory devices with the data needed are physically located much closer to you.

This means that when your correspondent just clicked on an *Economist* headline while on her laptop, it came from a data centre in London, made a short trip through fibre-optic cable and then, for the “last mile”, perhaps by way of old-fashioned copper wiring until arriving at a cable box and Wi-Fi router in her flat. An instant later, packets of data reassembled on her laptop in front of her eyes, a digital

article rendered on a digital screen.

If your correspondent had been the very first person in a region to ask for the article, the trip would have been slower, as if over the primordial internet of decades ago, because a cached copy would not yet have been available at a data centre nearby. Instead her request would have travelled through thin strands of glass that lie at the bottom of the Atlantic Ocean, to a data centre in northern Virginia, and back again. These fibre-optic cables form the backbone of the physical internet. It is through them that nearly all intercontinental internet traffic flows.

The internet relies on these cables, but not on any single cable; it relies on data centres, but not any single one. Its distributed nature and its abstractions make the internet difficult to pin down. But not so for the tech giants. They are vertically integrating the internet: laying cables, building data centres, providing cloud services and AI. As the internet becomes more powerful, it is becoming crucial to grasp both its physical and corporate composition. Only by peeling back the layers of abstraction can one lay bare the internet's foundations and understand its future. ■

Hard drives

Towers of glass and steel

Advances in physical storage and retrieval made the cloud possible. Further progress is needed to sustain it

ON SEPTEMBER 14TH 1956 IBM announced the first commercial computer to use a magnetic hard disk for storage. Weighing in at about 1,000 kilograms, the 305 RAMAC (random access method of accounting and control) was the world's most expensive jukebox. It stored 4.4 megabytes on 50 double-sided disks, each one measuring two feet in diameter and spinning 1,200 times a minute. Two access arms located and retrieved information in an average time of six-tenths of a second. Companies could lease the machine for \$3,200 per month—roughly equivalent to paying \$100m annually for a gigabyte of storage today.

Almost 70 years later, a gigabyte of storage costs pennies. Businesses and consumers can retrieve information much faster, from anywhere in the world, than they could have from a 305 RAMAC in the same room. What is more, they can work with this stored data where it is stored, rather than having to schlep it around. That is because their bytes are stored not in one jukebox, but in a great many of them: sliced up, replicated and distributed over a vast collection of computers and storage devices in massive data centres scattered across the world. In a word, the cloud.

The cloud is an abstraction of everything one could do on a 305 RAMAC and more. It endeavours to separate the actions of storing, retrieving and computing on data from the physical constraints of doing so. The concept intentionally obfuscates (clouds, one might say) the user's ability to see the existence of hardware. To users, the cloud is a big virtual drawer or backpack into which you can ►►

▶ put your digital stuff for safe-keeping, and later retrieve it to work on (or play with) anywhere at any time. It does not matter to you where or how—or indeed in how many pieces divided among various hardware devices strewn across the planet—your data is kept; you pay to not have to worry about it.

But to cloud providers the cloud is profoundly physical. They must build and maintain the physical components of the cloud and the illusion that goes with it, keeping up as the world produces more data that needs storing, sorting and crunching. The quantities of data being created are ever growing too. In 2023 the world generated around 123 zettabytes (that is, 123 trillion gigabytes) of data, according to International Data Corporation, a market-research firm. Picture a tower of DVDs growing more than 1km higher every second until, after a year, it reaches more than halfway to Mars. This data must be stored in different ways for different purposes, from spreadsheets that need to be available instantly, as on a bookshelf, to archival material that can be put in an attic. How is it possible to do all this in an orderly, easily retrievable way?

Magnetic appeal

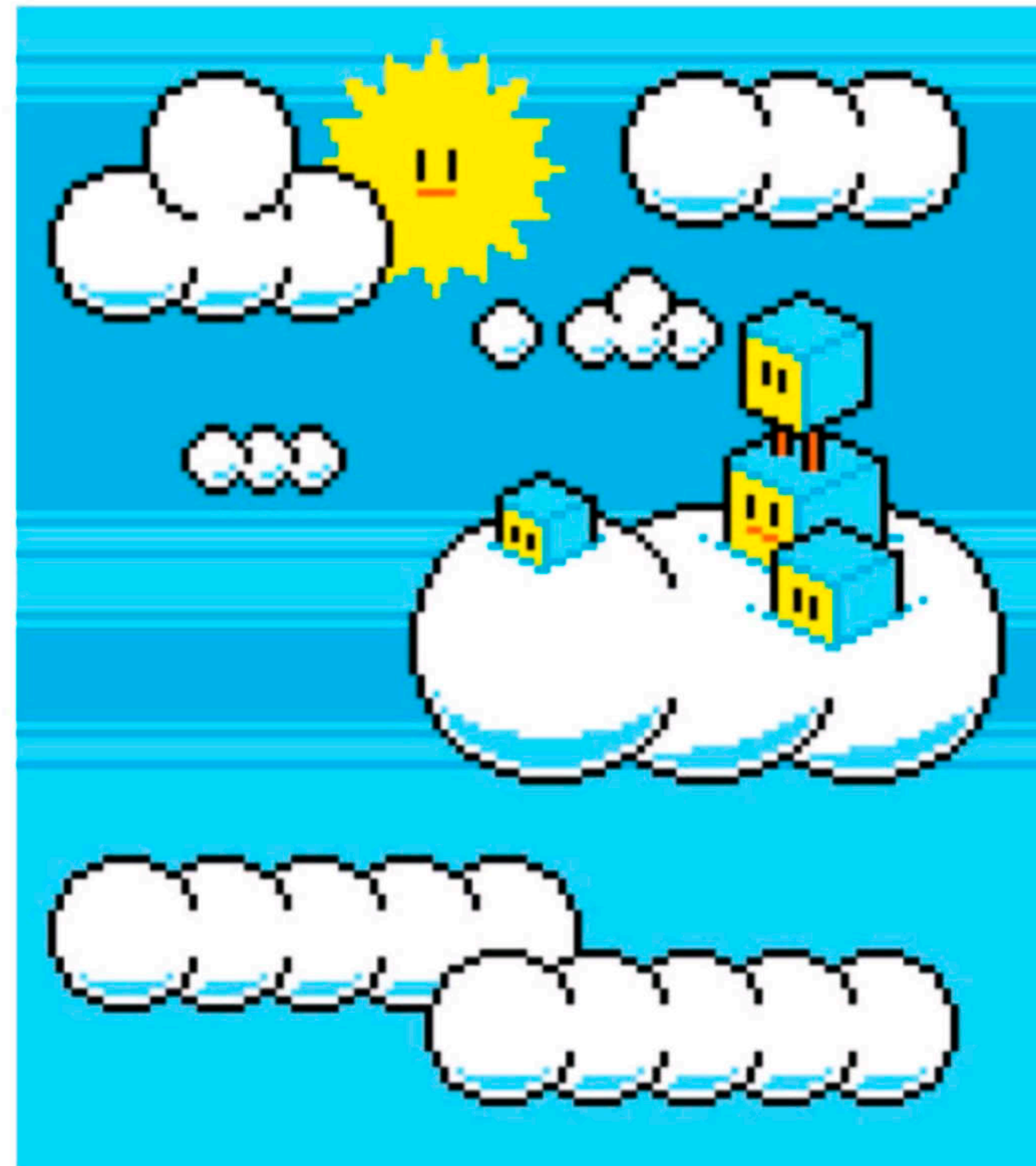
For a start, it helps to recognise the technical leaps in storage that have made the cloud possible. For each type of data and computational task there are different kinds of physical storage with trade-offs between cost, durability and speed of access. Much like the layers of the internet, the cloud needs these multiple layers of storage to be flexible enough to adapt to any kind of future use.

Inside an unassuming building in Didcot, England, in the Scientific Computing Department (SCD) at the Rutherford Appleton Laboratory, one of Britain's national scientific-research labs, sit Asterix and Obelix, two stewards of massive quantities of data. They are robotically managed tape libraries—respectively the largest and second-largest in Europe. Together Asterix and Obelix store and keep organised the deluge of scientific data that comes in from particle-physics experiments at the Large Hadron Collider, at CERN, along with various other sorts of climate and astronomy research. The data produced by all this research has scaled up by orders of magnitude, says Tom Griffin, SCD's director, which means they have had to switch from scientists coming in with laptops and USB sticks to creating a cloud of their own.

Asterix and Obelix form a sizeable chunk of the lab's self-contained cloud (its computing power is conveniently located in the same room). Together the two can store 440,000 terabytes of data—equivalent to a million copies of the three "Lord of the Rings" films, extended edition, in 4K resolution. Each is made up of a row of cabinets packed with tape cartridges; if all the cartridges were unspooled, the tape would stretch from Athens to Sydney. When a scientist requests data from an experiment, one of several robots zooms horizontally on a set of rails to find the right cabinet, and vertically on another set of rails to find the right tape. It then removes the tape and scans through the reel in order to find the requested information. The whole process can take up to a minute.

Magnetic tape, similar to that used in old audio cassette tapes, might seem like an odd choice for storing advanced scientific research. But modern tape is incredibly cheap and dense (its data density has increased by an average of 34% annually for decades). This has been made possible by reducing the size of the magnetic particles—called "grains"—in which information is stored and by packing them more closely together. A single cartridge, maybe the size of two side-by-side audio cassettes, can hold 40 terabytes of data. That equates to almost 1m 305 RAMACs. Plus, it is durable and requires little energy to maintain. These qualities make tape the storage medium of choice not only for this scientific data, but also for big chunks of the cloud at Amazon, Google and Microsoft.

But if you are not a scientist at Didcot—or if you are, but you are taking a break to scroll your recent group chats and Instagram posts on your phone—you will want your data from the cloud much more quickly than you can get it from tape. Flash memory,



in common use on laptops and phones, is best for when data needs to be frequently looked up or modified, like recent photos. Solid-state drives save data by trapping or releasing electrons in a grid of flash-memory cells. Retrieving the data is as simple as checking for the presence of electrons in each cell, and involves no moving mechanical parts; it takes about one-tenth of a millisecond, though if it is in the cloud instead of on your phone, add a few dozen milliseconds for delivery from the data centre. The data remains even when the power is turned off, though memory will eventually degrade as electrons leak out of the cells.

Backups for your backups

As new photos you take go to a data centre, your older ones get demoted from flash to old-fashioned hard-disk drives spread across multiple data centres, most likely including some in the country or at least the continent you live in (for most readers). These read and write data mechanically onto a spinning magnetic disk, not dissimilar from the 305 RAMAC, and are more than five times cheaper per gigabyte of storage than flash (though that gap is closing). Retrieval takes a sloth-like 5-10 milliseconds. Then years-old stuff that you forgot about might get further relegated, from disk drives to magnetic tape like they have at the Didcot lab.

Even on the side of the cloud provider, the exact physical device on which data is stored is abstracted away. One way that this is often done is called RAID (redundant array of independent disks). This takes a bunch of storage hardware devices and treats them as one virtualised storage shed. Some versions of RAID split up a photo into multiple parts so that no single piece of hardware has all of it, but rather several storage devices have slightly overlapping fragments. Even if two pieces of hardware break (and hardware failures happen all the time), the photo is still recoverable.

The cloud is also redundant in another way. Each piece of data will be stored in at least three separate locations. This means that were a hurricane or tornado or wildfire to destroy one of the data ▶▶

► centres that had a copy of your photo, it would have two copies left to fall back on. This redundancy helps make cloud storage reliable. It also means that most of the time, millions of hard-disk drives are spinning on standby, just in case.

Still, companies are working on making the infrastructure of the cloud more robust. Tape, in particular, has its disadvantages as a long-term storage medium. It must be kept within a certain range of temperatures and humidities, and away from strong magnetic fields, which could erase the information. And it requires replacing every decade or two. So the hunt is on for something that takes up less room, lasts longer and requires less maintenance.

One promising medium is glass. A fast and precise laser etches tiny dots in multiple layers within platters of glass 75mm square and 2mm thick. Information is stored in the length, width, depth, size and orientation of each dot. Encoding information in glass in this way is the modern equivalent of etching in stone, says Peter Kazansky, one of the inventors of the technology, based at the University of Southampton in Britain. If you fry, boil, scratch or even microwave glass slides, you can still read the data.

May you live for 10,000 years

Researchers at Microsoft are harnessing this tech to build a cloud out of glass. They increased capacity so that each slide can hold just over 75 gigabytes, and used machine-learning to improve reading speed. They claim their slides will last for 10,000 years. Microsoft has developed a system (much like the tape robots) that can handle thousands, or even millions, of these slides.

Achieving this kind of scale, without the need to supply power to storage shelves or to replace the storage devices themselves, is necessary to build a truly durable foundation for the cloud. Necessary, but not sufficient. For the cloud is not just a storage shed. Its users are demanding that it do a lot more computing work, and more quickly, than ever before. ■

Cloud computing

The edge of tomorrow

Applications got better and faster by moving data closer to users. Now the same must happen with computing power

UNTIL 1995 MANY messages sent between internet users in Frankfurt could expect to go on quite a ride. If the sender and receiver used different internet service providers (ISPs), the message would make a return trip across the Atlantic Ocean, pulsing along thousands of kilometres of underwater fibre-optic cables before ending up just a few kilometres from where it started. This was, in a way, a triumph of abstraction. The users had no idea about the intercontinental detour (except perhaps for how long it took). But for the ISPs involved it was a royal pain. So three of them got together and, in the back room of a post office, installed a switch that linked their networks together. It was called the Deutsche Commercial Internet Exchange, or DE-CIX.

The internet is a network of networks. Internet exchanges are the portals where lots of those networks are linked to each other; switches connect devices within these networks. As the internet has grown, exchanges and their switches have become more numerous and vastly more impressive, allowing levels of performance that would have been unthinkable using old technology.

Tucked behind a mesh door in a data centre in Frankfurt sits a machine the size of a refrigerator. Hundreds of yellow, pink and aquamarine cables are plugged in neat rows and columns on its front. Flashing green lights adorn the cables, which are connected

to servers that belong to a wide range of ISPs, cloud services and CDNs. During peak times (like nights when Champions League football matches are on) more than four terabits flow through this one machine each second—equivalent to over a million HD videos streaming simultaneously (a terabit is one trillion bits; there are eight bits in a byte). It is one of four such switches DE-CIX now runs at its Frankfurt exchange, which is spread across four data centres around the city. Between them they connect over a thousand networks, passing the packets making up video calls from one mobile-phone provider to another, or delivering data from TikTok to a local telecoms operator so that a German teenager can have their mind numbed by never-ending videos.

Not every bit which goes online travels through an internet exchange. Some networks have direct links with each other, and some bits never leave the local network they started on. But as the internet has grown, so has its need for marvels like the super fridges of Frankfurt; DE-CIX now runs 40 exchanges around the world. They and hundreds of others like them make routing more straightforward, which conserves bandwidth (the measure of how much information a conduit such as an optical fibre or Wi-Fi channel can cope with), which in turn reduces the total “load” or burden put on computers and cables. They also do much to shrink the system’s latency, or the time it takes for a click or swipe on an internet-connected device to be communicated to another such device, whether it belongs to a human or sits in a data centre.

The growing capacity and number of such exchanges, combined with the strategy of using CDNs to make sure lots of those exchanges have cached copies of the data their users most want immediate access to, have greatly enlarged the internet’s capacity to store and move data and at the same time have brought much of that data closer to its users. By doing so, they have enabled the internet to become what it is today.

What many want of the internet tomorrow, though, will require more. Virtual and augmented realities such as those of “metaverses” need latencies far lower than those tolerated by applications now. That means bringing more of the internet’s capabilities closer to its “edge”—that is to say, the users.

The edge is where the internet meets the real world. It is where data is produced and consumed. It is also where much of it is processed by the chips in phones and other devices, and for some uses that local processing power is more than adequate. For others, though—such as training AI models, weather forecasting and rendering animation and computer-graphics imaging for movies—the number-crunching capacity to be found in pockets, on laps and under desks is not enough. Hence the appeal of cloud-based computing, where numbers are crunched in data centres.

Getting the data from the edge to specialist computing centres takes time, though. For applications which are computer-intensive but latency-insensitive, such as training AIs, that is fine. But what of applications which need both lots of computing and low latency? Today’s internet typically delivers latencies of about 65 milliseconds. Metaverses and self-driving cars need latencies of less than 20 milliseconds—quite possibly a lot less. That means distributing not just connectivity and data storage throughout the system but also increasing amounts of processing power, too. Without that, some applications which might be hugely popular, useful and lucrative will remain impractical.

Directing traffic

Internet exchanges have reduced latency over the years by getting faster at moving information along. The most advanced switches in data centres can now handle 51 terabits per second. These switches are increasingly spreading out the load of moving data around, helping the internet as a whole function more efficiently. Cisco, a tech conglomerate, uses AI to predict the optimal times of day and routes for moving time-insensitive data, avoiding or minimising traffic jams that slow down networks. ►►

▶ There are ways to move data from place to place faster, too. Notably one can increase the speed at which light travels through fibre-optic cables by hollowing out their cores. Light, and thus information, travels nearly 50% faster through air than through standard glass. In December 2022 Microsoft acquired Lumenity, a startup focused on hollow-core fibre technology, citing its “significant advantages” in increasing speed and reducing latency.

In theory, latency and load can both be reduced even more by doing some of the switching at the speed of light, too. Most switches, like most computers, are electronic. Packets of data travel along optical fibres in the form of light, or photons. Whenever such a packet passes through a switch—as it may do several times on its way from one user or server to another—it must flip-flop from photonic to electronic and back into photons again. The “transceivers” which perform these conversions use up time and, also important, energy. If switches were photonic instead, the data could make the entire trip in the form of photons.

Switching costs

Photonic switches are a focus of research, but there are two main challenges to, er, switching to them. The first is inertia—nearly all routing protocols and software are designed for electronic systems, and they work. Changing to photonic systems would come at great cost and effort, and for now the benefits of doing so do not seem to be worth the trouble. The second challenge is that data encoded electronically is more tolerant of imperfections introduced in transmission (by, say, a faulty cable or external disruption). Setting a transistor to recognise a difference of 0.7 volts rather than one volt as a digital “one” leaves room for error without producing a “zero”; and when mistakes do get made, it is easy for an electronic switch to check and fix them, since they are literally binary.

But with light, data is encoded not in a pattern of binary numbers but instead along broad spectra of intensities, phases and po-

larisations. This approach demands far greater precision. One encoding strategy, for example, sends multiple streams of data in different wavelengths (colours) at the same time; a photonic switch would have to distinguish between different wavelengths and route them appropriately. Small errors would be extremely difficult to check and correct mid-transmission without slowing the process down enough to defeat the purpose of photonic switching. Errors could be fixed at the endpoint instead, but in the meantime tiny flaws would compound as they run through multiple photonic switches uncorrected.

One way to correct errors in the photonic domain is to send extra information in the packet, alongside the data, allowing the receiver at the other end to fix any distortions or alterations without the need for retransmission. Another is to use machine-learning algorithms to predict and correct errors. In the medium term, until further breakthroughs make purely photonic switching more realistic, hybrid systems might yield benefits from both worlds, combining the speed of photonics with the processing capabilities of electronics. This would work by, say, converting into ones and zeros only the header of the packet, which contains its shipping address, rather than the entire thing.

But in the near future the biggest reductions in latency and load will almost certainly come from upgrades to internet infrastructure on the edge. Early signs of the potential are being seen in CDNs and other distributed networks. Distributed networks have been integral to the growth of services like Netflix, TikTok and YouTube. They will also be absolutely essential to the internet of tomorrow. But for that to happen, CDNs (or their successors) need to do more thinking for themselves.

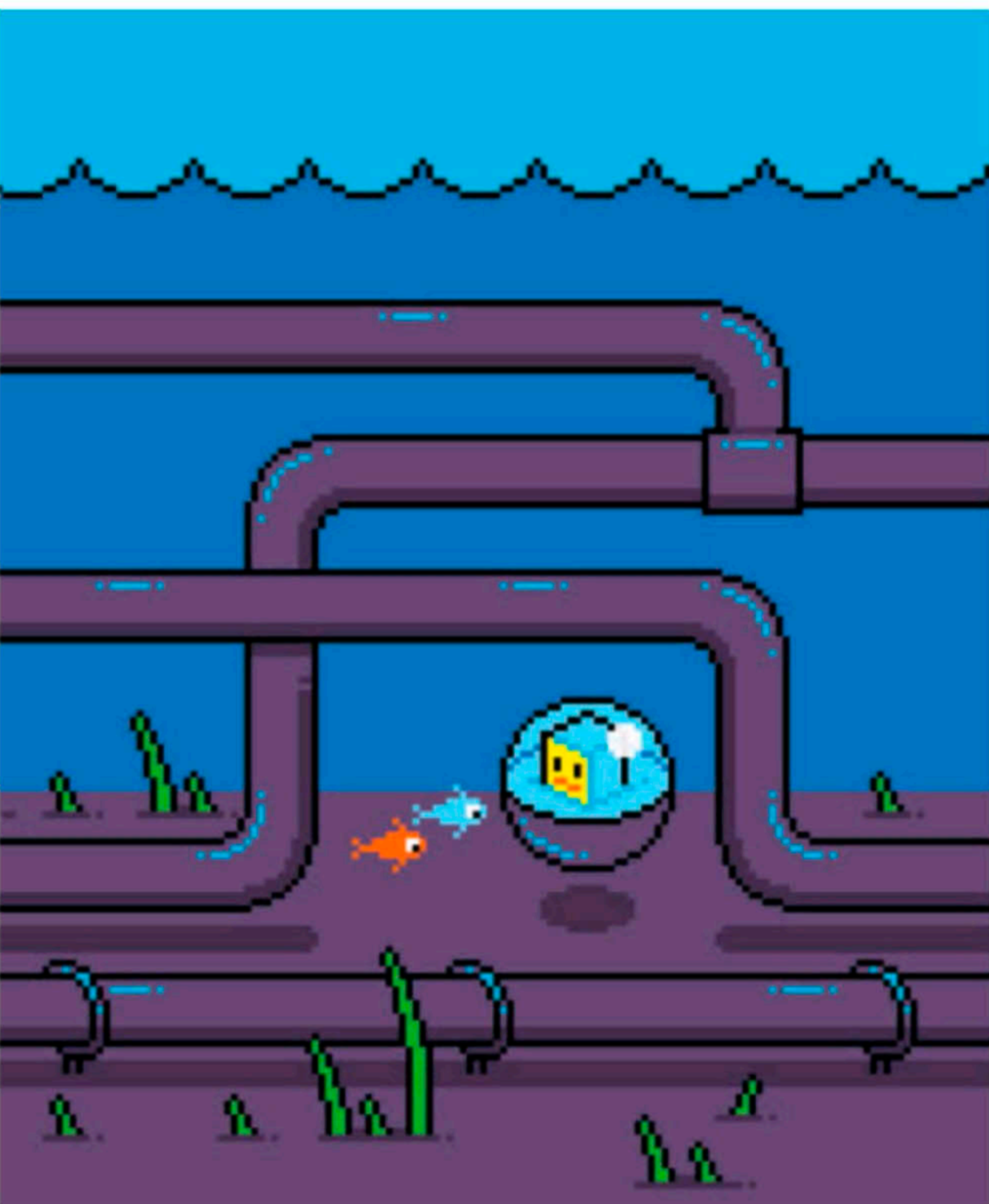
For applications which generate a lot of data from sensors—like, say, autonomous vehicles, augmented-reality glasses or various real-time “smart city” applications—it makes sense to bring your computational heft as close as possible to the data, rather than lugging gigabytes of data to a central hub and back. A new generation of CDNs, or something like them—call them content and computation delivery networks—is beginning to spring up in spots all around the world, providing applications with the edge-computing services they require to work in real-time.

Consider cloud gaming, through which players can access high-quality, high-resolution games without having to splurge on a high-end gaming computer. Companies provide this service by outsourcing computing tasks to servers. But if the servers are too far from users this can result in high latencies, leading to the most dreaded three-letter word in the gamer’s lexicon: lag. Major cloud providers with gaming platforms, like Meta and Nvidia, deal with this issue by renting space in lots of smaller data centres closer to the edge, greatly shortening the distance that most information has to travel between gamers and their games. (They are also building micro-data centres on the edge, but renting space is often more efficient.) This sort of solution will be especially important for augmented and virtual reality, where delays can lead to motion sickness and other sources of dissatisfaction.

Through a glass lightly

It might also be possible to combine computing close to the edge with the speed increases offered by photonic switches. Researchers are exploring various circuits and materials to better manipulate photons at high speeds with high precision.

Computing in light would speed things up in another way essential to the future of the internet: the development of AI. Training a neural network requires moving terabytes of data from storage to AI chips. Processing that data then requires moving it through the network, from (artificial) neuron to neuron, from layer to layer. Chips are now so fast, though, that it is currently not possible to feed them enough data quickly enough to fully take advantage of their processing capabilities. The speed of data transfer is capped by the physical limits of sending electrons over copper ▶▶



wires (the wires heat up, increasing resistance) or of converting photons into electrons and back.

This is a similar challenge to that of switches. As with the study of futuristic storage options (see previous chapter), glass may provide the answer. The manner in which information is encoded in light makes it possible to do a particular type of maths (namely, matrix multiplication) by separating and recombining light waves. This happens to be the same maths that AI chips do when training or running neural networks. With the aid of tools such as mirrors, beam-splitters and wave guides, devices called interferometers can manipulate light in a way that performs these calculations. Doing this at scale would vastly increase the speed and efficiency at which AI chips—both the current electronic ones and future photonic chips—go through data. Further, once an AI model is trained, its architecture could be etched in glass and run entirely without a chip from, say, Nvidia.

All this would save a lot of time, heat (from both data transfer and chip processing) and energy. It would make the cloud far more robust, powerful and efficient than it is today. But that technology is speculative and, at best, a long way off yet (optical computing has been a dream for decades). In the meantime, the builders of the internet are working on other ways to make it whir more efficiently. Without such or similar advances the environmental consequences of the cloud will raise doubts about how well the planet can cope physically with the internet. ■

Data centres

Economies of hyperscale

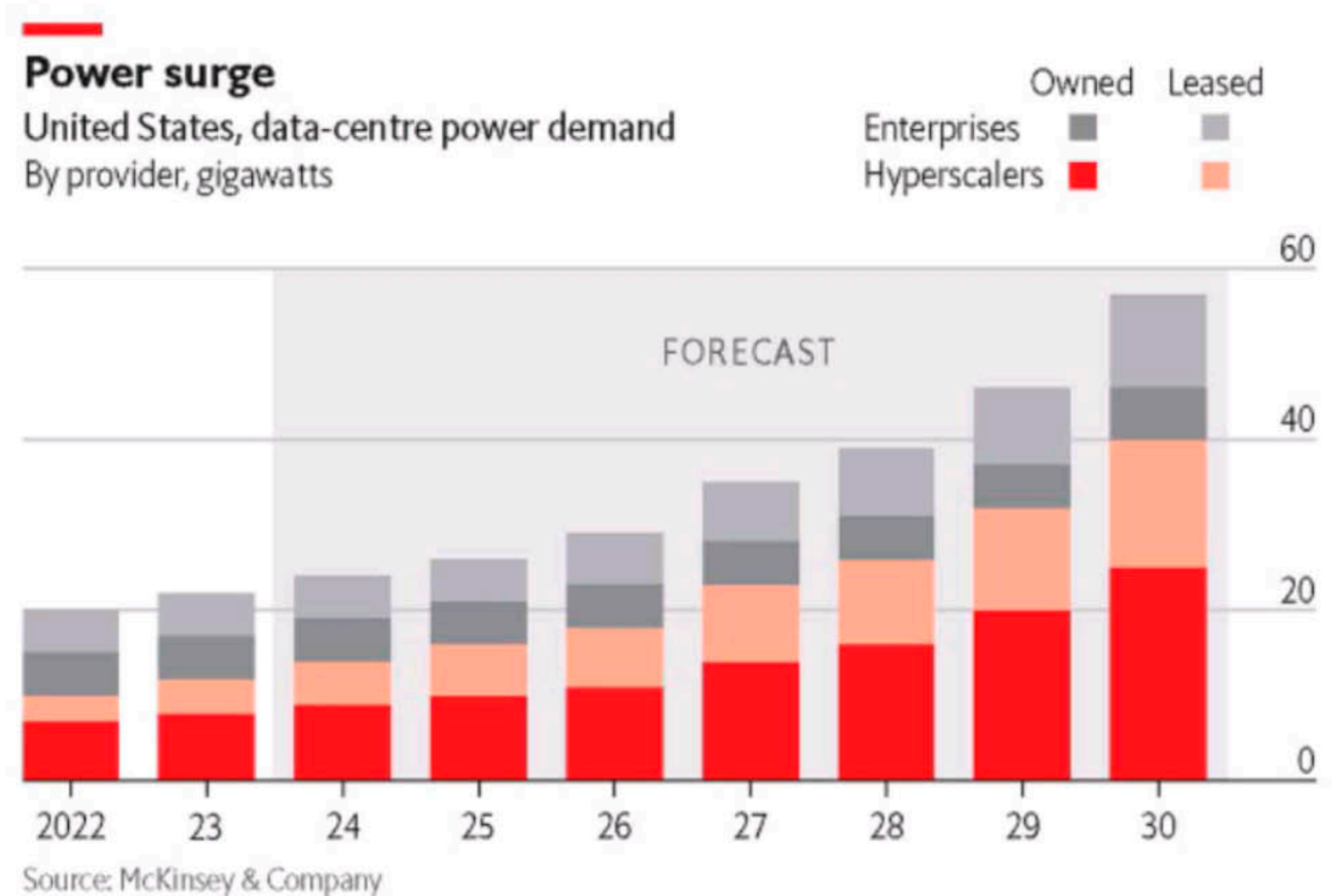
Data centres improved greatly in energy efficiency as they grew massively larger. Can that continue into the age of AI?

AS YOU STEP into one of 42 data halls on a plot of 74,000 square metres near Sydney, Australia, you become immersed in a sterile science-fiction world. Towering rows of black server cabinets stand in meticulous order, containing thousands of whirring hard drives, the beating metal hearts of a massive “hyperscale” data centre. Overhead, fibre-optic cables carry data down into each cabinet; metal wires, electricity. Outside a substation delivers power; batteries and generators provide backup. The digital world pulses unceasingly on an uninterrupted flow of electricity.

In 2022 data centres used between 240 and 500 terawatt-hours of electricity, roughly 1-2% of that consumed worldwide, up from 0.5% in 2000. At the low end of estimates that is more than Australia used as a country; at the high end, more than France, the 10th-biggest consumer of electricity.

Growing demand for digital experiences means more and bigger data centres. Amazon, Google, Meta and Microsoft used 72 terawatt-hours of electricity in 2021, more than double their usage in 2017, according to the International Energy Agency (IEA). By 2022 these four companies accounted for nearly 80% of global hyperscale data-centre capacity. A fair chunk of the rest is in China. Several hyperscale data centres are under construction in the remote northern city of Hohhot in the region of Inner Mongolia, on tracts as large as 140 football pitches. Huawei, a Chinese tech giant and cloud provider, is among the operators, along with major state-owned companies China Telecom and China Mobile.

Outside China, the pace of data-centre construction has been taxing resources to the point that some governments have felt compelled to slow it down. In 2019 Singapore temporarily halted the construction of new data centres, concerned that building more might make it difficult to fulfil its commitment to achieving



net-zero emissions by 2050. (It began issuing permits again in 2023, allocating power for several new data centres including for ByteDance, the parent company of TikTok.) In Ireland EirGrid, the national utility, has stopped issuing connections to new data centres until 2028 out of concern for running out of grid-connected energy capacity; data centres already account for 18% of electricity consumption there. (Microsoft may get around this issue by using a stand-alone gas plant to power a data centre in Dublin.)

In northern Virginia, Dominion, a utility company, paused new power connections to data centres for several months in 2022 to, as the company put it, “make sure that the integrity of our system can support this growth”. Sometimes referred to as data-centre alley, northern Virginia is home to just over three square kilometres of data centres, most of which are within 75 square kilometres in Loudoun County. Delivering a lot of electricity to a small area is logistically tricky. And demand is set to grow by about 85% over the next 15 years, Dominion says.

Pauses like these have not stopped data-centre growth, but rather shifted it elsewhere. More data centres are popping up in secondary markets that have fewer resource constraints, like Maryland and Malaysia. As data-centre activity grows in these areas, those governments may have to step in to protect their grids.

Despite all this the internet’s use of electricity has been notably efficient. According to the IEA, between 2015 and 2022 the number of internet users increased by 78%, global internet traffic by 600% and data-centre workloads by 340%. But energy consumed by those data centres rose by only 20-70%.

Such improved efficiency comes partly from improved thriftiness in computation. For decades the energy required to do the same amount of computation has fallen by half every two-and-a-half years, a trend known as Koomey’s law. And efficiencies have come from data centres as they have grown in size, with increasingly greater shares of their energy use going to computation.

Thirst traps

Unfortunately, some efficiencies of scale have come at the expense of another important resource: water. By the 2000s, as data centres evolved into tightly clustered racks of increasingly powerful servers, they began to require industrial-strength air-conditioning systems to cool the servers as they got hot from processing data. These systems require massive amounts of water to cool the air that cools the servers. In particularly hot places like Singapore, data centres’ thirst for water is even greater.

As chips get increasingly powerful, they run hotter too—packing more transistors into a smaller area means you can move electrons around more quickly, generating more heat. This makes chips more efficient per unit of computation, but requires more cooling per chip. In 2022 Google and Microsoft consumed 32bn litres of water, mostly in their data centres, the same as about

▶ 700,000 people in a rich country. (It is generally cheaper and more energy-efficient to throw away old water than to clean it and recycle it through cooling ponds.)

The world has been fortunate that the tech giants are concerned about the resources they use up, and are investing heavily in renewable energy (or that they have decided appearing concerned aligns with their long-term financial interests). Tech companies are by far the biggest buyers of green energy by means of power-purchase agreements (PPAs). These are long-term contracts between a buyer (like a data-centre company) and a power producer (like a solar- or wind-farm operator) to buy electricity at a predetermined price, instead of bulk-buying from utilities. PPAs provide a level of financial security, making it easier for renewable projects to get built. The data-centre industry has collectively added (or will add) 74 gigawatts of capacity in this way.

Tech companies also buy large quantities of renewable-energy certificates (RECs), which are a way of financing the creation of renewable capacity. A power company is issued RECs for electricity that is generated and delivered to the grid from a renewable-energy resource. They are then free to sell RECs as they wish. Tech giants using RECs can claim data centres as carbon-free when the actual electricity they are using to power the data centres is not.

The nuclear option

Data-centre giants have also invested more directly in unproven energy technologies, making bets before it might otherwise have seemed financially sensible. In the late 2000s Google invested in over two gigawatts of early solar and wind projects to help scale the technology to drive down costs.

Such investments are vital because renewable energy and data centres are far from a perfect match. A data centre is expected to be running 99.982% of the time, so it needs a steady and certain stream of power. Much of renewable energy is variable, dependent on the sun shining and the wind blowing. Running completely on clean energy will require other technologies to fill the gaps.

Nuclear technologies, like fusion or small modular reactors, could produce stable, limitless energy for data centres. They are not commercially available yet, but again data-centre companies are funding them. In 2023 Microsoft signed a PPA to buy fusion power from Helion Energy, a startup, by 2028. Tapping into geothermal energy is another possibility. Google first invested in the concept in 2008; in November the firm (along with Fervo, a startup) finished building a small, 3.5-megawatt geothermal plant in the Nevada desert. These technologies cannot yet compete at a commercial scale, but the same was true of wind and solar 15 years ago.

A big need right now is long-term storage, literally saving energy for a rainy day. Currently when a grid fails, a data centre will run on batteries for a few minutes until methane-fuelled generators kick in. Google, Microsoft and the like are investing in alternative storage technologies. Hydrogen, for example, can pack a lot of energy into a small space, and in theory could power a data centre for days instead of minutes. And data centres can alleviate the problem of variable load that afflicts re-

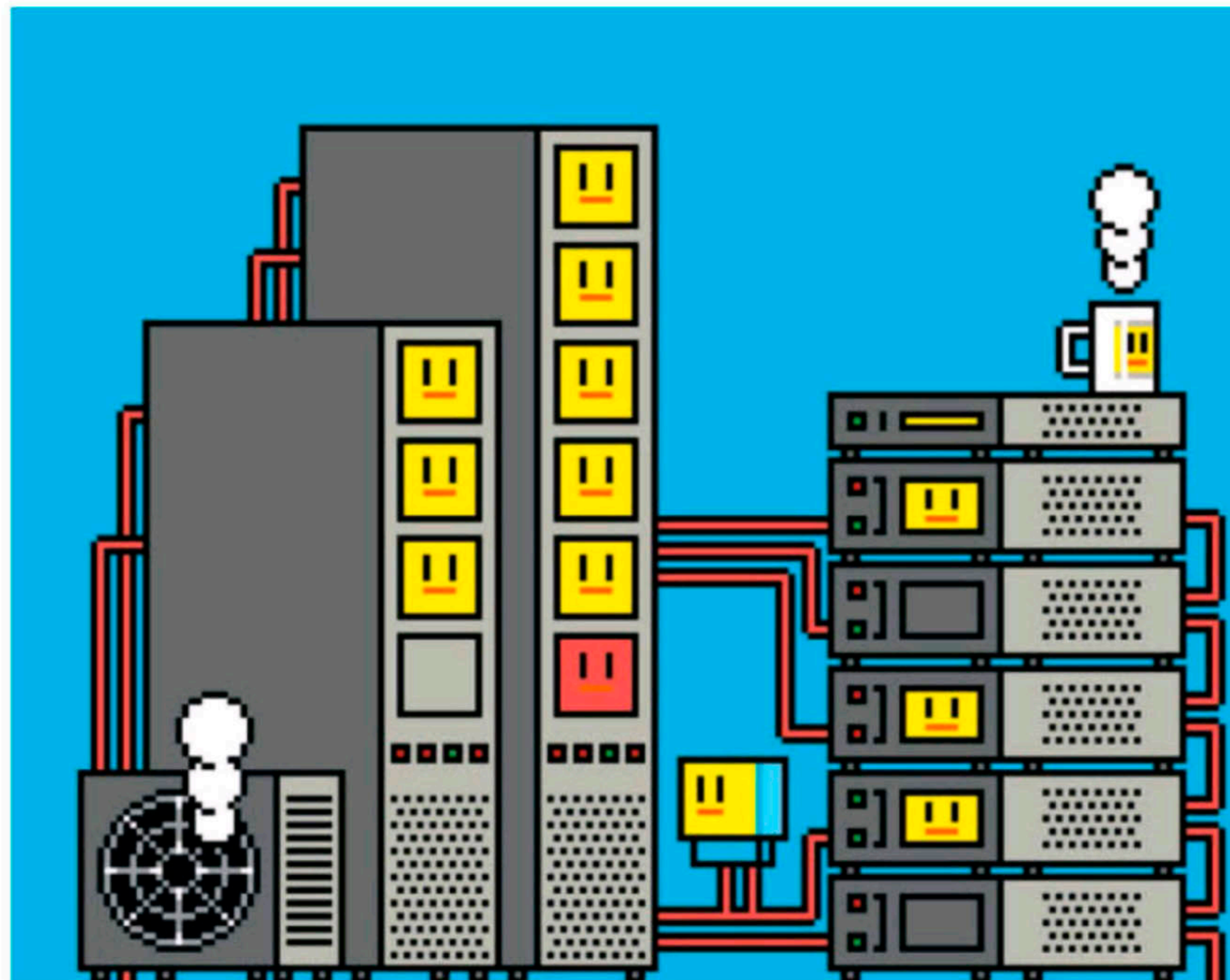
It is no coincidence that many advanced AI firms are data-centre giants



newables-based grids. In a practice called “load shifting”, data-centre operators move certain tasks that are not time-sensitive, like training an AI model, to different times or even to different data centres. Google has created a system that can shift computation jobs to when and where grids are cleanest.

Tech firms are also playing a leading role in another emerging climate-friendly technology, durable carbon-dioxide removal (CDR). This involves taking carbon dioxide out of the atmosphere and storing it somewhere in a safe way that keeps it from ever getting back there. In 2020 Microsoft declared its intention to use the technology to help reach its goal of going “carbon negative”. Such innovations help explain why the tech giants are making big promises about their environmental sustainability. Google and Equinix, another operator of hyperscale data centres, say they will run completely on carbon-free energy by 2030. Microsoft has committed to becoming carbon-negative and water-positive by 2030—that is, using offsets like durable CDR and cleaning dirty water. Microsoft says it will remove the equivalent of all the carbon the company has ever emitted by 2050 (when asked how the gas plant in Dublin fitted into these plans, Microsoft said its intention had been to use gas as a backup power source, and that the company remains committed to powering data centres “in the most carbon-friendly way possible”). Amazon’s goal is to reach net-zero carbon by 2040, running its data centres on 100% renewable energy by 2025 (as with the other companies, only when including RECs). Apple has committed to being 100% carbon-neutral by 2030 across its data centres and supply chains, through a combination of reducing emissions by 75% and investing in carbon removal. Meta says it will be net zero by 2030.

The tech giants will deserve plaudits if they can meet these goals. All the more so because the internet might be crossing an inflection point in electricity use after which it will grow even more quickly than it has to date. One factor in this surge in energy ▶▶



▶ demand to come is edge computing. Bringing more computing power closer to the user means a lot more (smaller, less efficient) data centres. Several consultancies project, perhaps boosterishly, that the edge data-centre market will more than triple in value globally by the end of the decade, to about \$30bn-40bn.

Another big factor is AI's ravenous appetite for energy. AI requires a lot more calculations than regular computing. A rack of normal servers might run on 7 kilowatts of electricity; for AI racks it can be 30-100 kilowatts. The reason for this discrepancy is that AI uses much more powerful hardware than is needed for, say, storing photos or maintaining websites. Because AI is based on matrix maths, it involves large blocks of computation being done at once, which means a lot of transistors have to change states very quickly. That draws a lot more power than normal computer tasks, which flip far fewer transistors at once for a typical calculation.

This adds up fast. A large language model may be trained for weeks on tens of thousands of power-hungry special AI servers. And as models get more advanced they consume more resources. One estimate suggests that it cost OpenAI more than 50 gigawatt-hours of electricity to train GPT-4 (or 0.02% of the amount of electricity California generates in a year). That is more than 50 times more electricity than training its predecessor, GPT-3, required.

An insatiable hunger for power

The energy costs of actually using AI models will dwarf training costs, according to Nvidia, maker of the most popular AI chip. Researchers at the University of California, Riverside, found that GPT-3 consumes roughly a litre of water to generate 40-100 responses; GPT-4 probably consumes even more.

The tech giants are investing heavily in AI. It is no coincidence that many of the most advanced AI firms are big data-centre companies, or are partners with one. The future of AI, who will get ahead and who will lag behind, depends greatly on who can build out the necessary physical infrastructure to support it. Microsoft—a cloud provider, a major player in AI research and an investor in OpenAI—plans to spend more than \$50bn per year on cloud infrastructure from 2024. Meta estimates that it will spend more than \$30bn on data centres in 2024. CoreWeave, a startup which provides cloud infrastructure for AI companies, grew in 2023 from three to 14 data centres in North America.

This scale of construction portends a serious ramp-up in electricity consumption (see chart on page 8). A recent analysis in *Joule*, an energy journal, suggests that at the rate they are being produced, AI servers could use about 100 terawatt-hours of electricity each year by 2027, between a quarter and a fifth of total data-centre consumption. Schneider Electric, a French firm that builds power supplies for data centres, projects that AI's share of data-centre electricity use will jump from 8% in 2023 to 15-20% in 2028.

Further gains in efficiency would help. Data centres may well achieve some through how they manage another challenge presented by AI chips: keeping them cool. Because they use up so much power, AI chips overheat more easily than normal ones and need special cooling technologies. One solution is to use liquid rather than air as a coolant, by circulating a fluid through a cold plate that is fixed directly to the chip. The heat from the chip goes directly into the coolant, which then flows through pipes to be cooled again. One study found that liquid cooling reduced the total power consumption of a data centre by just over 10%.

Such efficiencies will be helpful, but still amount to drops in the ocean compared with future energy demand created by the internet. No matter how efficient they get, you cannot stop data centres from needing power, because servers need power. Ultimately for data centres to become carbon-free, the electricity grids that power them will need to become carbon-free. Governments and the tech giants will have to work together towards that goal, but it will be a tall order. The geopolitics of climate change are not dissimilar to the geopolitics of the internet: convoluted and messy. ■

Politics

The physical borders of the digital world

To remain geopolitically robust as it gets more potent, the internet will need more diverse interconnections

ON JUNE 7TH 2022 Asia-Africa-Europe-1, a fibre-optic cable which connects Europe and Asia, was cut where it crosses land in Egypt. Somalia and Ethiopia lost 85% of their connectivity for several hours; the cloud services of Amazon, Google and Microsoft were all briefly disrupted, increasing latency for much international traffic; LinkedIn went down. And that was just one cable, on land, where the repair job was simple. Were all of the subsea cables to be severed at, say, the entrance to the Red Sea between Yemen and Djibouti, financial transactions would stutter. Zoom calls between London and Singapore would lag and glitch. Connectivity would persist—packets would be rerouted through America, or through space via satellites—but not without major slowdowns.

The submarine-cable system carries 99% of intercontinental internet traffic. A subsea fibre-optic cable gets cut every three days or so, according to TeleGeography, a consultancy, often because of fishing or an anchor dragging across the ocean floor. Yet the digital world rarely misses a trick for two very physical reasons. The first is that with 552 (active and planned) subsea cables spanning 1.4m kilometres, there is enough redundancy in most places to make up for cable failures (see map). The second reason is that a fleet of 60 repair ships around the world are on stand-by to fix broken cables.

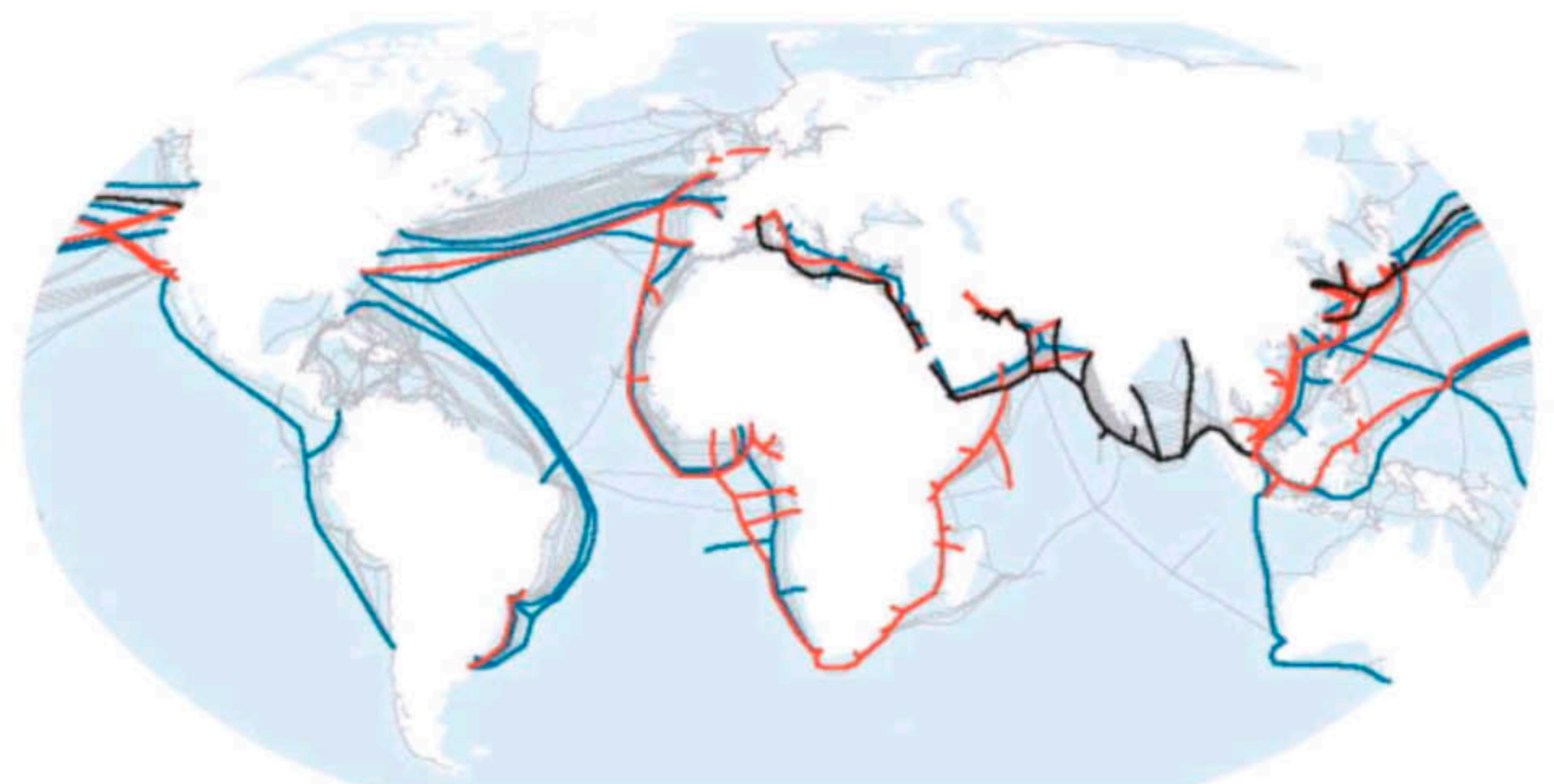
Fibre-optic cables run along various routes around the world, giving the internet options for directing traffic. In most cases if one path fails, packets of data will find their way around without users being the wiser. That is part of the beauty of abstraction. But in the Red Sea and Egypt, abstraction has masked a physical bottleneck. Just about all information sent from Asia to Europe flows through 11 fibre-optic cables at the bottom of the Red Sea, then mostly through Egypt via land cables controlled by one company, Telecom Egypt, before reaching the Mediterranean. If something disastrous were to happen to this route, people would notice.

Such a digital choke-point might seem alarming given that the Suez Canal has been a vulnerable physical choke-point, as shown by the badly parked Ever Given container ship in 2021, or by the recent attacks on shipping by the Houthis. In many ways, though, the physical shape of the internet—where wires are laid, where they stop, who is connected with whom—is dictated by geography, ▶▶

Sea features

Active and planned submarine-cable systems, December 2023

By investor — Google — Meta — Microsoft — Other



Source: TeleGeography

▶ politics and inertia. It is sensible to lay tracks where others have put them before. The British Empire opened the Red Sea route in 1870, when it laid telegraph cables to connect with its colonies. Telegraph was replaced by co-axial cable, then by fibre-optic.

Whenever a subsea cable is broken somewhere in the world, a repair ship will be dispatched. A pulse of light may be sent down the line to help pinpoint a rupture in a cable that is a few centimetres thick. The repair ship then uses sonar and a remotely operated vehicle (ROV) to find the break and haul the ends of the cable onboard. There humans will splice on a new section of fibre with precision. It is like trying to align three pieces of hair. Then the cable is lowered and reburied (often by an ROV) at the bottom of the ocean. In most cases users have no idea a cable was broken. Repair jobs generally take just a few days or a week, during which time internet packets automatically get re-routed anyway.

But where there is a choke-point, especially in a remote spot, a

cable break can be locally catastrophic. When the Hunga Tonga-Hunga Ha'apai volcano erupted in 2022, underwater mudslides severed the Tonga Cable, leaving Tongans without reliable internet for five weeks, until a repair ship could be wrangled. Many islands in the South Pacific have only one fibre connection, if any. Where there is no redundancy, there is vulnerability.

Building routes other than through the Suez Canal would be wise. But it is not easy. In the 2000s a cable was proposed that would link Jeddah and Istanbul, connecting by way of Amman and Damascus. Just after it launched, it was reportedly blown up during the civil war in Syria and never repaired. In 2021 Google started work on a new overland route through Israel, Jordan and Saudi Arabia; now that project appears to be on hold.

Adding more connections will also help the one in three people globally who do not have or cannot afford the internet. Many African countries lack sufficient data centres to store information, or internet exchanges to route traffic. As a consequence many packets of data must make a slow intercontinental trip. Long-distance land cables help, but they are hard to lay and maintain across rugged terrain. As more infrastructure gets built this problem will ease. In 2024 a route called 2Africa, which extends from Britain around the continent to India, will speed up service for many. Satellites help too, but users need subsidies (see box).

Laying fibre-optic cables is expensive. In the past, telecoms companies like AT&T formed consortiums to pay for the task. Now cloud companies like Google and Meta do so. Their hyperscale data centres need massive amounts of connectivity to keep clouds updated. They have come to want the "predictability" that ownership brings, says Frank Rey of Microsoft.

Google funded its first transpacific cable in 2008. It has since invested in at least 25 more, 12 of which it owns fully. Meta has invested in 15, one of which it owns outright. Microsoft partly owns four. Alcatel Submarine Networks, one of three major submarine fibre-optic-cable manufacturers in the world, reckons that more than two-thirds of current projects are supported by big tech firms. There is more than a whiff of vertical integration to this trend. As the cable map diversifies physically, it is concentrating corporately.

China, perhaps a bit oddly, stands outside this trend. Chinese companies are currently not invested in new transpacific cables, and planned cable routes mostly steer clear of hot spots like the South China Sea. Operators prefer to limit the interplay of politics and connectivity and let data come and go; Chinese and American network operators use many of the same cables for internet traffic, and there are no signs yet of China's role as a regional connection hub waning. But the question of who controls the physical connections of the internet—which few companies or indeed which countries—will become more urgent in times of real-world conflict. The centrality of the internet to modern life has made securing it an urgent necessity. ■

Starlink

Ground control to Major Musk

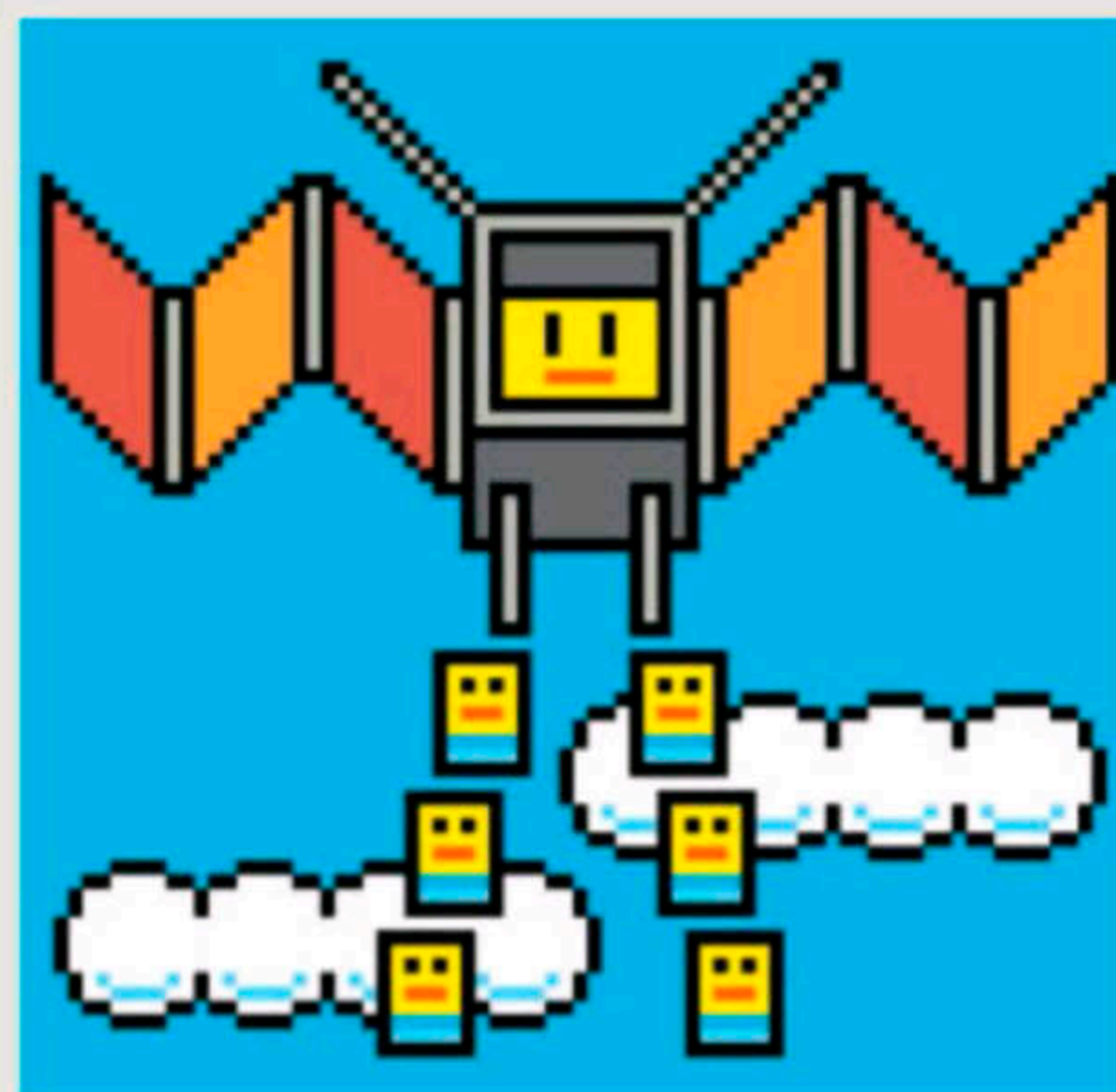
Satellite internet is good now. But a billionaire controls much of it

INFORMATION IS NOT just sent through cables. It is also sent through air and space, adding resilience when wires fail and reaching places that are otherwise isolated. For the hard-to-connect world, satellites can be the solution.

Elon Musk's Starlink has 5,288 satellites in orbit, with several thousand more approved for launch by 2031. (Mr Musk has said he wants 42,000 satellites.) The company claims more than 2m users. Jeff Bezos's Amazon plans to launch 3,236 satellites with Project Kuiper. OneWeb, a British company, has almost 650 satellites in orbit. More are coming as countries like China seek their own capacity.

Satellites in low-Earth orbit (LEO) a few hundred kilometres away from Earth's surface offer much faster and more reliable connections than satellite connections of old—good enough to stream Netflix in one's mountain cabin, though not lightning-quick like fibre-optic cable. But satellites in such orbits move across the sky very quickly from the point of view of an Earth-bound user, zipping in and out of range of receivers on the ground. This means LEO satellite systems require antennae which can track satellites as they pass overhead, recognising when one is moving out of range and identifying and switching to another satellite that has come into the picture. Software must repeatedly facilitate these handoffs such that the user never perceives a drop in service.

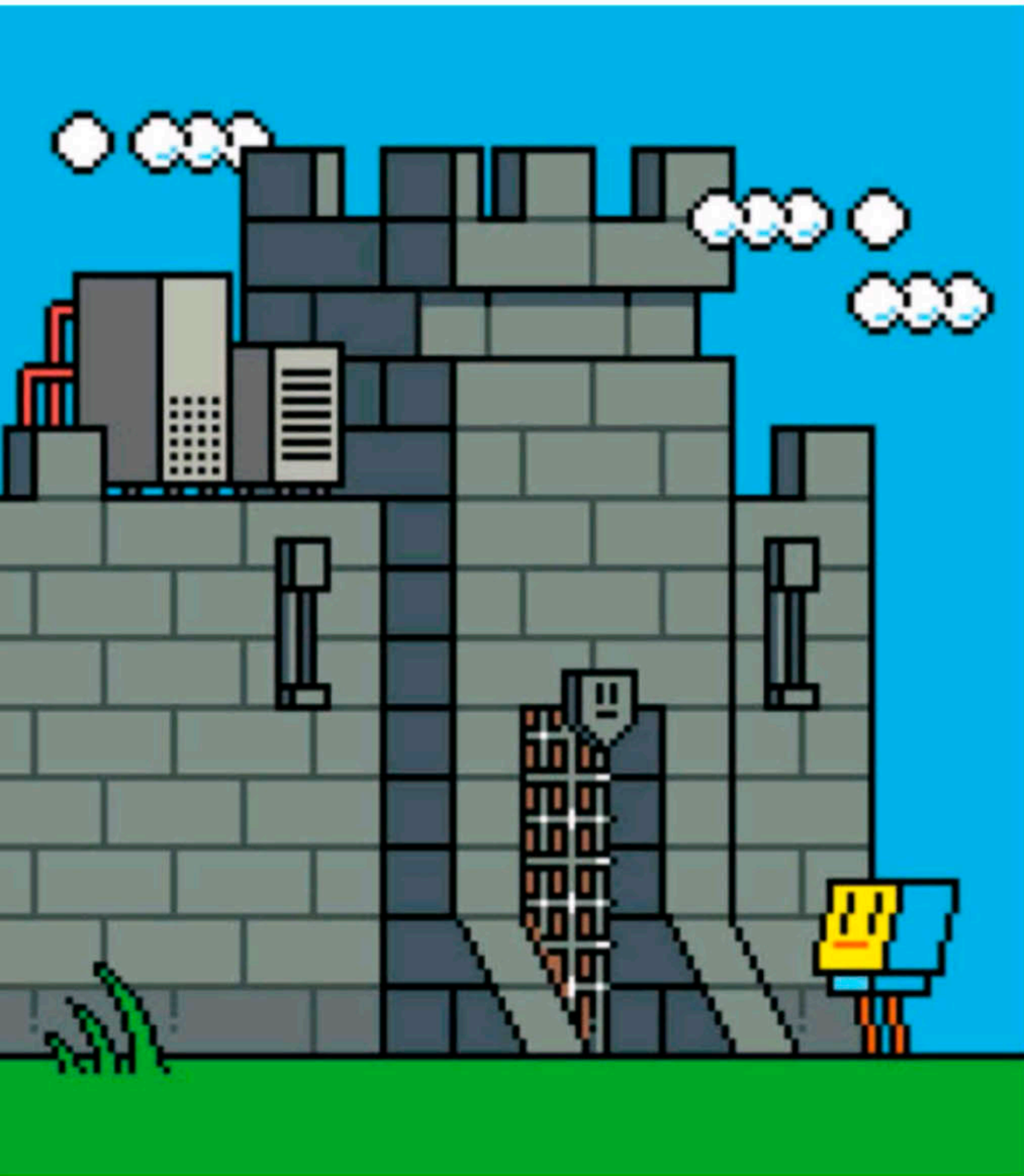
Satellite service is not yet cheap; for access in poor, isolated communities subsidies are required. That could change as eccentric billionaires with



proclivities for rockets and space keep launching more and more satellites.

This redundancy will be important should the wired system come under stress from climate change—or from politics and war. Heavy Israeli bombardment caused widespread internet black-outs in Gaza. Ukraine's army has used Starlink in its war with Russia.

But wars have also raised questions of what happens when one man with his own business interests controls internet access. In Ukraine Mr Musk has been accused of exercising a veto over operations that he felt might escalate the war. In Taiwan some worry about Mr Musk's significant Tesla business in China. If China were to attack Taiwan, starting a war that might well involve America, would Mr Musk allow Taiwan access to Starlink? All of a sudden the abstract question of who owns the internet would become a concrete geopolitical crisis.



An exponential age

Cloud fortresses

As the internet becomes integrated into virtually every aspect of life, keeping its infrastructure secure will be essential

THE SHEER amount of gold in Fort Knox was so great that Auric Goldfinger, the villain of the 1964 James Bond film which carries his name, knew he could not simply steal it: instead he planned to use a nuclear device to irradiate it, destroying its value and thus increasing that of his own reserves. Casing the facilities of equivalent strategic worth to the world today—the hyperscale data centres of Amazon, Google, Meta and Microsoft—suggests that something almost as dramatic would be needed to take them down. They are fortresses with layer after layer of protection, from fences to airlock-style entrances to biometric scanners.

Good thing, too. Much of the planet relies on these cloud fortresses, and will do so even more in years to come. Remarkable as the cloud is, there is no reason to think it is anywhere near completion. The generation of data and the need for its analysis continue to grow, and both storage and analysis are increasingly cloud-based. Hospitals use it to access patient records and share test results. Governments use it for elections, services and disaster alerts. The global financial system—bank transfers, stock trades—increasingly relies on it.

Because of abstraction and the distributed nature of cloud computing, no single data centre holds all the world's valuables. No single cable keeps the entire internet connected. No single hack will wipe out everyone's savings or turn everyone's lights off. But as the internet becomes integrated into virtually every aspect of life, keeping its infrastructure secure will be ever more essen-

tial. Spending on cybersecurity globally is expected to surpass \$200bn in 2024. Physical security for cloud servers is a big part of that bill. So is protecting servers from hackers, including those already inside otherwise secure buildings. All Google employees have a physical piece of hardware that they must use to log on.

Given that the internet came out of the Pentagon—its earliest incarnation was an American military research project, ARPANET—it may seem surprising that security is not built into its roots. But the goal of ARPANET, a project which began two years after “Goldfinger” hit cinema screens, was to develop a packet-switching system that would link the computers of various military-funded research institutions and, later, to ensure a multiplicity of routes such that the system could survive a nuclear attack. It was not to keep the system's data safe. And as ARPANET gave way to the purely academic world of the early internet, the idealistic graduate students who fostered its growth focused on creating an open and accessible network. It was not until the first browsers became commercially available in the mid-1990s that a protocol designed to encrypt data, authenticate servers and verify that data has not been tampered with was added to the internet. It was soon outdated and replaced; the same process continues today.

Big is beautiful

As well as attempting to steal data, hackers can also try to paralyse the systems that distribute it. On October 10th 2023 Amazon Web Services, Google Cloud, Microsoft and CloudFlare, a CDN provider, all disclosed that they had been the targets of a colossal distributed denial of service (DDoS, pronounced “dee doss”) attack in August and September. Google reported receiving 398m requests for data each second during the two-minute-long attack, more than 4,000 times the rate at which search queries normally come in—and seven-and-a-half times larger than the previous record.

The fact that the services under attack weathered the storm is just one more of the forces pushing the internet towards a more integrated business model, with companies operating at every level from cable and server to application, and thus favouring its giants. It is that sort of scale which allows firms to withstand and respond to attacks as well as they do now.

This is just one of the ways in which, as the cloud grows, more and more of that growth will be seen in the companies that dominate it. The biggest tech firms are spending heavily to distribute computing power to the edge of the network, to push an evolution from electronics to photonics, and to buy the capacity to provide reliable renewable power. The physical business of moving and processing the data used by people, companies and governments increasingly operates on an ever grander scale. As the infrastructure allows computation to be ever better distributed, the companies behind the scenes will continue to get bigger and bigger.

Perhaps, one day, that will stop. Perhaps, one day, the world will not need ever more computation to feed its appetite for services, for entertainment, for economic growth. In developed countries economic activity is increasingly decoupled from the use of energy; GDP can grow as energy use falls. It may be that, one day, the world will have all the computational power that it needs. But if that day ever dawns, it will not do so for decades to come. And until it does so, the abstracted world of human and artificial thought and communication will demand ever more investment and imagination from those who provide its underpinnings. ■

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Ukraine

Trouble at the top

KYIV

The feud between Ukraine's president and his army chief boils over

INSTABILITY AT THE top of Ukraine's war-time government was laid bare this week. On January 29th rumours swept Kyiv that the president, Volodymyr Zelensky, was about to fire his popular armed-forces commander, General Valery Zaluzhny, following weeks of reported tension. So far, Mr Zelensky has not announced the general's removal. That does not mean his job is safe; it may simply be that his replacement has not yet been lined up. As *The Economist* went to press on February 1st, a messy situation had still not been resolved.

A dramatic day in the capital had begun with leaks from MPs, who had been told about a "set of documents" sent to a security committee for signing. Later, sources in the general staff and close to General Zaluzhny confirmed that a shake-up was indeed in the works. *The Economist* has confirmed that an early-evening meeting took place on January 29th at which the president told his general that he had decided to dismiss him. Mr Zaluzhny was offered an-

other role: head of the national security council. He turned it down.

News of the plan was soon leaked to local media. The defence ministry and presidential palace denied that the general had been dismissed, which was technically true. But the problems—the dysfunctional relationship between the president and his general, and suspicions in the president's office that the general harbours political ambitions—have not gone away. Both men look damaged by the row, and the open disputes between Ukraine's political leader-

ship and its military command are worrying Ukraine's main allies.

Two generals are being mentioned as contenders for Mr Zaluzhny's job: Oleksandr Syrsky, 58; and Kyrylo Budanov, 38. Both are considered to be close to the presidential team. General Syrsky, one of the army's most experienced officers, was the operational brain behind two of Ukraine's most remarkable victories against Russia in 2022: around Kyiv and in the Kharkiv region. But his harsh approach to fighting has made him unpopular in parts of the army. Last year he sacrificed battle-hardened commanders in the arguably pointless defence of the small town of Bakhmut. General Budanov, Ukraine's enigmatic and ambitious head of military intelligence, embraces a much more unconventional and untested approach to command. He has not led conventional armed forces before. Some have suggested he turned the job down at the last minute.

The to-do has come at a critical time. The summer counter-offensive failed; Ukraine faces uncertainty over the degree of foreign support it can expect. The battle over General Zaluzhny's future will not make it easier for Ukraine to get funds flowing from its allies, as the commander is highly regarded in the West. Ukrainian troops on the front line are already complaining of a shortage of ammunition. Russian units are firing at least five times

→ Also in this section

42 Vladimir Putin's brave challenger

43 Meet the Knights of Malta

43 F-16s for Turkey

44 Ukraine's Black Sea victory

45 Charlemagne: Pitchfork protests

▶ as many shells as their enemy, and making modest territorial gains in the east of the country.

The defence of Kyiv and north-east Ukraine at the start of the war in 2022 made General Zaluzhny a cult figure. Polls repeatedly showed him to be more popular than his president; this created tension between the two men, whose relations were initially good. In particular, the general's endorsement of a charitable foundation set up in his name in April 2022 was seen by some as too political.

Mr Zelensky is by no means the only person to have noted his general's popularity. Prominent opposition figures, hitherto sidelined by the need for national unity, have started to align themselves with General Zaluzhny. That process has accelerated in recent weeks as rumours of the general's coming ouster intensified. The previous president, Petro Poroshenko, who harbours little love for his successor, was quick to take advantage of the disarray. "Firing Zaluzhny, if true, would hit at the heart of national unity," he wrote.

It is not unusual for civilian leaders to change commanders, even the top ones, in war. Sometimes it occurs because of insubordination, as with Harry Truman's decision to relieve Douglas MacArthur of command during the Korean war after the general publicly undermined American policy and defied the president's orders. In 2010 Barack Obama sacked Stanley McChrystal, his top commander in Afghanistan, after he and his staff made disparaging remarks about the president in a profile by *Rolling Stone*, a magazine.

On other occasions generals are sacked for poor performance. Abraham Lincoln fired George McClellan during the American civil war for military misjudgments. Sir John French was fired as head of the British Expeditionary Force in 1915 after failing to adapt to the prevailing trench warfare. Mr Obama fired General David McKiernan from the Afghanistan job after only 11 months, on the grounds that he lacked the bold instincts required to turn the faltering war around.

Military history is also replete with cases where commanders are relieved for less noble reasons. Generals are often heroic and dashing figures, eclipsing their political masters either through battlefield success or self-publicity—or both, as in the case of Ariel Sharon, a young Israeli officer and future prime minister who gave interviews to the foreign press after his daring exploits in the Yom Kippur war.

That breeds envy and resentment. General MacArthur was considered to be a plausible candidate for the Republican presidential nomination in the 1940s. David Petraeus, General McChrystal's replacement and later the director of the CIA, attracted persistent rumours of political am-

bition, prompting Mr Obama's aides to seek assurances that the general would not run against the president in 2012.

A similar dynamic appears to have influenced Mr Zelensky's decision to dispense with General Zaluzhny. True, there have been differences of opinion on military matters. In particular, the general has publicly pressed Mr Zelensky to launch a large-scale mobilisation of men; the president has resisted this, knowing it would be very unpopular. There were also fierce debates between the presidential palace and general staff over military strategy, including the argument over defending Bakhmut. But at the end of the day, it was probably General Zaluzhny's steadily growing political profile that piqued Mr Zelensky and those around him.

A president is entitled to change a commander in whom he no longer has confidence: the subordination of military to civilian leadership is a cornerstone of democracy. And General Zaluzhny's replacement, once appointed, will doubtless serve effectively. But removing a man as popular with his soldiers and the public as the general carries political and military risks. It is not clear how this story will end. But if Mr Zelensky keeps his top commander on, he will look weak. If he fires him, the clumsy way it has been handled will only damage confidence in the leadership. As so often in this conflict, there are no easy wins. ■

Russia's presidential election

A tame runner turns a bit wild

An anti-war candidate gets a boost that could embarrass the Kremlin

"I DON'T HAVE the charisma of Alexei Navalny or Boris Nemtsov. You can't make Che Guevara out of me, no matter how hard you try. I have no illusions and don't pretend to be a hero, God forbid. But it just so happened..." So speaks Boris Nadezhdin, a portly 60-year-old in glasses, a former physicist who spent the past 30 years inside Russian politics, mostly as someone's deputy or aide, attracting little attention from the wider public.

It is probably these dull Everyman qualities and a long and steady record of losing elections that persuaded the Kremlin to let him play a minor part in the farcical presidential poll on March 15th-17th. Vladimir Putin is certain to be elected to a fresh term. But the authorities have allowed Mr Nadezhdin to collect enough signatures to be included on the ballot.

But it just so happened that over the past few weeks hundreds of thousands of



Taking on the top man

Russians citizens have queued to sign for Mr Nadezhdin. The reason is a line in his manifesto that says Mr Putin's "special military operation" (in Ukraine) is "a fatal mistake". With his owlish appearance, Mr Nadezhdin epitomises the peaceful and ordinary life that has been uprooted by the military operation that Russians are not allowed to call a war.

Standing in line to provide a signature for a man whose last name means "hope" in Russian, without any immediate risk of being arrested, looks like an attractive option for many disgruntled Russians. After all, they can go to prison for displaying a pacifist slogan or for backing Ukraine. Their smallest protests are brutally dispersed. They have no free media, no fair courts and no space for debate.

Within days Mr Nadezhdin had collected over 200,000 signatures, twice the 100,000 he needed to qualify. To be sure, Mr Putin's "special electoral operation", as it is mockingly known, is as far from a free and fair election as Russia is from democracy, and Mr Nadezhdin is as far from winning it as he is from being Che Guevara. But the images of people queuing up for hours in the winter cold to support his candidacy add up to a political event in themselves. "I saw that there are people around me who think the same way as I do," one person wrote to Mr Nadezhdin.

Mr Putin's dictatorship relies on ostracising and isolating those who oppose his regime, depriving them of any participation or even the ability to communicate and organise. "My goal was to show to the whole world and to people themselves that they are not alone. I've achieved this goal 100%," Mr Nadezhdin told Meduza, Russia's largest independent online media outfit, operating in exile.

The queues have brought together people with diverse political views but a common anti-war sentiment, giving them a ▶▶

▶ chance to air their numbers. Musicians, bloggers and influencers with multi-million-strong audiences recorded short videos of the lengthy queues. Yulia Navalnaya, the wife of Alexei Navalny, Russia's leading opposition politician (who is locked away in a harsh penal colony in the Arctic), has signed up for Mr Nadezhdin. Political prisoners have saluted his courageous candidacy from behind bars.

The Kremlin's managers might have thought of Mr Nadezhdin as a controlled experiment, a way for Russians to let off a bit of steam, or perhaps they hoped that letting a licensed liberal get just a handful of votes would actually underscore Mr Putin's popularity. But the experiment seems to have escaped its control. Whether it will now actually let Mr Nadezhdin stand, or will invent a reason why he cannot, is the story's next episode. ■

Turkey

F-16s, by any means

ISTANBUL

Sweden clears a Turkish hurdle to NATO accession

FOR MONTHS, senior officials in Ankara had assured their Swedish counterparts that Turkey's ratification of the Nordic country's NATO membership bid was just around the corner. The long wait came to an end on January 25th, when Turkey's president, Recep Tayyip Erdogan, signed off on Sweden's accession protocols, shortly after his country's parliament backed the agreement. The ink of Mr Erdogan's signature had barely dried when America

agreed to provide Turkey with 40 new F-16 fighter jets and to modernise another 79, a deal worth some \$23bn. America simultaneously approved the sale of up to 40 F-35 stealth fighters to Greece.

The timing was no coincidence. For well over a year Mr Erdogan had used his veto power over NATO's enlargement to seek concessions from his Western allies. The F-16 sale is the most important of these. Mr Erdogan has not made any new friends in NATO. But he has notched up a number of victories. He got both Sweden and Finland to scrap their arms embargoes against Turkey, imposed in 2019 after Turkey launched an offensive against Kurdish insurgents in Syria. On January 29th Canada, another NATO member, said it would resume exports of drone parts to Turkey, which it had suspended in 2020.

Mr Erdogan waved through Finland's membership last March, but kept Sweden jumping through hoops. In response to Turkish pressure to crack down against the Kurdistan Workers' Party (PKK), an outlawed Kurdish group, the Nordic country passed a new terrorism law in 2023, a move that needed constitutional changes.

Sweden's accession also became entangled in a row featuring America, Turkey and Greece, another member of the alliance. Ever since it was booted from America's F-35 programme as a result of its purchase of an air-defence system from Russia, Turkey has sought to buy new F-16s and upgrade the ones it bought years ago. Mr Erdogan wanted the Americans to unblock the sale, which had been held up by Congress for years.

But America played hardball as well. Its officials made clear they would continue to block the F-16 sale unless Mr Erdogan gave Sweden the green light. They also suggested America would push ahead with the sale of the F-35s to Greece without waiting for Turkey, a move that risked upsetting the balance of power between the two neighbours. That threat helped clear the way for the vote. Sweden is now only a single Hungary-shaped hurdle away from membership in the alliance.

The F-16 sale will not transform America's relations with Turkey, thanks to continued irritation in Washington over Turkey's human-rights record, Mr Erdogan's support for Hamas and his reluctance to stand up to Russia. But the new planes will help anchor Turkey in NATO and strengthen its dependence on America's arms makers for spare parts and maintenance, at least for a while. Turkey is working on its own indigenous aircraft, known as the Kaan. But it is not likely to enter into service for another decade or so. The F-16s are expected to keep flying well into the late 2040s. Anyone prognosticating too anxiously over Turkey's imminent departure from NATO might take note. ■

The Knights of Malta

Still sovereign

ROME (BUT NOT ITALY)

An ancient global order gathers in the Eternal City

IT WAS ENOUGH to captivate any conspiracy theorist: in the grounds of an 18th-century Roman villa more than 100 well-connected men and women from around the world—many of them aristocrats—came together to discuss their common mission. The meeting, from January 25th-27th, brought together the ambassadors of perhaps the oddest entity in international law, the Sovereign Military Order of Malta.

Once the Crusaders' medical corps, the order later ruled Malta for more than 250 years. Driven out by Napoleon in 1798, its knights (and later dames) retained that intangible yet priceless asset, sovereignty. That lets the order not only maintain diplomatic relations with other states, but also issue stamps, coins, passports and car number-plates. Its Grand Master is entitled to be addressed as "Your Highness" and what little territory he rules—a villa on the Aventine Hill in Rome and a mansion near the Spanish Steps—is not part of Italy. The Italian soldiers and police guarding the ambassadors' pow-wow stayed outside the villa's gate.

Today the order is essentially a Catholic humanitarian NGO—and a very big one, with 13,500 knights and dames, almost 100,000 volunteers and more than 50,000 professional staff who care for the victims of natural disasters, wars, epidemics and poverty. In a room decorated with the coats of arms of scores of past dignitaries of the order, Riccardo Paternò di Montecupo, its Grand Chan-

cellor (similar to a prime minister), says its members do not proselytise. But, he adds, "If our work touches the heart of someone, well, we are very happy."

The order also runs permanent structures, notably the Holy Family Maternity Hospital in Bethlehem. It has no diplomatic relations with Israel. But, perhaps ironically in the land of the Crusades, it maintains an ambassador to Palestine: an American, Michele Burke Bowe. Like many other humanitarian outfits, it has been unable to gain access to the Gaza Strip. "But as soon as the occasion presents itself, we'll be in Gaza," says Ms Burke Bowe.



About the size of it

The Black Sea

Russia is losing

ODESSA

Ukraine wants to keep trade flowing and destroy Russia's fleet

ON SEPTEMBER 19TH Ukrainian military and civilian shipping officers huddled in a secret control room to watch the *Resilient Africa* as it left Odessa's Chornomorsk port. As this was the first vessel to leave using Ukraine's new emergency shipping corridor, established after the collapse of a UN-brokered grain deal, tensions were high. Russia had warned that it could open fire on ships using the corridor. Emergency services were on standby. "We readied ourselves for any scenario," says one of those present in the room. "We were really quite nervous." In the event, the ship sailed without incident, hugging 150km of Ukrainian coastline before entering first Romanian, then Bulgarian territorial waters, and continuing on through the Bosphorus to its destination, the Israeli port of Haifa.

The declaration of a shipping corridor in defiance of Russian bombardment was always going to be risky. But for Ukraine, it was a strategic necessity. Before the war, 60% of its trade went through its deep-sea ports, travelling to markets in Africa and the Middle East, as it had done for centuries. Russia's decision to reimpose a blockade was an act of economic war.

So Ukraine began secretly devising its own alternative route. It chose the shallowest waters, safe from Russian submarines, and close enough to the coast to be covered by onshore artillery. "We believed it would work, but it was about convincing others," says Yury Vaskov, Ukraine's deputy infrastructure minister. The first ships sailed at a loss, but confidence has seen the cost of insuring ships that take the route fall by three-quarters, and profits return. Nearly 500 vessels have followed the *Resilient Africa* in and out of Odessa.

Back to the beginning

With 6.3m tonnes of goods exported in December, the Odessa region's three ports—Odessa itself, Chornomorsk and Pivdenny—are now almost back to pre-war volumes. On an unusually sunny day in late January, the port of Odessa clinked to the rhythm of metal on metal. Fourteen ships stood loading in dock. Another 11 hung on the horizon, waiting their turn to be inspected by border officials, who shuttled in and out on speedboats. The border service is not only inspecting goods on board these days, but also checking for Russian saboteur groups, which remain a threat. Another wartime change is to subordinate

all traffic in the region to a single maritime command. "We connect traders with the emergency services, ecological services, weather reports, missile attacks and air raid alerts," says Yuriy Lytvyn, head of Ukraine's Sea Port Authority. "It's a unique Lego puzzle, a crazy amount of work."

On dry land the work is much the same as ever: delicate, demanding, dangerous. Dockers down their tools only during air-raid alerts, which can last several hours at a time. The raids add about 30% to loading times, says Denys Paviglianiti-Karpov, head of the Odessa port authority. But the constant threat of missiles and drones means no one is in the mood to cut corners. "Crimea is just 160km away and the missiles sometimes land even before the sirens start," he says. Inside the port, you don't have to look hard to grasp the mortal dangers. The wreckage of the passenger terminal, mangled by an Onyx anti-ship missile on September 25th, is Russia's most prominent calling card. But it is rare to see an intact roof or undamaged window here; corrugated plastic sheeting often replaces glass. The roads are pockmarked. A smell of burning lingers. In all, Russia has attacked nearly 200 port facilities since it withdrew from the grain deal in July.

Ukraine had to work hard to establish its own corridor, overturning Russia's dominance of the Black Sea without a single working warship. The first success



came soon after the Russian invasion, when Ukraine prevented an amphibious landing. It was a close-run thing, but the key moment was halting the Russian westward encirclement of Odessa 100 km away at Voznesensk in March 2022. Two months later, Ukraine was able to impose a 100-nautical-mile buffer in the north-western part of the Black Sea after destroying Russia's *Moskva* flagship and regaining control of the strategic Snake Island. The third phase, completed over 2023, saw Ukraine push Russian warships entirely from the north-western, central and even south-western parts of the Black Sea.

This final part of the jigsaw was predicated on Ukraine's maritime forces developing an arsenal of missiles and drones to hunt and sink Russian warships. Ukraine says it has destroyed at least 22 of the 80 working combat vessels of Russia's Black Sea fleet, and damaged another 13. Now not even the eastern coast of Crimea is considered safe for Russia's ships; its best ones shelter in Novorossiysk, 600km away, on the other side of the Black Sea. "It's a matter of time before we destroy the Black Sea Fleet in its entirety," says Dmytro Pletenchuk, the Ukrainian navy's spokesman.

A world-beating wager

Ukraine's new deterrence capability has allowed it to bet that Russia will not attack a foreign merchant ship. Not only would an attack invoke international opprobrium, but the threat of escalation now means it would increase insurance premiums right across the Black Sea, including for Russia-bound shipping. So far Ukraine has won the bet, except over a Liberian-flagged ship that was struck, probably by accident, while docked in Pivdenny last November (the danger may be greatest when a ship is in dock). Russia can and does throw glide bombs from the air in the general direction of the emergency corridor. Mines from the second world war are also an occasional problem. Both are a nuisance, but not enough to deter large cargo ships.

The return to action of Odessa's deep-sea ports is a timely boost to Ukraine's battered economy. Oleksiy Sobolev, Ukraine's deputy economy minister, says the unblocking of the sea is forecast to add at least \$3.3bn to exports this year, adding 1.2 percentage points to GDP growth.

Yet those involved are too cautious to declare victory. One trader, responsible for one of Odessa's largest private terminals, asked not to be named because he feared Russia would target his business. Mr Vaskov admits that the new corridor does not yet have enough air defences, international monitoring and, ideally, international military escorts to make it fully secure. But its functioning at the worst of times has proved a point: shipping can continue even during Russia bombardment. ■

Charlemagne | The pitchforks of our discontent

Grumpy farmers are a symptom of wider European malaise



IT TOOK 120 ships laden with bearded Vikings to besiege Paris in the spring of 845AD. They moved on only after being paid a tribute of 7,000 pounds of silver. In 1870 Prussians required two armies and batteries of cannons to blockade the city, which surrendered after locals grew tired of eating rats, cats, horses and whatever animals could safely be plucked from the zoo.

For “the siege of Paris”, 2024 version, the equipment of choice to throttle supply lines is branded John Deere, New Holland or Claas. Hundreds of tractors driven from across the hinterland have blocked eight motorways into the French capital since the start of the week, with few plans to move on. Farmers camped about 30km from the Champs-Élysées are keen to remind the *bourgeoisie* where the grub on their supermarket shelves comes from. The kangaroos and zebras in the city’s zoos are thought to be safe for now. Politicians looking to avoid becoming electoral road-kill may yet need to dodge a few tractors.

Across Europe, a revolt of the peasants is brewing. From Belgium to Germany, the Netherlands, Poland, Romania and Spain, farmers are up in arms. A sector used to exorbitant privileges—roughly one-third of the EU’s budget goes on subsidies to the common agricultural policy, after all—has felt them slip from its grasp. It is in many ways a familiar story, of a privileged caste sensing its status declining. For what is Europe if not an attempt to hold on to things as they once were in a changing world? Being wed to tradition and yet buffeted by modernising forces is the story of the continent writ large, as Europeans feeling the swoosh of China, India and others zooming past can attest. Farmers are not the only Europeans who would like the world to stop so that they can get off (and retire early).

Drop the sociological tosh, might come the answer from the fields. Life as a European farmer has become intolerable. The case was made to Charlemagne by a slew of *agriculteurs* who had descended on the EU institutions in Brussels, a time-honoured tradition often involving manure and egg-pelting devices. Perched atop tractors parked for the week, they explained that for every subsidy cheque comes a pile of forms to be filled out, a full-time job in itself. The green rules being spewed out by the EU machine have hit growers’ pockets, whether demanding chunks of land be

left fallow, dictating the size of chicken coops or how hedgerows should be tended. Having nagged farmers, politicians then sign trade deals that allow food to be imported from far-flung places with fewer environmental qualms. Energy and fertiliser costs, meanwhile, remain high (a stack of bills was proffered as evidence) as a result of the war in Ukraine, whose vast farms can now sell cheap grain and other foods in the EU without tariffs. Urbanite politicians whose main interaction with animals is eating them in fancy restaurants either fail to notice, or talk down to farmers while visiting the countryside just long enough to snatch a photo-op with a cow. Journalists, apparently, are no better.

The wave of revolt has at least gained the attention of the city-slickers. The public loves a profession that features in most family trees; farmers are nearly as popular as politicians are not. Concessions have thus come thick and fast. Planned increases on taxes levied on fuel used by farmers have been shelved in France and delayed in Germany. An EU trade deal with South America has been thrown under the tractor after a mere two decades of talks. Concessions to Ukraine, which had particularly irked farmers in neighbouring countries such as Poland and Romania, are being rolled back, even as EU leaders this week discuss sending it €50bn (\$54bn) in aid to keep its economy afloat. Ditto those pesky rules about leaving fields fallow, at least for now.

Politicians worry because agrarian populism has shown its potential at the ballot box. Last March an upstart farmers’ party in the Netherlands scooped first place in regional elections with 19% of the vote—in a country where just 2.5% of the workforce toils in agriculture. Hard-right politicians see an opportunity to harvest support ahead of European elections in June, spinning a tale of sneering elites and hard-working (white) rural folk. Even centrist pols talk about the need to moderate the demands of the Green Deal, through which Europe hopes to slash carbon emissions.

Animus farm

The decline of European farming typifies the continent’s ever-dwindling relevance. Agriculture has been left in the dust by other sectors much as the broader European economy has been overtaken by its geopolitical rivals. The EU’s share of global GDP has fallen by over a third since 1995; farming’s heft in the EU economy is down by a similar amount. Growing food now accounts for just 1.4% of GDP, less than the warehousing services needed to zip Amazon packages around. Like Europe more broadly, a continent conspicuously devoid of tech giants, European farming has failed to adjust to modernity: the sector is still dominated by family operations that lack scale. Almost two-thirds of its farms are smaller than five hectares, which can be walked around in ten minutes or so. The profession is ageing: one-third of farm managers are over 65. In a world of TikTok and ChatGPT, no amount of subsidies can attract a 20-something to a career that involves getting up at dawn six days a week and literally shovelling bullshit.

A recent motto heard in Brussels is the need to build “a Europe that protects”, whether from Russia, artificial intelligence, migrants or Donald Trump (pick your least favourite change agent). The continent tends to like the way things are, because they are how they used to be. Detractors think of Europe as an open-air museum, fit for tourists and pensioners; fans of the model like its 35-hour workweeks and August off. The pain felt by farmers is real. The feeling of being left behind by forces beyond your control is an uncomfortable one. Those protesting atop their tractors are merely the tip of the pitchfork. ■



The armed forces

Losing muscle

The British armed forces are stretched perilously thin

ALONE AMONG its allies, America could count on Britain to join its recent attacks on Houthi rebels in Yemen firing missiles at commercial shipping in the Red Sea. Royal Air Force jets operating from Akrotiri in Cyprus have twice attacked military targets with Paveway guided bombs.

Britain was also quick off the mark to deploy army battle groups across Europe after Vladimir Putin's invasion of Ukraine in 2022. It has often led the way in supplying Ukraine with the equipment it needs. As Ben Barry, a land-warfare expert at the International Institute for Strategic Studies (IISS), a think-tank, says: "Despite the legacy of Iraq and Afghanistan, Britain's armed forces, with the support of the British public, have a willingness to use force against enemies deep in their DNA that in Europe is matched only by France."

Britain has the biggest defence budget in Europe, slightly ahead of both France and Germany, and unlike them it has never dipped below NATO's target of spending at least 2% of its GDP on defence. This year it will be nearer 2.3%, with military spending hitting £52bn (\$66bn). Grant Shapps, the

defence secretary, recently boasted that Britain had stepped up to the challenge of a more dangerous "pre-war" world: by "investing billions into modernising our armed forces...when the world needed us we have risen to the moment".

Yet for all the billions and the bravado, the British armed forces are stretched perilously thin. The perception within Britain and among its NATO allies, particularly America, is one of relatively declining military power—of forces so small that they risk falling below critical mass, large procurement projects that go horribly wrong, an underfunded defence-equipment plan and a crisis of recruitment.

→ Also in this section

48 Europe's view of Labour

49 Bagehot: Tory unity

→ Read more at: [Economist.com/Britain](https://www.economist.com/Britain)

— A deal in Northern Ireland

— Powers for pharmacists

These problems show up most obviously in the army. In 2021 the then defence secretary, Ben Wallace, decided to reduce the projected size of the army by 10,000, to 72,500 by 2025 (see chart on next page). Russia's invasion of Ukraine has changed the security environment but not the cuts. General Sir Nick Carter, a recent chief of the defence staff, has warned that they could undermine Britain's NATO commitment to be able to field a full division in Europe. Malcolm Chalmers of the Royal United Services Institute, another think-tank, says the idea of a smaller but still capable force is all very well but "land warfare requires a bigger orchestra". One senior officer calls it a "hollowed-out shambles".

Although the army is getting an upgraded tank, the Challenger 3, it is ordering only 148 of them. By comparison, Poland is aiming for a fleet of 1,600 modern tanks. American generals and other allies have openly questioned whether after decades of cuts Britain's army can be regarded as even a small top-level fighting force.

There are still wide gaps in what it needs to be a credible force against a peer or near-peer enemy, including sufficient air defence, long-range missiles and electronic-warfare assets. There are concerns within the army that it lacks adequate intelligence, surveillance and reconnaissance capabilities, and that it does not have enough artillery. The army was short of munitions even before donations from its inventory to Ukraine. Although £2bn was allocated for replenishing its stocks last

▶ year, the money is at risk of vanishing into the general maw of the defence budget.

Mr Chalmers says that although the army now has quite a big capital-equipment programme, much of it is not yet on contract and could be cancelled or delayed. History suggests that there is a decent chance things will go wrong. The army has been both victim and culprit in two of the most troubled procurement programmes of recent years: the £3.2bn Morpheus battlefield-communication system and, especially, a £5.5bn contract for the Ajax armoured fighting vehicle.

Ajax was meant to be an off-the-shelf replacement for the Warrior armoured vehicle; it was due to start coming into service by 2018. However, it was loaded up with 1,200 “capability requirements” and ordered with a 40mm gun that no other armies had asked for. The result has been massive delays. The emergence of noise and vibration problems that were a danger to crews took years to resolve. The programme’s failings were laid bare in a 172-page report published last year under the optimistic title of the “Lessons Learned Review”. It made 24 recommendations for improving the way the defence ministry’s procurement arm, Defence Equipment & Support, manages major programmes.

The navy and air force are suffering similar problems. In 2021 the government conducted an “Integrated Review” of its foreign, defence, development and security policies (it was refreshed in 2023 because of Ukraine). The defence committee of the House of Commons concluded two years ago that the navy could not fulfil the review’s ambition for a “global Britain” with its current fleet, and that it needed more lower-end, adaptable vessels like the planned Type 31 frigate (the first of five is expected to enter service in 2027, four years later than first intended).

The navy is benefiting from significant capital investment, with new frigates and a planned successor to the Astute-class nuclear attack submarine as part of the AUKUS submarine deal with America and Australia.

lia. But the running costs and manpower demands of its two aircraft-carriers, first conceived of in the late 1990s, have had knock-on effects. Under current plans, the navy will have just 19 escort vessels. “The navy is too small by about half. We don’t have the flexibility to carry out full-spectrum activities,” says Tobias Ellwood, a former chair of the defence committee.

Nor have decisions taken in 2021 to reduce air power been revisited, despite the war in Ukraine. Those decisions include: early withdrawal from service of the Tranche 1 Typhoons to cannibalise them for spare parts; the early retirement of C-130s, with adverse effects on lift capacity generally and on special forces specifically; and the baffling choice to cut an order for the E-7 Wedgetail airborne-warning-and-control aircraft from five to three, for a saving of only 12% on the capital cost (“Lunacy,” says Mr Ellwood). Britain is leading a joint programme with Japan and Italy to develop a sixth-generation fighter to replace the Typhoon in the mid-2030s. But whether Britain will buy enough aircraft to make the project viable is debatable.

Mr Ellwood points out that when the cold war ended Britain had 31 fast jet squadrons “but now we may struggle to have seven”. The big concern is the loss of “combat mass”, which has been much steeper for Britain than for France, Germany or Italy. A further cause for concern has been the “painfully slow” programme to upgrade the Typhoons with AESA (active electronically scanned array) radar, which, says Douglas Barrie of the IIS, is “the single key sensor on modern aircraft”.

Fit kit?

Fixing such problems is made far harder by the ballooning cost of the programme to replace Britain’s nuclear deterrent, which has priority over everything else. It is now projected to account for 34% of the entire planned equipment budget of £289bn for the ten years to 2033. If the cost of the nuclear deterrent is left out, Britain is spending only about 1.75% of GDP on defence.

A report in December by the National Audit Office (NAO), an independent spending watchdog, declared the latest defence-equipment plan, which was recently updated, to be “unaffordable” (see chart). The cost of the plan had gone up to £306bn, revealing a “black hole” of £17bn (even this is a central estimate that the NAO thinks underestimates the problem). The main reason is the escalating cost of the Defence Nuclear Organisation, which includes the new attack submarines, four Dreadnought ballistic-missile submarines and the development of a new nuclear warhead. Costs have gone up by 62% since the NAO’s previous report just a year earlier.

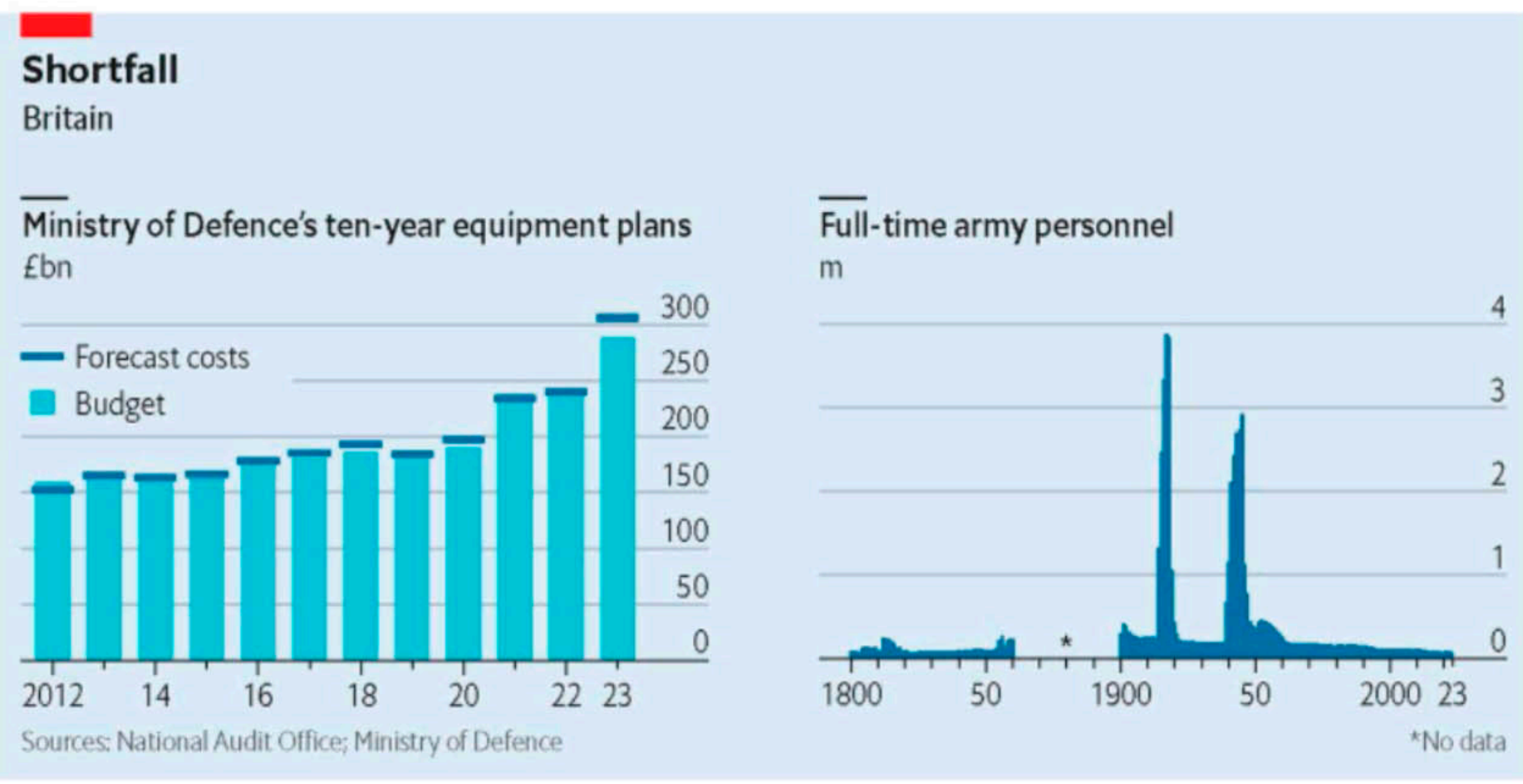
To add to Britain’s military problems, it is also experiencing a severe recruitment and retention crisis. The air force lacks the pilots and engineers needed to operate a bigger fleet of aircraft. The navy has been forced to retire older ships from service because it lacks crew. The army is struggling to meet even the reduced numbers that have been set, and may have fewer than 70,000 personnel within two years.

Some of the problems have been laid at the door of Capita, an outsourcing contractor that uses call centres to interview potential recruits. It can take months before an applicant even meets a serving officer. Low pay, poor food and often lousy accommodation (also largely managed by outsourcing companies) are partly to blame. Hopes of recruiting more skilled women have been set back by a stream of stories about sexual harassment in the forces.

A speech on January 25th by General Sir Patrick Sanders, the head of the army, calling for the training of a “citizen army” was misinterpreted as a plea for the return of conscription. But senior officers are pressing for the Army Reserve to be beefed up. Another suggestion is for fit and willing former regular soldiers, of whom there are probably about 200,000, to be invited to exercises once a year.

The issues undermining Britain’s armed forces come up time and again: endemic skills shortages across all branches of the services; a culture of applying short-term fixes; a broken procurement system that too often results in poor value for money. But the gap between capabilities and ambition is becoming more glaring as the risks to Britain’s security multiply—not least from what the potential election of Donald Trump might mean for Europe’s security architecture.

Ministers pay lip service to the dangers the country now faces. But almost nothing has changed since the cuts announced in 2021. The prime minister has said that defence spending will rise to 2.5% of GDP “as fiscal and economic circumstances allow”. This is a formulation that scarcely matches the scale of the problems and the gravity of the moment. ■



Britain and Europe

Ever closer?

BERLIN, BRUSSELS AND PARIS

How does the EU view the prospect of a Labour government?

THE IMMEDIATE reaction of European leaders to a widely expected Labour election win later this year would be a sigh of relief. After eight years of often tense relations with several Tory prime ministers, dealing with a pro-European Labour one would make a pleasant change. The EU remains by far Britain's largest trade partner; indeed, its share of British total trade has been rising in recent years. The deteriorating geopolitical situation has added to the case for closer cross-channel co-operation. It helps that old fears that Brexit might be copied by others in the EU have largely evaporated.

Yet Sir Keir Starmer, the Labour leader, remains cautious about Britain's relationship with the EU. He has promised not to reverse Brexit, and has ruled out rejoining the single market or the customs union. Instead, he wants to make Brexit "work better", a task already begun under Rishi Sunak, the prime minister. A year ago Mr Sunak signed the Windsor framework to simplify border checks between Great Britain and Northern Ireland (this week the Democratic Unionists swallowed their opposition to this and agreed to return to devolved government in Belfast). Britain has also rejoined the EU's Horizon and Copernicus scientific-research projects.

On the other side of the Channel, too, a warm welcome may not signal big changes. EU leaders have bigger problems to deal with. The war in Ukraine, a stuttering economy, a renewed migration crisis, the rise of far-right parties and the opening of debate over the club's next eastward enlargement all seem more pressing than improving relations with a former member. Officials note proudly that the Brexit trade deal signed by Boris Johnson in early 2020 is tilted pretty heavily in the EU's favour by providing for broadly free trade in goods but not in services.

The trade deal is up for review in 2025. But Fabian Zuleeg of the European Policy Centre, a think-tank in Brussels, detects no appetite for a fundamental renegotiation. Even resolving an array of niggling bilateral problems may be tricky.

One EU ambassador says a big priority for Europeans is improved mobility. Brexit has made it harder and more expensive for musicians, schoolchildren, interns and young people to travel in both directions. Red tape and visa costs could be reduced without bringing back unrestricted free

movement. The Europeans would also like Britain to rejoin the Erasmus scheme for student exchanges, though that may be opposed by the Treasury as it will cost money. Mutual recognition of professional qualifications is also complicated, because it touches on the single market.

Labour has proposed a veterinary agreement that would facilitate trade in farm products as well as further reducing border checks between Great Britain and Northern Ireland. Sir Keir has also talked of broader alignment with EU regulations in areas ranging from chemicals to carbon pricing. Yet EU officials are still nervous about British cherry-picking of bits of the single market that it likes without taking on the associated obligations.

A veterinary deal, for example, would imply acceptance of a role for the European Court of Justice, and maybe even payments into the EU budget. It is not clear that Labour has much appetite for this, let alone a Tory party that may lurch in a more anti-European direction after the election. Indeed, the risk that a future Conservative government might reverse any deals done by Labour will make them harder to agree.

The most promising path lies in areas where the EU sees benefits for itself. Laurence Boone, France's outgoing Europe minister, says this is most obvious in foreign and security policy, where closer links between Britain, France and Germany are desirable. The political declaration preced-

ing the trade deal envisaged such co-operation, but Mr Johnson rejected the idea. Wars and rising tensions with Russia and China underline the need to stick together. As Mujtaba Rahman of the Eurasia Group, a consultancy, notes, so does a possible return of Donald Trump to the White House.

None of this will satisfy those around Sir Keir who would dearly like to rejoin the EU. But that is implausible for now, especially if the Tories are opposed. Entry negotiations would take years, and the terms would be less favourable than before Britain left. Moreover, the EU is changing fast. In the foreseeable future it may expand to include several more eastern neighbours (including Ukraine), its spending and borrowing are likely to grow and almost all of today's members will become large net contributors to the budget.

Breternal optimism

British pro-Europeans may yet find crumbs of comfort in this prospect. For many agree with Ms Boone that an EU with as many as 35 members cannot work as now. An unofficial Franco-German paper published in September envisaged a tighter core of members committed to ever-closer union alongside a looser group that might be associate members but retain access to the single market. Anna Lührmann, Germany's Europe minister, talks of "flexegration". A multi-tier, multi-speed Europe might appeal not just to aspirant eastern members but also to non-members like Britain, Norway and Switzerland.

A new Labour government is not likely to lead to transformed relations with the EU. But cross-channel links that have dwindled since the Brexit vote in June 2016 would be strengthened. Some bolt-on agreements ought to be doable. And in time Britain's European destiny might take a different form entirely. ■



Bagehot | The search for Tory unity

The most powerful urge in British politics



IF AN ELECTORAL atom bomb reduced the Conservative Party to just two MPs, it would still be deeply divided. Sir John Hayes is the MP for South Holland and the Deepings, the safest Tory seat in Britain. He is the chairman of the Common Sense Group, a caucus which believes in a cultural struggle against wokery, mass immigration, the Human Rights Act and people Sir John calls “globalists”. The second safest Tory seat, and its geographic neighbour, is Boston and Skegness, held by Matt Warman. He is a rising star of the One Nation Group, a rival tendency of Tory centrists who believe in the defence of institutions and fiscal prudence and who are at ease with social change.

These two very different Tories are nonetheless usually found in the same voting lobby at Westminster. Like a lunar orbit sustained by the interplay of centrifugal force and gravity, the Conservative Party is trapped between two opposing instincts. One is ideological division, the other a craving for unity. The struggle to reconcile them is the cause of most of its agonies.

At the moment the party is defined primarily by its divisions. It has broken into an alphabet soup of factions. Tory leaders change more often than they used to and the resulting cabinet reshuffles are more brutal. (Anthony Eden sacked one colleague on taking office in 1955; Rishi Sunak fired 17, notes Nicholas Allen, an academic.) On January 23rd Sir Simon Clarke, a former cabinet minister, attempted to trigger a putsch against Mr Sunak himself, warning that the party “will be massacred” at the next election if he stays. MPs disagree on, inter alia, the European Court of Human Rights, the merits of Donald Trump, the Rwanda deportation scheme, tobacco control, net zero and house building. Some of these disputes can be fudged but many cannot.

It may seem like a miracle that the party doesn’t split. But there are good reasons it does not. Unity is strategy. The Tory party has governed Britain for 68% of the 106 years since the granting of universal male suffrage because it has united a right-leaning electorate with a wide coalition of MPs and fluid policies. David Marquand, an academic, has termed the failure of leftists to form a united front the “progressive dilemma”. For conservatives, there has been no question of a regressive dilemma: the Tory party has been the only game in town. Preventing a split on the right—first from

the UK Independence Party and now from Reform UK—has been a driving force within the government for the past decade.

Unity is also psychology. Being an MP is a lonely job. The burden of constituents, the opposition, the press and bullies on Twitter creates a siege mentality; their colleagues may be loons, but they are their loons. Lee Anderson resigned as deputy chairman of the Tories in January in order to vote against legislation to enact the government’s Rwanda scheme, only to abstain because “the Labour lot were giggling and laughing and taking the mick.” The party can inspire almost Leninist loyalty. Theresa May fought back tears as she was forced from Downing Street in 2019; months later she was campaigning on behalf of her nemesis, Boris Johnson.

Leonard Stark, an academic, has written that all party leaders are chosen according to a hierarchy of priorities that puts unity above electability and electability above competence. Mr Johnson, who had few fixed views, promised that only he could weld together a party that had fractured over Brexit. Unity undid him in turn. He was toppled in 2022 after his colleagues resigned en masse. “The herd instinct is powerful,” lamented Mr Johnson at the time. “And when the herd moves, it moves.”

Unity is easier when you have few rules. The Labour Party is a 20th-century bureaucracy whose direction is set by committees, conferences and endless motions. The Tory party is a preliterate tribe which finds consensus informally through MPs listening to speeches, hammering the tables and saying “yeeyeeeyeeeyee”. In Labour factional dominance requires capturing the machine; among Tories, it means winning the argument. A rare point of institutional rigidity—a rule by which Tory MPs can challenge their leader if they submit a certain number of confidential letters—is a source of destabilisation that many would like to jettison.

For all the noise, Mr Sunak’s government can be surprisingly harmonious. He secured a difficult new deal with the EU last year with only 22 rebels, and has only lost one vote during his tenure as prime minister. But the price of unity has also been a lowest-common-denominator agenda: Mr Sunak often prefers to water down legislation than risk a rift. The Rwanda bill is a piece of factional equipoise that no one thinks will work. A decisive party would have either hardened the bill or killed it; instead Tory MPs voted it through with only 11 rebels.

We’re all in this together

Unity can also seem irrational. Most of Sir Simon’s colleagues think that he has lost his mind in trying to install the party’s fourth prime minister in a single parliament. His supporters counter that the real madness lies in uniting around a leader who is steering their party to defeat. (Mr Sunak’s approval rating is net -46, according to Ipsos, a pollster; Sir John Major scored -30 in January 1997, ahead of his landslide defeat to Sir Tony Blair later that year). Division is better than unifying around something voters don’t want, runs the argument.

Many Tories are holding fire until after the election, and what is expected to be a battle to reshape the party. Rival factions are studying electoral projections to tally up how many allies will keep their seats. A foretaste of the jockeying will come on February 6th when Liz Truss will launch a new movement that she optimistically calls “popular conservatism”. But the winner of any future leadership contest will almost certainly pledge to unify a rump party. The Tories are itching for a clarifying schism but they are more likely to muddle through. It is a safe bet that Mr Warman and Sir John Hayes will remain uncomfortable political bedfellows. ■



War in space

Gathering the guardians

COLORADO SPRINGS

Satellites are too important to be untouched by earthly conflict

THE FIRST shot of the next war between the world's big powers, it is often said, will be fired in space. As conflict spreads on Earth, ill omens are emerging in the firmament. As countries race to develop new capabilities in space, some are also building the forces and weapons to fight beyond the atmosphere. On January 28th Iran said it had launched three satellites; Western countries fear they could be used in its ballistic-missile programme. Russia's invasion of Ukraine has opened a new chapter in space war. But America's biggest dread is China, which seeks to match if not surpass America's primacy in the heavens. Admiral Christopher Grady, vice-chairman of America's joint chiefs of staff, explains it bluntly: "Space has emerged as our most essential warfighting domain."

American generals scrutinise the cosmos from Space Command's headquarters in Colorado Springs. "Guardians", as America's new breed of space warriors call themselves, monitor about 15 daily missile launches, from Ukraine to Iraq and North Korea, at the Joint Operations Centre (JOC).

They also watch the fast-growing deployment of satellites, heaps of orbiting junk and the re-entry of objects into the atmosphere. Above all, they look for danger.

Among the most closely observed objects are two recently launched robotic space planes, smaller versions of the space shuttle. America's X-37-B lifted off from Cape Canaveral on December 28th (pictured). China's Shenlong, or Divine Dragon, was lofted a fortnight earlier. Both missions are largely secret. Space planes' ability to undertake long missions, deliver and capture payloads, change orbit and return to Earth to refuel make them potentially important weapons. Russia launched Cosmos 2570 in October, the latest "nesting doll" in orbit: it released a second satellite, which then let out a third. To American commanders, such things look like a test of a "kill vehicle", in other words a projectile for destroying satellites.

A foretaste of space hostilities came on the evening of November 14th 2021, Colorado Springs time, when two electronic bells warned the JOC of a missile fired from Rus-

sia's Plesetsk cosmodrome. Early-warning satellites detected the fireball, ground radars tracked the missile and computers soon projected its unusual trajectory: neither a ballistic-missile nor a satellite launch, but a Nudol anti-satellite weapon aimed at a defunct Soviet spy satellite.

Some in the JOC thought Russia would aim close to the target. Others reckoned, correctly, it would blast the bird. This may well have been a Russian warning to America: stay out of the impending war in Ukraine or risk conflict that will stretch into space. Never mind the 1,800 bits of debris that forced astronauts in the International Space Station (including two Russians) to shelter in their escape craft.

Put your helmet on

Russia's second shot was unambiguous: shortly before its tanks assaulted Ukraine on February 24th 2022 malware spread through part of the KA-SAT network owned by Viasat, an American firm, and operated by a partner. It disabled the satellite-internet modems of some 50,000 European users, among them many Ukrainian military units. Within weeks, however, Ukrainian forces were back online thanks to the vast constellation of smaller Starlink broadband satellites launched by SpaceX, another private company. Russian attempts at hacking and jamming satellite signals persist, and the country has warned that commercial systems "can become a legitimate target for retaliation".



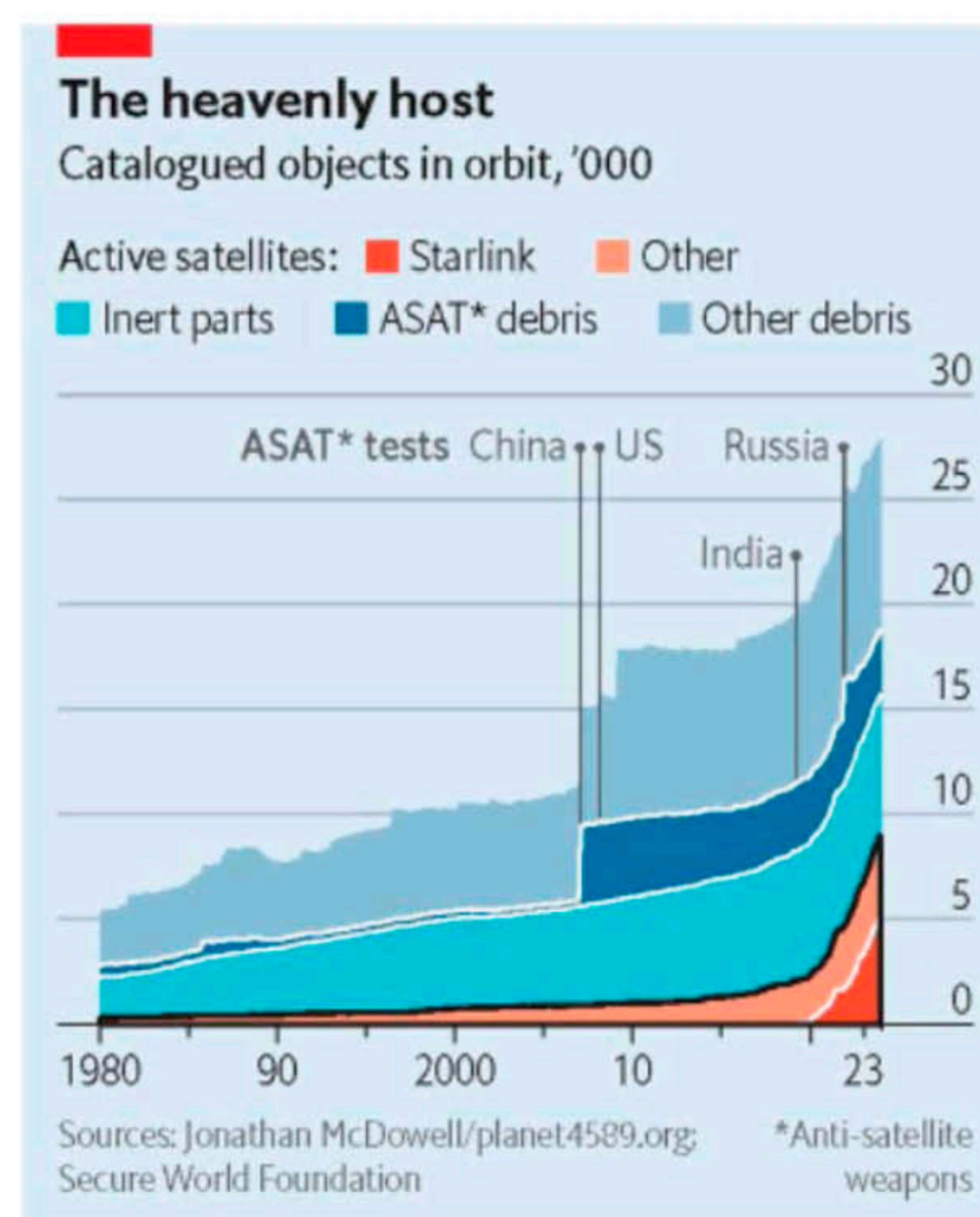
▶ All this shows that space is not just a place for peaceful exploration, but an arena for future combat. Control of space has become as important as dominance on land, sea and air. Space technology makes military forces in all other domains more powerful. Lose primacy in space and you risk losing wars on Earth. In any future conflict between America and China, for instance, satellites would be essential to finding and destroying targets across the vast distances of the Pacific Ocean (see China section). Much about warfare in space remains hidden, and most of what is known comes from America. What is clear, though, is that America is intensifying its effort to preserve its edge in space.

General John Shaw, a former deputy head of Space Command, argues that the world has entered “the third space age”. The first, in the cold war, was dominated by superpowers with large national-security satellites. Intelligence-gathering, early-warning and communications spacecraft were bound with nuclear deterrence. In the second stage, private firms became more prominent as they delivered communications, television and other services from space. Satellites such as the Global Positioning System (GPS) revolutionised conventional warfare, starting with the war in Iraq in 1991. Later on, especially in Iraq and Afghanistan, they made possible precision bombing and long-distance drone operations. Space itself, though, was regarded as a sanctuary.

Not so in the third age. Space services are woven ever more tightly into civilian life—GPS enables everything from financial transactions to mapping apps. Commercial firms such as SpaceX have reduced the cost of launches and satellites. Above all, the era features threats and potential conflict in space, says General Shaw.

Countries are beefing up military space branches. America’s Space Force, the youngest military service, seemed to be a whim of the then president, Donald Trump, when it was launched in 2019. In fact the germ of the idea had been around since at least 2001, when a bipartisan commission warned of a potential “space Pearl Harbour”. Carved out of the air force, and administratively tied to it, Space Force is by far the smallest American military service, but is growing fast. It counts just 8,600 active personnel, compared with 322,000 for the air force, but is likely to expand by 9% this year. Its budget of \$26bn last year, compared with \$180bn for the air force, is set to grow by 15%. Some worry about unnecessary duplication. Others question how far it has succeeded in overcoming a legacy of slow and costly procurement.

Like the air force, navy and other branches, Space Force is placing specialist units within America’s combatant commands, the headquarters responsible for



military operations in the Indo-Pacific, Europe and other regions. Abutting them all is Space Command, also newish, which oversees the “astrographic” domain from 100km above sea level to, in theory, infinity. Among other things, it defends against long-distance missiles and manages satellite services for other commands.

But forget Star Wars, hyperspace-faring spaceships and zapping ray guns. War in space is part of earthly strife. It is also in its infancy. Like hot-air balloons and dirigibles in early aviation, satellites are invaluable platforms for observation but are usually easy to spot, hard to manoeuvre and largely defenceless.

In space offence has the advantage over defence, argues Space Force’s chief, General Chance Saltzman; the side that delivers the first blow can quickly gain the upper hand. “There’s nothing to hide behind in space,” he explains. Satellites move in predictable orbits, and lines of communication with them are exposed.

America, China and India have all tested Earth-based anti-satellite (ASAT) missiles like Russia’s Nudol (see chart). Other threats include ground-based “directed energy” weapons: lasers, high-power microwaves and radio-frequency jammers. All this can be done in orbit, too, which is why “rendez-vous and proximity operation” satellites, which get close to other ones, cause particular jitters. A nuclear blast in space is another worry. America says its satellites are regularly dazzled, jammed and probed remotely.

America’s intelligence agencies say China has fielded ground-based lasers and ASAT missiles “intended to disrupt, damage and destroy target satellites.” Orbital weapons are under development, too. Chinese documents speak of using “surprise, swift, limited-scale, overawing strikes” in space—not as part of war, but to deter one or to force early capitulation. China has the second-largest number of satellites and

the country has stepped up the pace of its launches in recent years.

The Outer Space Treaty of 1967 bans territorial claims on celestial bodies and the stationing of nuclear weapons in space, but it is silent on conventional weapons. It has not prevented echoes of the cold war and earlier imperial land-grabs as America and China seek to establish lunar bases. Some have compared celestial bodies to contested islands in the Pacific.

Space “is increasingly congested, contested and competitive”, says recent military space doctrine from America’s joint chiefs of staff; America should preserve “space superiority”, not least through “offensive and defensive space operations”. Only a few guardians have direct experience of their domain. Some compare themselves to submariners, who must rely on sensors in order to fight shadowy, lurking foes. There is much about space that seems counterintuitive.

On Earth objects need propulsion to keep moving. In space they keep moving because friction is negligible, their orbits determined by gravity. A destroyed plane falls to the ground; a sunken ship goes to the bottom of the sea. The remains of a satellite struck by a missile stay in orbit for years or decades, endangering everything in their path. With enough junk, a collision could start a chain reaction of impacts, known as the “Kessler syndrome”, rendering some orbits all but unusable.

Your circuit’s dead

Instead of rivers and communications nodes, “key terrain” in space consists of orbital regions (see diagram on the next page). Low-Earth orbit (LEO), up to a height of 2,000km, is where most functioning satellites operate. They pass overhead only briefly, so large constellations are needed to ensure continuous coverage. Starlink has more than 5,000 in LEO, with plans to grow to perhaps 12,000 (see Technology Quarterly). Meanwhile China is creating rival mega-constellations.

Geostationary orbit (GEO), about 36,000km away, is a vital but increasingly crowded band. Satellites circle the equator once a day, so appear fixed in the sky, which favours broadcasting, missile-warning and more. In-between, medium-earth orbit (MEO) is used for GPS. The poles are best served by highly elliptical orbits (HEO), looping out to about 40,000km. Beyond, in “cis-lunar” space, lie Lagrange points where the gravitational interplay of the Earth and Moon allows satellites to keep stable positions with little fuel.

Even at orbital speeds—7.8km per second in LEO—actions in space can still seem rather painfully slow. An ASAT missile takes about ten minutes to strike in LEO, and hours to reach GEO. Co-orbital weapons may take days to approach their tar-▶▶

► gets. Friend and foe, private and military users, are intermingled.

Space Command's mission is to ensure there is "never a day without space". That requires it to do three things: detect threats, deter attacks and defeat enemies. Begin with detection. Just understanding what is happening beyond the atmosphere—space domain awareness—is demanding, slow and imperfect. Space Command tracks and publicises the movement of 45,000-odd objects ten centimetres in diameter and wider, of which only 9,400 are active satellites. Radars do not continuously watch all objects in LEO; telescopes monitoring GEO often cannot see in daylight or through clouds or when objects pass in the Earth's shadow; and there are few telescopes in space. Such observation gaps afford foes a chance to act unseen.

The stars look very different today

Surveillance involves predicting the orbit of each object, and confirming it when it passes a sensor. If one goes missing, it must be found and "custody" restored. The more eyes the better. America's main space-monitoring systems have long been concentrated in the northern hemisphere, a legacy of the cold war. But Space Command draws data from any radar it can, eg, those on warships. It is placing more sensors in Australia to cover the southern half of the globe, and is working with allies to share data. America, moreover, operates five satellites called GSSAP that wander in GEO to monitor objects. Guardians have enlisted commercial space-monitoring firms, too. What they lack in high-end sensors they make up for in numbers, global distribution and automation.

One company, LeoLabs, with six radar sites to monitor LEO, gave notice in December of Russia's latest "nesting doll" test. Another, ExoAnalytic Solutions, which specialises in watching GEO with hundreds of telescopes, recounted a striking Chinese satellite-removal manoeuvre in 2022. The SJ-21 satellite, seemingly equipped with a grappling arm and a net, captured a satellite tumbling in GEO and towed it to a graveyard orbit before returning. The manoeuvre was so abrupt that it was lost for some hours. "Like a magician's sleight of hand," in the words of one expert. Another trick is "zombie" objects: supposedly dead rocket motors and satellites that unexpectedly come back to life.

All this causes nervousness about what lurks in the vastness. A clean-up technique in peacetime could quickly turn into a crippling attack. "Deep space" beyond GEO, where it is harder to spot things, is a particular worry. Ultimately, though, any object able to manoeuvre can be steered into the path of another one to destroy it.

All of which emphasises the importance of deterrence. A vital step is to lower

the benefit of an attack through greater resilience. A long-standing priority has been to shift jobs done by a few "big, fat, juicy" satellites in GEO to myriad smaller satellites in LEO, akin to Starlink. The loss or jamming of any one makes little difference, and satellites can be replaced faster than ASAT missiles.

What if a set of orbits is rendered unusable? The answer is to have satellites in different orbits. America's new sensors to detect and track missiles, including hypersonic ones, will rely on constellations in LEO, MEO and HEO, supplementing older systems in GEO.

It helps if lost capabilities can be replaced quickly. On this front America enjoys an advantage. SpaceX alone conducted more launches in the past year than all other operators—private and state-run—combined. But such dominance also raises worries about America's dependence on a single provider, especially one run by an unpredictable CEO, Elon Musk.

Meanwhile, an exercise called Victus Nox in September showed that Space Force could mount and launch a new satellite within about a day, down from a typical 6-12 months. Guardians say they are trying to develop a "tactically responsive" mindset that involves making do and improvising with what is available, and fielding new systems rapidly by tapping into commercial technology. In times of need, they will also look to private firms and allies to provide back-up capabilities.

Space warriors are most cagey about the "defeat" aspect of their mission (a new Pentagon policy on declassifying space and other systems is itself classified). Projectiles are the most visible means to destroy spacecraft. But this may be self-defeating if debris makes parts of space unusable. "It's almost like saying, how do you win a nuclear war?" argues General Saltzman. "There's really just no winner when you go into a destructive on-orbit conflict."

The quest is to develop nimbler defences and surgical strikes. "Dynamic space operations"—the ability to manoeuvre—will

require spacecraft to carry more fuel, or have the ability to be repaired and refuelled in orbit. "Directed-energy weapons are likely to be the primary weapon of choice in space in the future," reckons General Shaw. Such weapons act at the speed of light. If based in space, they are unencumbered by land obstacles or the atmosphere. Satellites will need better protection, too. Some talk of "bodyguard" satellites to detect and counter foes. In time, General Shaw adds, satellites will feature artificial intelligence to act on their own.

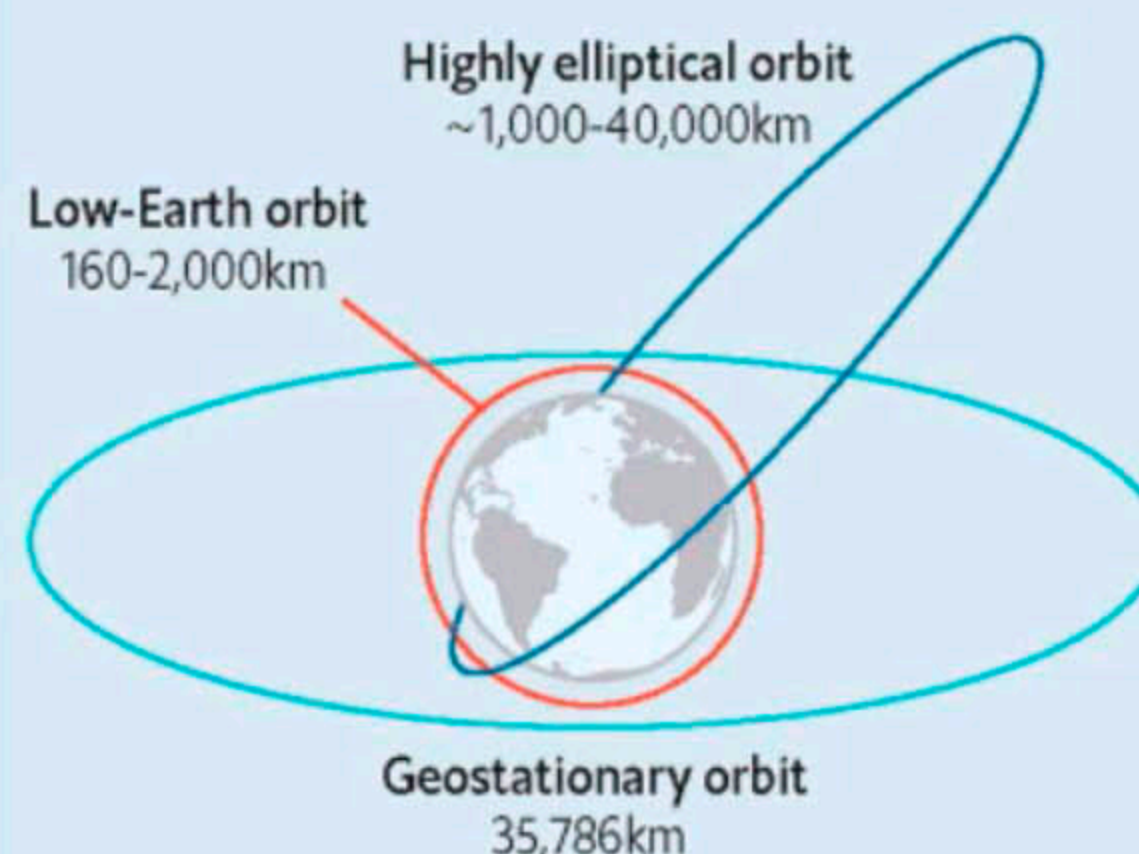
Satellites are only one part of a space system, and may be the hardest part to attack, notes Craig Miller of Viasat. Going after ground stations or communications links may be more effective. Indeed, commanders speak of a triad of military tactics involving space weapons, special forces and, especially, cyberattacks.

Without the experience of real war, guardians must learn from exercises and simulations. The Pentagon's wargames are classified. A recent one explored requirements for dynamic space operations. Henry Sokolski of the Nonproliferation Policy Education Centre, a think-tank in Washington, DC, notes several lessons for America from unclassified games he has run. One envisaged North Korea detonating a nuclear bomb in space, highlighting the need to harden commercial satellites against electromagnetic pulses. Another imagined Pakistani terrorists using commercial satellite imagery and communications to hit India with drones, showing that muddled regulations could play a part in drawing America and China inadvertently into a conflict in space. "The frontline of strategic deterrence is gravitating away from the surface of the Earth and into space," Mr Sokolski says.

If war does break out between America and China, the world will have to worry about much more than the fate of satellites. Perhaps the biggest near-term danger is miscalculation. The contest in space is novel and ambiguous. Nobody is certain what space weapons exist, not least because many civilian technologies have military uses. Rules of the road are ill defined or non-existent, with little prospect for arms control. "Grey-zone" attack, short of war, might thus be tempting. Like cyberattacks, disabling satellites does not usually kill people directly. But were an American early-warning satellite over the Pacific to be attacked, warns Brian Weeden of the Secure World Foundation, an American group that compiles public information on space weapons, perilous escalation might follow. "Washington would freak out and might think it was part of a nuclear attack. The understanding we had with the Soviets in the cold war is that interference with warning satellites would be interpreted as a sign of an impending nuclear attack." ■

Put a ring on it

Selected satellite orbits



Source: CSIS



Technology

After the iPhone

SAN FRANCISCO

The Vision Pro marks a new era of AI-powered gadgetry. It is not alone

APPLE FANS have eagerly awaited February 2nd to get their hands on the tech giant's latest gadget, a new augmented-reality headset called the Vision Pro. Some early reviewers complained that it caused headaches and had a two-hour battery life. Many potential buyers will be put off by the price tag of \$3,499. Still, perhaps 200,000 have been pre-ordered, about 40% of what Apple had reportedly expected to sell this year. Tim Cook, Apple's boss, has described trying the Vision Pro as an "aha moment". "You only have a few of those in your lifetime," he added.

Aha or not, the Vision Pro is part of a trend. In September techies got excited about a new pair of smart glasses made by Meta, Facebook's parent company, and Ray-Ban, an eyewear brand. The spectacles are controlled by voice and can play music, send texts and film everything you see. Two months later Humane, a startup founded by former Apple executives, launched the Pin, a brooch with which users interact by talking and gesticulating. In January the r1, a voice-controlled gizmo half the size of a smartphone, enthralled

attendees at the Consumer Electronics Show in Las Vegas. Its maker, a startup called Rabbit, has sold nearly 100,000.

What all these devices have in common is that they mostly do away with screens, keyboards and mice. Thanks to "generative" artificial intelligence (AI), computers are getting good at listening to, reading and watching stuff—and understanding it. That means hardware can be controlled by voice, gesture or image rather than touch. AI is thus enabling new "form factors"—tech-speak for gadgets in new shapes and sizes, just as the iPhone looked different from older handsets.

→ **Also in this section**

54 **Can AMD beat Nvidia?**

56 **Heirless family firms**

57 **Rolls-Royce goes electric**

57 **Biden's gas gaffe**

58 **Bartleby: CEOs' superpower**

59 **Schumpeter: Trump v TikTok**

Silicon Valley's elite are cheering on the potential shift. They believe AI could create a new market for consumer hardware, replacing the smartphone as everyone's essential device. Sam Altman, boss of OpenAI, the startup behind ChatGPT, is reportedly in talks to start a firm with Jony Ive, former head of design at Apple, to make a gadget purpose-built for AI. Satya Nadella, chief executive of Microsoft, an AI-ambitious tech titan, recently said that "once you have a new interface...new hardware is also possible."

One reason for all the excitement about new gadgets is that the old ones are looking unexciting. Last year 1.2bn smartphones were sold worldwide, down by 3% from the previous year and the lowest level for a decade, according to IDC, a research firm. PCs did even worse, declining by 15% in 2023 to 242m units. Cash-strapped consumers are opting for cheaper alternatives, such as second-hand devices, or holding on to their current ones for longer.

The hope is that they may be persuaded to fork out for all-new gadgets because they offer something that old ones do not. AI could, for instance, make using devices more seamless and more personal. Users can tell or gesture to the r1 to hail a ride, order food or play music without the need to toggle between apps. It also learns from users' previous actions. Until now people had to adapt to software, says Vinod Khosla, a veteran venture capitalist and early backer of Rabbit. In the r1, "the AI adapts to you."

New gadgets are also less finicky to ▶▶

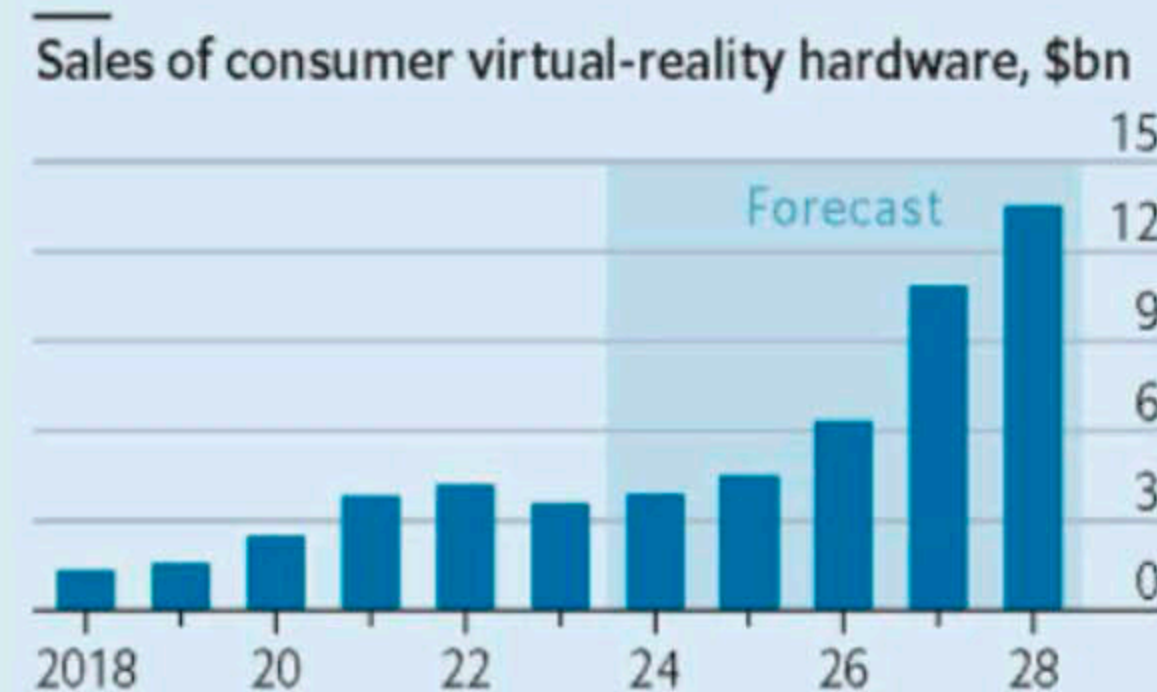
▶ develop and manufacture. Lior Susan of Eclipse, a venture-capital (vc) firm, says that ten years ago building a high-tech widget required hundreds of staff. Today he can do the same thing with about ten. Every step of the manufacturing process has become easier. Initial versions can be mocked up in design software. Rather than buying an industrial machine to make parts for a prototype, they can be ordered from 3D-printing firms like Shapeways. Sensors, batteries and chips can be bought off the shelf. Contract manufacturers, such as Foxconn, no longer insist on working only for big clients like Apple. Some offer dedicated services for hardware startups.

The resulting crop of new AI-powered devices falls into two broad categories. The first is headsets for augmented or virtual reality (VR). So far they have been most popular among gaming enthusiasts. Sales of VR headsets hit around 10m units in 2020 following the release of Meta's Quest 2, estimates George Jijiashvili of Omdia, a research firm. He thinks that the Vision Pro will breathe new life into the industry by making VR appealing to non-gamers (see chart). Promotional videos depict people using the Vision Pro to watch films, work or talk to friends.

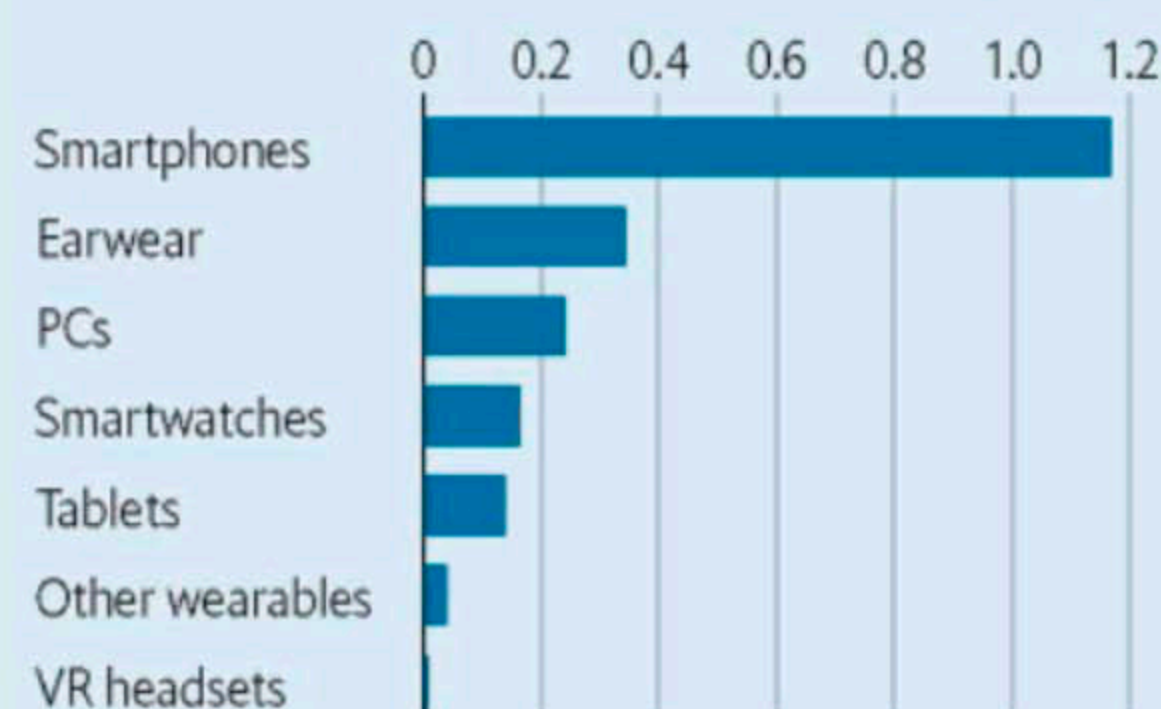
The second category consists of subtler gizmos. Some 540m "wearables" worth \$68bn were shipped last year, according to IDC. Many already incorporate AI in one way or another. They include earphones (which account for 63% of the units sold), smartwatches (another 30%), wristbands such as the Whoop, a fitness tracker, and smart glasses, like Meta's Ray-Bans (which together make up most of the remainder).

Who's the smart one?

Worldwide



Device shipments, 2023, bn



Sources: Omdia; IDC; Gartner

Humane's Pin and AI pendants made by two startups, MyTab AI and Rewind AI, are the latest additions to this group.

All these devices are nifty. Whether they are nifty enough to dislodge the smartphone and become the next big platform is another matter. For that to happen, consumers must take to them. This requires the things, first, to look good—which some failed early efforts, such as the dorky Google Glass specs, did not. The r1 owes its sleek retro feel to Rabbit's collaboration with Teenage Engineering, a Swedish design firm. Before its launch, the Pin appeared on a Paris catwalk at an event held by Coperni, a French fashion house. Meta's glasses are a hit in part because Ray-Ban knows what makes shades stylish.

Second, the new gadgets have to be useful in ways the old ones are not. Many hardware-makers are adding AI to existing devices. On January 31st Samsung started selling an AI smartphone that can do neat tricks such as summarising text-message threads. Microsoft's next generation of laptops and tablets will reportedly include specialist AI chips and a new keyboard button to summon "Copilot", its AI chatbot. Smart speakers, such as Amazon's Alexa and Google's Nest, and earphones, such as Apple's AirPods, are getting revamped with AI features. These including chatbots and, with AirPods, the ability to let through necessary sounds and turn down volume when the wearer is speaking.

To break through, the AI hardware will have to make life either much easier (for instance by booking a whole trip, flight, car and hotel included, with a single command) or much more marvellous (inspiring Mr Cook's "aha moment").

Users will also expect them to perform more than a couple of functions. That means lots of apps. Meta's latest VR headset, the Quest 3, offers 500 or so. The Vision Pro already boasts around 350 purpose-built apps, and can run the iPhone versions of most of the roughly 2m available in the App Store. Humane's Pin, which doubles as a phone, claims to be doing away with apps, instead offering a range of "AI-powered services" from providers such as OpenAI and Google. Rabbit's r1 piggybacks on smartphones' existing app universe, at least for the time being.

Third, although manufacturing things has got easier, managing supply chains remains the hardest part of running a hardware business, notes Shaun Maguire of Sequoia, another vc firm. Suppliers may take phone calls from smaller firms but some are still reluctant to give good prices to unproven newcomers with small orders.

None of the available AI devices overcomes all three challenges. Those that look pretty, like the r1, the Pin or Meta's Ray-Bans, seem to be peripherals more akin to AirPods than the iPhone. Independently

useful ones like the Vision Pro or the Quest are dorkier than Google Glass, and much clunkier. In addition, developing apps for Apple's headset is expensive, which is putting off developers, including some videogame studios, Netflix, Spotify and YouTube (which also happen to compete with Apple's own video and music-streaming services). Production problems afflict just about everyone. Jesse Lyu, founder of Rabbit, says that it took his product becoming an overnight sensation for him to gain a bit more bargaining power over his suppliers. Even Apple, the master of supply chains, reportedly had to scale back initial plans to ship 1m Vision Pros this year because of the complex manufacturing involved.

If some gadget-makers clear all three hurdles, they may stumble on another: keeping up with the breathtaking pace of AI advances. Apple took seven years to develop the Vision Pro, aeons in AI time. Even the next generation of Rabbit's device, which Mr Khosla says will be ready as soon as this summer, may be outmoded by the time it gets into users' hands. One of today's AI gadgets may one day dethrone the smartphone. More likely, the winning form factor has yet to take shape. ■

Semiconductors

The AI-chip race

AMD wants to give Nvidia a run for its money

"IT IS THE most advanced AI accelerator in the industry," boasted Lisa Su, boss of Advanced Micro Devices (AMD), at the launch in December of its new MI300 chip. Ms Su rattled off a series of technical specifications: 153bn transistors, 192 gigabytes of memory and 5.3 terabytes per second of memory bandwidth. That is, respectively, about 2, 2.4 and 1.6 times more than the H100, the top-of-the-line artificial-intelligence chip made by Nvidia. That rival chip-maker's prowess in the semiconductors fuelling the AI boom has, over the past year, turned it into America's fifth-most-valuable company, with a market capitalisation of \$1.5trn. Yet most experts agreed that the numbers and Ms Su weren't lying: the MI300 does indeed outshine the H100. Investors liked it, too—AMD's share price jumped by 10% the next day.

On January 30th, in its quarterly earnings call, AMD announced that it expected to sell \$3.5bn-worth of MI300s this year. It also reported strong revenues of \$23bn in 2023, four times what they had been in 2014, when Ms Su became chief executive. Its market value is up 100-fold on her ▶▶

watch, to \$270bn. Relative to forecast profits in the next 12 months, its valuation is richer even than Nvidia's. Last year it displaced Intel, which once ruled American chipmaking, as the country's second-most-valuable semiconductor company. Now it is taking aim at the biggest.

Such ambition would have seemed fanciful a decade ago. Back then, recalls Mark Papermaster, AMD's technology chief, AMD was facing an "existential crisis". In 2008 it had spun off its chip-fabrication business to focus on designing processors, outsourcing manufacturing to contract chip-makers such as TSMC of Taiwan. The idea was to be better able to compete on blueprints with Intel, whose vast fabrication capacity AMD could not hope to match.

It didn't work. Several of AMD's chips flopped. Sales of its central processing units (CPUs), mostly for personal computers, were collapsing. In 2013 it sold and leased back its campus in Austin to raise cash. A year later Ms Su inherited a net-debt pile of more than \$1bn, a net annual loss of \$400m and a market value of less than \$3bn, down from \$20bn in 2006.

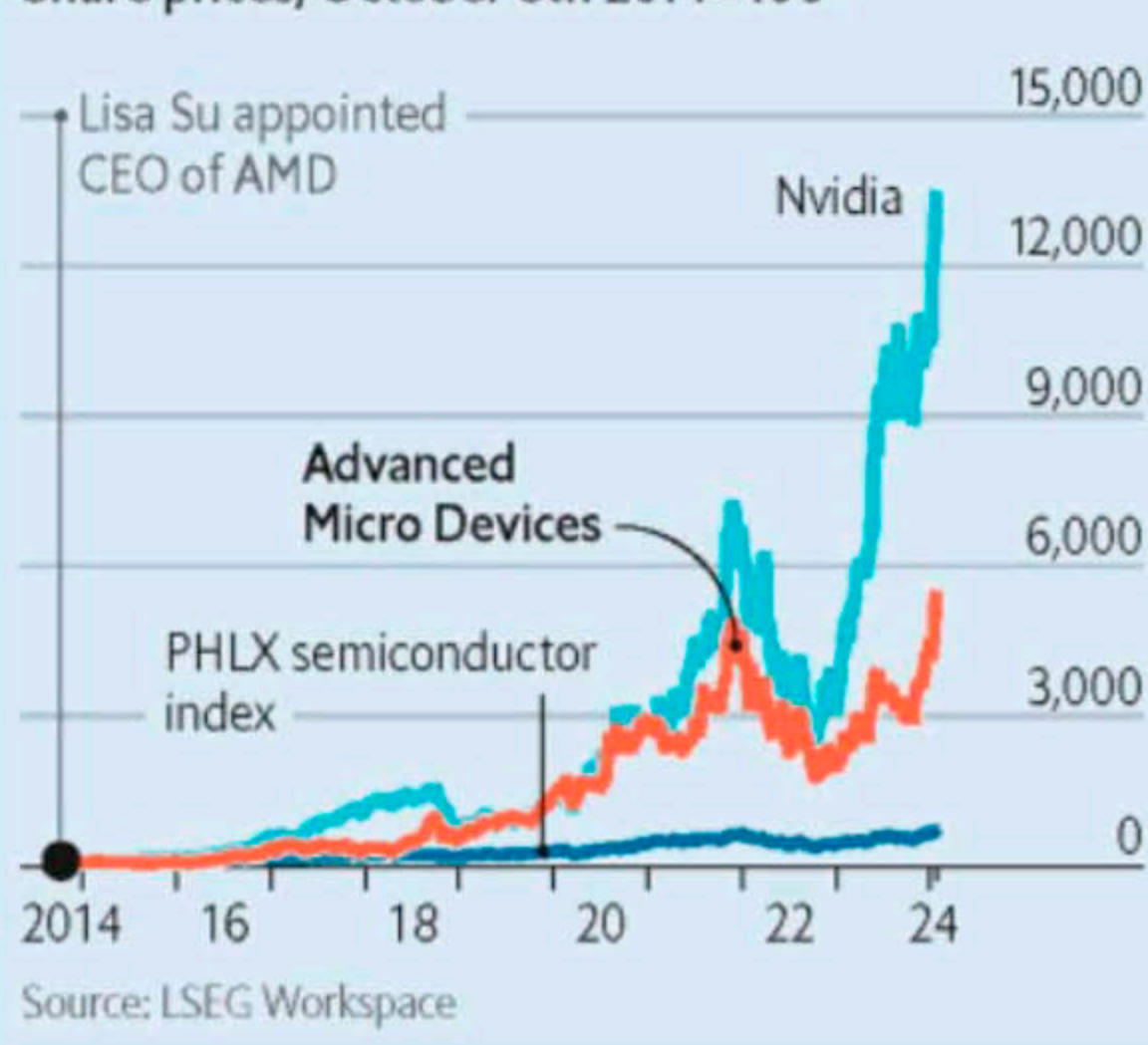
She realised that the only way for AMD to get back in the game was to steer it away from the sluggish PC market and focus on more promising areas like CPUs for data-centre servers and graphics processing units (GPUs, which make video-game visuals lifelike) for gaming consoles. She and Mr Papermaster took a gamble on a new CPU architecture designed to beat Intel not just on price, but also on performance.

When the going got tough

The idea was to use a Lego-like approach to chip building. By breaking a chip up into smaller parts, AMD could mix and match blocks to assemble different types of chip, at a lower cost. When the first such composite chips were released in 2017, they were zippier and cheaper than rival offerings from Intel, possibly in part because Intel was distracted by its own problems (notably repeated manufacturing slip-ups as it moved to ever tinier transistors). In

Hit the accelerator

Share prices, October 8th 2014=100



the past ten years AMD's market share in lucrative server CPUs has gone from nothing to 30%, breaking Intel's monopoly.

Having faced down one giant, AMD now confronts another. The contest with Nvidia is different. For one thing, it is personal—Ms Su and Jensen Huang, Nvidia's Taiwanese-born boss, are distant relatives. In contrast to Intel, Nvidia is, like AMD, a chip designer and thus less prone to production missteps. More importantly, the stakes are higher. Nvidia's market value of \$1.5trn is predicated on its dominance of the market for GPUs—not because of their usefulness in gaming but because they also happen to be the best type of chip to train AI models. Ms Su expects global sales of AI chips to reach \$400bn by 2027, up from perhaps \$40bn last year. Does she stand a chance against Nvidia?

Nvidia is a formidable rival. Both its revenues and operating margins are nearly three times AMD's. According to Jefferies, an investment bank, the company dominates the market for AI accelerator chips, accounting for 86% of such components sold globally; before the launch of the MI300, AMD barely registered. Nvidia also offers network gear that connects clusters of chips, and software, known as CUDA, to manage AI workloads. Nvidia has dominated AI chipmaking because it has offered

the best chips, the best networking kit and the best software, notes Doug O'Laughlin of Fabricated Knowledge, a research firm.

AMD's new processor shows it can compete with Nvidia on semiconductor hardware. This, Mr Papermaster says, is the result of a ten-year investment. AMD is spending nearly \$6bn a year on research and development, nearly as much as its larger rival—and twice as much as a share of sales (see table). This has enabled it to adapt its Lego approach to GPUs. Combining a dozen blocks—or "chipllets"—into a single chip lets AMD put processors and memory close to each other, which boosts processing speed. In December OpenAI, maker of ChatGPT and the world's hottest AI startup, said it would use the MI300s for some of its training.

To outdo Nvidia on networking and software, AMD is teaming up with other firms. In December it announced a partnership with makers of networking gear, including the two largest, Broadcom and Cisco. It is also supporting an open-source initiative for chip-to-chip communication called Ultra Ethernet Consortium as an alternative to InfiniBand, a rival championed by Nvidia.

Chomping at the byte

Nvidia's lead in software will be harder to close. It has been investing in CUDA since the mid-2000s, well before the current AI wave. AI developers and researchers love the platform, which allows them to fine-tune the performance of Nvidia processors. AMD hopes to tempt customers away from Nvidia by making its software, ROCm, open-source and providing tools to make the switch smoother, by translating CUDA programs into ROCm ones.

Beating Nvidia at its own game will not be easy. Mr Huang's firm is not standing still. It recently announced plans to bring out a new chip every year instead of every two years. The tech giants with the grandest AI ambitions—Alphabet, Amazon, Meta and Microsoft—are busily designing their own accelerator chips. Despite AMD's robust sales, investors were disappointed with its forecast for MI300 shipments. Its share price dipped by 3% the day after it reported its latest results.

Still, AMD has one big thing going for it. It is not Nvidia. AI companies are desperate for an alternative to its larger rival, whose dominant position allows it to charge steep prices and, with demand outstripping supply, ration chips to buyers. Despite efforts to design their own hardware, big tech firms will rely on chipmakers for a while, and AMD gives them options, notes Vivek Arya of Bank of America. Microsoft and Meta have already announced plans to use AMD's GPUs in their data centres. And if Nvidia slips up, AMD will be there to pick up the Lego pieces. Just ask Intel. ■

Ingredients of a fine chip

Selected financial measures

	Revenues 2023*, \$bn	Market capitalisation Jan 31st 2024, \$trn	R&D† spending 2023*, \$bn
Nvidia	59.1	1.52	6.6
Intel	54.2	0.18	16.0
Advanced Micro Devices	22.7	0.27	5.9

	Cash and equivalents Q3 2023, \$bn	Operating margin 2023*, %	Forward p/e‡ ratio Jan 31st 2024
Nvidia	18.3	59.6	29.9
Intel	30.7	8.6	29.2
Advanced Micro Devices	5.8	21.0	40.8

Sources: Bloomberg; LSEG Workspace

*Financial-year forecasts for Nvidia
†Research and development ‡Price-to-earnings



Intergenerational business

How to succeed with no successor

TOKYO

Many family firms lack heirs. Unrelated help is at hand

HANDING OVER a family business to the next generation can be a dramatic process. If the company is big and progeny bountiful, the intrigue is followed with zeal by both the financial press and the tabloids. When 29-year-old Frédéric Arnault, the second-youngest of five scions of the LVMH luxury empire, took over its watch unit at the start of the year, speculation swirled about the succession plan being put in place by his billionaire father, Bernard Arnault. Yet many more heads of family firms face the opposite predicament: they have no heir at all.

Legions of entrepreneurs born in rich countries during the two-decade baby boom starting in the 1940s are close to retirement age or past it. Some, like Giorgio Armani, the 89-year-old founder of the Italian fashion house, are childless. Others have offspring who want to chart their own career paths. Dalian Wanda, a sprawling Hong Kong conglomerate, faced a public headache when it turned out that the only child of the founder, Wang Jianlin, would not take over the company.

Most heirless firms are not quite so large or well-known. But they are numerous. Owners aged 65 or over run 23% of American firms with at least one employee, up from 20% in 2017. The share of German business-owners who are over 60 is 31%, three times the figure two decades ago. Only one in ten is younger than 40. By 2025 almost 2.5m small and medium-sized

businesses in Japan will have owners in their 70s or older, reckons the country's economy ministry. Half of that group have made no plans for a handover.

No owner likes to see a life's work fall into desuetude. When otherwise successful companies fold without a new owner or are sold off piece by piece by inheritors, they also lose valuable know-how and intangible assets. Collectively, their disappearance into oblivion may be a drag on the broader economy's productive potential. Fortunately for owners and governments, help is at hand thanks to a fast-growing industry of pseudo-heirs.

The most established group of helpers, called search funds, is an offshoot of America's private-equity industry. The first such fund was created in 1984 by a professor at Stanford University's Graduate School of Business (GSB). Many are run by one or two MBAs in their early 30s—GSB graduates were historically particularly common. They raise capital from outside investors, identify one small or medium-sized company, typically worth less than \$10m, buy it from its owners and take over as full-time chief executives.

Search funds are now popping up across the Atlantic, where Europe's ageing economies offer rich pickings. Arturo Alvarez, a Spanish search-fund founder, says he has looked at 3,000 companies in Spain and Portugal over the past two years or so, and has sat down for a conversation with

about 400, of which he will pick just one. Jürgen Rilling, an investor in search funds from Munich, notes that many of the more than 500,000 small and medium-sized firms in Germany's formidable *Mittelstand* with annual sales of between €2m (\$2.2m) and €50m are run by old-timers who might prefer to be soaking up the sun on Majorca.

The next target may be Japan. In the past some Japanese founders with no male heir relied on the practice of adult adoption—a son-in-law or loyal employee can become the legal descendant of a business owner, avoiding gift taxes. Nowadays adopted daughters are acceptable, too. But relentless demographic trends are making such adoption ever harder. Japanese 70-somethings, of whom there are 16.4m, outnumber 20-somethings by four to three.

Strangely, the world's most demographically challenged big economy has so far not attracted many search funds. Some enterprising types are, however, profiting from its demographic cliff in other ways. M&A Research Institute, created in 2018 and listed in Tokyo in June 2022, is a succession broker. It uses clever machine-learning algorithms to match buyers, mostly private-equity firms or larger Japanese companies, and sellers. Two-thirds of its target businesses are worth less than \$3.5m. The firm's 32-year-old founder, Sagami Shunsaku, says that about four in five of the owners he encounters want to sell because they have no alternative plan for succession. Some are in their 90s.

The pseudo-heir industry is still tiny. Between 1986 and 2021 search funds made deals worth just \$2.3bn in total. But they are rising in popularity: a third of that figure was invested in 2020 and 2021 alone, with a fair bit more almost certainly deployed since.

And they are doing a roaring trade. According to one GSB study, the typical search fund boasts an annual internal rate of return (IRR)—the private-equity industry's preferred performance measure, which calculates returns on deployed capital but ignores any uninvested money—of 35%. By comparison, conventional private-equity funds generated an IRR of around 15% over the past two decades. Jan Simon of IESE Business School in Spain (and an investor in search funds) says that the outsize returns are due to a combination of little competition from bigger private-equity firms, which prefer much larger deals, and plenty of involvement by the young managing partners.

The M&A Research Institute is similarly lucrative. Its operating profit more than doubled in the last financial year, to \$32m. Its share price has risen by over 450% since its listing; last month Mr Sagami's stake made him Japan's youngest billionaire. He is already eyeing other rapidly greying places in Asia, such as Singapore. ■

Rolls-Royce

High Rollers

SUNNINGDALE, BERKSHIRE

The maker of the waftiest luxury cars goes electric

ROLLS-ROYCE IS, in some respects, like any other carmaker. A recently revamped showroom in Sunningdale, close to London and closer still to a renowned golf club where its vehicles would look right at home, does not seem out of the ordinary. Some might think that a bright-yellow Cullinan on display is a tad brash (a spokesperson insists it is “expressive”). But it is an SUV and that makes it the company’s bestselling model, as SUVs tend to be. And, like other car companies, Rolls is embracing battery power, promising to go all-electric by 2030. Deliveries of the Spectre, its first electric vehicle (EV), began last autumn and are expected to make up 20% of sales this year. As part of BMW, it can tap its German parent for EV tech such as battery cells and motors.

Here, though, similarities with the rest of the industry end. For one thing, Rollers are ideally suited to electrification. Batteries do away with the need to muffle engine noise—its adverts once promised that the only disturbance in the cabin is the ticking clock. While other firms fret about the affordability of EVs, the Spectre’s £330,000 (\$420,000) list price will not make buyers’ eye water. That is more than a petrol-powered Cullinan or Ghost, a smaller saloon, but a bargain compared with the Phantom limo, which will set you back £420,000. And it is merely the starting price onto which you affix pricey add-ons. The aver-

age Rolls in fact sells for around £430,000. The firm sees itself as a luxury-goods firm rather than a carmaker. No kidding.

On closer inspection, the showroom is distinct, too. It harbours an *atelier*, a wood-panelled haven where customers can stroke rare leathers, assemble models to assess two-tone paint schemes or admire a roof lining of 1,340 LED lights mimicking the night sky.

If this were not bespoke enough, they can visit the company’s base in Goodwood in Sussex or a handful of “private offices” around the world to liaise with designers and commission more elaborate touches. Last year a Middle Eastern client ordered a car bedecked with mother of pearl and a roof lining of the stars on the day he was born. The feeling of membership of an exclusive club is enhanced by Whispers, an app that connects to your car but also acts as a social network for owners, where plutocrats can chat with fellow plutocrats.

Rolls-Royce is tiny, guaranteeing the exclusivity that attracts the richest motorists. It delivered just 6,032 cars in 2023 but has a monopoly over the priciest vehicles, ensuring bulging order books. Few carmakers command its net margins, reckoned to be over 20% (BMW does not disclose such uncouth details).

If there is a bump in the road it is one that Rolls will probably glide over. It sold only 11 more cars last year than in 2022. Sales in China, its second-largest market after America, fell as a struggling economy took its toll. But the marque has always traded on rarity rather than volume. It is expanding a scheme to make more bespoke models. Ever more buyers want exclusive—and expensive—features, such as scent-releasing headrests. And, happily for Rolls-Royce, they are prepared to pay through the nose to get them. ■

The energy transition

Gas gaffe

NEW YORK

Why does Joe Biden want to curb American LNG exports?

“FREEDOM GAS” saved Europe from an energy crisis. The old continent’s imports of American liquefied natural gas (LNG), first equated with liberty by Donald Trump’s administration in 2019, ballooned from 16m tonnes in 2021, the year before Russia invaded Ukraine and all but stopped piping gas to Europe, to 46m tonnes last year. The decisions to redirect LNG cargoes destined for Asia and elsewhere to Europe were made by private companies. But they enjoyed strong official support from Mr Trump’s successor, Joe Biden. So did LNG exports more broadly, turning America into the world’s biggest exporter, ahead of Qatar and Australia.

On January 26th Mr Biden threw a spanner in the gasworks. He announced a “temporary pause” on pending LNG-export projects such as gas terminals, so that officials can scrutinise their economic, security and environmental impact. The decision is not an export ban and does not halt initiatives that have already been approved by the Department of Energy. But it does freeze a few big proposed but unapproved projects that would benefit countries which do not have free-trade agreements with America (a large group which includes big markets in Europe and Asia).

The move delighted those climate campaigners who claim that LNG is not about freedom but about locking economies into continued dependence on fossil fuels. It disappointed the more level-headed sorts who see natural gas as a cleaner “transition fuel” that would help ease the shift to greener energy, especially in light of Mr Biden’s efforts to crack down on methane, a powerful greenhouse gas that can leak during the production and transport of the fuel. To America’s allies, it was another example of how the superpower is becoming an ever more unreliable partner.

For Mr Biden, though, it was all about politics. To stop the war in Ukraine from disrupting energy markets, his administration has overseen a big expansion in domestic fossil-fuel output. As well as being the world’s top LNG exporter, America continues to be the biggest oil producer. That angers the climate-anxious left wing of Mr Biden’s Democratic Party. In announcing the pause, Mr Biden adopted its language. His decision, he said, “sees the climate crisis for what it is: the existential threat of our time”. The head of a big environmental group calls it “a big win for progressives in ▶▶



A Spectre of profits

▶ an election year". Bill McKibben, an influential activist behind a campaign to end LNG exports, declared that "We all just won...I have a beer in my hand".

Mr McKibben may want to keep that beer on ice. As Joseph Majkut of the Centre for Strategic and International Studies, a think-tank, wryly points out, the impact of the pause on global markets—and thus on global emissions, which is what matters to the climate—will be minimal. Forgone American exports will be offset by fresh supplies from Qatar, Australia and elsewhere. "I think there is an opportunity,"

declared Jonathan Wilkinson, Canada's energy minister, on January 30th.

Moreover, American hydrocarbons will wash over world markets, pause or no pause. Should the carbon-cuddling Mr Trump return to the White House, which polls suggest is as likely as not, America will drill, baby, drill. Even if Mr Biden staves off the Trumpian challenge, America will keep producing lots of LNG. The approved projects alone would propel American exports to a level 50% above those of Qatar, a gas superpower, by 2030.

And if the extra scrutiny of projects

pledged by Mr Biden, combined with his methane crackdown, leads to further reductions in the carbon-intensity of American LNG, that would make the stuff more competitive in places like Europe and Japan, which want their fuel produced in the cleanest way possible, argues Amy Myers Jaffe of New York University. The movement that sought to topple America's LNG industry would then, in other words, shore it up instead, while damaging American alliances, which some of the same left-wingers would prefer to preserve. Mr McKibben had better enjoy a bitter. ■

Bartleby Klopped out

From football managers to CEOs, energy is a superpower

JÜRGEN KLOPP is a football manager. That means there is a limit to how much he can teach corporate bosses about how to do their jobs. Managers in firms tend not to be parent substitutes to their charges, envelop people in bear hugs after a successful meeting or use the *gegenpressing* technique against rivals. But Mr Klopp has drawn back the veil on a crucial ingredient of success in almost every walk of life: energy.

To general surprise Mr Klopp announced on January 26th that he would be leaving his job as manager of Liverpool Football Club later this year. His team is leading the English Premier League, the most-watched competition in the world's most popular sport. His job is secure—his contract does not run out until 2026—and he claims still to love it. But after eight years in the role, and more in management, he is running out of energy. His resources are finite, he said. "I can't do it on three wheels, I don't want to be a passenger."

Mr Klopp is not the first high-profile person to make this kind of decision. Jacinda Ardern resigned as prime minister of New Zealand in January 2023, saying that she no longer had enough in the tank to do the job. Jeff Kindler cited the extreme demands of his role when he stopped being the boss of Pfizer, a drug-maker, in 2010, saying he was looking forward to recharging his batteries. But admissions like this are nonetheless rare from someone leading an organisation.

For energy is one of those factors that reliably differentiates bosses from those below them. Ability, ambition and luck all play a big part in climbing the greasy pole. But energy plays an outside role. High-achievers have done their email and a full workout before the sun rises. They don't cancel breakfasts because

they are feeling a bit tired; they certainly don't admit to doing so. They are less likely to nod off in the middle of the afternoon. They get off the red-eye and work a normal day.

And that is just on the way up. Talk to people who have made the leap to CEO and they will frequently comment on how intense the job is, and how hard it is to switch off. Most organisations are pyramids. As decisions get tougher and more important, they land on an ever smaller number of individuals. And as these figures become more senior, the number of people who want to see them goes up.

The boss has to show their face to employees regularly, and it cannot be the face of someone who looks like they haven't slept for two weeks. They have to glad-hand the board, meet investors, attend endless networking events and make time for actual work. It is exhausting to contemplate, let alone do.

The sheer physical demands of big jobs mean that certain types of people have an advantage over others. Not having too many other calls on your time helps,

which tends to be bad news for women, who shoulder more chores and caregiving duties at home than men.

Extroversion offers an edge in terms of oomph. A survey of CEO time-use from 2017, conducted by Oriana Bandiera of the London School of Economics and her co-authors, found that bosses spend 70% of their time interacting with colleagues, clients and the like. If you are the kind of person who derives energy from spending time with other people, this is like being a phone on charge all the time. If you are introverted and find other people draining, your battery will be close to 1% and it is only a matter of time before you shut down completely.

Some lucky people naturally have more zip. These are the mitochondrial CEOs who can get by on three hours' sleep and do not know what it is like to grope for the snooze button. But if you haven't won the biological lottery, you can still work out what reinvigorates and what enervates. That might mean exercise at dawn, power naps in the afternoon or just protecting your calendar; when he was running Amazon, Jeff Bezos would aim for eight hours' shuteye a night and try not to schedule meetings before 10am. It means prioritising rest rather than getting by on less of it. In their book "The Mind of a Leader", Rasmus Hougaard and Jacqueline Carter found that senior executives were likely to sleep more than non-executives.

In admitting that his energy stores are now becoming depleted, Mr Klopp has offered an unusual reminder of how punishing leadership roles can be. His decision to hang up his Liverpool tracksuit brings to mind the aphorism of another great football manager, Sir Alex Ferguson. Hard work is a talent, Sir Alex liked to say. But it is also just hard.



Schumpeter | Bigmouth strikes again

How much should TikTok fear a resurgent Donald Trump?



UNLIKE WAR correspondents, business columnists do not risk their lives to bring stories to light. But they do occasionally make sacrifices on behalf of their readers. Schumpeter's most recent forfeiture has involved exploring TikTok for videos about Donald Trump. In truth, the subject matter is more fun than you would think. Mr Trump is made for gangsta rap ("DAS acting silly/ My mugshot's worth a billi/Sold some merch and made a milli," an artificial-intelligence version of his voice intones on the app). He warms the hearts of pro-racketeering Latino rappers ("Made me relate when they hit you with the RICO, now the whole 'hood is screaming 'Free Trumpito'"). The dangers are evident, though, when your columnist returns to his normal TikTok feed. Already the algorithm has polluted it with anti-woke jokes and so much Vivek Ramaswamy that he cannot swipe fast enough.

Sympathy for Mr Trump on TikTok is interesting. After all, in 2020 he sought to ban it, pressed ByteDance, its Beijing-based parent, to sell it to an American firm, and accused China of spying on its users' data and spreading propaganda (TikTok says it has never shared data with the Chinese government). It is such a bugbear to senior Republicans that it provoked one of the most risible moments of the primary debates—when Nikki Haley, a presidential contender, mocked Mr Ramaswamy, a rival, for using the app, then called him "scum" for daring to suggest that her daughter did, too.

Now that Mr Trump is on the verge of defeating Ms Haley for the nomination, and is a coin toss away from the presidency, should TikTok again worry about its future? So far the former president has not attacked it during the campaign, but it may be only a matter of time. Whether TikTok can stay above the fray hinges on three things: political expediency, the courts and its efforts to distance itself from China. None of these is fully within its control.

Mr Trump savours his grudges and the one against TikTok is no doubt acute. But before deciding whether to renew his crusade against the platform, he has a political calculation to make: how much would he gain by reviving the spectre of a ban compared with how much could he lose by alienating users? In 2020 he may have felt that jeopardising their support was a small price to pay. Many TikTokers, such as the κ-Pop fans who claimed tickets to his rally in order not to show up, were a thorn in his side. But TikTok is

different now. On January 31st Shou Zi Chew, its chief executive, told a congressional hearing that 170m Americans use it monthly. That is up from about 100m when Mr Trump left office. TikTokers are no longer just lip-synching teens. Their average age in America is over 30. Given that they account for more than half the population, it stands to reason many vote Republican. Though Mr Trump does not use the site, he is there by proxy. The hashtag #donald-trump2024 has 445m views on TikTok, compared with 22m for #joebiden2024. That does not reflect support. TikTokers may hashtag Mr Trump even if they hate him. But it does suggest that his presence is more kinetic than his rival's. He may relish that.

Legal obstacles are another reason taking on TikTok should give him pause for thought. Almost every attempt to ban the app has foundered in the courts. Two federal courts ruled in 2020 that Mr Trump's use of the International Emergency Economic Powers Act to in effect ban TikTok in America exceeded his authority. Late last year a judge blocked Montana from slapping the first state-wide ban on the app, saying it violated the free-speech rights of its users. A separate punitive measure started by Mr Trump, using the Committee on Foreign Investment in the United States (CFIUS) to enforce a sale of TikTok on national-security grounds, has hung over the platform during the Biden administration, too. But Mr Biden has his own supporters on TikTok to think about. It is doubtful he would risk antagonising them in an election year by using CFIUS to decapitate their favourite pastime.

TikTok's main line of defence is its own effort to protect users against meddling from China. Under its so-called Project Texas, it has set up an entity in America that it says is sealed off from ByteDance, is staffed by Americans, and stores user data and sensitive technology, such as algorithms and content-moderation systems, in a cloud run by Oracle, a Texan software company. It is voluntary, however, and may not be foolproof; on January 30th the *Wall Street Journal* reported that employees say they sometimes share data with ByteDance. (Mr Chew said "many things about that article" were "inaccurate".) Moreover, the most significant safeguard—reaching a deal with the government to create an independent board to oversee data- and national-security protections, with members vetted and approved by CFIUS—remains elusive. A deal is unlikely to be reached this year. In election season the Biden administration would not dare run the risk of looking soft on China.

China is still TikTok's Achilles heel. Lawmakers grilling Mr Chew (alongside four other tech CEOs) on his platform's response to online child exploitation could not resist airing concerns about TikTok's threat to national security as well. The worry is bipartisan. Under the Biden administration, use of TikTok has been banned on federal-government devices. Congress is mulling attempts to strengthen the president's authority to ban it. If anti-China rhetoric rises during the presidential campaign, TikTok is almost bound to be caught in the crossfire.

If you can't ban 'em, join 'em

Rhetoric is one thing. Securing a ban is another. For all of the anti-TikTok tirades, the app continues to thrive—as a platform, as an advertising medium and, incipiently, as a place to shop. Moreover, prominent mouthpieces for Mr Trump, such as Tucker Carlson, a broadcaster, are keen TikTokers. Ben Shapiro, a pro-Trump pundit, used it this week to promote a hit anti-woke rap song in which he co-stars ("If you want my pronouns I'm the man/I'm the man that don't respect you"). Maybe Mr Trump, potential gangsta-rapper-in-chief, should bury the hatchet and join them. ■

Avoid camping in dry forests

Market participants systematically underestimate the importance of vulnerabilities while correspondingly overestimating the importance of triggers.

Little is needed for a wildfire to start: a dry forest and an ignition. Say, lightning, or a discarded cigarette, or windswept ember from a campfire. While determining where to set up your tent, rather than guessing if, where, and when that deciding spark will alight, it's worth assessing the overall forest conditions first.

Market participants are naturally inclined to believe that forecasting triggers (ignitions)—e.g., what bank might fail next?—and taking action based on them is the way to succeed in investing. After all, triggers tend to get the most media attention and compelling headlines.

In our view, a more repeatable and intellectually honest approach is using non-predictive decision making: a focus on identifying vulnerabilities as opposed to forecasting specific outcomes.

In an uncertain world, there are any number of events that might influence the performance of a given investment; attempting to foretell all of them accurately is impossible. Moreover, trigger events almost

always serve as mere catalysts that expose existing, underlying vulnerabilities.

For example, the historic rise in interest rates over the past year had a profound impact on many companies, but the underlying vulnerabilities were always there. The trigger (a sharp rise in interest rates) revealed how certain businesses had become overly reliant on steadily rising asset prices and easy access to cheap capital during the preceding era of artificially low rates.

As long-term, bottom-up investors, we are skeptical of businesses with high degrees of leverage for this very reason, but there are plenty of other general categories of vulnerabilities we're wary of:

- Unprofitable companies that rely on continued access to capital markets to fund their operations
- Companies run by management teams with little skin in the game and/or poorly aligned incentives

- Businesses whose very existence depends heavily on the government's will to allow them to operate
- Companies whose stock prices provide no margin of safety

To be sure, there are scenarios in which any company can be zeroed; even the strongest businesses have vulnerabilities that can be exposed by the right trigger. This is why we focus on what we can control: steering away from areas where such vulnerabilities are sharpest rather than forecasting catalyzing events.

It's not easy. It requires a disciplined investment approach, well-defined philosophy and process, a culture in which different points of view are welcome and celebrated, and appropriate diversification that builds natural contradictions into the portfolio.

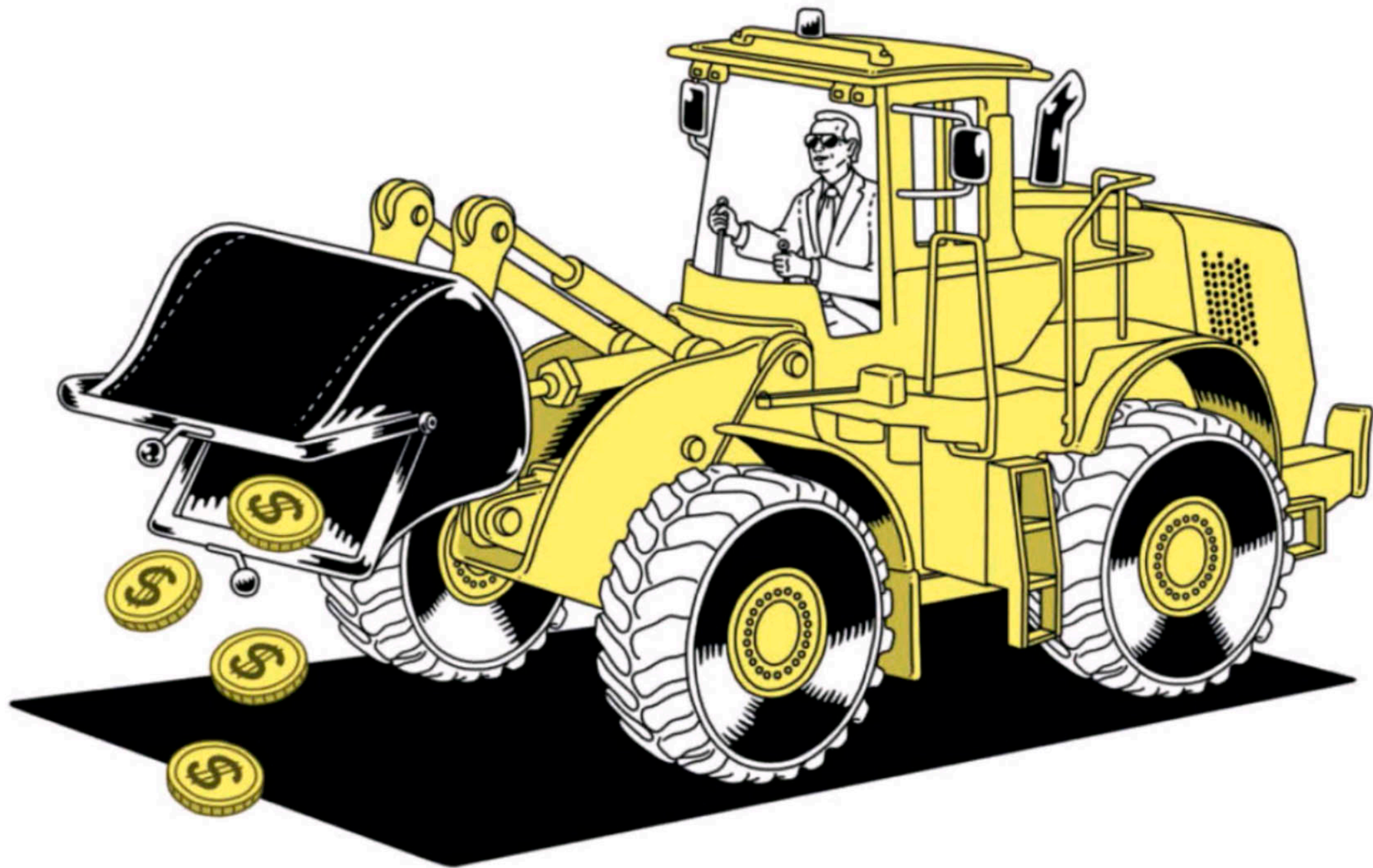
While this "boring" approach may sacrifice possible short-term gains in certain market environments, we believe it leads to better and more consistent outcomes over time.

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A second term

The octogenarian radical

WASHINGTON, DC

What four more years of Joe Biden would mean for America's economy

JOE BIDEN'S opponents focus on his age as something that makes him doddering, confused and ultimately unfit for office. So the great paradox of the 81-year-old's first term is that he has presided over perhaps the most energetic American government in nearly half a century. He unleashed a surge in spending that briefly slashed the childhood poverty rate in half. He breathed life into a beleaguered union movement. And he produced an industrial policy that aims to reshape the American economy.

There is plenty to debate about the merits of all of this. A steep rise in federal spending has aggravated the country's worrying fiscal trajectory. Subsidies for companies to invest in America have angered allies and may yet end up going to waste. But there is no denying that many of these policies are already having an impact. Just look at the boom in factory construction: even accounting for inflation, investment in manufacturing facilities has more than doubled under Mr Biden, soaring to its highest on record.

What would he do in a second term? Mr Biden's re-election motto—"We can finish

the job"—sounds more like a home contractor's pledge than the rhetoric of a political firebrand. Yet to hear it from the president's current and former advisers, Bidenomics amounts to little short of an economic revolution for America. It would be a revolution shaped by faith in government and a mistrust of markets.

Five elements stand out. The first is a desire to boost workers, mostly through unions. The second is more social spending, especially on early-childhood education. Third is tougher competition policy to restrain big business. Fourth, a wave of investment intended to make America both greener and more productive. Last,

→ Also in this section

63 Buttonwood: Bitcoin ETFs and gold

64 China's policymaking muddle

64 Evergrande's tricky liquidation

65 Why pay is still rising too fast

66 Free exchange: Biden's chances

Mr Biden wants to tax large firms and the wealthy to pay for much of this.

As with any president, Mr Biden's agenda thus far has been limited by Congress. The five elements were all present in the \$3.5trn "Build Back Better" bill that Democrats in the House of Representatives backed in 2021, only to run smack into a split Senate. The result is that the most prominent part of existing Bidenomics has been the investment element, comprising three pieces of legislation focused on infrastructure, semiconductors and green tech. Signing three big spending bills into law nevertheless counts as a productive presidential term. They add up to a \$2trn push to reshape the American economy.

If Mr Biden returns to the White House for a second term but Republicans retain control of the House or gain the Senate, or potentially both, advisers say that his focus would be on defending his legislative accomplishments. Although Republicans would be unable to overturn his investment packages if they did not hold the presidency, they could chip away at them.

Take the semiconductor law. Along with some \$50bn for the chips industry, it also included nearly \$200bn in funding for research and development of cutting-edge technologies, from advanced materials to quantum computing. But that giant slug of cash was only authorised, not appropriated, meaning it is up to Congress to pass budgets to provide the promised amount. So far it is falling short: in the current fiscal year, it is on track to give \$19bn to three fed- ▶▶

eral research agencies, including the National Science Foundation, which is nearly 30% less than the authorised level, according to estimates by Matt Hourihan of the Federation of American Scientists, an advocacy group. If Congress refuses to work with Mr Biden, these shortfalls will grow.

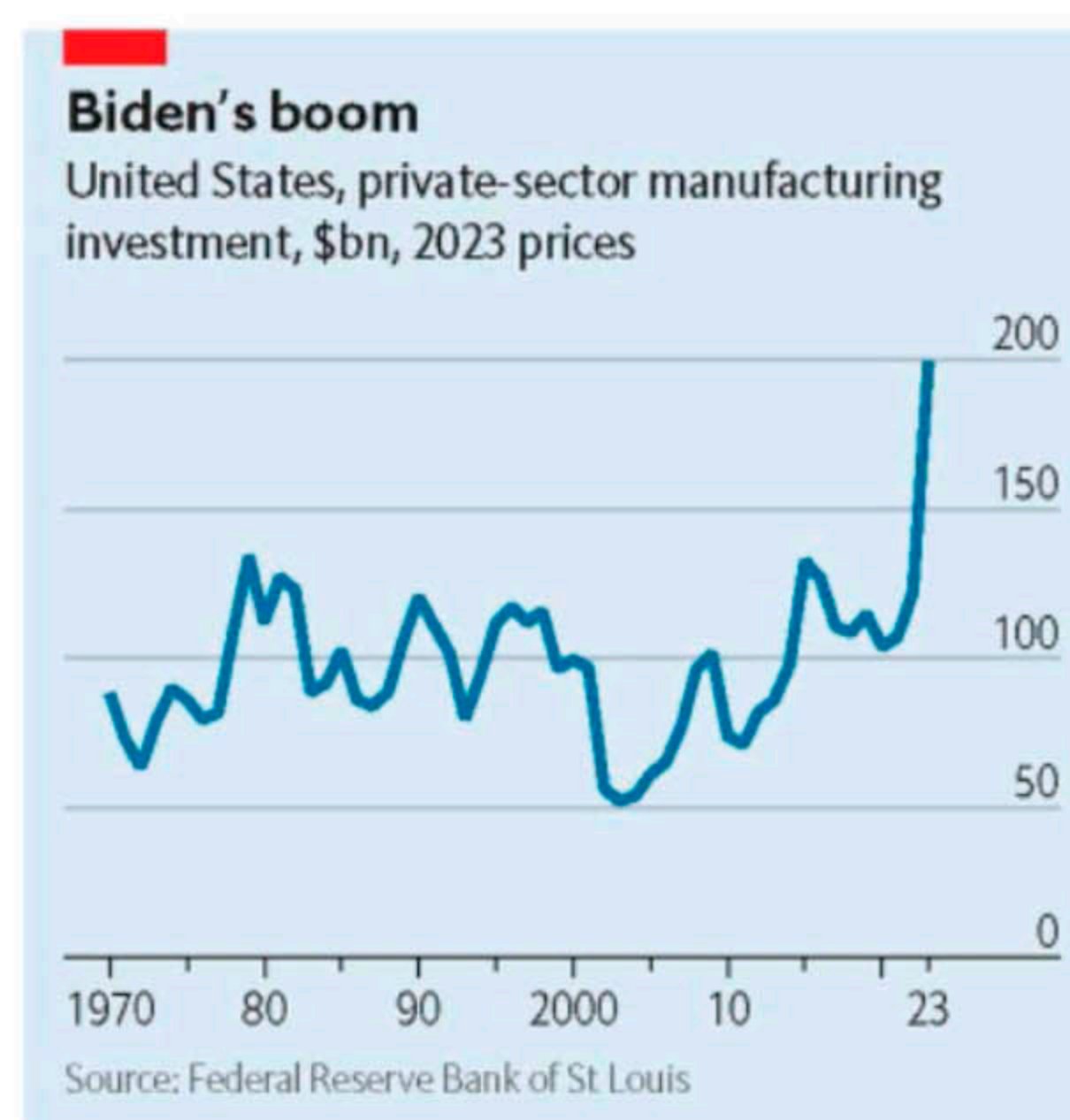
The funding directed at infrastructure and semiconductors is more secure, but much of it will run out by 2028, before the end of a second term. Without Republican support for funding, the investment kick-started over the past couple of years may ease off. High-cost producers will struggle to survive. Critics may see no reason to devote so much treasure to manufacturing when a modern economy based on professional, technical and scientific services already generates plenty of well-paying jobs.

But Mr Biden will have some leverage if Republicans try to water down his policies. Many of the big tax cuts passed during Donald Trump's presidency expire at the end of 2025. Republicans want to renew them, to avoid income-tax rates jumping up. So one possibility is that Mr Biden could fashion a deal in which he agrees to an extension of many of the tax cuts in exchange for Republicans in Congress backing some of his priorities, including his industrial subsidies—never mind that such an agreement would be fiscally reckless.

The White House is also hoping that Mr Biden's investment programmes will develop momentum of their own. "We are very pleasantly surprised by the extent to which private capital has flowed in the direction of our incentives," says Jared Bernstein, chair of the president's Council of Economic Advisers. Much of the money is going to red states, spawning constituencies of businesses and local politicians who would object to cuts. Meanwhile there is, in principle, bipartisan support for federal spending on science and technology as a way of safeguarding America's competitive edge over China. That is why a few dozen Republicans in the House and Senate, albeit a minority, voted for the semiconductor package. Given this constellation of interests and leverage, the industrial policies that defined Bidenomics in the president's first term would probably survive his second term, albeit in somewhat more limited form.

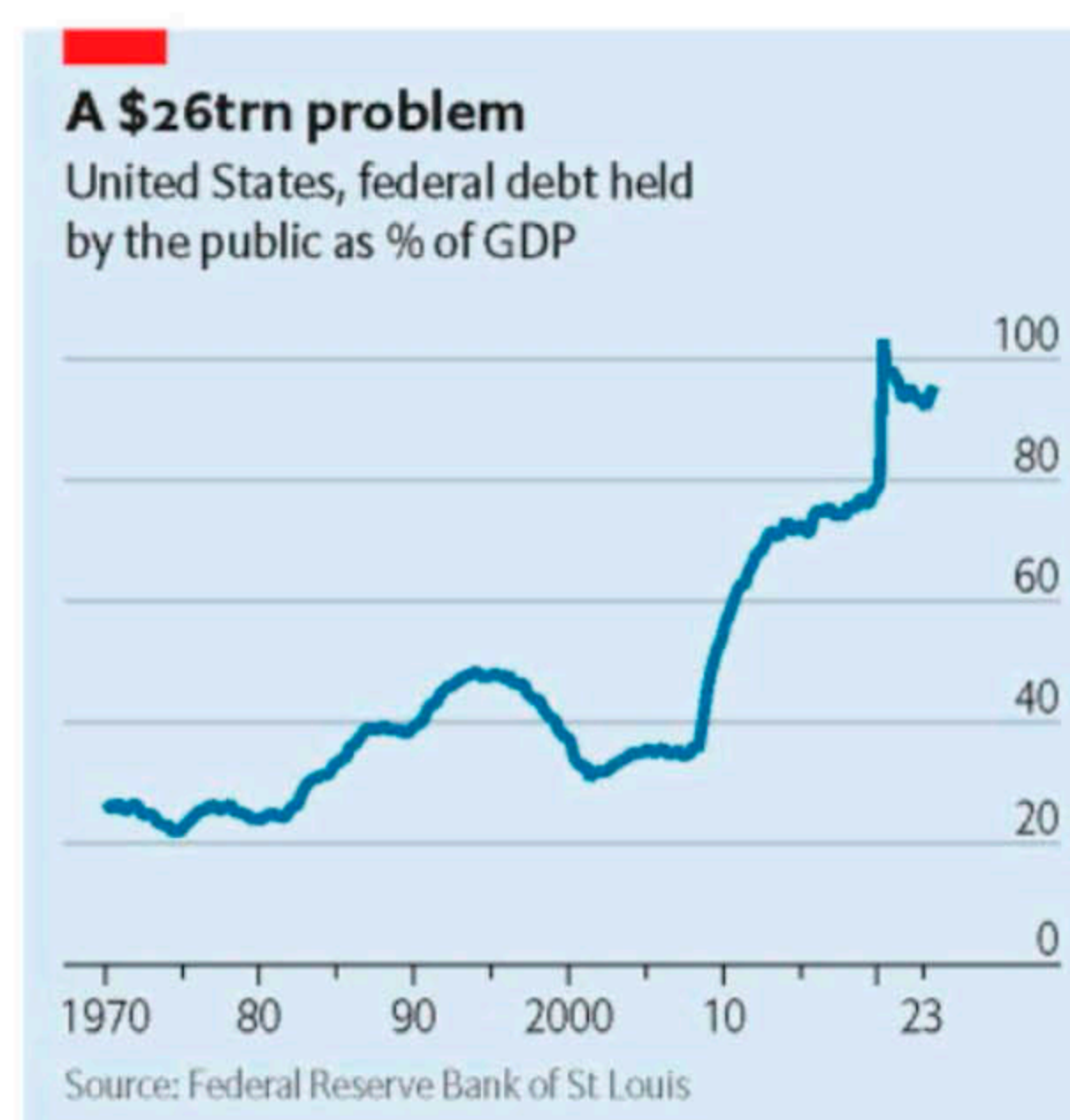
But what if Mr Biden is less constrained? To really understand the potential scope of Bidenomics, it is worth asking what the president would do if the Democrats ended up controlling both houses of Congress. Once they came down from their elation at such an outcome, the team around Mr Biden would know that they had a limited window—probably just two years, until the next set of midterm elections—to get anything of note done.

For starters they would turn to the social policies left on the Build Back Better



cutting-room floor. These include free preschool for three- and four-year-olds, generous child-care subsidies, spending on elderly care, an expanded tax credit for families with children and paid parental leave. Janet Yellen, the treasury secretary, has described this agenda as "modern supply-side economics". She argues that investments in education would make American workers more productive, while investments in care would free up people, especially women, to work, leading to a bigger labour force. But it would also be costly, running to at least \$100bn a year of additional spending—adding half a percentage point to the annual federal deficit (which hit 7.5% of GDP in 2023). And implementation would be challenging. For instance, funding for child care would fuel demand for it, which in turn would exacerbate a chronic shortage of caregivers.

Mr Biden's desire to strengthen unions would also receive fresh impetus. The president describes himself as the most pro-union president in American history—a claim that may well be true. In his first term support for unions was expressed most clearly through words and symbolic actions: when he joined striking car workers near Detroit in September, he became the first president to walk a picket line. Mr Biden would have liked to have



done more. He had at first wanted to make many industrial subsidies contingent on companies hiring unionised workers, a requirement that did not make it into law. The labour movement's big hope for a second Biden term is passage of the PRO Act, which would boost collective bargaining by, among other things, making it harder for firms to intervene in union votes. That would represent a gamble: the flexibility of America's labour market is a source of resilience for the economy, which has been good to workers in recent years.

The flipside of Mr Biden craving approbation as a pro-union president is that he has also come to be seen as anti-business. Members of his cabinet bridle at this charge, noting that corporate profits have soared and that entrepreneurs have created a record number of businesses during his first term. Yet the single biggest reason why Bidenomics has got a bad rap has been his competition agenda, led by Lina Khan of the Federal Trade Commission (FTC). Although her efforts to cut down corporate giants have sputtered, with failed lawsuits against Meta and Microsoft, she is not done. The FTC has introduced new merger-review guidelines that require regulators to scrutinise just about any deal that makes big companies bigger, which could produce even more contentious competition policy. Excessive scrutiny of deals would also use up regulators' scarce resources and poison the atmosphere for big business. An alternative focus, on relaxing land-use restrictions and loosening up occupation licensing, would provide a much healthier boost to competition.

Captain of industry

At the same time, Mr Biden may double down on the manufacturing policies of his first term. The \$50bn or so of incentives for the semiconductor industry has been a start, but it is small relative to how much investment is required for large chip plants. Advisers talk of a follow-on funding package. There would also be a desire to craft new legislation to smooth out bumps in the implementation of industrial policy. Todd Tucker of the Roosevelt Institute, a left-leaning think-tank, advocates a national development bank, creating a reservoir of cash that could be channelled to deserving projects.

How to pay for it all? Mr Biden has long made clear that he wishes to raise taxes on the rich, in particular on households earning over \$400,000 a year and on businesses. The president's advisers argue that he truly believes in fiscal discipline. His budget for the current fiscal year, for instance, would cut the deficit by \$3trn over a decade, or by 1% of GDP a year, according to the Committee for a Responsible Federal Budget (CRFB), a non-profit outfit. That, however, is predicated on Democrats exer-

► cising restraint as tax receipts increase—something that is hard to imagine, says Maya MacGuineas of the CRFB.

Notable by its absence in Mr Biden's first term has been any serious trade agenda, apart from an aversion to traditional trade negotiations. Perhaps Mr Biden may be somewhat less encumbered by the daunting domestic politics of trade deals in a second term. One test will be if America and Europe can establish a critical-minerals agreement, working together to secure inputs for battery production and curbing reliance on Chinese suppliers.

But Mr Biden's apparent mistrust of globalisation will probably rule out anything more ambitious. The president's decision on January 26th to pause approvals for liquefied-natural-gas exports was the latest demonstration of his protectionist instincts (see Business section). And he will almost certainly maintain a tough line on China. For much of his first term there was speculation that he would lower tariffs on China. Now, some in his orbit talk instead of adjustments: reducing duties on basic consumer goods, while raising them on high-tech products.

Most of the action, then, would be in the domestic arena—the battleground for everything from child-care spending to semiconductor subsidies. Supporters argue that these policies would make America more equal, propel its industry and tilt the playing-field towards workers and away from bosses. To others, they look like a lurch back to bigger government, with an outdated focus on both manufacturing and unions, which may strain ties with allies. Mr Biden was a most unlikely radical in his first term. If the polls head his way, he may go further yet in a second. ■

Buttonwood All that shines

Bitcoin ETFs are off to a miserable start. Will things improve?

THE PATH to approval for the first bitcoin exchange-traded funds (ETFs) was long and arduous. Applications appeared before regulators in 2013, when the price of a bitcoin was just shy of \$100 and nobody had heard of Sam Bankman-Fried or the phrase “to the Moon”. After a decade of rejection, promoters finally succeeded on January 10th, when the Securities and Exchange Commission (SEC) approved 11 applications for ETFs that track the spot price of bitcoin, which was at the time above \$46,000.

The advent of bitcoin ETFs was supposed to be a pivotal moment for the digital asset class. For years, devotees had hoped that such funds would attract strait-laced institutional investors, increase liquidity, and demonstrate the credibility and professionalism of crypto. They had also hoped that their approval might buttress demand for bitcoin, pointing to the precedent of a much older speculative asset. When State Street Global Advisors launched America's first gold ETF in 2004, the metal fetched less than \$500 per ounce, below its price in the early 1980s. Over the years that followed, it soared in value, reaching almost \$1,900 per ounce in 2011.

Could the SEC's blessing fuel a similar long-term rally in bitcoin? So far, the signs are not encouraging. After a steep climb last year, partly in anticipation of regulatory approval for ETFs, the price has fallen by 7% since the SEC gave the go-ahead. Inflows into ETFs launched by firms such as BlackRock, Fidelity and VanEck have been almost entirely offset by outflows from the Grayscale Bitcoin Trust, an investment vehicle that also became an ETF on January 11th.

Other factors helped drive gold's surge in the late 2000s. The final prohibitions on bullion ownership in China

were also lifted in 2004. As a result, the country's demand for physical gold rose from 7% of the world total in 2003 to 26% a decade later. The slide in global interest rates over the same period helped, too. An asset with no yield becomes more appealing in a world where little else offers a meaningful yield either.

Despite the metal's reputation as a store of value, when the first gold ETFs were launched the market was still dominated by jewellery, rather than investment. The new funds thus helped turn a largely physical asset into a liquid financial one. By contrast bitcoin is already a financial asset. Unlike gold, there is no use for digital currencies in the physical world. Although it will now become a little easier to gain exposure to bitcoin, it is already more readily available to investors than gold was in 2004. Whereas punters buying the metal had to consider options for delivery and storage, bitcoin is available via mainstream brokers such as Robinhood and Interactive Brokers.

A different set of ETFs provide a less optimistic precedent for bitcoin. In 2022

Itzhak Ben-David, Francesco Franzoni, Byungwook Kim and Rabih Moussawi, four academics, published research suggesting that thematic equity ETFs, which attempt to track a narrow industry or trend, underperform broader ETFs by about a third over the five years after their launch. That is because of a straightforward problem: when thematic ETFs get going, the buzz around the investment is already extensive and the underlying assets are already pricey.

To issuers, such hype is a feature not a bug. ETFs that track broad market indices are the supermarkets of the investing world. Issuers compete with one another on fees, compressing margins to almost nothing in pursuit of enormous volumes. Some of the largest ETFs that track big equity indices make just 30 cents a year for every \$1,000 invested. In contrast, more unusual offerings give providers an opportunity to charge higher fees. The more hype surrounding a given sector, the greater the inflows—and the greater the fees available.

Research published by Purpose Investments, an asset manager, finds that the lion's share of inflows to thematic ETFs tends to come when the assets are at their most expensive. When the underlying stocks are relatively cheap, investors tend to pull out their money. As Craig Basinger of Purpose puts it, a buy-high, sell-low strategy is unlikely to be a winning one for investors.

ETFs are not, therefore, a magic trick that boosts the price of the assets. Indeed, in many cases the funds turn out to be the exact opposite: a way to generate hype and long-run underperformance. Crypto bulls who had hoped that the advent of bitcoin ETFs would offer the asset an extended lift may, in fact, face extended disappointment.



Emergency interventions

Game changing

HONG KONG

China's markets and its policymakers struggle to understand each other

IN RECENT WEEKS, China's economic policymaking has been not just inadequate but a little skittish. On January 23rd draft rules on video games disappeared from the regulator's website a month after their appearance, as if they had never existed. The regulations, which would have sprinkled games with pop-up warnings against "irrational consumption behaviour", had triggered a steep sell-off in the shares of tech companies like Tencent.

The following day, Pan Gongsheng, governor of China's central bank, held an unusual press conference in which he cut reserve requirements for banks by more than expected, and vowed to "strive to stabilise the market". It was an attempt to reassure investors after the bank had failed to cut interest rates earlier in the month.

Whereas other governments are used to being bullied by the markets, China's prides itself on keeping finance in its place. These concessions to market sentiment were therefore notable. They were not, however, very effective. Data on January 31st showed a slowdown in construction and unremitting declines in manufacturing prices. China's stockmarkets fell again, returning to levels reached before Mr Pan spoke. According to Bloomberg, the stockmarkets of mainland China and Hong Kong have lost over \$1trn in value this year.

China's policy inconsistency has thus been expensive. And there are other examples. The central government has, for instance, ordered 12 provinces and cities to halt infrastructure projects, according to Reuters. Its worries about wasteful behaviour are understandable. But such strictures will make it all the harder for China's government to provide the fiscal easing required to revive confidence and growth.

Indeed, China is enduring "de facto fiscal austerity", reckons Robin Xing of Morgan Stanley, a bank. On-balance-sheet borrowing has "failed to offset" tighter off-balance-sheet local-government borrowing. Along with a property slump, this has led to a slowdown in China's nominal growth. The GDP deflator, a measure of prices, has fallen for three quarters in a row—the longest spell of deflation since the Asian financial crisis reached China in 1998.

The stockmarket's weakness reflects this economic predicament. It also reflects uncertainty about how the government will respond. The draft gaming rules brought back memories of the "regulatory

storm" of 2021, when officials cracked down with relish on internet firms and what they called the "disorderly expansion of capital" into realms like private tutoring. The economy is now weaker than it was then, and the government seems more sensitive. But if business were to recover, would such regulations return? The fear of what might happen if the market rebounds makes such a rebound less likely.

There are also doubts about just how far the government will go in order to rescue the property market. For now, it has set aside concern about speculation, giving cities freedom to scrap restrictions on owning several flats. Last week Guangzhou removed purchase limits for larger flats. This week Suzhou went further, abandoning restrictions for all flats.

Yet such rules are not the biggest obstacle to homebuying. Of more importance is fear that a flat bought in advance will not be delivered, as the property developer might run out of money (see next story). Some economists therefore think that the central government will need to set up a fund to take over unfinished projects or guarantee property prepayments, much as bank deposits are guaranteed.

It is also unclear how much fiscal stimulus the central government is prepared to provide. In October, when it increased its budget-deficit target and said it would issue an extra 1trn-yuan-worth (\$140bn) of bonds in its own name, it was possible to believe that a signal was being sent. After years of relying on local governments to prop up the economy, the central government was now willing to use its stronger balance-sheet to put a floor under growth.

Since then, the central government has been slow to spend the 1trn yuan. At the World Economic Forum in Davos, Li Qiang, China's prime minister, boasted about how little stimulus China had required. In March he will reveal the official growth target, budget deficit and bond quotas for the rest of this year. Perhaps the government will be ambitious. Yet with markets falling, March seems a long time away.

Although stockholdings do not represent a big share of household wealth in China, and equity issuance contributes a small share of corporate financing, the confidence of consumers, homebuyers and entrepreneurs is crucial to the country's recovery. Spirits are unlikely to revive if the market continues to deliver such a grim verdict on the economy's prospects.

Mr Pan, Mr Li and He Lifeng, China's economic tsar, have all stressed the importance of a stable stockmarket in recent days. But their words alone have not impressed investors. One image circulating online shows a case full of horns, trumpets and other blowhard instruments. They represent all that China's policy toolbox has to offer. ■



Property crisis

Never grand

SHANGHAI

Evergrande's liquidation pits Hong Kong's courts against the mainland

"ENOUGH IS ENOUGH," declared a Hong Kong judge on January 29th of Evergrande, a failing Chinese property behemoth, and its two-year struggle to avoid repaying its creditors. In a landmark ruling, the court ordered the liquidation of the firm, which is the world's most indebted property developer, with over \$300bn in liabilities. A provisional liquidator will be appointed, assuming management of the company. Foreign creditors will have to recoup losses from a firm that holds most of its assets in mainland China. The ruling thus pits Hong Kong's courts against a Chinese government anxious to restore public confidence in a struggling market.

No company has been more central to China's property crisis, which kicked off in mid-2021 when Evergrande first showed signs of weakening. Rules intended to wean developers from debt pushed the company to default later that year. Since then most of China's listed property developers have either failed to pay back their investors or been forced into restructuring. Their access to credit has been virtually cut off, causing builders to stop working ►►

Corrections: In last week's Buttonwood ("Monetary mistakes") we made a mistake of our own, writing that America's consumer prices rose by 6.5% in November, rather than in the year to December 2022. In our piece on the Big Mac index ("Milkshake and lies") some of the figures were incorrect, meaning that we wrongly suggested the price of a Big Mac in China had fallen. Sorry.

► on projects. Prospective homebuyers have delayed purchases, leading to a 6.5% decline in the sale values, year on year, and unnerving a population that stores most of its wealth in property.

Policymakers had hoped that restructuring Evergrande would pave the way for a steady revitalisation of the market. Instead, Evergrande missed important deadlines and, when it did offer a restructuring proposal, underwhelmed investors. Its plan, which was panned by bondholders, involved giving creditors a stake in some of its other businesses, such as an electric-vehicle line. Far from restoring confidence, the battle became increasingly ugly. At one point a group of bondholders demanded that Hui Ka Yan, Evergrande's chairman, put up \$2bn of his own money. Mr Hui was later detained by Chinese authorities. His whereabouts are now unknown.

China's housing crisis has drained global investors of confidence in the country's policymaking. It is now doing similar damage to Hong Kong. For decades, investors have accessed China via Hong Kong. One of the city's distinct features has been a legal system, separate from China's, that is based on common law. But court rulings in Hong Kong have no guarantee of being upheld in mainland China, where almost all of Evergrande's assets are based.

The liquidator appointed by a Hong Kong court will be forced to deal with local authorities that may not recognise an order drawn up outside China's legal system. Although a pilot project to recognise cross-border rulings was set up in 2021, qualification requirements are tough and the scheme is recognised only in a few cities. Hong Kong rulings can easily be shot down by mainland courts if they have the potential to disturb public order.

As Tommy Wu of Commerzbank, a German lender, has written, a full liquidation of Evergrande's Chinese assets would probably send a shockwave through the Chinese economy. Property developers have sold properties to ordinary Chinese folk that they have not yet provided. Investors' claims on Evergrande's projects or any cash holdings it still has could get in the way of delivery. This would work against Beijing's efforts to restore market confidence, almost guaranteeing that the liquidation process would be drawn-out.

The Hong Kong ruling leaves room for restructuring, with the judge noting that Evergrande could still offer it to creditors. The firm says it is aiming to produce a new plan. Since a liquidator will be taking over, there may now be a better chance of a deal. But it will not be one that includes many Chinese assets. And for a company that mainly owns Chinese property, that is a problem. Evergrande's liquidation marks a new low in China's property crisis—it is far from the end of it. ■

Labour markets

Wages of destruction

NEW YORK

Your pay is still going up too fast

CENTRAL BANKERS are entering the final stretch. Rich-world prices are rising by 5.4% year on year, down from a peak of 10.7% in October 2022. Although this is impressive progress, the last part of their quest—getting inflation from 5.4% to official targets of around 2%—could be the most difficult. That is because labour markets are not co-operating.

Until recently employers wanted to hire many more workers than they could find, resulting in an unprecedented surge in unfilled vacancies. In 2022-23 Google searches related to “labour shortage” jumped to their highest-ever level. With plenty of other options, workers asked for big pay rises. Year-on-year wage growth across the rich world doubled from its pre-covid rate to close to 5% (see chart), adding to firms' costs and in turn encouraging them to raise the prices they charged consumers.

In order to get inflation under control, wage growth therefore had to come back down. Given weak productivity growth across the rich world, a 2% inflation target is probably achievable only if nominal wages grow by 3% a year or less. Central bankers hoped that by raising interest rates they would cause demand for labour to fall—ideally cooling wage inflation without wrecking people's livelihoods.

The first part of the plan has worked. Demand for labour (ie, filled jobs plus unfilled vacancies) is now only 0.4% higher than the supply of workers, down from 1.6%. Searches for “labour shortage” have fallen by a third. Almost everywhere you are less likely to see “help wanted” signs.

Lower demand for labour has also caused surprisingly little damage to peo-

ple's employment prospects. We estimate that, over the past year, falling vacancies have accounted for the entire decline in labour demand across the rich world. During the same period the number of people actually in work has increased. The unemployment rate across the rich world remains below 5%. Some countries are even beating records. In Italy the share of working-age people in a job recently hit an all-time high—the country has swapped *la dolce vita* for *la laboriosa vita*.

Nevertheless, despite falling labour demand, there is less evidence of the final part of the plan: lower wage inflation. Although American pay growth has subsided from more than 5.5% year on year to around 4.5%, that is probably still too high for the Federal Reserve's 2% inflation target. And elsewhere there is little sign of progress. In recent quarters wage growth across the rich world has hovered at 5% year on year. British wage growth is more than 6%. “Very early indications for January show negotiated pay deals slowing only modestly,” reported analysts at JPMorgan Chase, a bank, last week. Euro-area pay is growing similarly fast.

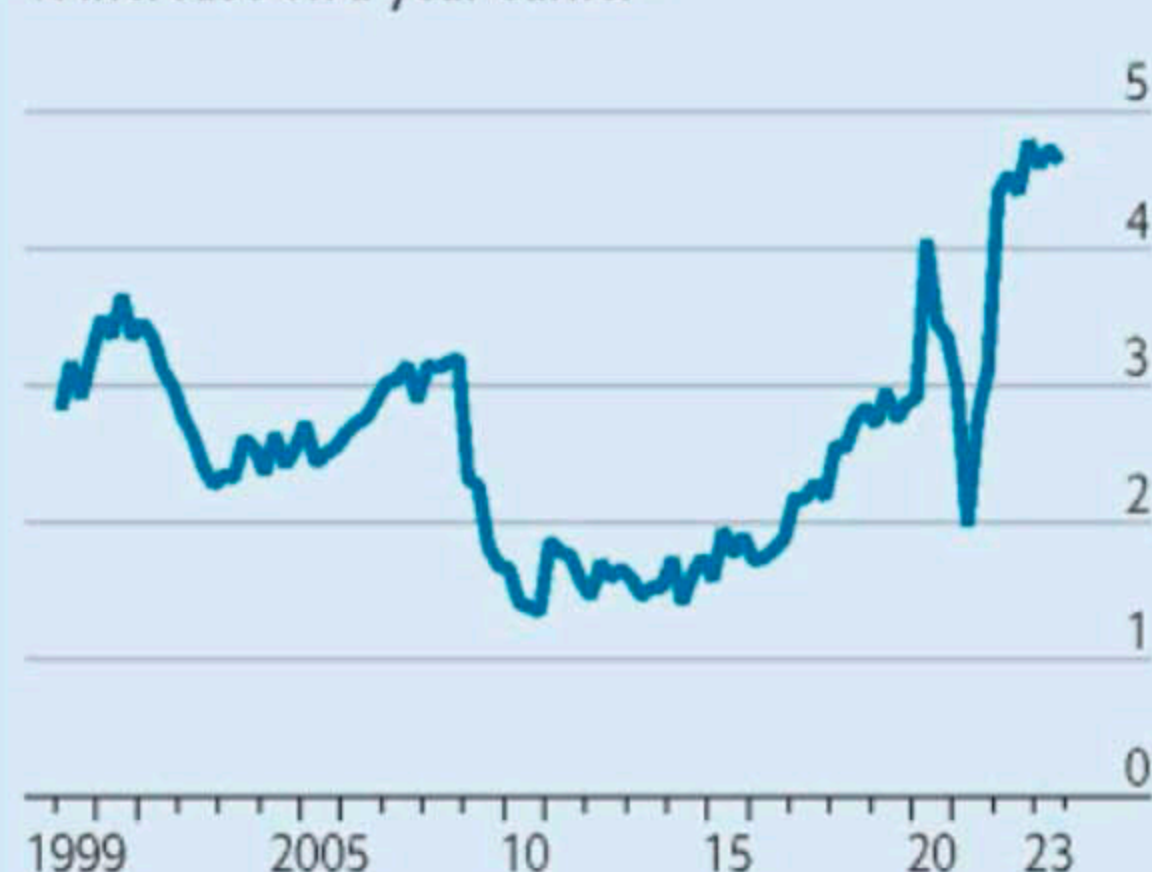
Is high wage growth, and thus above-target inflation, now baked into the economic cake? Some evidence suggests it is—especially in Europe. Spanish workers, for instance, have used their extra bargaining power to change their contracts, so that the share of workers whose pay is indexed to the inflation rate has risen from 16% in 2014-21 to 45% last year. A recent study by the OECD, a club of mostly rich countries, on Belgium worries about “more persistent inflation due to wage indexation”.

More generous wage agreements today could mean higher inflation tomorrow, leading in turn to even more generous agreements. Across the rich world strikes have become more common as workers seek higher wages. Last year America lost almost 17m working days to stoppages, more than in the previous ten years combined. Britain has also seen a surge in industrial action. On January 30th Aslef, a union for train drivers, began a series of walkouts, to the dismay of commuters.

There is, however, a more optimistic interpretation of these developments. Just as in 2021-22, when wages took a while to accelerate after labour demand rose, so today they could take time to lose speed. After all, companies and workers renegotiate wages infrequently—often annually—meaning that workers may only slowly realise that they have less bargaining power than before. Indeed, estimates for America published by Goldman Sachs, another bank, suggest that it can take a year or so for declines in labour demand to show up in lower wage growth—suggesting that the final stretch of disinflation will be annoyingly slow, but will pass. ■

Not there yet

G10 countries, nominal wages, % increase on a year earlier



Source: Goldman Sachs

Free exchange | I forgot that inflation existed

Why Joe Biden's chances of re-election are better than they appear

AMERICANS HAVE not been impressed by President Joe Biden's handling of the economy. In fact, according to polling averages, nearly 60% disapprove of it. Meanwhile, Donald Trump's ratings on economic matters are considerably better. The gap in perceptions augurs ill for Mr Biden's chances of winning the presidential election in November, especially since voters rank the economy as the most important issue facing the country.

But the economy is itself improving fast. Inflation is falling, growth is strong, the stockmarket is booming and, if investors are right, the Federal Reserve will cut interest rates by a percentage point before voters go to the polls—an expectation that is reducing the cost of mortgages. Despite Mr Biden's poor approval ratings when it comes to economic management, could the state of the American economy actually boost his chances of re-election?

Three lessons emerge from studies that look at the relationship between economic fortunes and election results. The first two are bad for Mr Biden: opinions about the economy matter a great deal and voters hate inflation. Ten months before the vote, Mr Biden has already presided over a 14.4% rise in prices, as measured by the personal-consumption-expenditures index—more than at the equivalent point in any presidential term since 1984. The stain of inflation appears to blot out today's healthy labour market and real wage growth that has hewn to the trend of the late 2010s, despite the disruption of the covid-19 pandemic.

The third lesson, however, is a lot better for Mr Biden: voters have short memories. "The clear consensus in the literature is that recent economic performance is much more relevant at election time than earlier performance," write Christopher Achen and Larry Bartels, two political scientists, in their book "Democracy for Realists". Americans, they argue, "vote on the basis of how they feel at the moment" and "forget or ignore how they have felt over the course of the incumbent's term in office". The authors show that increases in real disposable income per person in only the two quarters before a vote can, with an adjustment for tenure in the White House, predict the vote share of parties that are governing America to a striking degree of accuracy (see chart).

It is an important finding, particularly as inflation has recently tumbled. In the second half of 2023 prices rose at an annual pace of

2%, down from a peak of 7.7% in the first half of 2022. Even if the hot economy brings a resurgence in inflation, it is highly unlikely to match the earlier peak, especially since futures markets suggest that oil prices—and hence the cost of filling up a car—will stay flat during 2024. Because inflation has fallen without a recession, tight labour markets continue to produce strong real wage growth. In the last quarter of 2023 real disposable income per person grew at an annualised rate of 1.9%. If maintained until the election, that pace would be associated with a winning margin equivalent to Bill Clinton's in 1996. "Recent widespread pessimism about Biden's prospects seems to me excessive," argues Mr Achen. "The economy appears likely to help [him]."

Don't blame me

The impact of inflation just before elections is less studied than that of growth. America does not have many episodes of high inflation to draw on. That said, economists have long supposed that politicians in emerging markets attempt to win votes by temporarily suppressing price rises ahead of polls. A classic example is Brazil in 1986, when the government implemented price and wage controls and fixed the exchange rate in February, causing monthly inflation to fall from 22% to less than 1%. Only six days after winning parliamentary elections in November, the government had to abandon the plan amid huge economic imbalances. By the middle of 1987 annual inflation exceeded 1,000%. These "stop-go" strategies would fail if voters did not reward governments for bringing inflation to heel.

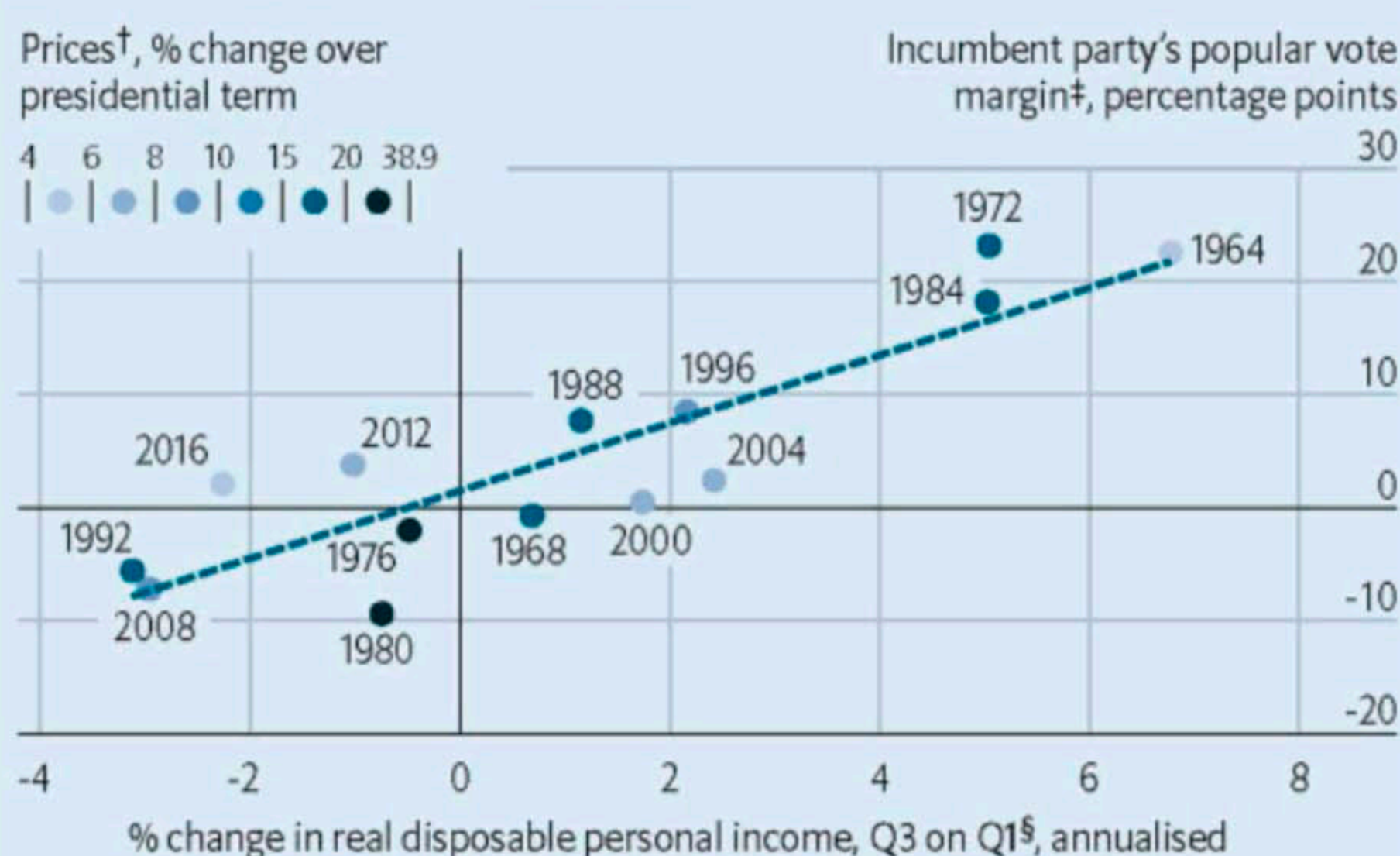
Are such examples relevant to America, where the inflation problem is more novel but far less severe? Calculations by Ray Fair of Yale University suggest that things may be more complicated. He finds that presidential elections are best predicted by a model including inflation over the entire term of the incumbent party, even while recent economic growth is given special weight. The memory of inflation being painful would explain why the usual relationship between consumer confidence and the economy broke down in 2023, with survey respondents staying gloomy even amid strong growth and lower inflation.

There are signs, though, that Americans are starting to feel better about their economy. Consumer confidence, as measured by the University of Michigan, rose strongly in December and in January's preliminary data—and is at its highest since July 2021 (a definitive reading will be released shortly after this column is published). Such improved sentiment is consistent with analysis by Ryan Cummings and Neale Mahoney, two former Biden-administration economists now at Stanford University, whose model allows the psychological impact of inflation to decay gradually over time. They calculate that, if inflation in 2024 is 2.5%, then by the end of the year the drag on consumer sentiment will be 50% lower than it is today and 70% down on the peak in mid-2022. Such an effect would surely spill over into Mr Biden's polling numbers.

Even Mr Fair's model—in which the high inflation of 2022 and the probably low inflation of 2024 weigh equally—predicts that economic growth will propel Mr Biden to victory in the popular vote. There is no guarantee that the economic forecasts feeding such models are right. Indeed, since covid struck they have often been wrong. The electoral college contains a bias towards Republicans; Mr Trump won in 2016 despite losing the popular vote. And Mr Biden is starting from a weak position, not just in terms of his economic reputation. But as the president tries to close the polling gap, the economy should provide him with a tailwind. ■

Goldfish voters

United States, presidential election years, 1964-2016*



*2020 omitted owing to covid-19 pandemic irregularities [†]Personal consumption expenditures index
[‡]Compared with second-placed party [§]Adjusted for tenure of incumbent party
 Sources: BEA; "Democracy for Realists", by Christopher Achen and Larry Bartels



Prosthetic limbs

Weird and wonderful

Tentacles, spikes, hands with two thumbs: prosthetic limbs may not need to look like real ones after all

IN A PHOTOSHOOT Kelly Knox—a British model and disability-rights advocate—poses with a prosthetic limb unlike any other. Ms Knox was born with her left arm missing from the elbow down. From the point her arm terminates, dozens of vertebrae-like structures extend to form a long, sinuous tentacle.

The limb is certainly striking. It is dextrous, too. Ms Knox can control its movements via pressure sensors in her shoes, which connect to the limb wirelessly. Artificial tendons can tighten or loosen, allowing the tentacle to reach and grasp. The limb—detached from Ms Knox and titled VINE 2.0—is due to go on display at “BODIES...The Exhibition” at the Luxor, a hotel and casino in Las Vegas, later this year.

The limb was designed by Sophie de Oliveira Barata, an artist, and Dani Clode, a designer and engineer. Although it is an art piece, it is one inspired by some intriguing recent developments in neuroscience that suggest there is no reason—at least from first neurological principles—why prosthetic limbs need to look or behave like the biological ones they replace.

The developments concern a phenomenon called “embodiment,” which is of interest to both neuroscientists and makers of prosthetic limbs. Embodiment is the way in which a brain identifies with the body it is located in, and determines the borders of what counts as “self” and what counts as “other”.

Sometimes, embodiment can go wrong. Most amputees—between 60% and 80% worldwide, according to several papers—experience the continued presence of their missing limbs, often for years after they were first removed. This “phantom limb syndrome” (PLS) demonstrates that the brain’s idea of the body’s boundaries does not always match up with physical reality.

Prosthetic limb-makers have long hoped to take advantage of embodiment to

make their designs feel like extensions of the body rather than foreign objects attached to it. Therapies for PLS, which use mirrors to create the illusion that a missing limb is still present, hinted that the brain could be persuaded to embody a prosthetic limb if it matched the form and function of the limb it was replacing.

But scientists’ understanding of embodiment has started to change. In a series of experiments in 2018 and 2020 Tamar Makin, a neuroscientist who runs the Plasticity Lab at the University of Cambridge, used functional magnetic-resonance imaging, which records blood flow in different parts of the brain, to peer into the heads of one-handed amputees.

Not what you think

Dr Makin had them look at pictures of three different types of object: biological hands, prosthetic ones and hand-held tools such as brushes and spoons. By comparing which bits of the subjects’ brains responded, Dr Makin hoped to establish whether the brain interprets prosthetic hands as something like a biological hand or an object closer to a tool.

To Dr Makin’s surprise, the answer appeared to be neither. Instead, she says, the brain “places prosthetics into a category entirely of their own, clearly distinct from the others”. That held true whether the prosthetic was a cosmetic one, designed to look like an organic hand, or a functional one, whether a sophisticated robotic version or even a simple hook.

→ Also in this section

68 Transmissible Alzheimer’s?

69 The risks of AI in science

70 Why whales can smell in stereo

▶ This does not mean that a prosthetic limb cannot be embodied. Many amputees report embodying their artificial limbs to some degree. But what it does demonstrate is that whether a prosthetic is embodied or not does not have much to do with whether it looks like a biological arm or leg.

This has several implications for the design of prosthetics. One is to open it up to all sorts of innovations in material, colour and form. This is where Ms de Oliveira Barata comes in. She runs the Alternative Limb Project (ALP), a British studio that makes custom prosthetics. Ms de Oliveira Barata, who has a background in make-up and special effects, started by making realistic limbs for amputees. But a project with a young girl who was determined to have her replacement leg covered in cartoons shifted her perspective.

These days the ALP creates striking, high-concept prosthetics for its clients. Its first major commission came from Viktoria Modesta, a British singer whose leg had been amputated below the knee. Inspired by an idea that came to Ms Modesta in a dream, Ms de Oliveira Barata designed a metallic black prosthesis in the shape of a long, conical spike vaguely reminiscent of a giant stiletto heel. Ms Modesta performed at the closing ceremony of the 2012 Paralympic games with a silver and glass crystal-covered leg, another of Ms de Oliveira Barata's creations.

And if a prosthetic need not mimic the limb it is replacing, then perhaps prosthetics could be more than just replacements? Ms Clode is an expert in the design of robotic prostheses controlled by artificial tendons. She is keen to explore the possibility of augmenting existing bodies with new capabilities, making prosthetics "a technology that could be of use to everybody, not just amputees". To that end she has designed the "Third Thumb", a small and robust prosthetic digit that does exactly what it says on the tin. Controlled, like Ms Knox's vine-arm, by pressure sensors in a pair of shoes, the thumb can be used to replace a missing one. But it can also be added to an intact hand on the opposite side from its existing, biological thumb.

Having two thumbs "extends what the human hand can do in surprising ways," says Ms Clode. Many involve holding an object and manipulating at the same time, such as peeling a banana or opening a soft-drink bottle one-handed. Using toe controls might seem primitive compared with some of the more sophisticated prosthetic hands on the market, which are designed to be controlled by picking up signals from the wearer's remaining muscles.

But Ms Clode says the opposite is true. Myoelectric prostheses can be slow and clunky. And since the muscles remaining at the site of an amputation are unlikely to be the same as those that were used to

move the missing limb, learning how to use them with the prosthetic can take months. Shoe-mounted controls, by contrast, can be mastered relatively quickly.

In future, it may be possible to give such prosthetics artificial sensory feedback. In November 2023, in a paper published in *Science Robotics*, a team of Chinese researchers led by Li Wen, a roboticist at Beihang University, described a flexible robotic arm that mimics an octopus tentacle. Although it was not designed as a prosthetic, the tentacle is controlled by a finger-glove that fits over the wearer's index finger, and provides touch feedback through the same mechanism that controls it.

Neither Ms de Oliveira Barata nor Ms Clode are neuroscientists. But academic researchers are starting to get interested, too. Ms Clode is working with Dr Makin to investigate how the brain adapts to bodily augmentation. They are particularly interested in how the brain reallocates its cognitive resources to accommodate new appendages and whether such appendages can be embodied. "I do not think we have come close to the limits of what is possible yet," says Ms Clode. "But we certainly intend to find out." ■

Medicine and dementia

Can Alzheimer's be transmitted?

New evidence suggests it can, in very rare circumstances

RESEARCHERS DIVIDE Alzheimer's disease, the most common form of dementia, into two types. "Sporadic" cases usually occur in people over 65. Rarer "familial" ones are associated with a handful of mutations that run in families. Symptoms can begin in a patient's 30s.

But evidence is mounting that a third,

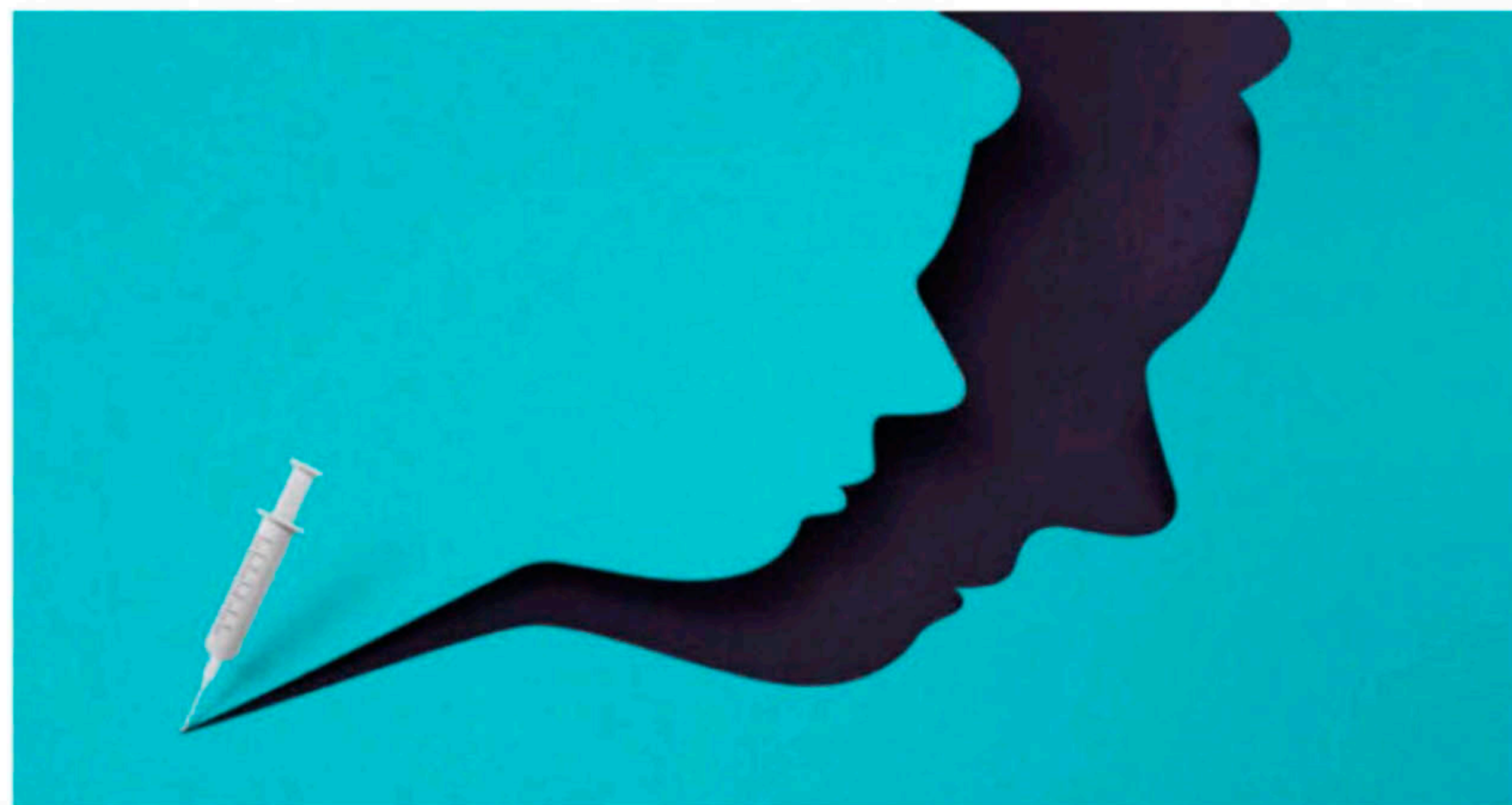
much rarer type exists as well. A paper published on January 29th in *Nature Medicine* describes five people with early-onset Alzheimer's who may have contracted it from human growth hormone (HGH) given when they were children. If that is indeed what has happened, it would establish a third "iatrogenic" form of the disease—one that is transmitted by medical procedures.

The paper, by John Collinge, a neurologist at University College London (UCL), and his colleagues builds on other research from the same group. But the story begins with a different malady—Creutzfeldt-Jakob disease (CJD), a fatal neurodegenerative condition best known for the variant (vCJD) that jumped to humans from cattle with "mad cow disease" in the 1990s.

In the 1980s Stanley Prusiner, a biochemist, showed that CJD, and some other related diseases, are caused not by a bacterium or a virus, but by a defective form of one of the body's own proteins. Before a newly created protein can do its job, it must fold itself up in exactly the right way. Sometimes that process goes wrong. Some of those misfolded proteins, dubbed "prions" by Dr Prusiner, can cause other copies of themselves to misfold in turn. And too many misfolded proteins can gum up the workings of cells and kill them.

Like Alzheimer's, CJD is mostly either sporadic or inherited. Only around 1% of cases are transmitted. The vCJD outbreak of the 1990s was caused by contaminated beef. But other routes are possible, too. Between 1959 and 1985 around 30,000 people around the world, mostly children, were given injections of HGH to boost their height. The hormone was taken from the brains of cadavers. Some, it later emerged, was contaminated with CJD-causing prions. To date, over 200 cases of CJD have been attributed to those treatments.

In 2015, while examining the brains of eight people who died in this manner, Dr Collinge found that four of the brains also contained deposits of amyloid-beta, another type of protein—but one that is asso- ▶▶



ciated with Alzheimer's, not CJD. As with the prion that causes CJD, misshapen bits of amyloid-beta can cause other copies of the protein to form tangled clumps in the brain. The presence of such clumps is one of the hallmarks of Alzheimer's.

Dr Collinge's team surmised that the people in question had been doubly unlucky: their hormone injections had been contaminated not only with CJD-causing prions, but with amyloid-beta clumps as well. In 2018 Dr Collinge went on to show that untouched samples of HGH that had been in storage since the 1980s contained amyloid-beta—and that injecting the stuff into mice caused their brains to develop Alzheimer's-like protein clumps.

Then, in 2019, a team led by Dr Gargi Banerjee, a neurologist who also works at UCL, found that three people who had received grafts of cadaveric dura mater, a membrane that covers the brain, were suffering from cerebral amyloid angiopathy (CAA), a condition closely related to Alzheimer's, and one in which amyloid-beta is also implicated. Dr Banerjee argued that this too was a case of the inadvertent medical transmission of misfolded proteins.

All that adds up to a highly suggestive pile of evidence. But until now, no one had found any patients who had received contaminated HGH and gone on to develop Alzheimer's. Dr Collinge's latest paper—co-authored with Dr Banerjee—does just that. It reports the cases of eight people who had been referred to the National Prion Clinic at UCL, and who had received childhood HGH treatments. Biomarkers, blood tests and even autopsies (carried out on two patients who died during the course of the study) concluded that seven had at least some signs consistent with Alzheimer's. Five had symptoms that met diagnostic criteria, and which had begun between the ages of 38 and 55.

The patients were all relatively young, making sporadic Alzheimer's unlikely. Five had been genetically tested as part of their treatment; none carried mutations that cause the familial form of the disease. That strongly suggests that their childhood medication is to blame, says Dr Collinge.

"We're not suggesting for a moment that you can catch Alzheimer's disease [from other people]," he says. He does, though, think that medical procedures

known to have transmitted CJD in the past ought to be looked at carefully. These days HGH is made synthetically, rather than harvested from the dead. The World Health Organisation advises against human dura mater grafts. But there have been rare cases of CJD associated with other medical treatments carried out in childhood.

If Dr Collinge is proved right, one question is how to stop such transmissions in future. Prions can survive routine sterilisation in an autoclave, and Dr Collinge thinks the same is probably true of amyloid-beta. He and his colleagues are planning to test an enzyme-detergent mixture which they developed to destroy CJD prions to see if it works for amyloid-beta as well.

Another is what it might mean for treating Alzheimer's, even in the majority of people in whom the disease develops spontaneously. The exact role that amyloid-beta plays in Alzheimer's is not fully understood. But Dr Collinge believes his study suggests that "what's going on in Alzheimer's is very similar in many respects to what happens in human prion diseases like CJD." That might open up new treatment possibilities for a disease that remains, for now, incurable. ■

Science and AI

Faster nonsense

AI could accelerate scientific fraud as well as progress

IN A MEETING ROOM at the Royal Society in London, several dozen graduate students were recently tasked with outwitting a large language model (LLM), a type of AI designed to hold useful conversations. LLMs are often programmed with guardrails designed to stop them giving replies deemed harmful: instructions on making Semtex in a bathtub, say, or the confident assertion of "facts" that are not actually true.

The aim of the session, organised by the Royal Society in partnership with Humane Intelligence, an American non-profit, was to break those guardrails. Some results were merely daft: one participant got the chatbot to claim ducks could be used as indicators of air quality (apparently, they readily absorb lead). Another prompted it to claim health authorities back lavender oil for treating long covid. (They do not.) But the most successful efforts were those that prompted the machine to produce the titles, publication dates and host journals of non-existent academic articles. "It's one of the easiest challenges we've set," said Jutta Williams of Humane Intelligence.

AI has the potential to be a big boon to



science. Optimists talk of machines producing readable summaries of complicated areas of research; tirelessly analysing oceans of data to suggest new drugs or exotic materials and even, one day, coming up with hypotheses of their own. But AI comes with downsides, too. It can make it easier for scientists to game the system, or even commit outright fraud. And the models themselves are subject to subtle biases.

Start with the simplest problem: academic misconduct. Some journals allow researchers to use LLMs to help write papers, provided they say as much. But not everybody is willing to admit to it. Sometimes, the fact that LLMs have been used is obvious. Guillaume Cabanac, a computer scientist at the University of Toulouse, has uncovered dozens of papers that contain phrases such as "regenerate response"—the text of a button in some versions of ChatGPT that commands the program to rewrite its most recent answer, presumably copied into the manuscript by mistake.

The scale of the problem is impossible to know. But indirect measures can shed some light. In 2022, when LLMs were available only to those in the know, the number of research-integrity cases investigated by Taylor and Francis, a big publisher of scientific papers, rose from around 80 in 2021 to about 2,900. Early figures from 2023 suggest the number was on course to double. One possible telltale is odd synonyms: "haze figuring" as another way to say "cloud computing", for example, or "counterfeit consciousness" instead of "AI".

Even honest researchers could find themselves dealing with data that has been polluted by AI. Last year Robert West and his students at the Swiss Federal Institute of Technology enlisted remote workers via Mechanical Turk, a website which allows users to list odd jobs, to summarise long stretches of text. In a paper published in June, albeit one that has not yet been peer-reviewed, the team revealed that over a ▶▶

Science and technology correspondent We are hiring a writer to cover subjects such as AI, biotech and space. Journalism experience is not essential but the ability to write clearly is. The deadline for applications is February 24th. For details visit: economist.com/scitechjob24

The Richard Casement internship We invite applications for our Richard Casement internship. The successful candidate will spend three months with us covering science and technology, and will be paid. The deadline for applications is February 5th. For details visit: economist.com/casement2024

▶ third of all the responses they received had been produced with the help of chatbots.

Dr West's team was able to compare the responses they received with another set of data that had been generated entirely by humans, leaving them well-placed to detect the deception. Not all scientists who use Mechanical Turk will be so fortunate. Many disciplines, particularly in the social sciences, rely on similar platforms to find respondents willing to answer questionnaires. The quality of their research seems unlikely to improve if many of the responses come from machines rather than real people. Dr West is now planning to apply similar scrutiny to other crowdsourcing platforms he prefers not to name.

It is not just text that can be doctored. Between 2016 and 2020, Elisabeth Bik, a microbiologist at Stanford University, and an authority on dodgy images in scientific papers, identified dozens of papers containing images that, despite coming from different labs, seemed to have identical features. Over a thousand other papers have since been identified, by Dr Bik and others. Dr Bik's best guess is that the images were produced by AI, and created deliberately to support a paper's conclusions.

For now, there is no way to reliably identify machine-generated content, whether it is images or words. In a paper published last year Rahul Kumar, a researcher at Brock University, in Canada, found that academics could correctly spot only around a quarter of computer-generated text. AI firms have tried embedding "watermarks", but these have proved easy to spoof. "We might now be at the phase where we no longer can distinguish real from fake photos," says Dr Bik.

Producing dodgy papers is not the only problem. There may be subtler issues with AI models, especially if they are used in the process of scientific discovery itself. Much of the data used to train them, for instance, will by necessity be somewhat old. That risks leaving models stuck behind the cutting edge in fast-moving fields.

Another problem arises when AI models are trained on AI-generated data. Training a machine on synthetic MRI scans, for example, can get around issues of patient confidentiality. But sometimes such data can be used unintentionally. LLMs are trained on text scraped from the internet. As they churn out more such text, the risk of LLMs inhaling their own outputs grows.

That can cause "model collapse". In 2023 Ilya Shumailov, a computer scientist at the University of Oxford, co-authored a paper (yet to be peer-reviewed) in which a model was fed handwritten digits and asked to generate digits of its own, which were fed back to it in turn. After a few cycles, the computer's numbers became more or less illegible. After 20 iterations, it could produce only rough circles or blurry

Marine biology

Bloodhounds of the sea

Why some whales are able to smell in stereo

ANY SCHOOLCHILD knows that a whale breathes through its blowhole. Fewer know that a blowhole is an adapted nostril, tweaked by evolution into a form more useful for a mammal that spends its life at sea. And only a dedicated cetologist would know that while toothed whales, such as sperm whales and orcas, have one hole, baleen whales, such as humpback and Rice whales, have two.

Even among the baleen whales, the placing of those nostrils differs. In some species they are close together. In others, they are much further apart. In a paper published in *Biology Letters* Conor Ryan, a marine biologist at the Scottish Association for Marine Science, suggests why that might be. Having two nostrils, he argues, helps whales smell in stereo.

Many types of baleen whales eat tiny

crustaceans known as zooplankton, which they catch by filtering them from seawater using the sheets of fibrous baleen that have replaced teeth in their mouths. But to eat something you first have to find it. Toothed whales do not hunt by scent. In fact, the olfactory bulb—the part of the brain that processes smell—is absent in such creatures. But baleen whales still have olfactory bulbs, which suggests smell remains important. And scent can indeed give zooplankton away. Zooplankton like to eat other tiny critters called phytoplankton. When these are under attack, they release a pungent gas called dimethyl sulphide, which scientists know is capable of attracting hungry seabirds.

Most animals have stereoscopic senses. Having two eyes, for instance, allows an animal to compare the images from each in order to perceive depth. Having two ears lets them locate the direction from which a sound is coming. Dr Ryan theorised that paired blowholes might bring baleen whales the same sorts of benefits.

The farther apart the sensory organs are, the more information can be extracted by the animal that bears them. The researchers used drones to photograph the nostrils of 143 whales belonging to 14 different species. Sure enough, baleen whales that often eat zooplankton, such as the North Atlantic right whale, have nostrils that are farther apart than do those, such as humpback whales, that eat zooplankton occasionally. Besides allowing them to breathe, it seems that some whales use their blowholes to determine in which direction dinner lies.



The smells of the sea

lines. Models trained on their own results, says Dr Shumailov, produce outputs that are significantly less rich and varied than their training data.

Some worry that computer-generated insights might come from models whose inner workings are not understood. Machine-learning systems are "black boxes" that are hard for humans to disassemble. Unexplainable models are not useless, says David Leslie at the Alan Turing Institute, an AI-research outfit in London, but their outputs will need rigorous testing in the real world. That is perhaps less unnerving than it sounds. Checking models against reality is what science is supposed to be about, after all. Since no one fully understands how the human body works, for

instance, new drugs must be tested in clinical trials to figure out whether they work.

For now, at least, questions outnumber answers. What is certain is that many of the perverse incentives currently prevalent in science are ripe for exploitation. The emphasis on assessing academic performance by how many papers a researcher can publish, for example, acts as a powerful incentive for fraud at worst, and for gaming the system at best. The threats that machines pose to the scientific method are, at the end of the day, the same ones posed by humans. AI could accelerate the production of fraud and nonsense just as much as it accelerates good science. As the Royal Society has it, *nullius in verba*: take nobody's word for it. No thing's, either. ■



Collaborative books

Write on

Authors are becoming more willing to collaborate with AI—and each other

Fourteen Days. Edited by Margaret Atwood and Douglas Preston. *Harper*; 384 pages; \$32. *Chatto & Windus*; £17.99

IMAGINE LIVING in a rundown apartment building on the Lower East Side in Manhattan. When covid-19 hits in 2020, you do not have the money to escape to a second home in the Hamptons or the Hudson Valley. Instead, in the evening you make your way up to the rooftop of your building, where, to your surprise, other tenants have come, too. You do not know most of them, but after some awkwardness, everyone starts meeting nightly, drinks in hand, to share stories about family, music, September 11th, love and, equally—inevitably—death.

This is the premise of “Fourteen Days”, a “collaborative novel” edited by Margaret Atwood (of “The Handmaid’s Tale” fame) and Douglas Preston (author of “The Lost City of the Monkey God”). In addition to Ms Atwood and Mr Preston, 34 notable authors of varied genres and backgrounds contributed to the book, including James Shapiro,

a playwright, and the novelists Emma Donoghue, Dave Eggers and John Grisham. Reading “Fourteen Days” is like sitting by a campfire, with characters taking turns telling tales about their lives. (This conceit is helpful, given the number of collaborators. The book’s plot is simple, so each character’s story can stand on its own.)

“Fourteen Days” is one of a growing number of new works, both fictional and factual, which are written collaboratively in some way. Stewart Brand, a writer and futurist from California, is working on a book entitled “Maintenance: Of Everything”, which allows early readers to comment on draft chapters. In January Audrey

Tang, Taiwan’s minister of digital affairs, and Glen Weyl, a noted economist and co-founder of the RadicalxChange Foundation, a group of activists, signed a contract to write a book, entitled “Plurality”, on digital democracy together with dozens of contributors. AI services, such as ChatGPT, have started to become co-authors, too. A more collective approach to authorship is on the rise.

There is a rich history of collaboration in writing. Just think of the Bible or the “Kalevala”, a Finnish epic, which were both written by many hands. Homer, if he was in fact a single person, probably synthesised bits of oral poetry for his “Iliad” and “Odyssey”. In the Renaissance plays had many authors, who often added new characters as they saw fit. Only after the invention of the printing press in the mid-15th century did books become a business. Single-author books proved easier to market, and the “myth of the solitary author” established itself, says Scott Rettberg, who leads the Centre for Digital Narrative at the University of Bergen in Norway.

In the 20th century collective authorship made something of a comeback. In the 1960s the idea re-emerged for all sorts of reasons, including as a counteroffensive against cultural conventions. In 1969 two dozen journalists wrote “Naked Came the Stranger”, a deliberately terrible book poking fun at American literary standards. (It became a surprise bestseller.) In the 1990s new technological possibilities prompted writers to work together—or, more accu- ▶▶

→ Also in this section

72 Fighting over Hong Kong’s past

73 The rise of slap fighting

73 A high-stakes art trial

74 The mother of modern dance

75 Back Story: “Mr & Mrs Smith” returns

▶ rately, to link to each other. A noted example is “Hypertext Hotel”, a collaborative writing space built online in 1991 by Robert Coover, an American experimental novelist, which uses a spatial metaphor to weave stories together.

Chances are, your bookshelf contains an example of a literary collaboration, say by Lee Child, who wrote some of the “Jack Reacher” series with his brother, Andrew, or James Patterson, whose bibliography of co-authors reads like a name-dropper’s address book. “Fourteen Days” nods to this history of collaborative writing. In their foreword Ms Atwood and Mr Preston cite the influence of “The Decameron” (1353) by Giovanni Boccaccio, a collection of stories about a small group of people who shelter in a villa near Florence to escape the bubonic plague.

Even if these projects do not blaze new trails, it is clear that something is different. The tools to write together have improved in recent years. Mr Brand publishes his draft chapters on Books in Progress, a website with a user-friendly commenting tool. He celebrates Google Docs: its features make co-authoring extremely easy. (*Economist* writers and editors are avid users.)

What Mr Weyl and Ms Tang are attempting is more novel. They intend to employ tools of the kind typically used to develop open-source software to co-ordinate their contributors and even “help them find a single authorial voice”, says Mr Weyl.

Their point of departure is Microsoft’s GitHub, a website that helps coders collaborate on open-source projects. But they have also added features, such as voting, to make it easier for contributors to agree on wording. Participants can earn a digital currency by doing tasks, too. This rewards their participation (and offers a share of the profits if the book makes money). This set-up is meant to create the right incentives, bribing people to do boring tasks like fixing typos and line editing.

Readers have become accustomed to collectively created works, Mr Brand argues: “We’re already living in a more interactive collaborative mode.” Social media has conditioned people to multi-author texts. Many have even contributed to collective works, such as Wikipedia, an online encyclopedia. But there are also all sorts of manuals, textbooks and writers’ groups for fan fiction, where people add and comment on new twists to existing works.

Generative AI will add more to the mix. It is not just that the algorithms powering services like ChatGPT are themselves collective works of sorts (trained on huge amounts of text scraped from the internet). Such models are also conversational machines, which can suggest phrases, give feedback and answer questions.

“Cyborg authorship” is what Mr Rettberg of the University of Bergen calls this.

He already has more than one tech-supported writing project under his belt (and recently co-curated an exhibition of books written with the help of AI at the University of California, Berkeley, called “More Than Meets AI”). He published a book jointly with colleagues, in which ChatGPT is invoked to generate reviews of famous works in the style of well-known authors—think Jane Austen writing about William Burroughs’s “Naked Lunch”.

Writing with collaborators, be they human or artificial, will only become more common. But individual authors will still dominate creatively. That is because collectively written books rarely make for great literature. The many contributions to “Fourteen Days” are cleverly woven together.

er. But the book does not quite gel (even if it does have a surprising ending).

Then there is authorial ego. Getting all 36 authors of “Fourteen Days” to agree on the text was a challenge, with some writers taking issue with how their story ended up being framed and referred to by other contributors later.

And AI is not yet fully accepted in literary circles. Recently Kudan Rie, the winner of Japan’s top prize for literature, admitted she used ChatGPT to write around 5% of her science-fiction novel “Tokyo Sympathy Tower”. Such candidness is rare. Most would never admit to using AI. A new sort of “ghost writing” may be having a moment, but many writers will never want to name ChatGPT as their co-author. ■

Chinese culture

So long, Hong Kong

HONG KONG

A row over the Heritage Museum’s fate is a window on China

THE HONG KONG Heritage Museum is beguiling and eclectic. Visitors wander through a colonial-era reading room and a full-sized replica of an opera house made of bamboo. An exhibition on Bruce Lee features quotes of the actor urging people to “be formless, shapeless, like water”—a slogan that roused pro-democracy protesters in 2019. It may be a hotch-potch collection, but it represents “our collective memory”, says Kacey Wong, a Hong Kong-born artist who has exhibited there: “So it’s very important.”

The museum affirms and protects the city’s distinct culture. Around 451,000 people visited last year. But it may not exist for long. Hong Kong’s pro-Beijing government wants to build the city’s first

major museum dedicated to China’s “grand development and achievements”. It recently outlined a plan to commandeer a site in the bustling tourist district occupied by the Science Museum and move the Science Museum into the Heritage Museum—disbanding the Heritage Museum’s collection. After pushback local media now report the government will overhaul the Heritage Museum to focus only on pop culture.

Last year John Lee, Hong Kong’s chief executive, promised two new museums to “cultivate a stronger sense of national esteem and patriotism”. Institutions that challenged the party line, such as a tiny museum dedicated to the Tiananmen Square protests of 1989, have closed. A Chinese Culture Promotion Office is in the works; it plans to ensure “Chinese culture and history” is prioritised. All this ties into China’s plans to be a “museum power” by 2035: it says it opened 382 new ones in 2022.

Hong Kongers are depressed about the likely fate of the Heritage Museum. “Turning it into a museum of popular culture is like people listening to bagpipe music but not talking about Scotland,” says Mr Wong. He organised a petition calling on the government to keep the Heritage Museum as is and expected around 60 signatures. Some 700 Hong Kongers signed it; many are associated with the pro-democracy movement and so have left the city. He does not expect the government to take any notice of their anger. Hong Kongers living abroad will preserve the city’s culture, he says. But “if you’re staying in Hong Kong then you have to endure.”



Red-washing history

The rise of slap fighting

Bad sport

The violence of a new combat sport is part of its allure

IN JANUARY 2023 Dana White, president of the Ultimate Fighting Championship (UFC), a mixed martial-arts firm, launched a new sporting endeavour: Power Slap, America's first official slap-fighting league. Slap fighting is simple. Two competitors, usually beefy men, slap each other. Hard. The bout typically ends when only one of them is conscious. As recently as a year ago the sport was obscure, watched largely on social media in eastern Europe. Now slap-fighting franchises are starting to hit the mainstream.

The league's first televised slap fight last year between two welterweights, Chris Thomas and Chris Kennedy, gave a sense of what was to come. Mr Thomas's initial strike was mighty, rippling Mr Kennedy's face and sending him to the mat, where he started displaying the fencing response. This is when a person's arms are extended after a blow. It can be a sign of brain injury. Officials rushed to him and explained, when Mr Kennedy came to, that he had just been knocked out. "Knocked out doing what? Was I fighting?" he asked.

Watching people slap each other may sound mindless. And that is exactly what television viewers thought. Mr White first launched his venture as a reality-TV show, "Power Slap: Road to the Title", but it failed to catch on and was dropped by TBS, a broadcaster, in March 2023, partly because of low ratings (and partly because of controversy after Mr White was filmed slapping his wife).

However, television trash can turn into social-media treasure. "Power Slap" garnered a devoted online audience and now claims 4.2m followers on TikTok, with some videos achieving more than 1m views. The hype on social media spurred Mr White to double down with a second season, this time broadcast on Rumble, a video-sharing platform. The season finale will air on February 9th.

The growing popularity of "Power Slap" is a slap in the face for those who worry about brain injury in combat sport. Contests involve unrestrained attacks with no defence: contestants are not allowed to duck, dodge or wince when hit. Most bouts conclude with a knockout (involving a fighter being unable to get up) or a technical knockout (with a referee deeming the fighter unfit to continue). In 26 of the 55 league matches to date a competitor was rendered unconscious.

Critics worry about brain damage and chronic traumatic encephalopathy (CTE), a neurodegenerative disease that occurs after repeated head trauma, often resulting in speech impediments and dementia. In recent years the reputations of American football, mixed martial arts (MMA) and rugby have been bruised because of the risks posed to athletes' neurological health, including more documented cases of CTE. (Health concerns, however, have not stopped fans from watching matches.)

Some critics are going so far as to try to ban children from contact sport. A committee of the California legislature recently passed a bill to make it illegal for those under the age of 12 to play tackle football. (Gavin Newsom, the governor, vetoed it, knowing political opponents would tackle him for regulatory overreach.) But even more than American football, slap fighting raises ethical questions about watching a sport that Dr Bennet Omalu, an expert on CTE, has called "inconsistent with the intelligence of humans".

The UFC experienced similar scrutiny in the 1990s. John McCain, a senator who later ran for president, branded MMA "human cockfighting" and attempted to ban it. The league introduced safety regulations, with the Unified Rules of Mixed Martial Arts markedly increasing safety for athletes and opening the sport to larger venues that previously refused to host MMA fighting.

What regulations to promote safety in slap fighting might look like is not entirely clear: the lack of protective kit and rules helps explain the sport's appeal for viewers. Most power-slappers are unbothered by complaints that their "sport" shows how desensitised viewers have become to violence. They just want a moment of social-media fame, brains be damned. ■



Don't turn the other cheek

Secrecy in the art market

Painted into a corner?

NEW YORK

A riveting trial pitted Sotheby's against a Russian billionaire

THE HORROR of it dawned on Dmitry Rybolovlev in paradise, of all places. Over lunch in St Barts in 2014, conversation turned to a painting by Amedeo Modigliani, an Italian artist, that the Russian billionaire had bought several years before in a private sale. At the table happened to be an art adviser for the previous owner, who revealed Mr Rybolovlev paid around \$25m more than what the seller had made.

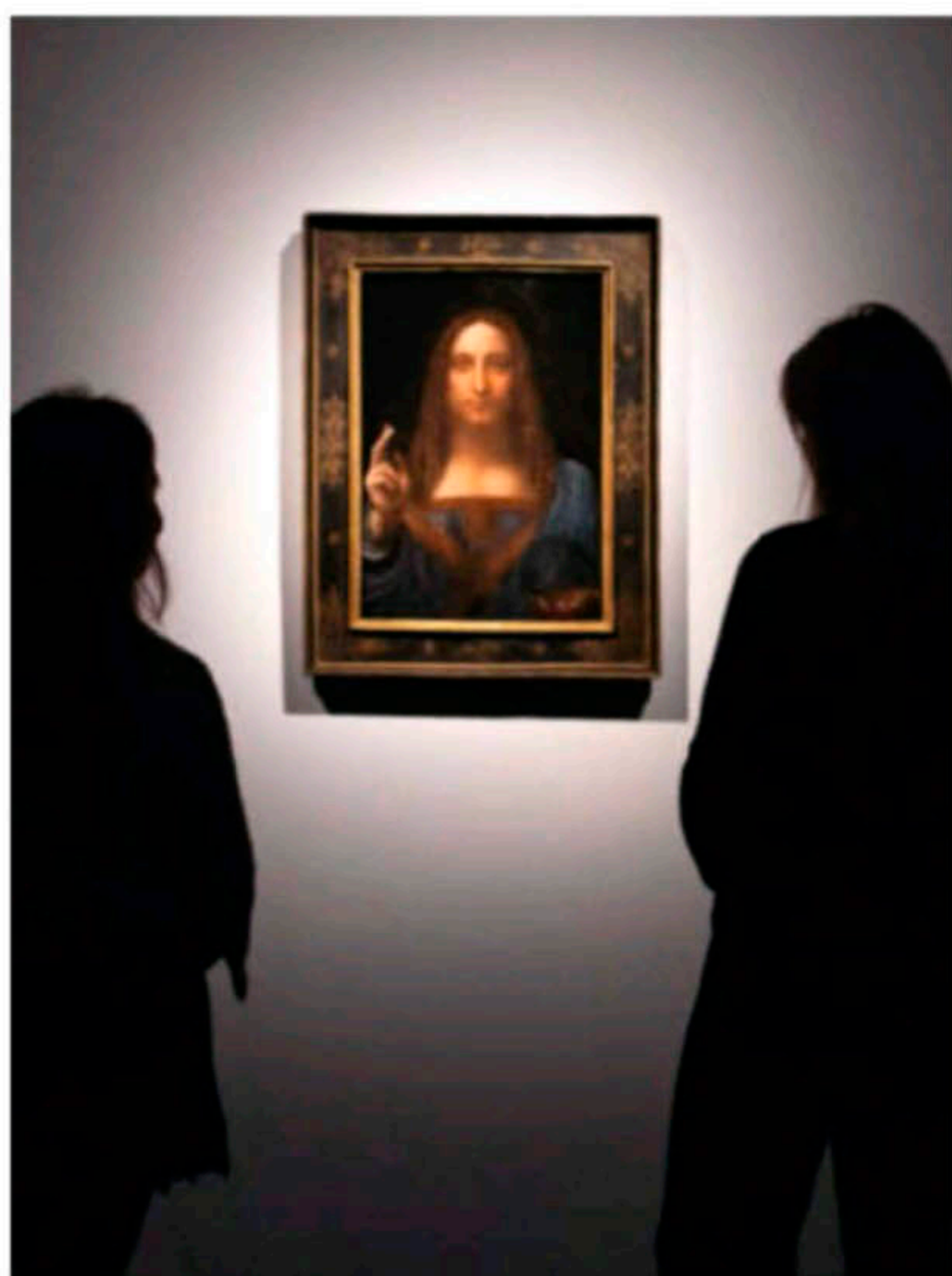
It turned out that a Swiss middleman named Yves Bouvier, whom Mr Rybolovlev thought was acting as his adviser, pocketed the difference, plus an agreed-upon commission. The staggering markup fit a pattern. Over 38 sales Mr Bouvier allegedly made more than \$1bn. On many occasions Mr Rybolovlev says he was told falsely that Mr Bouvier was haggling with the sellers to get better prices, only to inflate them.

Cue a nearly decade-long legal battle in Hong Kong, Monaco, Singapore, Switzerland and now America. On January 30th the art-filled drama concluded in a courtroom in Manhattan, with a disappointing result for Mr Rybolovlev. The trial concerned whether Sotheby's, an auction house, aided and abetted Mr Bouvier's alleged fraud. A jury found it did not. (Mr Bouvier was not a defendant; he and Mr Rybolovlev settled their dispute confidentially in Switzerland last December.)

Mr Bouvier denied wrongdoing and said that he acted not as an adviser but as a dealer, who is entitled to markups. He bought trophy paintings in private sales at Sotheby's, then flipped them to Mr Rybolovlev. The trial centred on pricey works by Leonardo da Vinci, Gustav Klimt, René Magritte and Modigliani. Mr Rybolovlev alleged that Sotheby's helped Mr Bouvier justify markups by providing inflated appraisals in a bid to keep Mr Bouvier's business, which Sotheby's denied.

The case was challenging to win. Proving fraud requires showing intent; the evidence presented at trial was circumstantial. The saga's main player, Mr Bouvier, never testified. That the alleged swindle took place on a yacht and in a penthouse apartment along Manhattan's "billionaire's row" near Central Park probably did not elicit much sympathy from the jury.

Another wrinkle in Mr Rybolovlev's case was the fact that he actually made out extremely well in at least one instance. In 2013 he bought "Salvator Mundi", a painting by da Vinci (pictured on next page), ▶▶



Beautiful art, shadowy characters

▶ from Mr Bouvier for \$128m. Mr Bouvier charged a 54% markup and congratulated him on a “great deal for this unique masterpiece”. That was shifty. But four years later Mr Rybolovlev sold “Salvator Mundi” for \$450m—a record for any artwork and more than triple what he paid.

After the verdict Mr Rybolovlev’s lawyers said that the case shone a “light on the lack of transparency that plagues the art market”, but “secrecy made it difficult” to win. Private sales, both through auction houses and art dealers, are notoriously opaque. Much like the derivatives market on Wall Street, which was revealed after the global financial crisis of 2007-09 to take advantage of “dumb-money” pension funds, middlemen can manipulate prices for art. This trial highlighted the shamelessness of profit-hungry players.

But there is more that Mr Rybolovlev should have done to protect his interests. For example, he never delineated in writing the nature of his relationship with Mr Bouvier: was he a dealer or an agent with a fiduciary duty? Lawyers for Sotheby’s hammered Mr Rybolovlev on why, as a shrewd businessman, he failed to draw up contracts or request invoices straight from the auction house. At the outset this could have cleared up the disagreement or at least mitigated the fallout, says Judd Grossman, an art lawyer.

To Mr Grossman this lesson recalls another art-world dispute decided in New York in 2010. That case also involved an agreement never put into writing between a miffed collector and David Zwirner, a blue-chip dealer. “Some in the art world desire a market that is neither open nor honest,” wrote the judge in his ruling. Collectors, he added, in this “seemingly refined bazaar should heed the admonition ‘caveat emptor’”. ■

Martha Graham

Dance like nobody’s watching

A new biography tracks the jumps, dips and drops of modern dance

Errand into the Maze. By Deborah Jowitt. *Farrar, Straus and Giroux*; 480 pages; \$35 and £30

IN 1929 AN American critic, Henry McBride, observed that “the centre of the world has shifted” from Paris to New York. America did not just have cultural capital—it was becoming the West’s cultural capital. Dance was flourishing because of two inventive and charismatic choreographers. George Balanchine, the father of American ballet, liberated classical dance from European strictures, replacing costume dramas with graceful abstractions.

Less well remembered today but just as influential was Martha Graham, who pioneered modern dance. The Martha Graham Dance Company, which she founded in 1926, was the first dance troupe in America. As Deborah Jowitt, a critic and former dancer, shows in a new biography, Graham helped “dignify” dance and elevate it from entertainment to art.

Graham never had classical training. As a young woman, she saw a performance by Ruth St Denis, an early pioneer of modern dance, and later attended Denishawn, St Denis’s school. There Graham was immersed in “oriental” dances, which were fashionable at the time and often performed in costume at vaudeville. But Graham soon moved beyond this cartoonish

style, which she dismissed as “the weakling exoticism of a transplanted culture”.

Drawing not just on Native American, black and folk traditions but also on philosophy and literature, Graham developed a style that was athletic and expressive. Still taught in Graham-style classes, its signature movement involves a deep breath in as the dancer leans forward in “contraction”, followed by a “release”. Graham thought dance began in the muscular core; she sometimes enjoined women to “dance from the vagina”. There were no positions, as in ballet, but rather a “lexicon of movements”, Ms Jowitt describes.

In her 181 works, Graham explored not just the fine arts (making dances about Emily Dickinson, the Brontë sisters and Greek myth) but also contemporary social and political questions, such as the Spanish civil war, the influence of technology on society and, above all, sex and gender. If Balanchine’s ballet idealised the female body and made women into angels, Graham’s modern dance doubled down on their fleshiness.

Though Graham’s company was never financially successful, her dances made a mark. She was famous enough to be caricatured in newspapers and magazines and in 1937 became the first dancer to appear at the White House (invited by Franklin Roosevelt and his wife, Eleanor). The State Department sent the Martha Graham Com- ▶▶



Graham, in the centre of it all

pany on world tours seven times between 1955 and 1987. Her energetic dances represented American freedom on stage, delighting audiences from Paris to Tokyo.

Today dance is more peripheral and “not nearly as culturally important in America as it was in the last century”, says Brian Seibert, who writes about dance for the *New York Times*. In 2017, the latest year data is available, around 1.9m Americans attended a dance performance, down by more than half since 2012, according to analysis of government surveys by Daniel Fonner, an adjunct lecturer at Southern

Methodist University in Dallas.

Dance remains expensive to attend, and stubbornly physical. Beyond TikTok, dance does not translate well to filmed media, which limits its distribution and appeal. Fundraising has become more difficult as audience attendance and interest have flagged. Graham’s company has struggled to find its way since its founder died in 1991; so have other dance troupes that proliferated in Graham’s dynamic shadow.

What are modern dance’s next steps? To attract new viewers, dance companies are tackling subject matter with clearer con-

nections to people’s lives and popular taste. The San Francisco Ballet recently commissioned a new dance about artificial intelligence, called “Mere Mortals”, based on the myth of Pandora unleashing ills. More dance companies are staging performances about race and sexual identity, too. Contemporary venues sometimes feature hip-hop-inspired groups one night and traditional companies the next.

Just as ballet did not die with Balanchine, modern dance did not die with Graham. But it needs to work even harder to stay modern. ■

Back Story Shots from a marriage



In a new “Mr & Mrs Smith”, the assassins’ mission is to make you think

IF YOU REMEMBER “Mr & Mrs Smith”, a romantic-comedy spy caper of 2005, it may not be for its shrewd analysis of matrimony. The film starred Brad Pitt and Angelina Jolie as husband-and-wife assassins; their on-set attraction helped assassinate Mr Pitt’s marriage to Jennifer Aniston and inaugurate the cult of “Bran-gelina”. Yet beneath the stunts and perfect hair bubbled deeper emotional questions. A new TV version of the story amplifies and adds to them—casting light on changing times and contrasting artistic ambitions.

In the film, the Smiths did not know they shared a vocation until their employers, rival contract-killing agencies, dispatched them to rub each other out. Matrimony, the film winkingly suggested, is an exercise in espionage and subterfuge, coiffed exteriors hiding secrets from both spouses and the world. For some it can feel a bit like mortal combat. “There is this huge space between us,” Mrs Smith told a therapist, “and it just keeps filling up with everything that we don’t say to each other. What is that called?” “Marriage,” came the reply.

The new series, out on Amazon Prime Video on February 2nd, was co-created by Donald Glover, the small-screen auteur behind the offbeat masterpiece “Atlanta”. Mr Glover plays John Smith; this time he and Jane Smith (Maya Erskine) are strangers recruited by the same mysterious firm, which assigns their cover names and concocts their fake marriage. Would they have hit it off, they are asked, if the company hadn’t matched them? In essence, this is a question many couples ponder, since all are brought together by propitious circumstance and chance.

The movie’s Smiths were super-human: not just absurdly gorgeous but pain-free, conscience-free and able to

roll around amorously on glass-strewn surfaces without cutting themselves. The TV Smiths (pictured) are regular millennials, but with a high tolerance for violence. Novices as both agents and spouses, they cope with buggings and bombs, but also jealousies and petty rows, bickering over table manners and a missing phone-charger. “Do you think the cheese plate was too much?” asks Mrs Smith in a lull between dinner and a gory mission.

Sex is a different story, too. Mr Pitt’s and Ms Jolie’s characters got down to it shortly after meeting; in the updated version sex is a subject of cagey negotiation. Only after accidentally killing someone do these Smiths find comfort in each other’s arms.

The movie had a touch of girl-power feminism, as when Mrs Smith complained about being given the smaller gun. Now the politics are starker, especially the racial kind (Ms Erskine is half-Japanese; Mr Glover is black). This Mr Smith worries that he will be conspicuous at a swish art auction, so disguises himself as a waiter. Verbal microaggressions trouble the pair



as much as murder seems to.

Another detail of the film is foregrounded on TV. The big-screen Smiths lived in the sort of palatial home, with a two-car garage and Greenland-sized kitchen island, which passes for normal in American dramas. In the revamp the house that comes with the job—a huge Manhattan brownstone rather than a suburban mansion—boasts a roof garden and a pool. But no longer is it an unremarked perquisite of the killing business. Through the house, the show becomes a study, not only of marriage, but of the aspirations, grind and compromises of the 21st-century rat-race.

If this makes “Mr & Mrs Smith”, the reboot, sound overstuffed or didactic, it isn’t. On the contrary, the show squeezes in a generous quota of car chases and explosions, racking up a body count to compete with the movie’s. It also, elastically, finds time for the languid chats about nothing much, naturalistic and absurd at once, which are among Mr Glover’s trademarks. Amid the shoot-outs, people say things like “You’re being weird.” On the shore of Lake Como, in the middle of a kidnapping, the Smiths fall out over whether to have children.

It is, in other words, a bold experiment in form, not only in transposing a film to TV. Like “The Sopranos” and “The Americans”, “Mr & Mrs Smith” mixes domesticity with violent careers, stirring in elements of Hitchcock and dating shows. It is a thriller, a parable and a joke.

Should you watch it? The lurching tone is a challenge, but persevere. At the close of the sugar-rush film, the gleaming Smiths have vanquished their foes and honesty has rejuvenated their relationship. On TV, the story is far more nuanced and equivocal, much like the real-life drama of marriage.



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	Gross domestic product			Consumer prices		Unemployment rate		Current-account balance		Budget balance		Interest rates		Currency units		
	% change on year ago			% change on year ago		rate		% of GDP, 2023†		% of GDP, 2023†		10-yr gov't bonds	change on	per \$	% change	
	latest	quarter*	2023†	latest	2023†	%						latest,%	year ago, bp	Jan 31st	on year ago	
United States	3.1	Q4	3.3	2.4	3.4	Dec	4.1	3.7	Dec	-2.8	-6.3	4.0	47.0	-		
China	5.2	Q4	4.1	5.5	-0.3	Dec	0.3	5.1	Dec†§	2.3	-3.8	2.3	§§	-41.0	7.18	-5.8
Japan	1.5	Q3	-2.9	1.8	2.6	Dec	3.3	2.4	Dec	3.9	-5.0	0.7		23.0	146	-11.0
Britain	0.3	Q3	-0.5	0.2	4.0	Dec	6.8	4.3	Jun††	-2.9	-3.9	4.0		54.0	0.79	2.5
Canada	0.5	Q3	-1.1	1.0	3.4	Dec	3.8	5.8	Dec	-0.9	-1.5	3.3		40.0	1.34	-0.8
Euro area	0.1	Q4	0.1	0.6	2.9	Dec	5.4	6.4	Nov	2.4	-3.3	2.2		-12.0	0.92	nil
Austria	-1.8	Q3	-2.1†	-0.7	5.7	Dec	7.7	4.9	Nov	1.6	-2.2	2.7		-20.0	0.92	nil
Belgium	1.5	Q4	1.6	1.3	1.5	Jan	2.3	5.6	Nov	-1.1	-4.3	2.8		-12.0	0.92	nil
France	0.7	Q4	-0.1	0.8	3.4	Jan	5.7	7.3	Nov	-1.1	-4.9	2.7		2.0	0.92	nil
Germany	-0.2	Q4	-1.1	-0.1	3.1	Jan	6.0	3.1	Nov	5.6	-2.2	2.2		-12.0	0.92	nil
Greece	1.8	Q3	0.1	2.2	3.7	Dec	4.2	9.4	Nov	-5.3	-2.1	3.2		-111	0.92	nil
Italy	0.5	Q4	0.7	0.7	0.5	Dec	5.9	7.2	Dec	0.5	-5.4	3.7		-56.0	0.92	nil
Netherlands	-0.8	Q3	-1.2	0.1	1.0	Dec	4.1	3.6	Dec	9.4	-2.1	2.5		-16.0	0.92	nil
Spain	2.0	Q4	2.5	2.3	3.5	Jan	3.4	11.9	Nov	2.0	-4.0	3.2		-8.0	0.92	nil
Czech Republic	-1.0	Q3	0.8	-0.5	6.9	Dec	10.7	2.6	Nov†	-1.3	-3.9	3.8		-83.0	22.9	-4.4
Denmark	-0.5	Q3	-2.6	1.5	0.7	Dec	3.8	2.9	Dec	11.1	1.5	2.4		-13.0	6.86	-0.1
Norway	-1.9	Q3	-2.1	0.4	4.8	Dec	5.4	3.7	Nov††	17.2	10.6	3.6		68.0	10.5	-4.5
Poland	0.5	Q3	6.1	0.5	6.2	Dec	11.4	5.1	Dec‡	1.7	-4.7	5.2		-84.0	3.98	9.1
Russia	5.5	Q3	na	2.8	7.4	Dec	6.2	2.9	Nov‡	3.0	-2.8	11.6		105	89.8	-21.8
Sweden	-0.5	Q4	0.4	-0.6	4.4	Dec	6.0	7.7	Dec‡	4.6	-0.3	2.3		21.0	10.3	1.4
Switzerland	0.3	Q3	1.1	0.8	1.7	Dec	2.1	2.2	Dec	10.9	-0.7	0.8		-43.0	0.86	7.0
Turkey	5.9	Q3	1.1	4.5	64.8	Dec	53.9	8.8	Nov‡	-4.3	-5.0	25.1		1,462	30.3	-38.0
Australia	2.1	Q3	0.9	1.9	4.1	Q4	5.7	3.9	Dec	0.3	0.3	4.2		76.0	1.51	-6.0
Hong Kong	4.3	Q4	2.0	3.4	2.4	Dec	2.1	2.9	Dec††	7.2	-1.7	3.6		40.0	7.82	0.3
India	7.6	Q3	8.6	6.9	5.7	Dec	5.7	6.8	Jan	-0.5	-5.9	7.1		-20.0	83.0	-1.3
Indonesia	4.9	Q3	na	5.0	2.6	Dec	3.7	5.3	Q3‡	0.4	-2.5	6.6		-11.0	15,780	-5.0
Malaysia	3.4	Q4	na	3.8	1.5	Dec	2.5	3.3	Nov‡	1.5	-5.1	3.8		-1.0	4.73	-9.7
Pakistan	nil	2023**	na	nil	29.7	Dec	30.8	6.3	2021	0.2	-8.0	14.6	†††	7.0	280	-4.2
Philippines	5.6	Q4	8.7	5.4	3.9	Dec	6.0	4.2	Q4‡	-4.1	-7.2	6.2		3.0	56.3	-3.0
Singapore	2.8	Q4	7.0	1.2	3.7	Dec	4.8	2.0	Q4	18.8	-0.7	2.9		-6.0	1.34	-2.2
South Korea	2.2	Q4	2.5	1.3	3.2	Dec	3.6	3.3	Dec‡	2.1	-2.7	3.4		3.0	1,335	-7.7
Taiwan	5.1	Q4	8.8	1.4	2.7	Dec	2.5	3.4	Dec	12.9	-0.1	1.2		-2.0	31.3	-4.1
Thailand	1.5	Q3	3.1	2.5	-0.8	Dec	1.3	0.8	Dec‡	0.8	-2.7	2.8		28.0	35.5	-7.0
Argentina	-0.8	Q3	11.3	-1.1	211	Dec	135.3	5.7	Q3‡	-3.4	-4.4	na		na	826	-77.4
Brazil	2.0	Q3	0.6	2.9	4.6	Dec	4.6	7.4	Dec†††	-1.2	-7.5	10.6		-249	4.94	3.0
Chile	0.6	Q3	1.3	nil	3.9	Dec	7.6	8.5	Dec†††	-3.5	-2.4	5.5		10.0	932	-14.3
Colombia	-0.3	Q3	1.0	1.1	9.3	Dec	11.7	10.0	Dec‡	-3.4	-4.2	9.4		-276	3,911	18.7
Mexico	2.4	Q4	0.4	3.4	4.7	Dec	5.5	2.8	Dec	-1.4	-3.8	9.3		58.0	17.2	9.4
Peru	-1.0	Q3	-1.1	-0.5	3.2	Dec	6.3	5.8	Dec‡	-1.0	-2.7	6.6		-133	3.80	1.3
Egypt	2.7	Q3	na	3.8	33.6	Dec	33.9	7.1	Q3‡	-1.5	-6.2	na		na	30.9	-2.3
Israel	3.4	Q3	2.7	1.2	3.0	Dec	4.2	3.1	Dec	5.9	-4.6	4.2		84.0	3.64	-5.0
Saudi Arabia	3.8	2023	na	-1.1	1.5	Dec	2.3	5.1	Q3	3.0	-2.0	na		na	3.75	nil
South Africa	-0.7	Q3	-1.0	0.6	5.2	Dec	5.9	31.9	Q3‡	-1.9	-5.2	9.8		8.0	18.6	-6.3

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. Note: Euro area consumer prices are harmonised.

Markets

In local currency	Index	% change on:	
		Jan 31st	Dec 30th 2022
United States S&P 500	4,845.7	-0.5	26.2
United States NASComp	15,164.0	-2.1	44.9
China Shanghai Comp	2,788.6	-1.1	-9.7
China Shenzhen Comp	1,544.9	-6.2	-21.8
Japan Nikkei 225	36,286.7	0.2	39.1
Japan Topix	2,551.1	0.9	34.9
Britain FTSE 100	7,630.6	1.4	2.4
Canada S&P TSX	21,021.9	nil	8.4
Euro area EURO STOXX 50	4,648.4	1.8	22.5
France CAC 40	7,656.8	2.7	18.3
Germany DAX*	16,903.8	0.1	21.4
Italy FTSE/MIB	30,744.2	1.3	29.7
Netherlands AEX	818.2	1.4	18.8
Spain IBEX 35	10,077.7	1.0	22.5
Poland WIG	77,416.3	2.7	34.7
Russia RTS, \$ terms	1,125.6	0.1	16.0
Switzerland SMI	11,333.4	1.2	5.6
Turkey BIST	8,496.7	5.0	54.2
Australia All Ord.	7,912.8	2.1	9.6
Hong Kong Hang Seng	15,485.1	-2.6	-21.7
India BSE	71,752.1	1.0	17.9
Indonesia IDX	7,207.9	-0.3	5.2
Malaysia KLSE	1,513.0	0.6	1.2

	Index	% change on:	
	Jan 31st	one week	Dec 30th 2022
Pakistan KSE	61,979.2	-4.4	53.3
Singapore STI	3,153.0	nil	-3.0
South Korea KOSPI	2,497.1	1.1	11.7
Taiwan TWI	17,889.6	0.1	26.5
Thailand SET	1,364.5	-1.2	-18.2
Argentina MERV	1,260,563.0	0.7	523.8
Brazil BVSP*	127,752.3	nil	16.4
Mexico IPC	57,372.8	3.6	18.4
Egypt EGX 30	28,281.9	2.2	93.7
Israel TA-125	1,861.9	-0.3	3.4
Saudi Arabia Tadawul	11,796.6	-3.1	11.9
South Africa JSE AS	74,555.9	0.3	2.1
World, dev'd MSCI	3,205.3	0.1	23.2
Emerging markets MSCI	975.8	-0.7	2.0

US corporate bonds, spread over Treasuries

	latest	Dec 30th 2022
Investment grade	108	154
High-yield	384	502

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

Commodities

The Economist commodity-price index

	2020=100	Jan 23rd	Jan 30th*	% change on	
				month	year
Dollar Index					
All items	126.8	129.4	-0.3	-6.5	
Food	130.5	130.8	0.5	-8.8	
Industrials					
All	123.7	128.2	-1.0	-4.4	
Non-food agriculturals	129.6	130.7	2.8	-6.0	
Metals	122.3	127.6	-2.0	-4.0	
Sterling Index					
All items	128.6	131.2	-0.7	-9.1	
Euro Index					
All items	133.8	136.4	0.7	-6.3	
Gold					
\$ per oz	2,026.2	2,033.4	-1.6	5.5	
Brent					
\$ per barrel	80.2	82.8	8.7	-2.6	

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

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The short-tempered klavier

Peter Schickele and P.D.Q. Bach, two sides of the same coin, died on January 16th, aged 88

HIS OWN musical career looked fairly good on paper. He had more than 100 serious works to his name. The National Symphony, the Minnesota Opera and several string quartets had all commissioned works from him. He wrote film scores, too, including tracks for “Silent Running” in the 1970s. But Peter Schickele could indulge his dream of serious composing only because, for half the year, he was touring the concert halls of America with the much more celebrated part of his persona, a bibulous, cranky, chaotic remnant of the 18th century called P.D.Q. Bach.

This last gasp of the Bach family had been mercifully forgotten until, in 1954 or so, Mr Schickele found the score of P.D.Q.’s “Sanka Cantata” being used as a filter in a caretaker’s percolator in a castle in Bavaria. From that moment, in taverns, attics, trash cans, even the East River, scores kept turning up. All were in surprisingly fresh condition, though also much scribbled over. As self-proclaimed professor of musical pathology at the University of Southern North Dakota at Hoople, Mr Schickele was now on a mission to uncover and promote this mystery composer. It took up the rest of his life, and entertained audiences hugely along the way.

Research into the Bach family revealed that there was indeed a 21st child, born in Leipzig on April 1st 1742. So backward did he prove that his dates were often given as 1807-1742. His very name, P.D.Q. (presumably “Pretty Damn Quick”), suggested his usual mode was the sulky reverse. Though his father never trained him, and he gave up music at three, the illustriousness and sheer productivity of “Big Daddy Bach” made it hard to avoid that life. The struggle was immense. P.D.Q.’s Chorale Preludes on “Ah” and “Should” could not find anything more to say. His “Short-Tempered Clavier” was subtitled “Preludes and Fugues in All the Major and Minor Keys Except for the Really Hard Ones”. And no one could mistake the rage that animated his “versus” concertos: Concerto for bassoon [his own instrument] v Orchestra, Concerto for

Piano v Orchestra, Concerto for Two Pianos v Orchestra, where the final final final all-marmalising chord from the orchestra was inevitably answered by some mocking keyboard twiddle or other.

Besides the burden of the name, P.D.Q.’s life was sadly undisciplined. Some works evoked the expected chaos of a large household: “Breakfast Antiphonies”, for example (played in stereo, strings on one side of the room, winds and brass on the other), or “Allegretto Gabinetto for Plumber and Keyboarder”, or his famous Canine Cantata, “Wachet, Arf!”

But his principal problem was drink. When Mr Schickele divided his doppelgänger’s musical life into just-about-coherent periods, he called them “The Initial Plunge”, “The Soused (Brown-Bag)” and “The Contrition”. In the first, which lasted about six days, P.D.Q. learned all he ever would about the craft of music. Most of the second, almost foolishly productive spell was spent face-down in a gutter in Wein-am-Rhein. In the third, he nursed his hangover in hopes it would end. An unexpected portrait of him, found in an alleyway in Leipzig, showed an august, bewigged patriarch at first glance. But the knees of his breeches were muddy and his tankard, in a minute, was about to tip into his lap.

Years of work on the scores left Mr Schickele with two main conclusions. The first was that P.D.Q. was an utterly shameless plagiarist of other people’s works. Forgetting for a moment the all-pervading Bach connection, he was a merciless filletter of Mozart (“Eine Kleine Nichtmusik”), and Haydn (“Half-Nelson Mass”). Yet he was often so drunk as he did his borrowings that he forgot how the notes actually went, and in his fumbblings could be dazzlingly original. Though Mr Schickele insisted on his “absolute and utter lack of talent”, in his heart of hearts he did not always think so.

P.D.Q.’s originality with instruments was perhaps a sign of genius, too. After all, what lovely sounds might emerge from a pasta-phonie, a dill piccolo, a shower hose or a tromboon, which had the slide of a trombone and the reedy top end of a bassoon? A favourite with both men was the lasso d’amore, one of those whirly whistling plastic tubes developed by Viennese cowboys who found that, once made musical, they were useless to round up cattle.

The louche Leipziger was also a seer of sorts. Internal evidence suggested that, though he never went there, he knew the United States and its musical future curiously well. How else to account for the title of his most celebrated cantata, “Iphigenia in Brooklyn” (with Orestes’s poignant aria, “Oh ye gods, who knows what it is to be running?/Only he who is running, running, running knows”)? Or the rousing harmonica-led “Blaues Gras” cantata, or the mini-opera “Oedipus Tex”? How to explain the tenderness of the Christmas carol “Oh Little Town of Hackensack”, or the vibrant “Concerto for Horn and Hardart”, America’s first dispenser of hot mac n’ cheese through an Automat?

Yet prescience could work two ways. Mr Schickele had speculated on the possibility of another Bach son while, as a bluff and frisky midwesterner, he was doing his music studies at the Aspen Music School and Julliard. Already, like P.D.Q., he enjoyed larking around with the styles of other composers, expertly noodling popular songs into serious sections, letting weird sounds intrude wherever useful and generally shocking people. Nobody was better than P.D.Q. at that, and luckily the works kept coming. Something already in Mr Schickele led him to just those insalubrious spots where his kindred spirit had left an offering. Even the piece of paper he skidded on once in New York, as he walked home from the baker’s, turned out on close inspection to be the score of P.D.Q.’s “Four Next-to-Last Songs”.

When friends sympathised with his strange condition—rescuing one highly dubious composer from neglect, while getting mostly neglected himself—it was hard to know what to reply. P.D.Q. had indeed netted four of his five Grammys. But they had joyously broken most of the musical rules together, twinned in “a satire of love”. The best response was probably a sigh and a wink, followed by a rousing tootle on the left-handed sewer flute. ■

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