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DECEMBER 5TH–11TH 2015

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On the cover
 Worries about corporate myopia miss the point. Even in America, capitalism is not dynamic enough: leader, page 13. Is the pace of business really getting quicker? Pages 22-24

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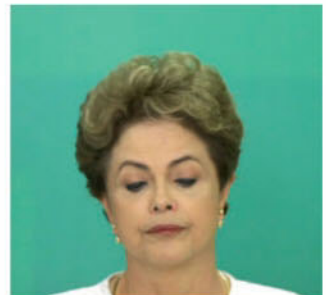
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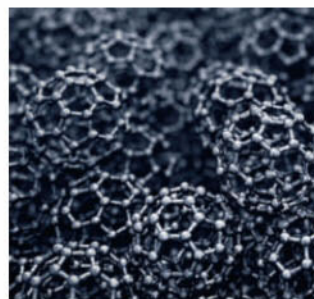
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Tel: 020 7830 7000

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Tel: 41 22 566 2470

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Politics



Eduardo Cunha, the Speaker of the lower house of **Brazil's** Congress, initiated impeachment proceedings against Dilma Rousseff, the president. He accepted the arguments of three lawyers that she had illegally allowed the government to be funded by financial institutions that are under its control, hiding the dire state of its finances. Meanwhile, Brazil's economy shrank by a whopping 4.5% year-on-year in the third quarter.

Scores of **Cubans** protested outside Ecuador's embassy in Havana, angered by its decision to reimpose a visa requirement. Many Cubans have bought plane tickets to Ecuador in the hope of travelling north to enter the United States before improved relations with Cuba make that more difficult. Some 3,000 Cubans who attempted the journey are stuck at Costa Rica's border with Nicaragua.

There to help

British fighter jets began air strikes against Islamic State in Syria for the first time, hours after David Cameron's Conservative government secured the support of the House of Commons for action by 397 to 223 votes following an emotionally charged day-long debate. A similar motion had been defeated in Parliament in 2013. Jeremy Corbyn, the leader of the opposition Labour Party, succumbed to pressure from his own MPs and allowed them a free vote. Some suggested it was his weak leadership that guaranteed Mr Cameron victory in extending British air strikes from Iraq to Syria.

Russia accused **Turkey** of buying and selling oil from Islamic State, and deepened its trade sanctions against Turkish firms. Tensions have heightened since Turkish jets shot down a Russian fighter plane last month because it had penetrated Turkish airspace. Russia now calls Turkey an ally of terrorists and has redoubled its bombing of the Syrian rebel groups that Turkey supports.

NATO invited **Montenegro** to become its first new member since Albania and Croatia joined in 2009. The announcement triggers the start of accession talks for the tiny Adriatic country. Russia objected to the invitation.

The European Union and Turkey reached a deal to reduce the flow of **migrants** from the Middle East. Europe will provide Turkey with €3 billion (\$3.2 billion) in aid to improve refugees' lives in Turkey. Turkey will crack down on smugglers who ferry migrants to Greece. In exchange the EU will reopen talks on Turkish accession.

In a case brought by the **Northern Ireland** Human Rights Commission, a court in Belfast ruled that abortion should be made available in the province in instances of rape, incest and where fetuses have fatal abnormalities. British abortion laws do not apply to Northern Ireland. Its attorney-general is considering an appeal against the court's decision.

A serious falling out

The Afghan **Taliban's** new leader, Mullah Akhtar Mansour, was reportedly shot and wounded when fighters from the group gathered to meet in the Pakistani city of Quetta. The Taliban's spokesman dismissed the reports as baseless. In Afghanistan hundreds of Taliban have died fighting each other since splitting into factions upon the death of the previous leader. It was also reported that Mullah Mansour Dadullah, the head of a faction aligned with IS and a rival to Mullah Mansour, had been killed.



The worst flooding in a century brought chaos to the state of Tamil Nadu in southern India. At least 269 people have died in recent weeks because of unusually heavy rains. **Chennai's** airport was shut down, as were the city's schools.

The most important UN summit in years on **climate change** got under way in Paris. Barack Obama attended and expressed optimism that the meeting will produce a legally binding mechanism for countries to adhere to targets that cut greenhouse gases. Narendra Modi, India's prime minister, said that the burden should fall on countries enriched by "the prosperity and progress of an industrial age powered by fossil fuel."

Transition of power

Roch Marc Christian Kaboré was elected as **Burkina Faso's** president, gaining a majority of votes in the first round. The former prime minister had defected from the government nine months before peaceful protests ended Blaise Compaoré's 27-year rule.

Pope Francis visited a mosque in the Central African Republic on the final day of a six-day trip to Africa, telling worshippers that "Christians and Muslims are brothers and sisters." The country has been racked by sectarian violence since a coup in March 2013.

Israel ordered contact to be suspended with EU bodies involved in the Palestinian peace process, after the European Commission ruled that goods made in Israeli settlements must be labelled as such. The EU described relations with Israel as "good".

Cameroon claimed to have killed 100 **Boko Haram** fighters and freed 900 hostages, without specifying if the latter included the 219 schoolgirls still missing after being seized from Chibok in northern Nigeria more than a year ago.

South Africa's Supreme Court of Appeal found that **Oscar Pistorius** was guilty of murder when he shot his girlfriend in 2013, overturning a lower court's verdict of manslaughter. The former Olympic athlete faces a lengthy sentence.

Egyptologists found strong evidence that there is a hidden, yet-to-be explored chamber in the tomb of **Tutankhamun**. It may hold the lost remains of Queen Nefertiti, thought to be both the boy-pharaoh's stepmother and mother-in-law.

The madness



Fourteen people were killed by two shooters at an office party in San Bernardino, California. The suspects, a man and a woman, wore body armour and were killed by police in a subsequent gunfight. It was the worst **mass shooting** in America since the Sandy Hook school massacre in 2012. Barack Obama once again called for gun reforms; some Republicans called for looser gun controls so that citizens could protect themselves. Five days earlier a gunman killed three people at an **abortion** clinic in Colorado.

Sheldon Silver, a former Speaker of the **New York** state Assembly, was found guilty of corruption in a federal court. He is the biggest name by far to be convicted in a number of corruption cases involving New York's politicians.

Business

The IMF added the **yuan** to the Special Drawing Rights basket of currencies, joining the dollar, euro, yen and pound from next October. It will be the third-biggest currency in the SDR system, with a weighting of 10.9%. The IMF's decision, after years of lobbying by officials in Beijing, underscores the rise of China as an economic power by in effect designating the yuan as a global reserve currency. After a sudden depreciation in August, the People's Bank of China promises there will be no more "sudden changes" in the yuan's value.

A report by Standard & Poor's warned that creditworthiness at China's **big state firms** has worsened in recent years. The ratio of gross debt to earnings has increased to more than five on average.

Robbing Peter to pay Paul
Puerto Rico managed to avoid a default by paying all the principal and interest due on \$354m of a category of bonds that carry government guarantees. The American territory made the payment by using money that had been set aside to pay a lower class of bonds next month. The island is struggling to cope with \$72 billion in debt. Alejandro Garcia Padilla, the governor, went to Congress this week to ask it to pass a plan that would allow Puerto Rico to seek a type of bankruptcy protection; he warned that "we have no resources left".

Americans bought 1.3m cars in November, the best month in 14 years. The spree was driven by cheap financing and promotions over the Thanksgiving weekend. But sales of Volkswagen-branded vehicles slumped by 25% compared with the same month last year. VW has stopped selling diesel cars that do not meet emissions standards, after admitting that it cheated on federal tests. But even excluding diesel cars, its sales would still have been sharply lower for the

month. Standard & Poor's this week downgraded VW's credit rating and gave it a negative outlook.

The share price of **BTG Pactual**, Brazil's biggest investment bank, dropped by a third in the week following the arrest of André Esteves, its chief executive, on charges related to a political scandal. The bank moved swiftly to appoint an interim CEO and reassured investors that other partners would buy the controlling shareholding of Mr Esteves. He denies any wrongdoing.

Shining again



Buoyed by rising manufacturing output, **India's** economy grew by 7.4% in the third quarter compared with the same three months last year. Buffeted by financial gales two years ago, India is now the best performer among the BRICS

economies, outpacing China's growth rate of 6.9% in the third quarter. Inflationary pressures have receded, but reforms intended to streamline taxes, such as introducing a national sales tax, have stalled in parliament.

The European Commission is preparing an investigation into the **tax arrangements** that McDonald's uses in Luxembourg, it has emerged. The commission is probing into several sweetheart tax deals, and in October ordered back taxes to be recouped from Starbucks and Fiat.

America's **Federal Reserve** modified its procedures on emergency lending to financial companies, restricting further its ability to intervene. The central bank is no longer allowed to provide emergency lending to individual banks on the verge of collapse. Instead any bail-out plan must have wider "broad-based eligibility", which the Fed now defines as being applicable to at least five firms.

Britain's seven biggest banks passed the Bank of England's latest round of **stress tests**, although Standard Chartered and Royal Bank of Scotland only did so because of steps

they have announced to strengthen their capital position. The central bank also said the banks have almost fulfilled the long-term requirements on the amount of capital they should hold.

It was reported that **Peroni and Grolsch**, two global beer brands owned by SABMiller, could be sold off to satisfy antitrust regulators looking at its \$108 billion takeover by Anheuser-Busch InBev. Their merger will create a brewer with a third of the world market.

Generous to a fault

Mark Zuckerberg announced that he and his wife, Priscilla Chan, would give away 99% of the shares they own in Facebook to fund philanthropic activities. The shares are worth around \$45 billion at today's prices and will be put into a new foundation to focus on education, medical research and "connecting people". The foundation is structured as a limited-liability company rather than a non-profit organisation. This means it can lobby government in policy debates and can make investments in for-profit ventures.

Other economic data and news can be found on pages 88-89





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Hyperactive, yet passive

Worries about corporate myopia miss the point. Even in America, business is not dynamic enough



IT IS easy to make the case that modern business is too frenetic. This week 10 billion shares of America's 500 largest listed firms will have changed hands in frenzied trading. Their bosses will have been swamped by 750,000 incoming e-mails and a torrent of instant data about customers. In five days these firms will have bought \$11 billion of their own shares, not far off what they invested in their businesses. With one eye on their smartphones and the other on their share prices, bosses seem to be the bug-eyed captains of a hyperactive capitalism.

Many bemoan the accelerating pace of business life. Long-term thinking is a luxury, say these critics of capitalism. When managers are not striving to satisfy investors whose allegiance to firms is measured in weeks, they are pumping up share prices in order to maximise their own pay. Executives feel harried, too. Competition is becoming ever more ferocious: if Google or Apple are not plotting your downfall, a startup surely is. Yet such perceptions do not bear close scrutiny. Short-termism is not the menace it seems (see pages 22-24). And the problem with competition is that it is not fierce enough.

Myopia: the long view

Start with short-termism. The fear that capitalism is too myopic has a long history. John Maynard Keynes observed that most investors wanted "to beat the gun". For over 50 years Warren Buffett has made money on the premise that other investors behave like headless chickens. But this drum has seldom been banged more loudly than today. If she wins the White House, Hillary Clinton wants to end the "tyranny" of short-termism. The Bank of England and McKinsey & Co, a consultancy trusted in boardrooms, worry investors cannot see past their noses. The French have legislated to give more voting rights to longer-lasting shareholders. Economists fret that firms' reluctance to invest their profits hurts growth.

Since the 1990s the clock of business has whirred faster in some ways. Silicon Valley upstarts have unsettled some mature industries. Computers buy and dump shares in the stock-market within milliseconds. Yet even in America Inc, the home of hyperactive capitalism, "short-termist" is the wrong label.

Since the crisis of 2008-09 firms' horizons have in fact lengthened. New corporate bonds have an average maturity of 17 years, double the length they had in the 1990s. In 2014 departing chief executives of S&P 500 firms had served for an average of a decade—longer than at any point since 2002 (and longer than most presidents). The average holding period of an S&P 500 share is a pitiful 200 days, but that is double the level of 2009. Constant trading masks the rise of index funds whose holding period, like Mr Buffett's, is "for ever". Larry Fink, the boss of BlackRock, the world's biggest asset manager, asks firms to draw up five-year plans.

Nor are firms investing less. The same system that is accused of myopia has just financed the \$500 billion shale-energy revolution, a boom in experimental biotech companies and

the electric-car ambitions of Elon Musk, a maverick entrepreneur. Relative to assets, sales and GDP, American firms' investment has held steady. The mix has shifted from plant and machines to things like software and research and development (R&D), but that is to be expected as equipment costs fall.

Economists grumble that listed firms are not investing their record profits, particularly since low interest rates mean that the cost of capital is cheap. But were companies to reinvest the cash they spend on buy-backs, their capital spending and R&D costs would rise to 15% of sales, way above the 25-year average of 9%. Few bosses would opt for such a splurge just because rates are low, especially if they are low as a result of economic worries. It is natural for mature firms to return cash to investors through dividends and buy-backs. And firms can invest too much as well as too little. China's idle factories and steel mills, absolved of duty to make a profit, are nothing to emulate.

That still leaves American businesses, and many of their rich-world peers, with a problem. If firms are sitting on cash, it can lead to a deficit in overall demand in the economy. Even if they return their surplus profits to shareholders, that may not boost demand if those shareholders are already rich and squirrel away the extra money. Macroeconomic policies to boost demand will help. But competition can also make a difference by reducing outsize profits and spurring firms to invest more. Here there is cause to fret.

The boom in Silicon Valley gives an impression of a golden age of dynamism—in some industries, such as taxis, startups are indeed causing revolutions. Overall, however, American capitalism is more sluggish than it was. Small firms are being started at the slowest rate since the 1970s. Young firms' weight has shrunk, measured by their number and share of employment. The labour market has become less dynamic.

Most industries are getting cosier. Of the 13 sectors in America (excluding farming), ten were more concentrated in 2007 than in 1997. Since Lehman Brothers folded in 2008, American firms have done \$11 trillion of deals—worth 46% of their market value—whose main aim has been to increase market share and pricing power. Airlines, cable TV, telecoms, food and health care have all become less competitive. Giant tech firms with high market shares are making huge profits—tech firms together have 41% of all the cash held by non-financial firms.

Long-term paranoid

The answer is twofold. First, remove the barriers to the creation of small firms. Nearly 30% of American occupations now require licences—tourist guides in Nevada need 733 days of training, for example. Some 22% of small firms complain that red tape is their biggest problem; many have trouble getting credit. Both issues loom even larger in Europe. Second, be vigilant about oligopolies: so far America's antitrust regulator has blocked only a handful of the large deals proposed since 2008, although it is now scrutinising combinations such as Office Depot and Staples. Rather than trying to stipulate the horizon over which investors and firms should think, governments should promote competition. That is the best way to harness capitalism's hyperactive energy in the service of growth. ■

Brazil

The pot and the kettle

A flawed impeachment risks prolonging the country's agony



MOST Brazilians, the opinion polls have reported for months, would be delighted to see the back of Dilma Rousseff, their president. After Eduardo Cunha, the Speaker of the lower house of Congress, set the impeachment of Ms Rousseff in motion on December 2nd, they may well get the chance. Though the talk had recently receded, impeachment has been discussed for months. Nevertheless, Mr Cunha's move is flawed and threatens only to drag Brazil deeper into the mire.

An act of personal revenge

It is not hard to see why Ms Rousseff is so disliked. Little more than a year ago she narrowly won a second term by vowing to defend Brazilians' jobs, living standards and welfare benefits from the evils of a "neoliberal" opposition. It was a false promise. Because of mismanagement and overspending in her first term, the economy is trapped in a sickening vortex: output in the third quarter was 4.5% lower than a year earlier, the real has lost a third of its value this year; the fiscal deficit is nearing 10% of GDP and inflation is heading for 10%. Unemployment has soared to 7.9%.

Mainly because of the economy, Ms Rousseff is the most unpopular and ineffective president in modern Brazilian history. She lost control of Congress at the start of her second term; she has been unable to get the spending cuts and fiscal reforms needed to repair the economy. The audit tribunal rejected her government's accounts for 2014, alleging that she hid the true state of government finances in an election year.

Then there is a vast corruption scandal centred on Petrobras, the state-controlled oil giant. Prosecutors allege that, during the governments of Ms Rousseff and her predecessor, Luiz

Inácio Lula da Silva, cartels of contractors paid huge bribes to politicians from the ruling Workers' Party (PT) and its allies. Some of Brazil's leading tycoons are in jail; more than 40 politicians are under investigation. The latest to be locked up on suspicion of wrong-doing—which they deny—are André Esteves, a billionaire investment banker, and Delcídio do Amaral, the government's leader in the Senate.

Although there is plenty to be unhappy about, Mr Cunha's impeachment bid looks like an act of revenge. Prosecutors are investigating whether he took bribes to arrange contracts with Petrobras, which he denies. He acted just hours after three PT members on the lower house ethics committee said they would vote to remove him from Congress. The reason he gave for impeaching the president is that this year she continued the practices condemned by the audit tribunal. Ms Rousseff deserves to be punished for her fiscal irresponsibility, but this is a technicality. In a democracy, impeachment is the supreme weapon: it should have a solid legal and political basis.

Ms Rousseff has vowed to fight back. She is not the one with Swiss bank accounts, she reminded Mr Cunha (his family's, he says). The PT brands the impeachment "a coup". That is wrong, but it heralds a divisive battle over the next few months. At present, there is no reason to believe that the opposition has the votes to remove the president. Next year that might change, especially if evidence emerges that ties Ms Rousseff personally to the wrongdoing at Petrobras, whose board she chaired in 2005-10 (none has so far).

Impeachment is thus the ultimate distraction for a government that was already too distracted to govern. That bodes ill for the economy. Ms Rousseff deserved another few months to try to get a grip. Should she fail, there would be a strong case for persuading her to resign for the good of her country. By striking too soon and on the flimsiest of grounds, Mr Cunha may have given a weak and destructive president a longer lease of life. ■

Poland

Europe's new headache

The new government in Poland has made an awful start



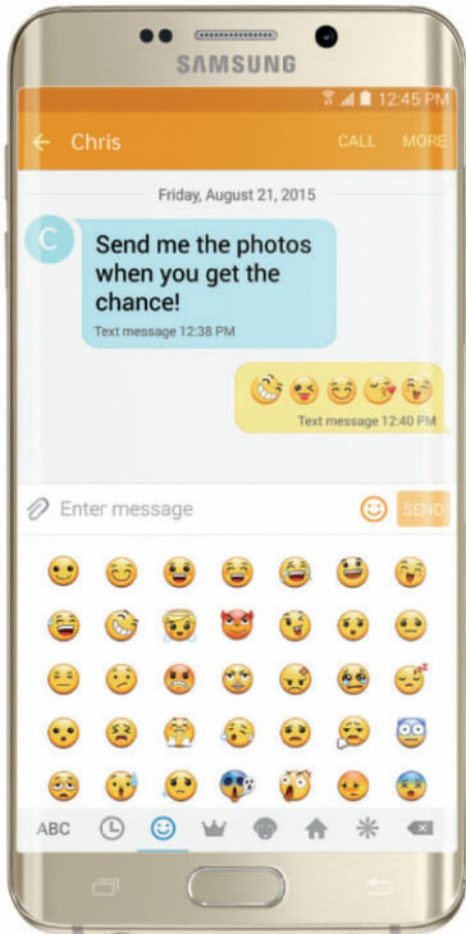
THE genius of democracy is that voters can boot out a government without damaging the state. But sometimes a new government, not content with whisking the old one from the podium, will take a hammer to the stage itself. That is the worry in Poland. The populist Law and Justice party (PiS), swept back into power after eight years in opposition, is remaking the country in a hurry (see page 51). It has violated the constitution to replace the previous government's appointees on the constitutional court, put partisans in charge of the intelligence

agencies, purged officials and backtracked on Poland's commitments to the European Union. When PiS was last in power, its tenure was marked by erratic policies and nationalist paranoia; it appears not to have mellowed with time.

Poland matters. It is the anchor of east-central Europe, the region's biggest country and largest economy by far. It has been the flagship of the EU's eastward expansion, proof that democracy and the rule of law can spread. Its stability, prosperity and pro-European orientation have won it respect and diplomatic clout. If PiS wants that era to end, it is going about it the right way. The party's leader, Jaroslaw Kaczynski, admires Hungary's prime minister, Viktor Orbán, who says he favours "illiberal democracy". PiS is taking its first steps in the same di- ►►

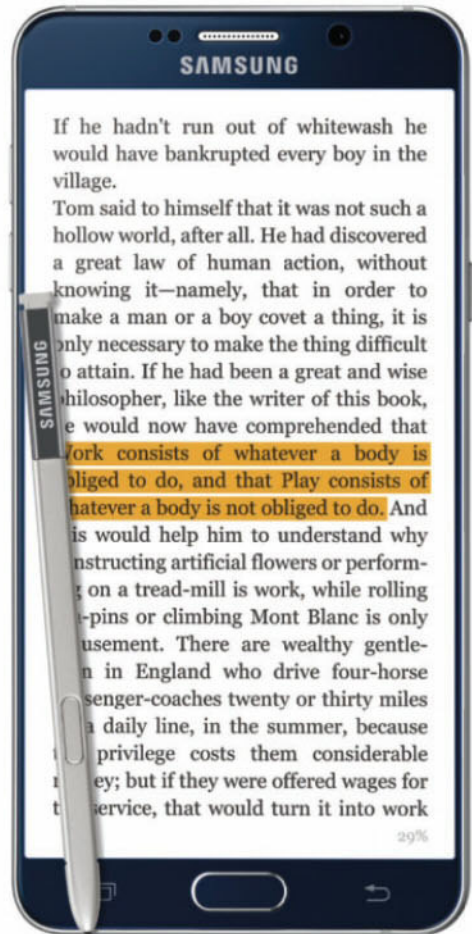
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rection. An EU weakened by crisis is ill-prepared to resist it.

Obviously, there is nothing wrong with Poles deciding to turf out their government. PiS won the presidential and parliamentary elections this year because voters were fed up with the centrist party, Civic Platform, which had acquired an aura of complacency and sleaze. PiS's animating drive is hostility to Poland's liberal, secular, urban elite. It is a motley coalition of social conservatives, Catholic nationalists, Eurosceptics, anti-corruption zealots, conspiracy theorists, protectionists and agrarians. Like many populist parties, it mixes illiberal foreign and cultural policies with statist and short-sighted economics. One of its first plans is to lower the retirement age, reversing a reform by the previous government. This is fiscally reckless in rapidly ageing Poland, but popular with the greying voters who back PiS.

The last time PiS was in power, in 2005-07, it picked fights with Germany and created an atmosphere of hysterical unpredictability. Party officials advanced a theory that the post-Soviet Polish state was secretly run by communist-era apparatchiks. After PiS lost power, when a plane crash in Smolensk in 2010 killed President Lech Kaczyński (Jarosław's twin brother) and dozens of others, many in the party alleged that Russia had brought it down—and that Civic Platform and its leader, Donald Tusk, had covered this up.

During the elections, the party ran a moderate, Beata Szydło, for prime minister. But since it took power, Mr Kaczyński has pulled the strings. Antoni Macierewicz, one of the worst plane-crash conspiracy theorists, is now defence minister. The new culture minister threatens to purge the public broadcasters. PiS opposes gay rights, and President Andrzej Duda has vetoed a sex-change law for fear that pregnant women might become men before giving birth. Mr Kaczyński warns that Muslim migrants "carry diseases". There are murmurs of putting Mr Tusk, now president of the European Council, on trial.

This lurch towards populism will hurt Poland. But the broader worry is that it will cripple the EU on critical issues, particularly the refugee crisis. The European Commission's plan for redistributing migrants across the union faces dissent from Hungary and two other members of the Visegrad group, Slovakia and the Czech Republic. A deal was reached only with the backing of Visegrad's fourth member, Poland. The PiS government is now threatening to renege. The Visegrad group lacks the votes to block commission decisions, but if it becomes an illiberal bulwark, Europe's east-west divide will become a chasm.

That way lies madness

The conspiracy theories that PiS favours play on Polish feelings of victimhood which are deeply held—and deeply self-indulgent. The facts may seem obvious, but they need restating. The peaceful collapse of communism in Poland was a triumph, not a plot. The plane crash in Smolensk was an accident. The past 25 years have transformed the country into a European heavyweight; EU membership was essential to that success. Good relations with Germany benefit Poland, especially in opposing Russian aggression in Ukraine.

In normal times Europe could afford to wait for PiS to come to terms with reality. The new government has only just started its vandalism. PiS might yet correct course or fall victim to poor organisation and infighting. Poland has institutions that are capable of defending their independence. It takes a lot to ruin a nation.

But these are not normal times. The EU faces challenges, from refugees to climate change to Vladimir Putin. Countering them will be much easier with Polish partners who are part of the solution, not part of the problem. The alternative is a Europe that cannot get things done and the slow decay of Poland's institutions. Its citizens should tell PiS to stop now. ■

Criminal justice in Japan

Forced to confess

Suspects in Japanese police cells are far too vulnerable to abuse



ON THE face of it Japan's system of criminal justice looks as if it gets a lot right. Crime rates are lower in Japan than almost anywhere else—the murder rate is less than a tenth of America's. Those arrested for minor wrongdoing are treated with exceptional leniency. Less than one in 20 Japanese deemed to have committed a penal offence go to prison, compared with one in three of those arrested in America, where the average jail term is much longer. In Japan the emphasis is on rehabilitation, especially of young offenders. The rates of recidivism are admirably low, partly because the state is adept at involving families in reforming those who stray.

Yet the state's benign paternalism has a dark side. The chief reason the system looks good is that Japan is a remarkably safe society. And where once police worked closely with local communities to solve crimes, now they struggle to catch criminals. The system relies on confessions, which form the basis of nine-

tenths of criminal prosecutions. Many confessions are extracted under duress. Some of those who admit guilt are plainly innocent, as recent exonerations have shown (see page 39). The extraordinary lack of safeguards for suspects in Japanese interrogation cells is a stain on the whole system, failing victims as well as those wrongly convicted.

Say you did it, even if you didn't

In a country more inclined than the West to think of itself as a big family collective, admission of guilt is often seen as the first step to readmission into society. It is also the surest route to a conviction. Prosecutors and police are thus under immense pressure to make suspects talk, and have powerful tools to encourage them to do so.

Common criminal suspects may be held in detention for 23 days without charge. Many have only minimal contact with a lawyer. Few interrogations are recorded, and then not in their entirety, so there is not much to stop interrogators piling in. Physical torture is rare, but sleep deprivation, which is just as effective, is common. So are various other forms of psycholog- ▶▶

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ical coercion. Some interrogators use moral blackmail (“Think of the shame you are bringing on your family”). A few, if they are convinced that the suspect is guilty, simply fabricate a confession and press the suspect into signing it.

In a court system without an adversarial approach to establish innocence and guilt, judges too rarely question whether confessions really are voluntary. Yet time and again innocent people have been shown to confess to crimes in the hope of a more lenient sentence—or simply to make the interrogation stop. In October a mother convicted of killing her daughter for the insurance money was released after a crime reconstruction proved her innocence. Last year Iwao Hakamada was freed after 46 years on death row when a judge declared that his conviction was unsafe (among other things, he appears to have been tortured at the time of his arrest). One lawyer estimates

that a tenth of all convictions leading to prison are based on false confessions. It is impossible to know the true figure, but when 99.8% of prosecutions end in a guilty verdict, it is clear that the scales of justice are out of balance.

As a step towards restoring due process, all interrogations should be filmed from start to finish. Suspects should have ready access to defence counsel, to whom prosecutors should also disclose all evidence. Interrogations should be much shorter; suspects should be properly rested. Investigators who fabricate evidence should be put in the dock themselves. Prosecution cases should rely more on detective work, and less on self-incrimination. Such reforms would not improve conditions in Japan’s psychologically brutal prisons (see page 40). But they would give the innocent a better chance of keeping their liberty. ■

Biodiversity

In defence of invaders

Most campaigns against foreign plants and animals are pointless, and some are worse than that



EVERYBODY loves to hate invasive species. Americans battle rampant plants such as kudzu, a Japanese vine; Europeans accuse the American grey squirrel of spreading disease and damaging forests. As *The Economist* went to press, a scientific committee was expected to sign off on Europe’s first invasive-species blacklist. Cross-border trade in 37 species will be banned (the list is bound to grow longer as conservationists add more troublemakers). Where it is not already too late to wipe out these alien invaders, EU member states will be required to do so.

Europeans are restrained in comparison with other countries. The international list of invasive species—defined as those that were introduced by humans to new places, and then multiplied—runs to over 4,000. In Australia and New Zealand hot war is waged against introduced creatures like cane toads and rats. In 2013 New Zealand used helicopters to drop a poison known as 1080 on 448,000 hectares of land—an area about the size of Yosemite and Sequoia national parks put together. Just four public objections were recorded.

Some things that are uncontroversial are nonetheless foolish. With a few important exceptions, campaigns to eradicate invasive species are an utter waste of money and effort—for reasons that are partly practical and partly philosophical. Start with the practical arguments. Most invasive species are neither terribly successful nor very harmful. Britons think themselves under siege by foreign plants like Japanese knotweed, *Rhododendron ponticum* and Himalayan balsam. In fact Britain’s invasive plants are not widespread (see pages 59–60), not spreading especially quickly, and often less of a nuisance than vigorous natives such as bracken. The arrival of new species almost always increases biological diversity in a region; in many cases, a flood of newcomers drives no native species to extinction. One reason is that invaders tend to colonise disturbed habitats like polluted lakes and post-industrial wasteland, where little else lives. They are nature’s opportunists.

New arrivals often turn out to be useful, even lovely. Americans fret about the decline of a vital crop-pollinator known as the American honey bee. *Apis mellifera* is actually an invader from the Old World: having buzzed from Africa to Europe, it was brought to America by colonists and went wild. Invasive plants provide food and nests for vulnerable natives; invasive animals can help native species by killing their predators, as the poisonous cane toad has done in Australia.

Another practical objection to the war on invasive species is that they are fiendishly hard to eradicate. New Zealand will not get rid of its rats any more than Britain could wipe out its grey squirrels. Culls tend to have a short-term effect at best. It is, however, sometimes possible to get rid of troublesome immigrants on tiny oceanic islands. Because the chances of success are higher, and because remote islands often contain rare species, efforts there are more worthwhile.

The philosophical rationale for waging war on the invaders is also flawed. Eradication campaigns tend to be fuelled by the belief that it is possible to restore balance to nature—to return woods and lakes to the prelapsarian idyll that prevailed before human interference. That is misguided. Nature is a perpetual riot, with species constantly surging, retreating and hybridising. Humans have only accelerated these processes. Going back to ancient habitats is becoming impossible in any case, because of man-made climate change. Taking on the invaders is a futile gesture, not a means to an achievable end.

No return to Eden

A rational attitude to invaders need not imply passivity. A few foreign species are truly damaging and should be fought: the Nile perch has helped drive many species of fish to extinction in Lake Victoria. It makes sense to keep out pathogens, especially those that destroy whole native tree species, and to stop known agricultural pests from gaining a foothold. Fencing off wildlife sanctuaries to create open-air ecological museums is fine, too. And it is a good idea for European gardeners to destroy Japanese knotweed, just as they give no quarter to native miscreants like bindweed and ground elder. You can garden in a garden. You cannot garden nature. ■

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It's no secret: business has changed—in every way, for every business. Modern technologies have brought new opportunities and new challenges, like BYOD and a mobile workforce, that old networks just weren't built for. While demand on these networks has increased exponentially, networking costs have skyrocketed and IT budgets haven't kept pace.

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Delivering the goods

“How to lose \$5 billion” (November 21st) painted an unduly negative picture of the United States Postal Service’s finances. For example, you didn’t mention that the USPS made a \$1.2 billion operating profit in the 2015 fiscal year, the second consecutive year in which revenue earned from delivering the mail has exceeded the costs of delivery by more than \$1 billion. The combined operating profit over the past three years is \$2.9 billion. Income from delivering letters has stabilised, but rocketed from package deliveries, driven by the rise of online shopping. Moreover, much of the criticism of the postal service in your article came from an anti-tax group, which is curious, since the USPS is not funded by taxpayers.

Also remember that Congress made the postal service pre-fund 75 years’ worth of future retirement health-benefits in advance. No other American entity, public or private, is required to pre-fund even one year. That \$5.6 billion annual charge accounts for the “red ink”. If Congress fixes this fiasco, the USPS can continue to provide Americans and their businesses with the industrial world’s most-affordable delivery network.

FREDRIC ROLANDO
President
National Association of
Letter Carriers
Washington, DC

I am amused by those suggesting that the USPS “should venture into banking”. The US Postal Savings Bank had several billion dollars in deposits and was readily available to everyone until it went out of business in 1967.

DERALD PORTER
Kirkland, Washington

The post office delivers an inordinate amount of advertising mail, which is a nuisance to many. In the 18th century advertising through the post and other public mailings were considered part of the desirable exercise of free speech, conducive to good

government and worthy of subsidy. Today we wallow in a perpetual morass of digital and traditional advertisements. These negative externalities are a substantial waste of the recipients’ time; the cost of disposing of junk mail has also risen. Perhaps many households would pay a fee to the post office to stop receiving junk mail.

We can already stop unwanted nuisance calls from salesmen. We should have a similar “do-not-deliver list” for unwanted mail.

JACOB MEERMAN
Former economist at the
World Bank
Washington, DC

Bilingual Belgium

It is wrong to describe Belgium as “a French-speaking country” (“Jihad at the heart of Europe”, November 21st). The majority of Belgians speak Dutch (Flemish), and Brussels itself is bilingual. Ask David Cameron, who recently invited the burgomaster of Antwerp, Bart De Wever, to Downing Street for a cup of tea. Mr De Wever is the president of the Flemish nationalist NVA, the main political party in Belgium, which is now a member of the federal government, together with Flemish Christian Democrats and Liberals, and Walloon (French-speaking) Liberals.

By the way, the now infamous Brussels neighbourhood of Molenbeek (the actual name of which is St Jans Molenbeek Saint Jean) is bilingual; but it is true that its foreign population is mostly French-speaking.

ANDRÉ MONTEYNE
Former member of Parliament
(VLD, Flemish liberals)
Brussels

Fishing for business

Orri Vigfusson called for a halt to the “killing of wild Atlantic salmon by any method” for three years in order to help salmon stocks recover (Letters, November 21st). He was particularly critical of mixed-stock coastal netting. How does he explain the fact that

until the 1980s salmon were routinely fished by anglers and coastal nets took far more fish than the tiny number they take today, yet stocks remained healthy? There must surely be plenty of other reasons for the Atlantic salmon’s decline. Take your pick from salmon farming, booming seal populations, climate change, pollution, the poor management of rivers and illegal fishing on the high seas.

I write as one of those coastal netmen whom Mr Vigfusson wishes to put out of business.

GEORGE CHAMIER
Evanton, Highland

Abortion and the courts

Your leader on the biggest abortion case in 20 years that is winging its way towards America’s Supreme Court stated that “nine unelected judges can do a better job... than thousands of elected politicians” (“Back in court”, November 21st). This may be true sometimes, but the court’s solution to the abortion laws in its *Roe v Wade* decision has made abortion the most divisive issue in our country.

When the Supreme Court gets it wrong, it’s extraordinarily difficult to put it right. The *Dred Scott* case took a civil war and a series of constitutional amendments to undo. *Plessy v Ferguson* in 1896 allowed Jim Crow to become the law of the land for decades.

The legislative process is often messy, but over time it is self-correcting through the electoral process. Abortion was already legal in some states in 1973 and on the way to becoming legal or adopted with more flexibility in many others when the court dropped the *Roe* bombshell. Gay marriage, too, was being accepted one state at a time before the court stepped in and legalised it nationally.

Abortion may have become widely available, and we might have been a less divided country today, had the court not decided *Roe*, but we’ll never know.

ANDREW TERHUNE
Philadelphina

Mickey Mouse startups

You compared a school for startups in Silicon Valley to a television talent show (“Y Combinator, the X Factor of tech”, November 7th). A better comparison for Y Combinator would be the pop princess creating-machine that is Disney. Just as Disney launched the careers of the likes of Britney Spears, Christina Aguilera, Lindsay Lohan, Miley Cyrus, Selena Gomez, Demi Lovato and others, Y Combinator has served as the launching pad for startups that include Airbnb, Instacart, Stripe, Dropbox and many more. For many an aspiring entrepreneur, Y Combinator is the new Mickey Mouse Club.

ANDREW MCCONNELL
Atlanta

Play acting



As a frequent plane passenger I often have to go through the charade of the “security theatre” before boarding a flight (“No more of the same, please”, November 14th). I have lost many nail clippers, because everyone knows how dangerous those things are in the hands of a terrorist.

Why then, I wonder, do they still serve dinner with steel knives and forks in business class? Do airline companies assume that terrorists can only afford a seat in economy class?

KOEN DE REGT
Johannesburg ■

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The creed of speed

Is the pace of business really getting quicker?

A CUSTOMER downloads an app from Apple every millisecond. The firm sells 1,000 iPhones, iPads or Macs every couple of minutes. It whips through its inventories in four days and launches a new product every four weeks. Manic trading by computers and speculators means the average Apple share changes hands every five months.

Such hyperactivity in the world's biggest company by market value makes it easy to believe that 21st-century business is pushing its pedals ever harder to the metal. On Apple's home turf in Silicon Valley the idea that things are continually speeding up is a commonplace. "The pace of change is accelerating," Eric Schmidt and Jonathan Rosenberg of Google assert in their book "How Google Works". For evidence look no further than the "unicorns"—highflying startups—which can win billion-dollar valuations within a year or two of coming into being. In a few years they can erode the profits of industries that took many decades to build.

Like dorks in awe of the cool kids, the rest of America's business establishment chastises itself for being too slow. If you ask the boss of any big American company what is changing his business, odds are he'll say speed. Firms are born and die faster, it is widely claimed. Ideas move around

the world more quickly. Supply chains bristle to the instant commands of big-data feeds. Customers' grumbles on Facebook are met with real-time tweaks to products. Some firms are so fast that they can travel into the future: Amazon plans to do "anticipatory" shipping before orders are placed.

"We are putting a premium on speed," said Jeff Immelt in his latest letter to the long-suffering shareholders of General Electric (GE). Ginni Rometty, who is struggling to revive IBM, recently told the *New York Times*, "People ask, 'Is there a silver bullet?' The silver bullet, you might say, is speed, this idea of speed." The shareholders' reports of the firms in the S&P 500 index of America's biggest are littered with "speed", "fast" and their synonyms, not to mention a goodly dollop of "disruption".

Mavericks and geese

America's executives worry that they won't keep up with this quickening world. Others worry about the things they may do in the attempt. Hyperactive bosses are accused of slashing jobs and overdosing on share buy-backs to hit quarterly earnings estimates. The unease goes beyond the activities of individual firms to those of the corporate sector as a whole. In his 2014 book, "The Impulse Society", Paul Roberts, a social critic, decries a system "so hostile

to the notion of long-term investment, or commitment, or permanence, that it is becoming incapable of producing anything of durable social or economic value."

The idea that time is speeding up is clearly popular. It is also plausible. There is just one problem. It is very hard to prove that it is actually happening.

Capitalism has always had its skates on. As Karl Marx and Friedrich Engels noted in 1848, it sweeps away "all fixed, fast-frozen relations, with their train of ancient and venerable prejudices and opinions...all new-formed ones become antiquated before they can ossify."

Take transport. In 1913 Henry Ford's reinvention of the assembly line cut the time it took to make a car from 12 hours to 90 minutes. Alfred Sloan, who ran General Motors as president and then chairman from 1923 to 1956, invented "dynamic obsolescence"—using a flurry of new products to whip up demand and make existing models seem out of date. Honda took this idea to an extreme: in 1981-82 it launched 13 models of scooter in 18 months. Japanese firms pioneered flexible supply chains and reorganised factory floors in the 1970s and 1980s—eking out efficiency gains by eliminating delays. In 1990 George Stalk and Thomas Hout, of BCG, a consulting firm, popularised this approach in "Competing Against Time" (a favourite book of Apple's boss, Tim Cook).

There are plausible reasons why the pace of business might be even faster this century than in the previous one. The regular doubling of processing power known as "Moore's Law" has provided decades of exponential growth in computing power. Information technology is ever more em- ▶▶

bedded in customer's lives. More firms use contracts and accounting systems with "mark-to-market" prices, exposing themselves to rapid changes that long-term contracts used to smooth over. Deregulation and globalisation mean that it is easier for firms to employ workers and make products through networks of third-party suppliers whose efforts can be amped up or services sloughed off with ease.

Yet hard evidence of a great acceleration is hard to come by. *The Economist* has considered a variety of measures by which the speed of business in America (unless otherwise stated) can be quantified. A few do show some acceleration. But a lot do not (see chart).

The speed with which ideas zip around the world has increased. Take the "adoption lag"—or the average time it takes slow or poor countries to catch up with pioneering countries' usage of a technology. It has shortened from over 100 years for the spindle (invented in 1779), to 13 years for mobile phones, according to Diego Comin and Martí Mestieri, two scholars. Patent registrations, which, though an imperfect measure of innovation, probably track it to some extent, have been growing by about 11% a year for the past half-decade, compared with a long-term average of 6%. The frequency with which consumers shop for groceries, which has been declining for a decade or more, may have picked up thanks to the spread of e-commerce.

But other measures suggest sloth, not celerity. The rate of new consumer-product launches is probably slowing or in decline. Factories do not seem to be making things faster. A crude gauge of production speed can be gained by looking at the inventories of industrial firms, which mainly comprise half-finished goods, or "work-in-progress". The ratio of work-in-progress to sales points to a slowdown over the past decade (though if you exclude Boeing, an aircraft-

maker, it is merely flat). And there is no obvious evidence that outsourced production overseas differs in this respect. At Hon Hai Precision, also known as Foxconn, which makes iPhones and other gizmos in China, things have gone the same way.

If products were zipping through smart supply chains faster you would expect the overall level of inventories to fall. But in 2014 big listed American firms held 29 days of inventory, only slightly less than in 2000. For the economy as a whole inventory ratios improved in the 1990s but have deteriorated sharply since 2011. And just as the stuff that is sold may not be turning over any more quickly, neither are the people who make it. The median private-sector worker has held his job for 4.1 years, longer than in the 1990s. There has been a slight decline in the tenure of older men, but a slight lengthening for women.

More creative destruction would seem to imply that firms are being created and destroyed at a greater rate. But the odds of a company dropping out of the S&P 500 index of big firms in any given year are about one in 20—as they have been, on average, for 50 years. About half of these exits are through takeovers. For the economy as a whole the rates at which new firms are born are near their lowest since records began, with about 8% of firms less than a year old, compared with 13% three decades ago. Youngish firms, aged five years or less, are less important measured by their number and share of employment.

Some studies suggest that the period over which firms could sustain a competitive advantage shortened in the 1970s and 1980s, perhaps owing to deregulation. But for today's incumbents life looks sweet and stable. In 2000 about half the S&P 500 had been making a pre-tax return on capital of at least 12% every year for five years. The share is the same today. The rate at which listed firms depreciate their plant

and software has held fairly steady, too.

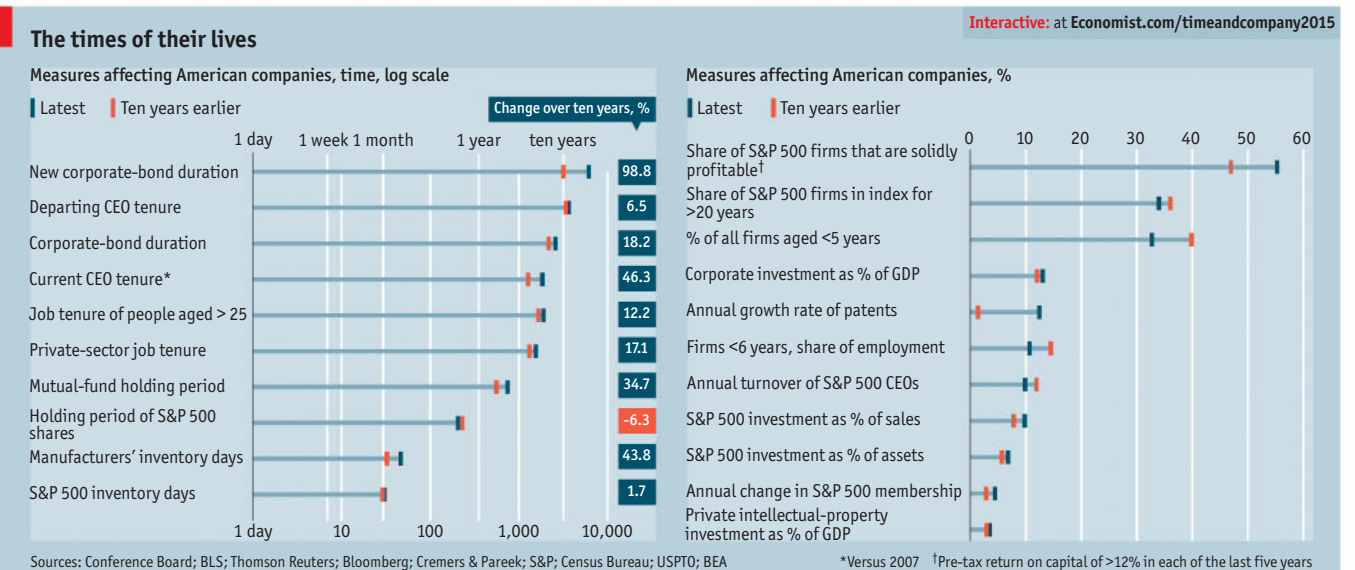
Many bosses complain that capital markets amplify a wired-up society's hyperactive impulses. But on some measures they are becoming less short-term. The average maturity of a newly issued corporate bond has risen to 17 years from ten years in the 1990s, reflecting the attractions of borrowing for longer maturities when interest rates are low. The average holding period for a share of an S&P 500 firm is still a pitifully low 200 days, but that has doubled since 2008 and is comparable with levels a decade ago. The big fall was in the 1990s.

Intra-day churn by high-frequency trading programs accounts for about half of stockmarket turnover, according to Ana Avramovic of Credit Suisse. But that masks the rise of more stable investors. Large "passive" fund managers such as BlackRock and Vanguard have got much bigger in the past decade and their holding periods are indefinite. The average holding period of actively managed mutual funds, meanwhile, has risen to about two years. In 2000 it was closer to one.

Breathless

Some executives are doubtless spivs, willing to cut investment to hit earnings targets. And economists have shown that investors discount the value of far-off profits more than they should. But it is not clear that long-term investment has shrunk. For both S&P 500 firms and the economy as a whole, corporate investment (including plant and equipment, software and R&D spending) has been steady relative to sales, assets and GDP.

Investment has fallen relative to profits, but that is because margins are at a record high thanks to lower wage costs. Companies are generously giving their owners dividends and share buy-backs while being stingy with their staff. But by historical standards they are not being miserly about ▶▶



▶ investment. Were firms to invest what they spent on buy-backs, investment would have to rise to 15% of sales, far above the 25-year average of 9%. Low interest rates may mean the cost of capital is cheap, but most firms worry that they reflect the risk of slow economic growth.

Bosses grumble they are under constant pressure to perform, but they are being pushed down the gangplank more slowly. The median tenure of serving CEOs was five years in 2014, up from three in 2007. The average retiring chief executive of an S&P 500 firm in 2014 had been in office for ten years—the highest figure since 2002.

The result is a puzzle. Business people feel time is accelerating—but the figures suggest they are largely talking guff. One possibility is that their perception of speed is a leading indicator, and that a giant wave of disruption is just about to strike. But many of the reputational giants of Silicon Valley are financial tiddlers. Uber has \$2 billion of sales—if it were listed it would be the world's 3,882nd-biggest public firm. Airbnb's sales account for 1-2% of the hotel industry's total. These firms are platforms for purchasing services, but beneath them, the assets and people—cars, rooms, drivers—change far less dramatically, if at all. People who use dating apps still go to restaurants. Overall, McKinsey & Co, a consulting firm, estimates that technology disruption could lower global corporate profits in 2025 by 6%: significant but not overwhelming.

A better explanation of the puzzle comes from looking more closely at the effect of information flows on businesses. There is no doubt that there are far more data coursing round firms than there were just a few years ago. And when you are used to information accumulating in a steady trickle, a sudden flood can feel like a neck-snapping acceleration. Even though the processes about which you know more are not inherently moving faster, seeing them in far greater detail makes it feel as if time is speeding up.

This unsettling sensation is common to most chief executives—a straw poll suggests that they receive 200-400 e-mails a day. Their underlings are deluged with information, too. AT&T now tracks faults on its telecoms networks by monitoring social media for grumpy customers letting off steam online. Big consumer brands are subject to a rolling online plebiscite from their customers. This abundance of information gives firms a cloak of hyperactivity.

Lift up the hem, however, and the illusion of acceleration gives way to a dangerously stolid reality. As well as lower rates of new company creation, industries have become more oligopolistic. Of 13 industrial sectors in America, ten were more concentrated in 2007 than they had been in 1997. Since then there has been a huge round of

mergers in health care, consumer goods, airlines, cable-TV, telecoms and technology hardware. Most of these deals have created bigger firms with higher market shares and more pricing power.

The technology platforms through which people get information and shop—those of Google, Apple and the like—have high market shares too. These firms are extraordinarily profitable and have accumulated a lot of cash—41% of the total held by big American firms outside the financial sector sits with tech companies. Perhaps they are clinging to these safety belts because they fear that they will be swept away by new rivals. Perhaps they will use their huge resources to buy other firms and further increase their pricing power.

For managers the illusion of acceleration is dangerous if it prompts them to



churn their portfolio of businesses ever faster. GE has bought and sold businesses worth over 100% of its capital base in the past decade or so. American pharmaceutical firms have attempted \$1.1 trillion of deals since the start of 2014, equivalent to 51% of their current stockmarket value.

Time and relative dimensions in space

Perhaps these efforts at permanent revolution will succeed. But not every firm can pursue this approach without creating a fallacy of composition: someone has to own the slow-growing businesses. Doing lots of deals involves paying large fees. And what appears hot today may be cold tomorrow. Western firms invested \$3 trillion in emerging markets in the 15 years to 2012, just before their growth slumped.

If firms are not experiencing an overall acceleration, though, they still need to pay new attention to time. In the 1930s Ronald Coase, an economist, argued that firms existed to perform tasks that entrepreneurs were unable to do easily through markets. But another way of thinking about firms is that they are time transformers, mediating

the different time horizons of customers, staff, suppliers and owners.

Bondholders, for example, want a steady stream of payments over decades, a stream derived from customers paying instantly for products that take weeks to make and transport and that are sold by staff who are employed for years. The company is the body that can satisfy all of these constituents. This capacity to straddle time frames is most extreme in banks, which raise money in the form of deposits that can be withdrawn immediately and extend that money as loans that take years to repay, an inherently risky process known as “maturity transformation”. But the transformation of time is the business of all companies, not just financial ones.

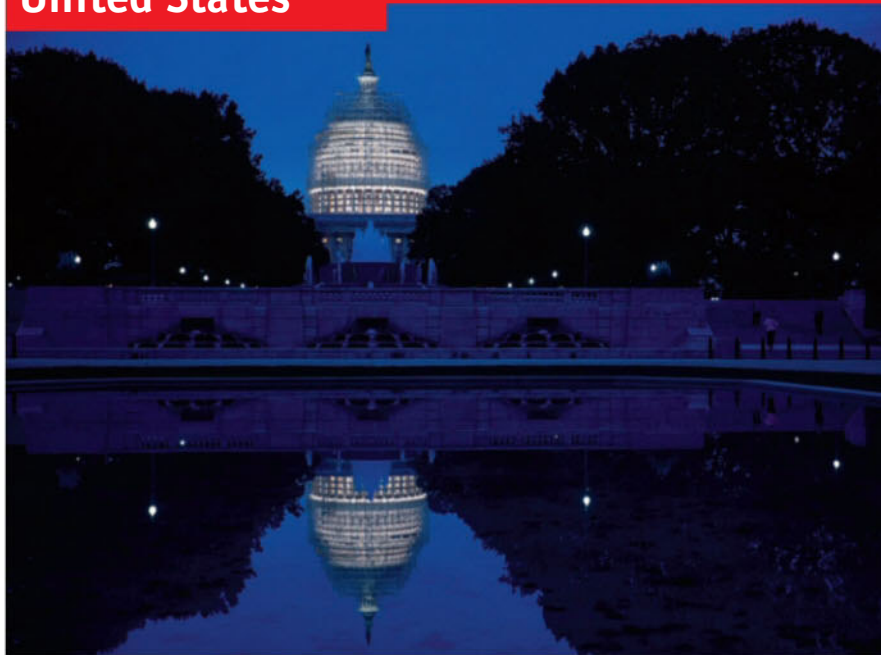
More information provides firms with an even broader range of time frames over which to exert their transformational powers—to operate second by second, if they so desire. But to do this well requires them to be as deliberate over some time horizons as they are flighty over others.

Inditex, the owner of Zara, a “fast fashion” retailer, designs 40,000 products a year that are shipped to stores twice a week. It has helped end the idea that fashion only has two big seasons a year. But the ever faster flow of frocks requires steady purpose in other dimensions of the business. It employs 900 folk in its design department, rather than outsource this function to fickle outsiders. It has persuaded its suppliers to accept payment in 160 days, twice as long as a decade ago. The manufacturers in its European network stick around for many years. Its assets are expected to last a decade and it invests twice as much per dollar of sales as its peer group. Its founder, Amancio Ortega, has held a controlling stake for 40 years.

New technologies spread faster than ever, says Andy Bryant, the chairman of Intel; shares in the company change hands every eight months. But to keep up with Moore's Law—named after Intel's founder—the firm has to have long investment horizons. It puts \$20 billion a year into plant and R&D. “Our scientists have a ten-year view...If you don't take a long view it is hard to keep your production costs consistent with Moore's Law.”

And what about Apple, with the frantic antics of which this article began? Its directors have served for an average of six years. It has invested heavily in fixed assets, such as data centres, which will last for over a decade. It has pursued truly long-term strategies such as acquiring the capacity to design its own chips. Mr Cook has been in his post for four years and slogged away at the firm for 14 years before that. Apple is 39 years old, and it has issued bonds that mature in the 2040s.

Forget frantic acceleration. Mastering the clock of business is about choosing when to be fast and when to be slow. ■



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The federal budget

Reflections on projections

WASHINGTON, DC

As Congress hammers out yet another budget deal, future fiscal problems lurk

WHEN John Boehner handed the Speakership of the House of Representatives over to Paul Ryan in October, he hoped to leave a “clean barn” for his successor. The budget deal he bequeathed to Mr Ryan was an outline, rather than a finished work. It set total spending limits for 2016 and 2017, but left the finicky work of doling out that money until now. In all likelihood, Congress will do this in time for the new year. The Republican leadership has little appetite for a shutdown, which would blot Mr Ryan’s nascent Speakership. But as Congress steers away from a shutdown next week, it has lost sight of bigger fiscal problems on the horizon.

America’s population is ageing (see chart). This is squeezing the federal budget by increasing the cost of Social Security (public pensions) and Medicare, government-provided health care for the over-65s. By 2025 these programmes will have roughly 70m beneficiaries, up from 44m in 2007. Today, they consume about 10% of GDP. That will rise to 12% of GDP by 2025 and 14% of GDP by 2040, according to the Congressional Budget Office (CBO). At the same time, rising interest rates will increase the cost of servicing the national debt. Only eight of 34 members of the OECD, a club of mostly rich countries, have failed to reform their public pensions in the past two years—America is one of them. To keep debt in 2040 beneath to-

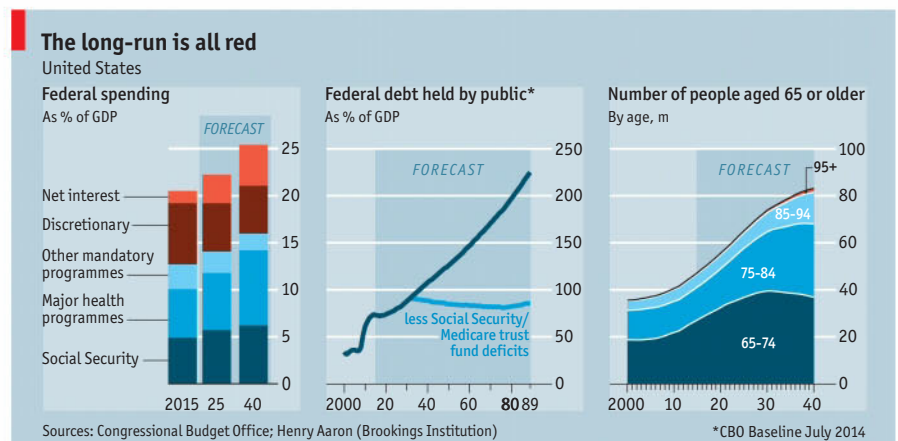
day’s 74% of GDP, taxes need to rise, or spending needs to fall, by about 6%.

In 2010 the president established a commission, headed by two Washington veterans, to tackle the problem. It contained a sensible mix of higher taxes and reduced spending and was pronounced dead on arrival. In 2011 Congress and the White House tried to force an agreement by planning a decade of deep and indiscriminate cuts that would bite, painfully, if no long-term deal were reached. None was. Since then, budget negotiations have sought mainly to slow this self-flagellation.

As a result of the cuts—and an improving economy—the deficit has fallen from

8.7% of GDP in 2010 to just 2.5% of GDP today, its lowest level since 2007. But the knife has fallen mainly on so-called discretionary spending: on infrastructure, education, transport and the like. For instance, federal investment, adjusted for depreciation, turned negative in 2014 for the first time since 2001, despite the woeful state of the nation’s roads and bridges.

This is the fiscal equivalent of bloodletting, because the long-term problem remains unsolved. From 2019, the CBO predicts, borrowing will begin to rise again. This will push debt up to 78% of GDP by 2025, compared to a historical 45-year average of 45% of GDP. America could tolerate much higher borrowing: Moody’s, a rating agency, estimates debt could safely rise to 124% of GDP in many countries. That does not mean it should. The pressure on the budget still matters for three reasons. The first is risk-management: higher debt leaves less leeway with which to respond to future downturns. The second is investment: in the long-term, government debt gobbles up savings, pushing up interest ▶▶



▶ rates for private-sector borrowers and deterring productive investments. That is not a worry while interest rates are at zero, but such conditions will not last for ever.

The third pressure is politics. Though the budget deficit counts all the Treasury's spending and receipts, Social Security and parts of Medicare are officially paid for by trust funds, which raise ring-fenced revenue through payroll taxes. The latest forecast says the Medicare fund will run dry in 2030 and the Social Security pot four years later. There is a rationale for the funds: ring-fencing makes it clear where taxpayers' money goes, and limits the share of the budget that entitlements can swallow.

To that end, Republicans favour trimming Social Security and raising the retirement age to account for longer lives. But recent gains in life expectancy have been concentrated among the rich. Between 1980 and 2010, life expectancy at 50 for the poorest fifth of Americans actually fell.

Benefit cuts do not save much if focused on rich folk. Chris Christie, a Republican candidate, wants to phase out benefits for those earning more than \$200,000, but by one estimate from 2011 these account for just 0.6% of Social Security spending. (Other Republican candidates have similar but less detailed plans.) Better, reckon Democrats, to raise revenues. Bernie Sanders wants to levy Social Security taxes, which currently stop at \$118,500, on incomes over \$250,000. This would impose a whacking 15 percentage-point increase on the marginal tax rate of high-earners.

Social Security is stingy by international standards. Between 2010 and 2015 America ranked joint 29th of 33 OECD members for pension spending—a rank that will barely change by 2050. It is not surprising that Americans overwhelmingly favour protecting Social Security from cuts.

By contrast, Uncle Sam's extravagant health spending stands out. Adjusted for purchasing power, America's government spends more per person on health care than Canada, Sweden and Britain—all of which have universal taxpayer-funded systems. Health-care inflation has slowed since 2012, but will soon accelerate again, according to Alec Phillips of Goldman Sachs, a bank. Controlling health costs, which account for two-fifths of the fiscal pressure until 2040, is crucial. The sequester cuts Medicare payments to doctors, but this can only go so far. Expanding pilot programmes to contain costs, which formed part of the Affordable Care Act, is a more promising route to savings.

Ultimately, though, the country must confront a deep question: what is the purpose of spending on the silver-haired? If it is to provide only a minimum standard of living, there is plenty of scope to pare back benefits. If it is to provide an expansive alternative to private saving, the solution must be higher contributions. ■

A mass-shooting in California

Lamentable

LOS ANGELES

Fourteen are killed in San Bernardino

ON DECEMBER 2nd two shooters, heavily armed, murdered 14 people and injured at least 17 at a county health-centre in San Bernardino, California. The police identified the suspects, who were shot dead, as Syed Farook and Tashfeen Malik, a married couple. At a time of heightened focus on jihadist terrorism, some worried that they acted out of religious fanaticism. As *The Economist* went to press their motives were unknown.

What is clear is that it was easy for them to get hold of high-powered weapons. Responding to the murders, Barack Obama seemed more numbed than after the attack on the Planned Parenthood clinic in Colorado Springs on November 27th, in which three people were killed. Then he insisted that "If we truly care about this," rather than merely saying it did, "we have to do something...Enough is enough."

Rage, grief, numbness: Mr Obama, like many other Americans, seems to run the gamut of these responses to the country's drumbeat of mass shootings. Such events have occurred this year at a rate of more than one per day, and in almost every state, according to the Mass Shootings Tracker (an online count that includes incidents in which four or more people were wounded or killed). Only the most public and egregious cause national ripples; most are domestic tragedies, in which men (usually) shoot their spouses or exes or children.

Beneath that ghostly rhythm is a hum of still quieter crimes that warrant only a mention on the inside pages of local papers, if they make the news at all. Then there are the gun-related suicides and accidents: children shooting their siblings, and so on. Taken together these deaths—32,000 in 2013—dwarf those inflicted on Americans each year by terrorism and war. Each confirms what is intuitively true: guns kill. Intuition, however, is the least of it. The terrorising of San Bernardino will not lead to tighter gun laws, just as the slaughter of children at Sandy Hook in 2012 did not. In fact, rather than tightening the rules, some state legislatures will loosen them further.

Meanwhile, if previous massacres are a guide, thousands of ordinary citizens will respond in what seems to them a rational way. Believing that having their own guns will make them safer—a mistaken conviction held, polls suggest, by a rising proportion of Americans—they will go out and buy one. Whatever happened in San Bernardino, it will make the problem worse. ■

Policing Chicago

The fall guy

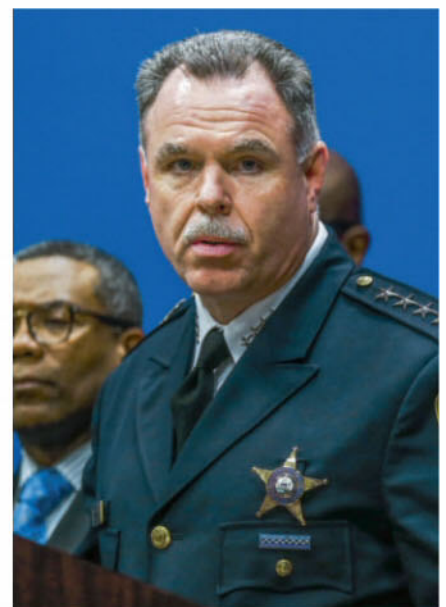
CHICAGO

Rahm Emanuel fires his top cop

GARRY MCCARTHY led Chicago's police force for longer than many of his predecessors. The native New Yorker was appointed by Rahm Emanuel after he was elected mayor of Chicago in 2011. Mr Emanuel backed his top cop when the city made headlines after more than 500 people were murdered there in 2012, considerably more than in New York or Los Angeles.

He was behind Mr McCarthy in 2013 when the city was shocked by the murder on the South Side of 15-year-old Hadiya Pendleton, who had marched with her high-school band at Barack Obama's inauguration, and more recently, in November, when a nine-year-old boy, Tyshawn Lee, was gunned down in an alley by a gang member, also on the South Side. And at first he supported his police chief when protests erupted after the release of a police car's dashboard-camera video of the fatal shooting last year of Laquan McDonald, a black teenager, by Jason Van Dyke, a white police officer.

The video, which went viral after a Cook County judge ordered its release on November 24th, shows Mr Van Dyke and his colleagues in pursuit of the 17-year-old, who had been spotted earlier trying to break into cars. When two police cars stopped ahead of him, the teenager, who was armed with a small knife, swerved away. He briefly turned to the officers emerging from the cars, whereupon Mr ▶▶



Exit Mr McCarthy

▶ Van Dyke fired his gun. The young man fell to the ground but the officer continued to fire, pumping a total of 16 bullets into the writhing body. It transpired afterwards that Mr Van Dyke would have reloaded had another officer not intervened.

The video is as appalling as the images of the fatal shooting of an unarmed black man, Walter Scott, in South Carolina in April, or of Samuel DuBose, another black man, by a police officer of the University of Cincinnati last summer, both during routine traffic stops. But in both cases the videos were quickly publicised, the officers were charged with murder and fired from the police force. Mr Van Dyke remained on the police force with full pay for more than a year, until he was charged with first-degree murder just hours before the release of the Laquan McDonald video.

Many Chicagoans, smelling a cover-up, demanded the resignation of Mr McCarthy, Anita Alvarez—the state’s attorney in Cook County who brought charges against Mr Van Dyke only after a court ordered the release of the video—and even Mr Emanuel. Protesters took to the streets chanting “16 shots” and blocked entry to fancy shops on Michigan Avenue on the Friday after Thanksgiving, one of the busiest shopping days of the year.

Yet “firing the cop at the top and at the bottom will not solve the problem of culture”, says Peter Moskos, a former police officer who teaches at John Jay College. A study by the Invisible Institute, an NGO, and the University of Chicago showed that fewer than 2% of the more than 28,500 citizen complaints filed against the Chicago Police Department (CPD) between March 2011 and September 2015 resulted in any form of sanction of the officer concerned. It also revealed Mr Van Dyke to be the subject of 20 complaints, including allegations of excessive use of force and racial slurs. In each instance he claimed to have acted properly, even though the city had to pay \$350,000 to a man who had been injured during his rough arrest by Mr Van Dyke.

Even though he was at times an inept manager of the CPD, Mr McCarthy has many good ideas about police reform. He is co-chairman of a group of more than 130 police chiefs, prosecutors and attorneys general looking at alternatives to incarceration and decriminalising relatively minor violations of the law, such as possessing pot or writing a cheque that bounces.

Mr Emanuel shares many of these ideas; hence his loyalty to his police boss for so long. But he now admits that “public trust in the leadership of the department has been shaken and eroded”. He is setting up a task force to promote police accountability, and is expanding the use of body cameras. Yet changing the CPD may take a generation. Though most Chicago cops are doing a dangerous job well, some have been getting away with murder. ■



Donald Trump’s persistence

The greatest show on Earth

SARASOTA, FLORIDA

Donald Trump’s support will not collapse, but he is still a long-shot for the Republican nomination

FOR anyone unsure what sort of an event was about to unfold in Robarts Arena, in sunny Sarasota, on November 28th, the elephant was a clue. It stood meekly outside the entrance, a long-suffering fairground veteran, with “Trump: Make America Great Again” chalked on its flank.

Had the thousands of fun-seekers filing past the pachyderm, most of them grey-haired and wearing shorts, needed additional clues, there were plenty. There was the carnival chatter inside the arena, a real holiday buzz, rising from tightly-packed rows of seating, a column of mobility scooters and elderly ladies—80 years old, some of them, but still game—wearing glittery stars-and-stripes hats, badges and earrings. There was also the entrance of the ringmaster himself.

Donald Trump, who still leads the polls in the Republican primaries, sprang from his helicopter and asked someone to bring him “six or seven beautiful children” to take a ride in it. (In that crowd, even ugly ones were hard to see.) Then Mr Trump, just landed, launched directly into his speech. It was relayed into the arena, where maybe 4,500 people faced, in bewilderment, an empty podium, long before he entered corporeally. It was like the Wizard of Oz, only louder.

Mr Trump would object to this portrayal. In recent days, he has castigated the media coverage of his campaign for the Republican nomination; at a rally in South Carolina, he spiced up one of his harangues with a mocking impression of a

disabled *New York Times* correspondent, shouting “You gotta see this guy...” as he gurned and aped his crooked arms. He claims to be serious—seriously tough, seriously clever, “the best in the world at finance”, as he told the wrinklies in Sarasota. But Mr Trump is not at all serious. He is a clown, and an increasingly sinister one.

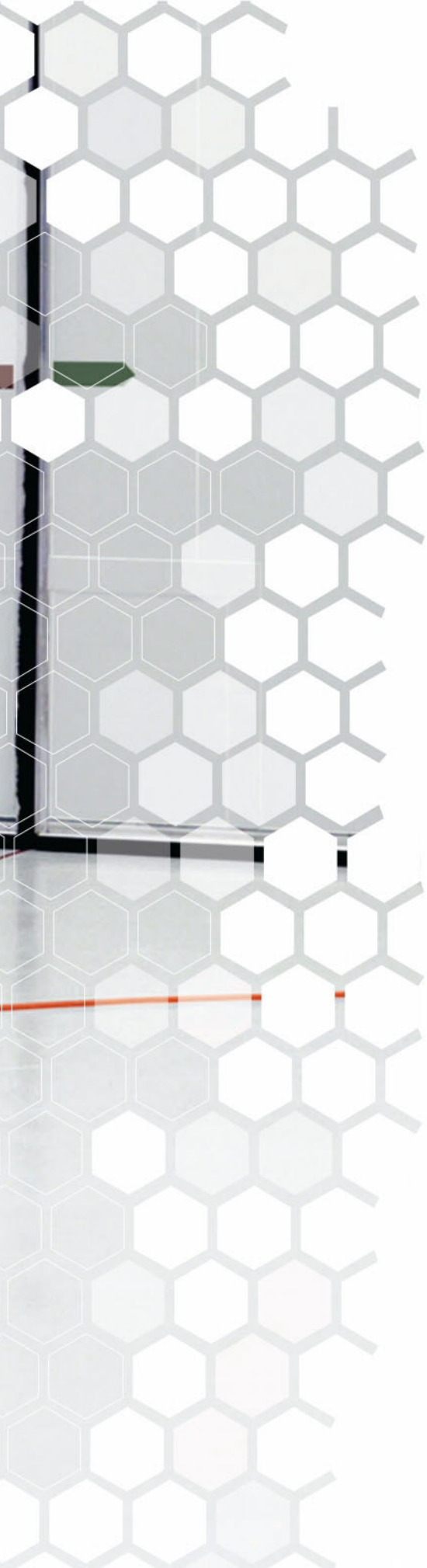
His shtick is to describe a make-believe fallen America, beaten by everyone, emasculated and immiserated by having “the worst government in the world, there’s nobody as bad”. Then he proposes outlandish ideas to make America great again, in Ronald Reagan’s phrase. As president, he would wall off Mexico and make it pay for the privilege, then kick out 11m illegal immigrants and their offspring. He would tax Chinese goods sufficiently to get back millions of American factory jobs filched by those devious Asians. He would seize Iraq’s oil wells and hand their revenues to the veterans of wars in Afghanistan, Iraq and, hell, Syria, too, he told the crowd in Florida (presumably with drone operators in mind).

Mr Trump’s ability to tell people just what they want to hear means they forget that he was once a Democrat and pro-choice; now he is Republican and pro-life. He used to be anti-intervention, but now wants to “bomb the hell out of” Islamic State. He used to dislike loose guns laws, now he loves them: “Some of those folks that were just slaughtered in Paris, if a couple of guns were in that room and were held by the good guys, you would have ▶▶



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Discover the freedom of a system that moves as fast as you do. Pure's radically simple, all-flash storage frees your business from complex infrastructure and technological complexities. That means you can start working smarter — and dreaming bigger.



▶ had a completely different story.”

Mr Trump can be funny; but in less than two months Republicans must start choosing their presidential candidate. So how come 32% of them, when there is that serious task to be done, say they want Mr Trump? One theory is they are also clowning—that they have not yet made a firm choice, and when they do, it will not be the billionaire builder. But Mr Trump’s persistence suggests this is outworn, and so did his fans in Sarasota. In interviews with over a score, most said they had made up their minds and were for Trump. “I don’t have a second choice,” said Joan Combs, a retired country-club manager from Long Island with glittery flags in her greying hair.

By far the most common explanation for this strange loyalty was that Mr Trump “tells it like it is”. That seemed to confuse plain language, which Mr Trump is good at (“Listen you motherfuckers, we’re going to tax you 25%” is how he would talk to China), with plain speaking. He does not go in for that. Not even he could believe the nonsense he spouts. Yet for most of his supporters, Mr Trump’s larger-than-lifeness bridges the credulity gap.

Asked whether they believed Mr Trump’s absurd promises, many interviewees offered the thought that “He’s a rich businessman, so he knows what he’s doing”. Mr Trump’s biggest fans are middle-aged or older, white, rather poorly educated and disposed to be awed by a shouty billionaire. The interviewees included former light-blue-collar workers, retired secretaries and nurses, a plumber, a prison officer and salesman. When pressed, others in the crowd acknowledged that Mr Trump’s biggest pledges, the wall, the mass deportations and so on, are probably hokum. Nonetheless, they felt they showed that “his heart is in the right place”.

The chauvinism Mr Trump displays when denigrating Mexicans as rapists and Muslims as terrorists is another thing some of his supporters like. “I don’t want any Syrians near me,” was one man’s main reason for backing Mr Trump. “You need to take back Britain from the Pakis before you come over here,” another volunteered, in response to being asked what the message on his T-shirt—“It’s not that all Muslims are terrorists, it’s that all terrorists are Muslims”—really meant.

Most of Mr Trump’s fans would probably disapprove of such rudeness. His racism, and maybe theirs, is of a less obtrusive, don’t-you-be-offended-by-this kind. The ninnies in Washington, not Mexicans, are his main scapegoat; he claims to employ the latter by the thousand, and love them. This helps supporters argue that it is not Mr Trump, bad-mouther of women, Mexicans and the disabled, who has the problem, but rather the politically correct liberal zealots. “As a Christian there’s lots of things I can’t say,” says Debbie Shiraz.

“Lots of things, like ‘Merry Christmas.’”

Mr Trump is trying to rein in his offensiveness. At a rally in Alabama last month he appeared to condone, or encourage, the roughing up of a black protester. But when a heckler in Sarasota began to shriek, he enjoined the crowd, with a pained expression, “Don’t hurt the person!” as she was carted off. Nonetheless, a line has been crossed. If nothing else, Mr Trump’s ugly racism would prevent him becoming president, because he has turned off too much of America. Scouring the crowd in Sarasota, your correspondent found three non-whites. One was an activist from the group Black Lives Matter, who had come to heckle. Another was an elderly Sikh, Dr Steve Bedi, who said he was a “guru in unconditional consciousness and how you can become a tree”, skills he thought Mr Trump might wish to acquire. The third was Dr Bedi’s Jamaican disciple.

Rabbit at Rest

The anxiety Mr Trump supporters betray by looking for scapegoats says most, of course, about themselves. Typically members of the white lower middle-class, they are at once jealous of the small privileges that distinguish them from the toilers below, and bitterly resentful of the faraway government that provides their Social Security and Medicare. Remonstrating in hard times, they are the “radical centre”, in academic jargon, who turned out for George Wallace, a populist southern Democrat who ran for president four times in the 1960s and 70s, and for another pair of crowd-pleasers, Pat Buchanan and Ross Perot, in the 1990s. Asked who was the last politician to excite them like Mr Trump, several in Sarasota cited Mr Perot. Mr Trump’s big achievement is to have entered the race with a message already per-

fectly crafted for this group.

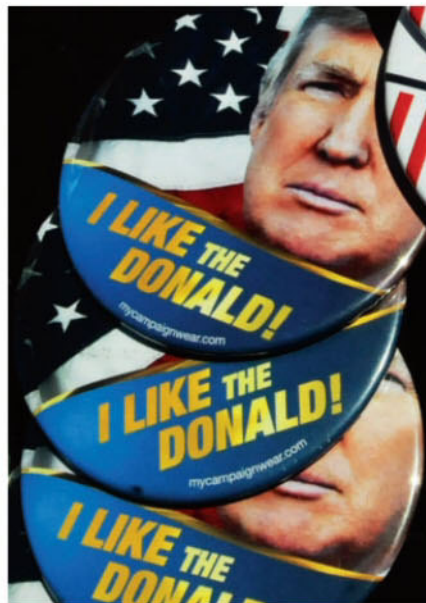
Now, as then, a fear that America is getting weaker, economically or militarily, plays to its members’ fear of loss and change. That also plays to a nationalistic desire for a strong hand on the tiller—for someone, as Linda Miller, a retired accountant, said admiringly of Mr Trump, “to kick ass and take names”.

It may seem odd to come across such bottled fury and despond among the oldsters of the Sunshine State: they are enjoying the retirement, almost an after-life, millions of Americans have aspired to for decades. Yet retirement lends itself to the feelings of insecurity on which Mr Trump preys; it is no coincidence that John Updike sent his great exemplar of the radical centre, Rabbit Angstrom, from whose flabby mouth dripped endless expressions of impotence, anger and glum humour, to Florida to nurse his disappointment. “You are still you,” Rabbit reassures himself, in the fictionalised late 1980s, under the same azure sky from which Mr Trump descended, “The US is still the US, held together by credit cards and Indian names.”

The angst of America’s disgruntled centre cuts across the Republican coalition. Mr Trump is picking up some support from evangelical Christians and Tea Party agitators, as well as national-security obsessives: wherever the seam runs of resentment and anxiety. It also goes beyond it. Strikingly, about half of those quizzed in Sarasota once voted Democratic, especially for Bill Clinton. Shamefacedly, one man said he had even voted for Barack Obama.

This suggests that if Mr Trump wins the nomination, he might give his opponent—especially if, as is likely, she is Hillary Clinton—a scare. That prospect is no longer unimaginable; Mr Trump was supposed to have fizzled long ago. Still, the size of his core support, perhaps 30% of the Republican primary, and the opprobrium in which he is held outside it, makes it unlikely. Mr Trump’s lead is chiefly the gift of a fractured field, in which the steadier conservative vote is split between three or four candidates. Mr Trump’s strong ratings, points out Nate Silver of *FiveThirtyEight*, represent the views of only around 25% of the 25% of Americans who identify as Republicans. That equates to 6-8% of the electorate—roughly the proportion who think the Apollo moon landings were faked.

Mr Trump’s hold on American politics has been nasty, brutish and longer than expected. Nothing about it has been pleasant; not even the appearance of the pretty elephant in Sarasota, whose owner, it transpired, was once arrested for animal cruelty, and whose trainer is in the forefront of a fight for the right to chastise elephants with sharp sticks. Almost none of Mr Trump’s jokes are good jokes. It would be good for America if the end of him, as seems likely, is in sight. ■



The noisy minority

Enlightened agriculture

Moveable feasts

NEAR AUBURN, ALABAMA

A farmer-philosopher who confounds expectations about Islam and outsiders in the South

THE voice at the other end of the line wanted a lamb. Might Frank Randle have an intact male animal that he was willing to sell? “Yes, ma’am,” he replied. “I do.” The caller explained that she was a liaison officer at Fort Benning, an army base about 40 miles from Mr Randle’s farm. She told him to expect a customer.

Soon a black Mercedes, windows tinted, turned off the road that traverses his shallow Alabama valley, with its beautiful creek, and pulled up to the farmhouse. Two enormous, shaven-headed bodyguards wearing black suits and Uzis strapped to their hips got out. Mr Randle selected a lamb and bound its legs. The flunkies placed it, baaing, in the limousine’s boot. Finally the car’s rear window rolled down, just enough for a hand—belonging, it afterwards transpired, to a Saudi prince—to proffer a \$100 bill, a suitably royal sum for a single creature.

That was 30 years ago. Mr Randle—now 64, lean, bronzed and moustachioed—still doesn’t know why they called him, though it helped that his sheep were and remain uncommon livestock in the pork- and beef-eating South. The transaction was the start of his role as a supplier of meat to generations of Muslim officers seconded to Fort Benning and Maxwell Air Force Base. Having been educated in England, many of them, he says self-deprecatingly, “speak better English than I do”; over the decades their nationalities have varied with America’s shifting alliances in the Middle East. His clientele expanded to include Muslims throughout southern Alabama and up to Atlanta: professionals and university types from across the Arab world, Africa and South-East Asia. Demand spikes with the births of children and the feast at the end of Ramadan; every year a Malian imam in Tuskegee hand-delivers a religious calendar so Mr Randle can anticipate it.

Unlike the prince, many of these southern Muslims are reluctant to take live animals home, for fear, he says, of winding up on the local news. So he installed a modest slaughtering facility at the farm (a tub to drain blood; hooks for carcasses): a “judgment-free zone to do what their culture asks them to”. Senior officers, he notices, leave the throat-slitting to their underlings. Some of his customers have become friends. Sitting on his porch—wind-chimes jangling, turkey vultures circling overhead—Mr Randle recalls a banquet on the lawn between his house and the orchard,



Welcome to Alabama

involving dates, pomegranates and palpitation-inducing shots of coffee, consumed cross-legged and without cutlery. Afterwards his guests prostrated themselves in prayer, he remembers, pointing the way towards Mecca.

That hospitable attitude isn’t universal in the region. Following the atrocities in Paris, Alabama’s governor was one of many to declare that he would not be accepting Syrian refugees—a mostly symbolic gesture, since the state has never taken any. It is also among the ten to have passed laws banning the application of foreign (ie *sharia*) statutes in secular courtrooms, another solution to a non-existent problem. Mr Randle himself has been warned by xenophobes that he is “consorting with the enemy”. “It’s a free country,” he tells them.

South and east

But then, Mr Randle is an unusual man. He grew up in northern Alabama in a family of tenant farmers and coalminers. His mother was a Baptist but his father a Methodist, making him, he jokes—though it was less funny at the time—“the product of a mixed marriage”. He attended segregated schools; there weren’t many Muslims

around. Those northern roots mean some neighbours still consider him an outsider, though he has farmed near Auburn for 40 years. (On the day he bought the property, a tornado ripped the roof off the house and destroyed the outbuildings.)

He traces his enlightened outlook to three influences. The earliest was a summer programme at Yale Divinity School, his first time on an aeroplane and “a slap in the face” for a hitherto insular high-school student. Next was Booker T. Whatley, a visionary agronomist. Mr Randle studied entomology, paying for college by keeping bees and selling honey; later he became a state bee inspector. He fell in with Whatley, one of whose aims was to generate an agrarian black middle class: the idea was to repatriate young blacks from the north to the smallholdings given to some ex-slaves after the civil war. In that respect his success was mixed, but his impact on Mr Randle was profound. His third mentor was Wendell Berry, a Kentucky poet and theorist of localism and community.

A devotion to both economic and ecological sustainability is the result. “I want my sons and my grandsons to be able to keep doing this,” Mr Randle says. That hope is half-accomplished, since his two sons live and work on the farm. Rather than the usual southern rota of corn, cotton, soybeans and peanuts, they grow blueberries, grapes, pears, persimmons and sweet potatoes; they raise chickens and Thanksgiving turkeys along with the sheep. The fruit is picked by visitors or pre-sold to buyers in a harvest-sharing scheme, an approach known as “community-supported agriculture”. That helps to spread hard-pressed farmers’ risks and guarantee their income, and is catching on in the South. The bees are gone: Mr Randle’s wife became allergic to their stings, and he was forced to choose between them.

After taking in a slice of an old plantation, the farm now encompasses some 230 acres. Mr Randle reckons that is ample: “if you can’t walk over it in a day, you don’t need it.” Like many farmers he rarely leaves, but, for him, the land has its own inexhaustible fascination: “There’s more going on underneath your feet than most folks could ever appreciate.” And, as compensation, “The world comes to me”.

Having raised his lambs from birth, Mr Randle isn’t keen to slaughter them himself; in any case, he explains—stooping to return a lost newborn to its mother—state rules forbid him to, though his Muslim guests may do so for their personal consumption. He admires the solemnity and reverence with which they go about it: evidence, he thinks, of a sense of responsibility to the natural world, and of the sanctity of life, which he shares. When employed expertly and painlessly, the *halal* technique is “the most humane way”, says the farmer-philosopher of Alabama. ■

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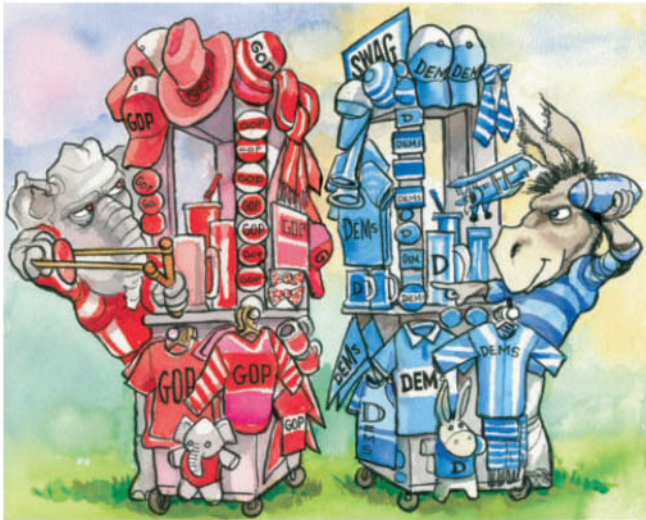


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Lexington | Wooing with whimsy

What political campaign badges and novelties reveal about America



IT IS hard to pick the oddest campaign knick-knack being sold by a presidential candidate just now. Some items stand out for their whimsy in an election season marked by anger. Consider a trio of hiply ironic “ugly Christmas sweaters” and sweatshirts being sold by Hillary Clinton, the Democratic front-runner, and her Republican rivals, Senator Ted Cruz of Texas and Ben Carson, a retired neurosurgeon. The three candidates spend their days dealing sharp jabs—a recent low point followed a mass shooting at an abortion clinic in Colorado, blamed on an unstable man whose hatreds reportedly include Barack Obama. That prompted Mrs Clinton to criticise Republicans for making abortion a “political football”, and Mr Cruz to retort that “the overwhelming majority of violent criminals are Democrats”. At the same moment, their campaigns were promoting knitwear variously adorned with snowflakes, reindeer and a smiling Mr Cruz in a Santa hat.

Some items aim to humanise candidates who can make campaigning look a joyless chore. Jeb Bush, the former governor of Florida, is selling a \$75 “Guaca Bowle” [sic] so supporters may imitate his favourite weekend treat, whipping up avocado dip with his Mexican-born wife Columba on what the Bush family calls “Sunday Funday”. Other items let supporters feel like insiders. For \$250, Senator Marco Rubio of Florida lets fans “adopt a staffer for the day”, as if his field organisers were winsome zoo animals.

It is all a bit mysterious. In a grumpy and bitter election season, campaigns have filled websites with merchandise that celebrates the business of politics. Alarmists might suggest a gloomy explanation: that image-makers have taken over. Seeking a bit of perspective, Lexington this week headed to the National Museum of American History, a branch of the Smithsonian Institution in Washington, DC, to ponder whether this election marks a final triumph of marketing over ideas.

Tell that to President William Henry Harrison, is your columnist’s response, after some useful hours being shown round the vaults of the history museum, high above the National Mall. Harrison won what is often deemed the first “modern” presidential campaign, in 1840. The retired general was swept into the White House with the help of a blunder by his opponents. A Democratic-leaning Baltimore newspaper sneered that Harrison was old and idle, and should be pensioned off to a log cabin with a barrel

of hard (ie, alcoholic) cider. Whigs pounced, presenting Harrison as a frontier-dwelling “log cabin and hard cider” war hero. They staged vast rallies at which free cider flowed, and crowds roared campaign songs like “The Log Cabin Waltz”.

There are about 100,000 objects in the Smithsonian’s political-history collection, started a century and a half ago when a donor dropped off Abraham Lincoln’s top hat. The collection includes a grinning, foot-high plastic peanut honouring Jimmy Carter, cabinets of campaign badges, and brass medals from George Washington’s inauguration in 1789. Treasures from 1840 include a model log cabin that could be carried in parades, a cane with a cider-barrel top and plates showing Harrison at his humble log home. This was nonsense: Harrison was born in a Georgian mansion in Virginia to a grand colonial family, though he did later own a farmhouse in Ohio with some log walls in it. But what counted was Harrison’s campaign story, says Harry Rubenstein, chairman of the history museum’s political division: an American tale of a common man called from rural simplicity to govern.

Smithsonian curators have collected badges, stickers and other swag in the field since the 1980s. Yet the late 1990s marked an anxious time, recalls Mr Rubenstein. With campaigns fixated on television advertising, curators might visit field offices in Iowa or New Hampshire and find few objects to buy. Happily, recent elections have seen a resurgence of physical merchandise, as campaigns use sales to gather voters’ e-mail addresses and other data.

Winning, one bumper sticker at a time

Today’s abundance of campaign swag suggests that Democrats and Republicans are limbering up for a gruelling contest in 2016, in which exciting and mobilising supporters is a higher priority than converting opponents. Matt Bennett, a veteran of several Democratic presidential campaigns, notes that nobody is persuaded to vote for a candidate by a T-shirt. Instead, swag offers a “piece of the action” to voters who already like a candidate. Can memorabilia do much for struggling campaigns. Simple saxophone pins given to Bill Clinton’s most important backers in 1992 became “highly sought-after status symbols”, recalls Mr Bennett, now with Third Way, a think-tank. But few people fought for Michael Dukakis badges four years earlier.

Quirky campaign items serve several purposes, says Matt Ipcar, a designer at Blue State Digital who worked on both Obama presidential campaigns. They allow technologically sophisticated campaigns to target supporters with precision. Thus someone who buys gay-pride Hillary shirts can expect campaign e-mails about same-sex rights (while Republicans buying camouflage caps should brace for messages about guns). The quirkiest—those ugly Christmas sweaters—generate free news coverage. Lastly, they are a way to sidestep or manage partisan nastiness. In 2012 a resurgence of rumours that Mr Obama was born outside America risked souring Democrats on politics, just when their enthusiasm was needed to re-elect the president. A mug that Mr Ipcar designed, bearing a photo of Mr Obama’s birth certificate and the legend: “Made in the USA”, allowed fans to defend their president lightheartedly. It became an Obama campaign bestseller.

The Smithsonian will open a big political exhibition in 2017. Expect some frivolous objects: the museum owns a Theodore Roosevelt “Rough Rider” doll and a model axe that Lincoln supporters carried to honour their man’s wood-chopping youth. But in America, symbols and images are not a distraction from politics. For better or worse, they are what democracy looks like. ■



Brazil's president

Dilma's disasters

SÃO PAULO

The impeachment proceedings against Dilma Rousseff are bad for Brazil. But they make it more likely that she will remain in power until the end of her term

IT WAS just what Brazil needed. With a vast corruption scandal in full swing, an economy in free fall, public finances in tatters—and a self-serving political class in no mood to tackle any of it—the country has now been served up a constitutional crisis. On December 2nd Eduardo Cunha, Speaker of Congress's lower house, initiated impeachment proceedings against the president, Dilma Rousseff. "I take no pleasure in this act," Mr Cunha told a press conference, stressing that his decision was of a purely "technical nature". Its consequences will be anything but.

The arguments that apparently won Mr Cunha over had been laid out by three respected lawyers, including Hélio Bicudo, a champion of human rights and former member of Ms Rousseff's left-wing Workers' Party (PT), which he helped found. The trio's main allegation is that by failing on time to stump up cash to state-owned banks paying welfare handouts on its behalf, the administration let itself be funded by entities under its control. This practice is barred by the fiscal responsibility law. Yet it occurred in 2014, the accusers claim, and, crucially, also this year. Mr Cunha had thrown out Mr Bicudo's earlier motion because it referred only to Ms Rousseff's first term in 2011-14, agreeing with most jurists that a sitting president can only be pursued for actions committed in the current term in office.

Ms Rousseff would not be the first Brazilian president to tamper with public accounts. Such practices are neither illegal nor uncommon, her defenders say; earlier presidents used them with abandon. However, none had his administration's books rejected by the national comptroller. In October the National Audit Tribunal urged Congress not to approve Ms Rousseff's accounts for 2014 (legislators have yet to vote on the matter).

For all his protestations to the contrary, few doubt that Mr Cunha's motives were not technical but political—possibly even personal. The Speaker, whose Party of the Brazilian Democratic Movement (PMDB) belongs to the governing coalition, is one of 34 sitting congressmen under investigation over alleged involvement in the bribery scandal centred on Petrobras, the state-controlled oil-and-gas giant. Prosecutors allege that in exchange for padded contracts Brazil's biggest construction firms paid more than a billion dollars in bribes to Petrobras directors, who in turn funnelled the money to their political masters.

Around 140 businessmen, including some of Brazil's richest men, have been charged with crimes such as bribery and money-laundering. On November 25th, police arrested a prominent PT senator, Delcídio do Amaral, for allegedly attempting to spirit a former Petrobras director out of the country before he could co-operate

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with the authorities.

Many think Mr Cunha could be next. His name has cropped up repeatedly in the context of the affair. On November 30th it did so again, when a leak from the investigation suggested that he had received 45m reais (\$12m) from BTG Pactual, an investment bank, in exchange for favourable legislation. BTG's billionaire founder, André Esteves, was also arrested for plotting with Mr do Amaral. Both men, as well as BTG, deny wrongdoing.

Mr Cunha, too, continues to protest his innocence. But evidence against him has been piling up. This week the lower-house ethics committee was expected to recommend ousting the Speaker from the legislature for hiding Swiss bank accounts. After much dithering, PT senators signalled they would cast their deciding votes against the Speaker, in line with public opinion but against the quiet wishes of the presidential palace, which feared that Mr Cunha would drop the impeachment bombshell to divert attention from his own travails.

The process now takes on a life of its own. Congress has until December 4th to set up a special committee to examine the charges. Within a month deputies must decide whether to pass the case to the senate, which requires a two-thirds majority. Senators would then have 180 days to try the president, during which time she would be suspended from her duties. The vice-president, Michel Temer, would take over.

Brazil has been here before. In 1992 Fernando Collor, Brazil's first directly elected president after two decades of military rule, was impeached over corruption two years into his term (he was subsequently cleared of the charges on a technicality). A charismatic populist, Mr Collor's main sins were a failure to quash hyperinflation—and, even deadlier in Brasília, showing dis-

▶ respect to Congress.

Ominously, Ms Rousseff, too, has an economic disaster on her hands, largely the result of irresponsible fiscal and monetary policies and incessant microeconomic interventionism in her first term. Figures released this week show that GDP shrank for the third consecutive quarter between July and September. It was 4.5% lower than in the same period last year; 2016 will mark the second year of recession—the longest downturn since the 1930s. Inflation was around 10% in November and unemployment is rising. Alberto Ramos of Goldman Sachs, an investment bank, speaks of an

“outright depression”.

Ms Rousseff appears finally to have grasped that budgetary belt-tightening is the first step to recovery. But, like Mr Collor, she lacks the skill to negotiate Brasilia’s fragmented political landscape. Her approval rating, sapped by the Petrobras scandal and the deteriorating economy, is around 10%, roughly where Mr Collor’s was on the eve of his impeachment.

Here, though, the similarities between her and her disgraced predecessor-but-three end. Unlike him, Ms Rousseff has not been accused of enriching herself. And she retains the backing of the PT, which has not

lost all its strength.

Perhaps most important, there is little evidence that the opposition wants to take the mess off Ms Rousseff’s hands. It would rather watch her suffer and win an easy victory in the next election in 2018. The PMBD—led by Mr Temer, who would become president in case of her departure—might accept it, but probably only if it could count on the pork and patronage that have historically been the party’s main objective. With the budget deficit near 10% of GDP and the economy shrinking, it would instead be getting “a plate of hot potatoes with a small side of pork,” quips one in- ▶▶

Bello | The toilet-paper tangle

A new breed of competition regulator takes on the cartels

IN OCTOBER Chileans discovered that for ten years they had paid over the odds for toilet paper because of a cartel linking the dominant suppliers, CMPC, a Chilean multinational paper and pulp firm, and a smaller rival. According to Chile’s competition authority, CMPC, with 80% of the market, colluded with its competitor, now owned by SCA, a Swedish company, to fix prices. A consumers’ association reckons that the two firms ripped off Chileans to the tune of \$500m.

The revelation has caused a stir in Chile, for two reasons. The first is that CMPC’s chairman is Eliodoro Matte, the country’s third-richest man, with a fortune of \$2.3 billion, according to *Forbes* magazine. He is a pillar of his country’s business community and a preacher of corporate social responsibility. He denies knowing of the cartel; he says that when he found out, thanks to an investigation in another country, he ordered his managers to confess. Nevertheless, the affair has smashed Mr Matte’s halo of corporate virtue. In an interview last month in *El Mercurio*, a newspaper, he adopted a quasi-Maoist tone of self-abasement.

The more important reason that this affair matters is that it is far from exceptional. In Chile in recent years regulators have discovered and punished price-fixing by pharmacy chains and poultry producers, for example. While Latin America’s private sector talks of the virtues of free markets, too often it practises the vices of monopolies and cartels. Other corporate sins include cronyism and rent-seeking in which profit derives from political connections rather than competitive excellence, as the corruption scandal at Petrobras in Brazil illustrates. Foreign multinationals often imitate rather than challenge their local rivals.

Most Latin American countries threw



open their economies by slashing tariff barriers in the 1980s and 1990s. But that was not enough to ensure healthy competition. Even for tradable goods, let alone services, small and remote national markets lend themselves to oligopolies. Rigged markets don’t just hurt consumers. They are a development problem. The World Bank finds that a lack of competition is associated in Latin America both with income inequality and lack of innovation.

Attempts to promote competition are growing. Chile is a pioneer: it has set up a specialised competition tribunal, and rewarded rulebreakers with lighter or no punishment if they have snitched on their co-conspirators.

Mexico, which was long notorious for monopolies, is now fighting them. The government of Enrique Peña Nieto set up a new telecoms regulator to implement a law that has forced América Móvil, whose main owner is Carlos Slim, the world’s second-richest man, to cut its charges. This law has encouraged AT&T to enter Mexico, presenting Mr Slim with a heavyweight competitor for the first time.

The government has also beefed up the

Federal Competition Commission, which regulates all markets except telecoms. It is investigating possible cartels in eggs, sugar, private pension funds and airport slots, according to Alejandra Palacios, its director. It has the power to block mergers that create monopolies and to make recommendations, such as one that encouraged Mexico City’s government to allow Uber to operate its car service.

Brazil, too, recently reformed its competition agency to make it speedier and more effective. Other countries in the region are lagging. Peru so far has no provision to prevent market concentration: SABMiller held 96% of the beer market there even before its recently agreed merger with AB InBev (which has the other 4%), while Grupo El Comercio controls around 75% of the newspaper market. Peru may soon set up a stronger competition agency because its free-trade agreement with the European Union requires it to, says Tania Zúñiga-Fernández of ESAN, a business school in Lima. But she adds that passing a law is just the start. Implementing it means finding qualified professional staff.

There is a risk of regulatory populism. Some competition experts questioned Mr Peña’s competition law because it includes provisions to force powerful firms to divest in some circumstances. But Ms Palacios says these are “a last resort” and that they exist in Britain, too. Others argue that prior approval of mergers may impose more costs than benefits in small markets. But that sounds self-serving.

Capitalism in Latin America needs defenders, sometimes against the capitalists themselves. That should be the role of the new breed of regulators. Their work should remind the region’s business people that the prime corporate social responsibility is to comply with the law.

▶ vestment banker.

Ironically, Mr Cunha's move to impeachment may have made Ms Rousseff's survival until 2018 more likely rather than less. The timing works in her favour. Mr Cunha can easily be painted as self-serving rather than statesmanlike, putting a question-mark over the whole rigmarole. The PT is likely to close ranks in support of its president. And Ms Rousseff will no doubt be more adamant than ever that she is not stepping down of her own accord, as some in the opposition had been hoping. Responding calmly to Mr Cunha, she spoke of her "indignation".

Sadly, the furore will divert Brazilian politicians' already scattered attention away from fixing the country's many problems, starting with the ballooning budget deficit. History may judge this to be Mr Cunha's greatest sin. ■

Venezuela's parliamentary election

Vincible

CARACAS

A vote with momentous consequences

AS VENEZUELA prepares for a crucial election, state-controlled radio is playing a schmaltzy pop ballad called "*Invencible*". It is a eulogy to the "invincible commander", the late president, Hugo Chávez, sung by Daniela Cabello, a pop star who is the daughter of the powerful head of the National Assembly, Diosdado Cabello.

The message is clear. *Chavismo*, the populist movement founded by Chávez, never loses. It has won every election since 1998. Perhaps if he were still alive that record would continue when a parliamentary election is held on December 6th. One recent poll gave him a 58% approval rating.



A hymn to Hugo

But *chavismo* minus Chávez, and with the economic chaos he bequeathed, is now far from invincible. This time the opposition Democratic Unity (MUD) alliance is the favourite to win, and by a huge margin. Luis Vicente León, who accurately predicted the government's unbroken string of electoral victories, says the question now is not whether the MUD will win but by how much.

That matters. Under the constitution, the powers of a majority in the National Assembly depend greatly on its size. If the MUD wins a simple majority it could irritate the executive branch by, for example, refusing to pass the annual budget or to approve the president's foreign travel. A "supermajority" of more than two-thirds would give the opposition much greater power, for example to dismiss judges from the supreme court, which is controlled by the government and enables its authoritarian rule. With a voting block that big the MUD may feel strong enough to launch a referendum in 2016 to recall the unpopular president, Nicolás Maduro.

In a fair fight, the MUD might well win a supermajority. Millions of Venezuelans, suffering the worst recession in over 70 years and appalling levels of crime, want a change. But the government is making that hard. Pre-election rigging, with the collusion of the electoral authority, the CNE, has been blatant. In April it assigned extra representatives to districts where the government is strong. The ballot paper is confusing. The government has banned several opposition candidates on spurious grounds, including one of the MUD's top leaders, Leopoldo López, who is in jail. The ruling United Socialist Party has narrowed the gap with the MUD in recent polls.

Mr Maduro has repeatedly threatened violent consequences if the opposition wins. His prediction seemed to come prematurely true when, at a packed rally in the state of Guárico on November 26th, Luis Manuel Díaz, a regional opposition leader, was shot dead. Lilian Tintori, Mr López's wife, was on the same stage, close enough to be sprayed by Mr Díaz's blood. She calls the murder "state terrorism". The government says it was the work of gangsters; three men have been arrested.

Despite the fevered atmosphere, the election will not be well monitored. Whereas Chávez welcomed foreign observers (to give legitimacy to his near-certain victories), Mr Maduro says Venezuela "will not be monitored by anyone". He refused an application by the Organisation of American States to send a mission. Luis Almagro, the organisation's secretary-general, criticised preparations for the election in a detailed letter to the CNE. Mr Maduro's response: Mr Almagro, a former foreign minister in Uruguay's leftist government, is "garbage". The only observation team allowed into the country is from the Union

Tetraphobia

Nothing to fear...

VANCOUVER

...but four itself

THE lift at 1009 Expo Blvd in Vancouver goes directly from the 12th floor to the 15th. The omission of the 13th caters to Western superstitions. The absent 14th acknowledges an Eastern anxiety. The numeral four sounds in Mandarin and Cantonese like the word for death. Fourteen sounds like "certain death"; 24 is "easy death". 1009 Expo is missing the fourth, 24th and 34th floors as well.

Developers in Vancouver have been building four-free apartment blocks for a decade to attract Chinese buyers, among the biggest customers for luxury condominiums and a prime cause of a boom in property prices. The city will not change street names but is relaxed about house numbers: 224 can become 223B.

Some multicultural neighbourhoods elsewhere in Canada have also forsworn fours. Richmond Hill, a suburb of Toronto, banned the number on new houses a few years ago.

First responders argue that it is the numeral's absence that is lethal. The omission of a 14th floor can confuse firefighters, who often take the lift to a level below a reported fire and walk up. The consequences could be dire, warns Jonathan Gormick, a fire-department captain in Vancouver. Though he cannot point to a disaster in real life he says that "at some point we had to draw a line."

The city of Vancouver agreed. In October it banned non-sequential numbering schemes. Existing buildings can remain four-less but new ones may not skip numbers. Chinese buyers will normally accept an unluckily numbered unit for a discount, but property developers fret that the new rule will depress prices. No one can accuse the city of cultural discrimination: tall buildings will have to have a 13th floor as well.

of South American Nations. Its remit is limited. Brazil, which is normally indulgent towards Venezuela's leaders, pulled out of the mission when Venezuela rejected Nelson Jobim, a former president of Brazil's supreme court, as its leader.

Whatever happens, the election will move Venezuela into uncharted territory. If the MUD falls short of a majority, its supporters may erupt in protest. If it wins a landslide victory, radicals could seek an immediate and potentially destabilising removal of the president. If, as seems likely, the MUD scores a narrow victory, will Mr Maduro consider dialogue? Or will he use repression to keep *chavismo* invincible? ■



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Extractor, few fans

TOKYO

An overreliance on confessions is undermining faith in the courts

A VISITOR from overseas can hardly fail to be struck by what a peaceable, law-abiding land Japan is. Crime rates are roughly a tenth of those in other rich countries. A wallet left on a train is handed in with scrupulous honesty. Gun crimes are nearly unheard-of, and even muggings are vanishingly rare. Neighbourhood cops often patrol the unmean streets with no more threatening an instrument than a sit-up-and-beg bicycle. Often the biggest headache seems to be shoplifting by Japan's growing numbers of elderly.

For most criminals, the country's justice system is remarkably lenient and focused on rehabilitation. Police and courts make every effort to keep first-time offenders out of confinement. Minor wrongdoers who confess and apologise are often allowed to go free with a stern warning. The state works with families to ensure that miscreants return to the straight and narrow. When young criminals are sent inside, it is to what resembles a strict boarding school more than a penal institution. Courts incarcerate citizens at a far lower rate than most developed countries: 48 per 100,000 people compared with 148 in Britain and 698 in America. This approach seems to work. Rates of recidivism for all ages are relatively low.

The system places huge emphasis on confessions. Admitting guilt is considered

the first step towards rehabilitation. It is also, however, the "king of evidence" in cases too serious to let the suspect walk free. Last year confessions underpinned 89% of criminal prosecutions in Japan. And almost without exception, those who confess are found guilty. The overall conviction rate is a staggering 99.8%.

The trouble is, not all confessions are true. Some suspects will falsely admit guilt just to end a stressful interrogation, and interrogations in Japan can be very stressful. Police and prosecutors may hold ordinary criminal suspects for up to 23 days without charge—longer than most other rich countries allow even terrorist suspects to be detained. Access to defence lawyers during this period is limited. In theory, suspects have the right to remain silent; but in practice prosecutors portray silence as evidence of guilt.

Prosecutors put pressure on the police to extract confessions, and 23 days is plenty of time to extract one. Interrogators sometimes ram tables into a suspect, stamp on his feet or shout in his ears. Interviews can last for eight hours or more. Suspects are deprived of sleep and forced into physically awkward positions. Few people can withstand such treatment. "Not being able to sleep was the hardest for me," says Kazuo Ishikawa, who held out for 30 days before signing a confession he couldn't read

(he was illiterate at the time) to a murder he says he didn't commit. He spent 32 years in prison and is still fighting to be exonerated.

Sometimes police methods are strangely ritualistic. In 2003 in a small town in southern Japan 13 elderly men and women were falsely accused of electoral fraud. Police forced one man to trample on the written names of his family—just as early Christians in Japan were forced to trample on images of the Madonna.

Growing numbers of false confessions have come to light. Iwao Hakamada, for example, served 46 years on death row—probably longer than anyone else alive—before his release in March 2014. The judge who freed him found that police and prosecutors had fabricated evidence in his original trial for murder. He has also said he was interrogated for 11 hours a day for 23 days, beaten with nightsticks and prodded with pins when he fell asleep.

If in doubt, make it up

Keiko Aoki spent 20 years in prison after she confessed to having burned her 11-year-old daughter to death. In fact, her daughter died in a fire that started from leaking petrol in the family garage. But so harsh was Mrs Aoki's questioning that she admitted to murder after just a day. She was released in October.

The scale of wrongful convictions is hard to gauge. One defence lawyer guesses that 1,500 people, or a tenth of the total sent to jail each year, are wrongfully convicted. One reason why past miscarriages of justice are coming to light is that DNA-matching techniques have improved. Defence lawyers and activists are calling for more cases to be reopened. Over a dozen are being investigated by teams of lawyers and supporters of those convicted. ▶▶

▶ A prominent case is that of Michitoshi Kuma, who was hanged for murder in 2008. A forensic expert, Katsuya Honda of Tsukuba University, who has helped secure recent exonerations, believes old and faulty DNA evidence was used to convict Kuma and that he was innocent. More than half of the 128 inmates on Japan's death row (see next story) are seeking a retrial.

The activists liken their push to one in

America in the early 1990s that overturned many convictions, including of some prisoners who had been sentenced to die. In particular, they want to reform the rules that govern interrogations.

Prosecutors everywhere like to win; and in Japan they have extra incentives. An official survey five years ago found that nearly a third of them believed that a not-guilty verdict would hurt their career. (It

might; most prosecutors have never lost a case.) A quarter said superiors had told them to write confession statements that differed factually from what defendants had actually said. Yet there is little scrutiny of misconduct. Even a probe of the procedures that robbed Mr Hakamada, who is 79, of most of his life appears unlikely. Prosecutors have clout.

Recent governments have made a few stabs at judicial reform. Japan does not have juries—a panel of judges decides whether the accused is guilty. But since 2009 the government has allowed ordinary civilians to become lay judges in certain cases. To date, over 50,000 people have served in this role in trials for serious crimes, including murder. Yet the use of lay judges has done little to reduce the system's overreliance on confessions, or to lower the conviction rate.

At the time of that reform, the justice ministry also said it wanted more suspects' interviews to be filmed. The police seem to be inching towards that goal, especially in cases that come before lay judges. Yet few interrogations are recorded from start to finish, so officers can still bully suspects when the camera is not rolling. Nobody expects filming of all interviews to be mandated any time soon. ■

India's diamond polishers

Hard faces

SURAT

A remarkable cottage industry is under pressure

NINE-TENTHS of the world's natural diamonds pass through the Indian state of Gujarat, where in and around the city of Surat they are cut and polished before being sold on through the trading houses of Antwerp and Dubai. Diwali, a Hindu holiday marked by gift-giving, fell in early November. By this time of year, shops around the world are stocked with the gems to last till Christmas. It is when the diamond-polishing workshops of Surat, on the Arabian Sea, shut down for an annual unpaid, month-long break for their workers. Perhaps half a million diamond-cutters head home for the holidays, while shop managers sit down to settle their accounts in homemade *chopri*, or bank books.

A port once notorious for an outbreak of plague in 1994, but since then nicely spruced up, Surat has for generations been home to what may be the world's biggest cottage industry. Perhaps 2,000 of the 5,000-odd operations that buy diamonds for polishing are reasonably large, employing 300-500 grinders, most of them migrant workers. The rest are small family-▶

Japan's prisons

Silent screams

TOKYO

Why you might prefer a Bangkok jail to one in Chiba

LIKE the rest of Japan, its prisons are strikingly clean, safe and orderly—and as quiet as retirement homes. Yet reformers who have surveyed some of the world's penal hellholes say that Japan's jails rank among the cruelest—for the psychological toll they take on inmates.

Past inmates describe draconian rules. Eye contact with prison wardens is often forbidden or, when allowed, has to be accompanied by a smiling demeanour. Some compulsory prison work can be mind-numbing—folding pieces of paper into eight and unfolding them, for instance. Talk is banned for much of the day. Reading is only sometimes allowed.

Toshio Oriyama is a former restaurant owner who spent 22 years behind bars for a murder he insists he did not commit. "You weren't free to do anything except breathe the air," he says; even to stand up required a guard's permission. Mr Oriyama had to sit cross-legged much of the time, in some pain; and "when we took a bath, the bums of all my inmates were dark like bedsores" from sitting in the same position all the time. A common punishment for misdemeanours was solitary confinement, where Mr Oriyama had to sit facing the door all day long. Two people with whom he shared a cell separately hanged themselves after losing their status as well-behaved prisoners, he says.

Death-row inmates have it worst. They wait in solitary confinement, sometimes for many years. They are not told when they will be executed; prisoners wake each day not knowing if it is their last. Sakae Menda, who was exonerated of murder and released in 1983, once described how when the guards stopped each morning at his door "your heart would pound".

Ordinary Japanese are often either unaware or untroubled by their penal system's cruelty. The media generally regard judges' verdicts as "the voice of heaven", says Ichiro Hara, chief producer of "The Scoop Special", a news show

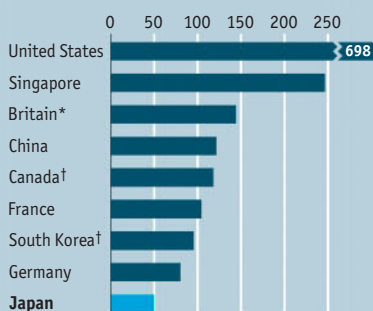
from TV Asahi that, unusually, draws attention to wrongful convictions. Japanese tend to put themselves in the shoes of crime victims, not of suspects, says Kana Sasakura, a law professor attempting to overturn wrongful convictions. Broad-based civic pressure for reform does not yet exist.

A broad overhaul of criminal justice, and even the scrapping of the death penalty, seemed possible when the Democratic Party of Japan won power in 2009. But since the conservative Liberal Democratic Party came back to office in late 2012, executions have gathered pace, while the government stands firmly behind prosecutors and the police. It is even trying to toughen the regime for juvenile offenders, despite a fall in crime.

Change may start with judges. The judge who freed Iwao Hakamada (see previous story) went so far as to accuse the authorities of fabricating evidence, albeit long ago. Campaigners hope he may overturn other wrongful verdicts. Another judge who later criticised interrogation techniques was one of the three who passed down the death sentence on Mr Hakamada. But too many others, say campaigners, only discover their consciences as they near retirement, with no chances of further promotion.

Japan's good side

Inmates per 100,000 population, 2013



Source: UNODC

*England and Wales †2012



But will it pay the rental?

owned affairs with maybe a couple of grindstones. Many struggle to afford the rough diamonds in the first place.

The side streets of Varachha bazaar, thick with scooters, give a clue as to how the small fry operate. Peer through the ground-floor windows and you see halogen lights illuminating the bright white stones being worked by hand. Most families here are “Kathis” from the Patidar caste, migrants from Gujarat’s Kathiawar peninsula. Many of them came from its dry, overworked tracts as dispossessed farmers in the 1960s. Other Surtis esteem them grudgingly for their devotion to clan, to long hours and to *mawa*, the harsh tobacco they chew to stay sharp behind the cutting wheel.

Last year the bigger polishing outfits distributed eye-watering bonuses to lure their (migrant) workers back. This year some are flirting with bankruptcy. A worldwide glut of polished diamonds and falling prices have hit the Surat business hard. The polishers buy on credit, so even when demand is low they must sell, however sharp the loss. Exports in October were down by 17% year-on-year, driven partly by slowing Chinese demand for luxury goods.

At sunset in Varachha, men lounge on pillion seats and handcarts, passing around open packets of rocks worth several years’ salary. The trust embodied in this form of community is astounding—and essential to their trade. The newcomers are mainly from Bihar, where semi-skilled work and half-decent wages are hard to find. One Bihari expects 20,000 of his countrymen to leave Surat permanently during the current slump. Damji Mavani of the Surat Diamond Association, whose family came from the Kathiawar in 1964,

expects Varachha as a whole to survive. Kathi clansmen will lend to clansmen, with every Kathi in these warrens watching out for everyone else. But the bigger houses, with access to bank credit, will fare better. Mr Mavani predicts that the cottage industry will consolidate. Small family firms, unlike the diamonds they polish, are not forever. ■

Minor vices in Malaysia

Smoke signals

JOHOR BAHRU

A debate over vaping touches deeper nerves

KRYP TONITE, Paddle Pop and Breakfast Crunch are just a few of the flavoured “vape juices” sold to connoisseurs in Johor Bahru, Malaysia’s third city. The frontier town, facing Singapore, is something of a hub for fans of electronic smoking—whose toys these days include pricey pipes fuelled with liquids producing vapours in countless tastes. But Johor’s vaping stalls, boutiques and lounges will soon be forced to close their doors. On November 29th the local sultan said he wanted the trade shut down.

Malaysia’s vaping culture has grown rapidly since 2013, in part thanks to stiffer taxes on tobacco. The country now has at least 400,000 vapers, and perhaps as many as 1m; fans claim that theirs is the second-biggest market in the world. One certainty is that the thousand or so vape shops which have sprung up in places such as Johor are making nice returns for their

young, predominantly ethnic-Malay owners. Brands with names like Phatjuice and OctoBrew have benefited from a preference for Malaysian-made vaping liquids over pricey imports.

But while vaping is less harmful than smoking cigarettes, it is still a mucky habit. Some people worry that the profusion of fruity vapours, most of which contain nicotine, will get children hooked on the drug. And so far the government of Najib Razak, doubtless distracted by a never-ending stream of scandals (see *Banyan*), has bungled its response. In early November health officials started, and then abruptly stopped, raiding vape shops that they said peddled nicotine illegally. That perplexed shop owners who thought that cabinet ministers had agreed, only days earlier, to let their trade proceed.

Malaysia is hardly the only country struggling to regulate newfangled smoking devices (Singapore, its buttoned-up neighbour, will introduce an outright ban from mid-December). But the country’s fractious politics has made its debate unusually dismal. For one thing the issue, like so many in Malaysia, has taken on a racial hue. Anxious vapers have insinuated that the health minister, who is a citizen of ethnic-Indian origin, would not be cracking down on the pastime if it were as popular with Indian Malaysians as it is with ethnic Malays.

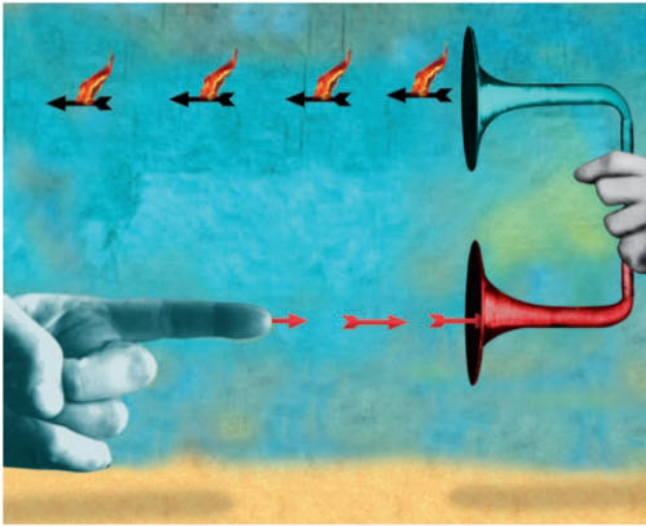
A second worry is the Sultan of Johor’s unexpected intervention. In theory he, in common with the country’s eight other Malay kings, who retained ceremonial roles when modern Malaysia was formed, has little formal power. But state politicians say they will implement the sultan’s decree by January 1st regardless of what vaping regulations federal lawmakers eventually decide to impose. The episode adds to concerns that the country’s local monarchs are attempting to claw back their influence as a beleaguered central government flounders. For defenders of Malaysia’s liberal constitution—including its sizeable non-Muslim minority—that is more than just hot air. ■



Taking a hit

Banyan | Stick-in-the-mud

Beset by scandal, Najib Razak nevertheless seems safe in his job as Malaysia's prime minister



IN ANY country, a leader who received deposits of nearly \$700m in a personal bank account from an unnamed donor in the Middle East for unspecified purposes would find his position under scrutiny. Najib Razak, Malaysia's prime minister, is no exception. Ahead of a general assembly starting on December 8th of his party, the United Malays National Organisation (UMNO), one of his predecessors, Mahathir Mohamad, published an open letter calling for the umpteenth time for his resignation. But the biggest risk facing Mr Najib at the assembly is the trivial embarrassment of a spot of booing and heckling; politically, he is unassailable. That may be good news for Mr Najib's many friends abroad. What it says about Malaysian politics, however, is profoundly depressing.

Mr Najib has denied any wrongdoing in receiving the money, in 2013, or making any personal gain. Malaysia's anti-corruption commission confirmed that the money had come from donors and was not, as had been alleged, siphoned off from a troubled state investment fund called 1MDB, whose advisory board Mr Najib chairs. So the prime minister does not face any serious legal threat. But in many countries, even tangential association with the kind of murky scandals surrounding 1MDB would have been enough to finish a politician's career. Detailed stories of alleged impropriety at the fund have appeared in the international press. One recent twist involved allegations that a murdered public prosecutor, whose body had been found in a river in a cement-filled oil drum, had been investigating 1MDB. Mr Najib has shrugged off all the mudslinging as malicious innuendo spread by his political opponents. He earlier weathered another kerfuffle, over bribes allegedly paid when Malaysia bought French submarines during his time as defence minister in the early 2000s.

Apart from a few malcontents, most notably the nonagenarian Dr Mahathir, his party seems to be behind him. As Jahabar Sadiq, who runs a well-informed website, the *Malaysian Insider*, puts it, Mr Najib has "bested his master" (Dr Mahathir) and is "sailing on, as grandly as a gondola". Dr Mahathir played a big role both in installing his immediate successor, Abdullah Badawi, and in replacing him with Mr Najib in 2009 after a disappointing election result the previous year. The next election, in 2013, went even worse for the coalition that UMNO heads: it lost the popular

vote and only clung on to power thanks to gerrymandered constituencies. But Dr Mahathir's dire warnings that UMNO faces doom at the next election, due in 2018, sound increasingly like the impotent rants of a cranky has-been.

This is in part a tribute to Mr Najib's skill at playing politics the Malaysian way. The son of a former prime minister, he has spent a lifetime learning how to pull the levers of patronage and punishment. Many delegates at UMNO's assembly will have personal reasons to feel thankful to him. And no obvious rival has emerged within UMNO. Of those conceivably in the frame, none seems likely to fare any better at the polls than Mr Najib. As for the opposition, it is in disarray. The leader of the coalition that won the most votes in 2013, Anwar Ibrahim, is in jail, on what many believe to be trumped-up charges of sodomy. Mr Anwar managed to bridge a coalition including a party appealing largely to the ethnic-Chinese minority (nearly a quarter of the population) and an Islamic party appealing to ethnic Malays. Without Mr Anwar's unifying figure, that coalition has splintered, and its successor has a narrower appeal.

Mr Najib also seems to have learned from Dr Mahathir, who, facing political difficulties in 1987, locked up more than 100 critics under the colonial-era Internal Security Act. Mr Najib's administration has repealed that act. However, it has made ample use of the similarly draconian Sedition Act to charge opposition politicians, journalists and critics of all sorts. One, a cartoonist known as Zunar, faces no fewer than nine sedition charges and a possible 43 years in prison. He is challenging the constitutionality of the act itself, but believes there is "no hope at all" of winning.

In Kuala Lumpur for the East Asia Summit last month, President Barack Obama could not entirely ignore the domestic criticism of Mr Najib. In private he reportedly called for Mr Anwar's release, and perhaps was told that the judiciary is free from political interference. But Mr Obama was restrained. He and Mr Najib get on. They played golf in Hawaii last Christmas. Mr Najib is urbane, charming and plays up Malaysia's strengths. It is a bastion of moderate Islam, an important ally against Islamist extremism. Thanks to Mr Najib, it signed the region's American-led free-trade agreement, the Trans-Pacific Partnership, which is unpopular in Malaysia. The prime minister also gets on well with China, one of whose state-owned firms helpfully agreed to buy some of 1MDB's assets. And Malaysia had a successful year, just concluded, as chairman of the Association of South-East Asian Nations, and host of its various summits.

A dangerous course

So at home and abroad, many have reason to cheer Mr Najib's ability to roll with the punches. And with the economy growing at about 5% a year, he can probably also survive a weakening currency and grumbles about rising prices. But angry critics point to the costs; they draw comparisons to Ferdinand Marcos's Philippines (not least because Mr Najib also has a wife known for her love of shopping—Zunar depicts her with multiple posh handbags). They see three big risks: an erosion of the integrity of Malaysian institutions, from the judiciary to the central bank; a more frequent resort to repression to stifle criticism; and, perhaps most worrying, an ever-increasing role for race and religion in Malaysian politics. Mr Najib presents himself as both the defender of the Muslim-Malay majority, and as the best protection the Chinese and Indian minorities have against resentful and assertive Malay political dominance. He is adept at balancing acts. ■

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Climate change

Raise the green lanterns

BEIJING

China is using climate policy to push through domestic reforms

WHEN world leaders gathered in Paris to discuss cutting planet-heating emissions, a pall of smog hung over Beijing. In parts of the capital levels of fine particulate matter reached 30 times the limit deemed safe. Though air pollution and climate change are different things, Chinese citydwellers think of them in the same, poisoned breath. The murky skies seemed irreconcilable with the bright intentions promised in France.

Yet a marked change has taken place in China's official thinking. Where once China viewed international climate talks as a conspiracy to constrain its economy, it now sees a global agreement as helpful to its own development.

China accounts for two-thirds of the world's increase in the carbon dioxide emitted since 2000. It has come a long way in recognising the problem. When China first joined international climate talks, the environment was just a minor branch of foreign policy. The ministry for environmental protection had no policymaking powers until 2008. Only in 2012 did public pressure force cities to publish air-pollution data.

Yet today China pledges to cap carbon emissions by 2030 (reversing its former position that, as a developing power, it should not be bound to an absolute reduction); and it says it will cut its carbon intensity (that is, emissions per unit of GDP) by a

fifth, as well as increase by the same amount the electricity generated from sources other than fossil fuels. The latest five-year plan, a blueprint for the Communist Party's intentions that was unveiled last month, contains clear policy prescriptions for making economic development more environmentally friendly.

There's more

Right after the Paris summit, however it ends, China is expected to make more promises in a new document, co-written by international experts, that presents a far-reaching programme of how China should clean up its act. It is based on models that account for both economic and po-

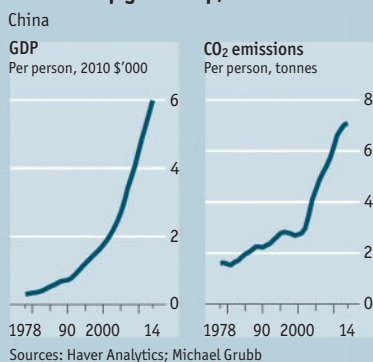
litical viability. On top of existing plans, such as launching a national emissions-trading scheme in 2017, the government may even outline proposals for a carbon tax, something that has eluded many prosperous countries in the West.

The big question is why China is now so serious about climate change. The answer is not that Communist leaders are newly converted econuts. Rather, they want to use environmental concerns to rally domestic support for difficult reforms that would sustain growth in the coming decades. Since a global slowdown in 2008 it has become clear that to continue growing, China must move its economy away from construction and energy-intensive industry towards services. At the same time, China faces an energy crunch. For instance, in recent years China has been a net importer of coal, which generates two-thirds of China's electricity. It all argues for growth plans that involve less carbon.

This is where signing international accords, such as the one hoped for in Paris, come in, for they will help the government fight entrenched interests at home. Observers see a parallel with China's joining the World Trade Organisation in 2001. It allowed leaders to push through internal economic reform against fierce domestic opposition. In the same way, a global climate treaty should help it take tough measures for restructuring the economy.

It will not be easy. Provincial party bosses and state-owned enterprises hate to shut factories, particularly in those parts of the country, such as Shanxi and Inner Mongolia in the north, where coal is a big employer. Cutting demand for energy is even harder. Even if the amount of electricity used by state industry falls, that used by private firms and households is bound to increase. What is more, environmental reg- ▶▶

Now to keep growth up, emissions down



ulations and laws laid down by the centre are routinely flouted.

But cleaning up China's act has, for the central government, become a political necessity too. Environmental issues have been major public concerns for over a decade, says Anthony Saich of Harvard University, which has conducted polls. True, rural people fret most (and with good reason) about water pollution. But those in the cities gripe about their toxic air. Both represent a reproach to the government over its neglect of people's lives and health.

That is why national economic goals, political goals, public opinion and international pressure all point towards trying to cut emissions, pollutants included. In particular, says Zhang Zhongxiang of Tianjin University, now that dealing with climate change is a pillar of China's diplomacy, the government must show it can keep its promises. It has some tools at its disposal. Across the country, the environmental record of government officials has become a crucial part of their evaluation by the Communist Party; and cadres will be held accountable for their actions even after leaving their position. Several provinces have already punished officials for environmental accidents and for not enforcing environmental laws.

Fifty shades of grey

But there are obstacles to real change. The electricity grid and national power market are ill-equipped to increase renewable generation by much. Corruption in industrial procurement remains widespread, which does nothing to promote long-term efficiency or reductions in emissions. Competing incentives are also in play: earlier this year, the authorities forced a big Chinese investment company to buy back shares it had sold in old-fashioned industrial fields, for fear that it might depress share prices (which crashed anyway in a more general stockmarket meltdown). The government will not trust market mechanisms alone, says Yang Fuqiang of the Natural Resources Defense Council, an activist group.

Nor are leaders yet pushing for change on all fronts. For instance, government efforts to cut emissions of carbon dioxide and nitrous oxide are greater than for many other greenhouse gases. Scarce and polluted water, one of China's most severe environmental challenges, is almost entirely beyond the scope of the current raft of reforms. And China refuses to publish its estimate of the environmental toll of economic growth.

Sceptics scoff that China's promises in Paris are irrelevant because emissions will probably peak regardless, long before the promised 2030. Nor has the government said how high that top might be. Yet the sceptics underestimate the importance of an international agreement for China and

beyond. Like other countries, China has to date followed a pattern of "grow first, clean up later". Yet very quickly it has recognised the dangers and drawbacks of such a policy and has been pouring money into clean energy and other innovations it hopes will provide green growth. In that, it may prove a model for other fast-developing countries. That might signal a small patch of blue sky. ■

Stars and morals

That's entertainment

BEIJING

The party says celebrities must behave

IT IS getting harder to be a bad-boy, or bad-girl, pop star in China. Prudish standards in the state-run entertainment industry keep Chinese performers from treating audiences to the bawdy antics of a Miley Cyrus, or the steamy sex scenes that so often feature in foreign films. But in their private lives, Chinese entertainers can party just as hard as their Western peers. Some have revelled in drugs and prostitutes. But now the party animals are being told by party hacks to behave better—both on screen and off.

A new "Joint Pledge of Self-Discipline in Professional Ethics" for the press, publishing, broadcasting and film industries has recently been signed by 50 official media and entertainment organisations. They, in turn, are expected to enforce the pledge among performers and other employees. Works must refrain from vulgar words or images, instead promoting "healthy" and "advanced" aesthetics, whatever they are. More to the point, the pledge commands

support for the Communist Party's leadership, the national interest and "socialist core values". It prohibits the voicing of opinions that defame the party or country. It's a blast.

Also out is behaviour that "violates morals or public order". Pornography, drugs and gambling are spelled out. Even before the pledge, libertines have paid a price. Last year one big-budget film was in the last stages of editing when its star got arrested in Beijing for smoking weed. The film had to be reshot with a new leading man. Organisations that have signed the pledge are now bound to blacklist violators for up to three years.

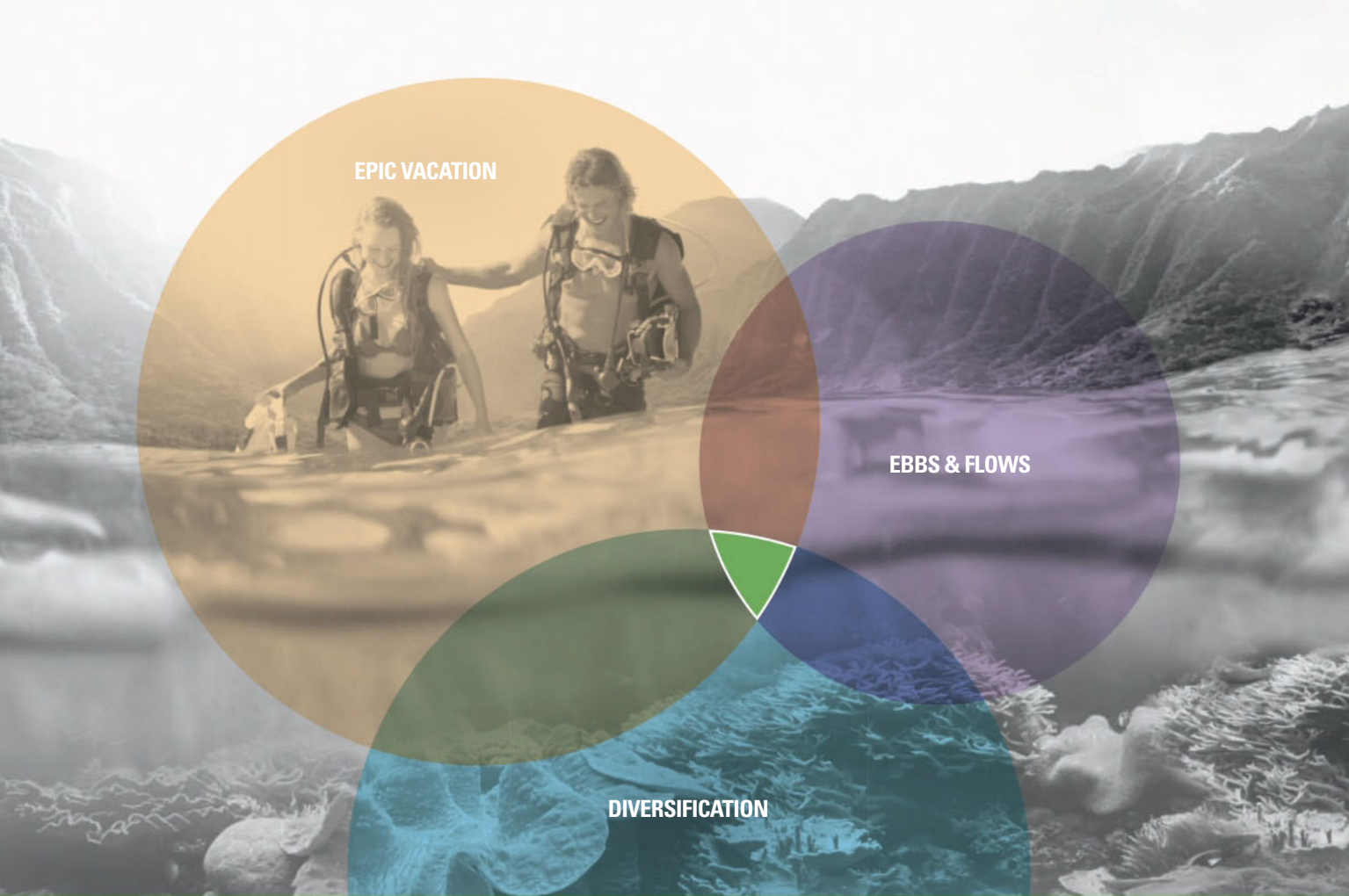
In October, a few weeks after the pledge was published, China's top official in charge of ideology and propaganda, Liu Yunshan, held a gathering with leading figures in art and literature with the aim of promoting the "prosperous development" of those fields. Mr Liu wanted to encourage works embodying the "Chinese dream" and "positive energy".

These terms come straight from the dogma factory of Xi Jinping, China's president. He has spoken often—if vaguely—of the Chinese dream as an organising principle for the country's development. He has also helped turn the term "positive energy" into a catchphrase, one that is repeated in the entertainers' pledge. Mr Xi used the phrase in October 2014, during a speech on the appropriate role of art and culture. That speech evoked a famous talk about culture given in 1942 by Mao Zedong.

Many of the same buzzwords also appeared in a speech this month by Fan Bingbing, one of the most glamorous boosters of the pledge. Ms Fan has popped up more than once in gossipy tabloid stories. But party hacks were surely thrilled to hear her singing the praises of "socialist core values". The party animals among her many fans presumably felt differently. ■



Fan Bingbing gets in touch with her inner socialist



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Censorship

This article is guilty of spreading panic and disorder

BEIJING

More general signs of a crackdown on expression

IN THE middle of August Zhao Shaolin, a retired Communist Party boss of Jiangsu province in eastern China, was carted away by the country's anti-corruption commission. Nothing unusual there. Dozens of local party bosses have fallen foul of a national anti-bribery campaign. What was surprising were the charges levelled against him. These usually stress the vast wealth the accused is said to have squirreled away by his or her nefarious activities. Mr Zhao's crime, according to *Beijing News*, a party newspaper, was to flout party discipline by criticising government policies. Some people, Xie Chuntao of the Central Party School sniffed, think "they are cleverer than the Party, which cannot be allowed."

Mr Zhao was not the only one. In mid-October the anti-corruption commission arrested two serving provincial party chiefs, in Hebei near Beijing and Guangxi in the south. Their list of crimes also included criticising the party. On October 12th the Politburo approved a new edition of the party's rules. It was, *Xinhua*, the state news agency, said, "the most complete and stringent code of conduct" in the history of the Communist Party. It bans party members from making "negative comments" or "irresponsible remarks" about policy. Members may debate issues—but only if they say nice things.

This stress on ideological conformity marks a return to older habits. In September 2013 Xi Jinping, China's president, had called criticism and self-criticism "a powerful weapon...The more you use it, the more you improve the ability of leaders to discover and solve their problems." Yet over the past few months, and not for the first time in the history of the People's Republic of China, a more open debate has given way to tighter restrictions on expression, which has never been wholly free.

In his key speech last year on the arts, Mr Xi not only called for "positive energy" in the arts. He also slammed modern architecture and the emulation of western art. The timing of the speech made liberals uncomfortable. It was to celebrate the anniversary of a speech by Mao Zedong which paved the way for a spasm of violence called the Rectification Campaign in which 10,000 people died. Criticism of that monster Mao himself has again become unacceptable. After a popular television anchorman, Bi Fujian, was unwittingly filmed singing a parody of a Peking



Xi Jinping nixes the negativity

opera mocking the Great Helmsman, he was fired.

The media are feeling the chill. Last month Zhao Xinwei, the editor of *Xinjiang Daily*, was sacked, apparently for expressing worries about an anti-terrorist crackdown in the Muslim-majority province of Xinjiang in China's far west. In August Wang Xiaolu of *Caijing*, a financial magazine, was paraded on state television and confessed to spreading "panic and disorder" during the summer's stockmarket crash. His crime was to report that the China Securities Regulatory Commission was looking for ways to stop propping up the market.

At the same time, three of China's last remaining liberal publications, *Southern Weekend*, *Southern Metropolis* and *Southern Daily*, collectively known as the Southern series, got a visit from the censors. A reporter who works there told the Committee to Protect Journalists, a lobby group in America, that the subsequent fawning coverage of a big military parade on China's national day "killed the last bit of expectation and good impression that the public has for the Southern series." Getting the message, 50 media organisations signed a "self-disciplinary pact" in September, promising not to "publish or spread opinions that damage the look of the party and our country."

Summing up the expanding range of restrictions earlier this year, Freedom House, an American non-governmental organisation, said that out of 17 frequent objects of censorship—such as grassroots activists, professors and Tibetans—11 have faced more intense pressure under Mr Xi. Over 100 lawyers were rounded up in the summer. A group of feminists were arrested (then bailed) on charges of "provoking trouble". In fact, they were drawing attention to sexual harassment on public transport. Academics are being told to watch their step.

Since he came to power in 2012, Mr Xi has repeatedly rejected insidious western ideas such as a free press and human rights. At the same time, however, he has balanced that tradition of command and control by occasionally talking about the importance of China's constitution, a more liberal document. Three things are happening now to cause him to emphasise the control side of things.

Freeze: the new normal

First, his self-appointed task to clean up a rotten Communist Party is becoming ever more daunting. The anti-corruption campaign has netted thousands of high-ranking officials, and there is little sign that it is faltering. (As well as the first arrests of serving provincial bosses, this year has seen an expansion of the campaign to go after the bosses of state-owned enterprises.) Mr Xi may have concluded that restricting the opinions of party members is necessary in order to push his campaign forward.

Second, the government is trying to beef up controls over social media, which exploded just as Mr Xi was coming to power. New guidelines from the State Internet Information Office, issued in August, impose restrictions on China's so-called microblogs (blogs published, for example, on WeChat, an instant-messaging service). Revisions to the criminal code which came into force in November make "spreading rumours" online punishable by up to seven years in prison—and the law does not specify what counts as a rumour. And a draft cyber-security law would require internet companies to restrict online anonymity and report ill-defined "security incidents" to the government.

Thirdly, it seems likely that a slowdown in the economy is reviving fears that labour or other forms of unrest could threaten the party's grip on power. It claims legitimacy from the fact that living standards have risen fast for many years; as those standards rise more slowly, ordinary people may start to complain about their rulers. Party leaders feel that sort of thing should be pre-emptively squashed.

The Chinese president has called slower economic growth "the new normal". Tighter controls on expression are becoming a new normal, too. ■

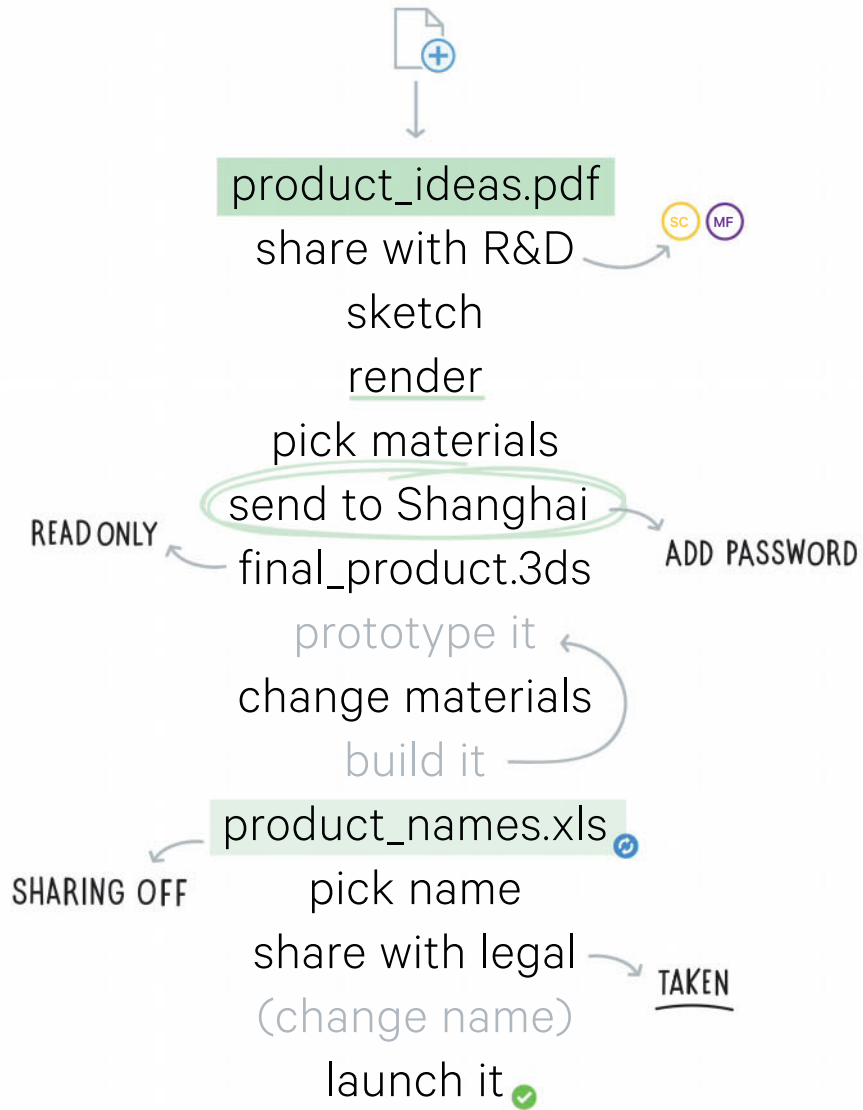
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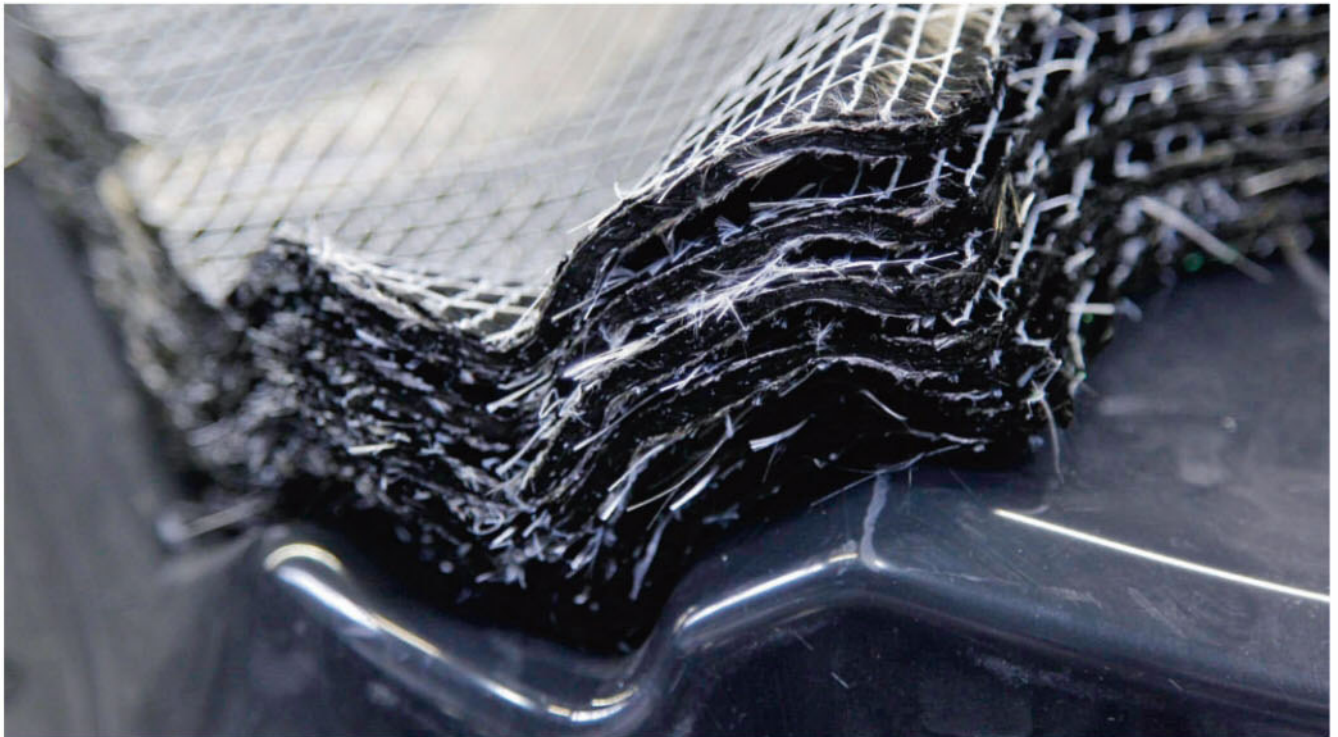
TECHNOLOGY QUARTERLY | December 5th 2015
NEW MATERIALS FOR MANUFACTURING

Material difference





The Dropbox you love. The controls you need.



Material difference

Materials science is rapidly transforming the way that everything from cars to light bulbs is made, says Paul Markillie

"I DO not depend on figures at all," said Thomas Edison. "I try an experiment and reason out the result, somehow, by methods which I could not explain." And so it was that by testing 1,600 different materials, from coconut fibre to fishing line and even a hair from a colleague's beard, Edison finally found a particular type of bamboo which could be used, in carbonised form, as the filament in the first proper incandescent light bulb. He demonstrated it on New Year's Eve 1879 at his laboratory in Menlo Park, New Jersey.

The details of all this painstaking trial and error filled more than 40,000 pages of Edison's notebooks, but his solution was soon superseded. By the start of the 20th century filaments were being made from tungsten, which burned brighter and lasted longer. For over 100 years the world was illuminated by light bulbs with tungsten filaments, and the light bulb became the cartoonist's fixed shorthand for innovation of all sorts.

Now light bulbs are being replaced by light-emitting diodes (LEDs), which are more efficient at turning electricity into light than filaments are, and far longer-lived. LEDs first appeared in the 1960s as indicator lights on electrical equipment. Today they provide powerful illumination for buildings, streets and cars. In poor parts of the world they are bringing light to people who have never seen an old-fashioned bulb.

Both Edison's light bulb and the LED are in-

ventions of materials science, the process of turning matter into new and useful forms. But in the years between them both the materials and the science became much more complex. The semiconducting materials, such as germanium or silicon, from which LEDs are made, often with the careful addition of atoms of some other substance, require a different approach from that at Menlo Park. The sort of light they produce is fine-tuned by microscopic structures and the details of those extra atoms. *Pace* Edison, this sort of thing depends on a lot of figures—not to mention quantum theory.

The ability to understand the properties of materials at the tiniest scales not only lets people do old things better; it lets them do new things. In Edison's day, using light to send messages was the province of the Aldis lamps that flashed messages in morse code from ship to ship. Laser diodes—semiconductor devices engineered to produce a much purer light than LEDs—can flicker on and off in a controlled way billions of times a second. In an astounding number of applications where information has to get from A to B—be those end points a DVD and a speaker, a bar code and a supermarket checkout or the two ends of a transatlantic fibre-optic cable—laser diodes are doing the work. For all its seeming abstraction, the virtual world is built on very real, very well-understood materials.

This is what some scientists describe as a "golden age" for materials. New, high-performing sub- ▶▶

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Carl Bass of Autodesk

5 What next?

“We are coming out of an age where we were blind”

stances such as exotic alloys and superstrong composites are emerging; “smart” materials can remember their shape, repair themselves or assemble themselves into components. Little structures that change the way something responds to light or sound can be used to turn a material into a “metamaterial” with very different properties. Advocates of nanotechnology talk of building things atom by atom. The result is a flood of new substances and new ideas for ways of using them to make old things better—and new things which have never been made before.

University materials departments are flourishing, spawning a vibrant entrepreneurial culture and producing a spate of innovations (see box below). Many of these discoveries will fail to scale up from laboratory demonstration to commercial proposition. But some just might change the world, as light bulbs did.

Faster, higher, stronger

The understanding of the material world provided by a century of physics and chemistry accounts for much of the ever-accelerating progress. But this is not a simple triumph of theory. Instruments matter too. Machines such as electron microscopes, atom-

ic-force microscopes and x-ray synchrotrons allow scientists to measure and probe materials in much greater detail than has ever been possible before.

A project at the International Centre for Advanced Materials at the University of Manchester shows such advances in action. In one of its labs scientists are using secondary ion mass spectrometry (SIMS) to study the way that hydrogen atoms—the smallest atoms there are—diffuse into materials such as steel, a process that can cause tiny cracks. SIMS works by bombarding a sample with a beam of charged particles, which causes secondary particles to be ejected from the surface. These are measured by an array of detectors to create an image with a resolution down to 50 nanometres (billionths of a metre). It does not just reveal the crystalline structure of the metal—and any flaws in it—but also determines chemical impurities, such as the presence of hydrogen. “We can now do in an afternoon what we once did in months,” says Paul O’Brien, a professor at the university. The hope is that BP, the oil company which is sponsoring the centre, will get better steels for its offshore and processing work as a result.

As well as having ever better instruments, the researchers are also benefiting from a massive increase in available computing power. This allows them to explore in detail the properties of virtual materials before deciding whether to try and make something out of them.

“We are coming out of an age where we were blind,” says Gerbrand Ceder, a battery expert at the University of California, Berkeley. Together with Kristin Persson, of the Lawrence Berkeley National Laboratory, Mr Ceder founded the Materials Project, an open-access venture using a cluster of supercomputers to compile the properties of all known and predicted compounds. The idea is that, instead of setting out to find a substance with the desired properties for a particular job, researchers will soon be able to define the properties they require and their computers will provide them with a list of suitable candidates.

Their starting point is that all materials are made of atoms. How each atom behaves depends on which chemical element it belongs to. The elements all have distinct chemical properties that depend on the structure of the clouds of electrons that make up the outer layers of their atoms. Sometimes an atom will pair off one of its electron with an electron from a neighbouring atom to form a “chemical bond”. These are the sort of connections that give structure to molecules and to some sorts of crystalline material, such as semiconductors. Other sorts of atom like to share their electrons more widely. In a metal the atoms share lots of electrons; there are no bonds (which makes metals malleable) and electric currents can run free.

When it comes to making chemical bonds, one element, carbon, is in a league of its own; a more or less infinite number of distinct molecules can be made from it. Chemists call these carbon-based molecules organic, and have devoted a whole branch of their subject—inorganic chemistry—to ignoring them. Mr Ceder’s Materials Project sits in that inorganic domain. It has simulated some 60,000 materials, and five years from now should reach 100,000. This will provide what the people

Latest discoveries

Curiouser and curiouser

IN the month of November 2015 alone, materials scientists alerted the media to more than 100 significant discoveries. Here is a small selection from the professional journals:

- A type of crystal called a perovskite can be used to make light-emitting diodes that glow exceptionally bright. These could be used in lighting and displays. Hanwei Gao and Biwu Ma of Florida State University. *Advanced Materials*.

- Experiments with an exotic form of electronics called “valleytronics”, named after one of the ways in which electrons can move through a semiconductor, shows that the technology might be used to make ultra-low-power computers. Seigo Tarucha and colleagues at the University of Tokyo. *Nature Physics*.

- Quantum dots made from nanoparticles of iron pyrite, commonly known as fool’s gold, could help batteries charge up much faster. Cary Pint, Anna Douglas and colleagues at Vanderbilt University, Nashville. *ACS Nano*.

- Biosensors made from graphene can provide high levels of sensitivity to help speed up the development of new

drugs. Aleksey Arsenin and Yury Stebunov of the Moscow Institute of Physics and Technology. *ACS Applied Materials and Interfaces*.

- Materials called microwave absorbers are used to make detection by radar of objects such as stealth fighters more difficult. A new lightweight material with arrays of patterned conductors would greatly improve cloaking properties. Wenhua Xu and colleagues of Huazhong University of Science and Technology, China. *Journal of Applied Physics*.

- A new class of “porous liquid”, which features permanent holes at the molecular level, could provide a number of practical applications, including capturing carbon-dioxide emissions from factories. Stuart James and colleagues at Queen’s University Belfast. *Nature*.

- Voltage-sensitive nanomaterials could be inserted into human tissue to gather information about how the brain functions and help diagnose injury and disease. James Delehanty and colleagues at the US Naval Research Laboratory, Washington, DC. *NANO Letters*.

NEW MATERIALS FOR MANUFACTURING

▶ working on the project call the “materials genome”: a list of the basic properties—conductivity, hardness, elasticity, ability to absorb other chemicals and so on—of all the compounds anyone might think of. “In ten years someone doing materials design will have all these numbers available to them, and information about how materials will interact,” says Mr Ceder. “Before, none of this really existed. It was all trial and error.”

A walk through the labs of General Electric (GE)—the firm into which Edison’s trial-and-error-based businesses were merged in 1892—shows similar approaches already in practice. Michael Idelchik, the head of GE Research, points to new artificial garnets developed for use in body scanners. The scanners have to turn x-rays into visible light to create images, and the better they do so the lower the dose of x-rays the patient is exposed to. The company looked at 150,000 subtly different types of crystal that scintillate when subjected to x-rays before settling on a specific type of garnet which, it hopes, will make scans much faster—safer and more pleasant for the patient, more cost-effective for the hospital.

On top of the possibilities offered by single materials comes the potentially even richer world of combining them. Elsewhere in Mr Idelchik’s empire work focuses on replacing nickel-alloy parts for jet engines with parts made from ceramic-matrix composites (CMCs). Their strong chemical bonds mean ceramics can endure more heat than metals; at the same time, and for related reasons, they are more brittle. A CMC that combines a metal with a ceramic—GE is using silicon carbide—can get you the best of both worlds. The company hopes CMCs that need less cooling will mean more efficient engines that emit less carbon dioxide.

Computing power helps create such hybrids. It also helps designers understand how such novel materials can best be used. Many prototypes are

now produced in virtual form long before a physical item is made, using software from companies such as Altair, a Michigan firm, Autodesk, a Californian one (see the “Brain scan” interview later in this report) and Dassault Systèmes, a French group. Engineers can model a chemicals plant, architects can “walk” clients through a digital representation of a building, and cars can be virtually test-driven on different roads and parked alongside rivals’ vehicles in street scenes.

All this greatly speeds up product development. The software is powerful enough to take the properties of the materials used into account, allowing it to calculate things such as loads, stresses, fluid dynamics, aerodynamics, thermal conditions and much more.

Manufacturers are only just beginning to realise the potential this offers, says Jeff Kowalski, chief technology officer of Autodesk. Many firms simply adapt parts to use new materials, expecting to produce them with the same tools and processes as before. That gives “substandard results”, he reckons. It is when new materials are used to redefining production processes and enable wholly new types of product that things get really innovative, and cartoonists get to draw light bulbs over people’s heads.

Just the thing

Business is heading towards a world of “generative design”, says Mr Kowalski: engineers will set out what they want to achieve and the computer will provide designs to fit that purpose. As materials knowledge grows, computers will also find materials to meet the properties specified by a designer. The properties of materials may even vary throughout their length and breadth, because it is becoming easier to tinker with the microstructure. Some companies are already well on their way to offering such Savile Row tailoring of materials. ■

Producers are heading towards a world of bespoke manufacturing

Nanoparticles: To the heart of the matter

Engineering at the molecular level improves old materials as well as creating new ones

NANOPARTICLES are often seen as a new, man-made invention, but they have long existed in nature—salt from the sea and smoke from volcanoes can be found in the atmosphere in the form of nanoparticles. What interests materials scientists is that with modern processing techniques it is possible to turn many bulk materials into nanoparticles—measured as 100 nanometres (billionth of a metre) or less. The reason for doing so is that nanoparticles can take on new or greatly enhanced properties because of quantum mechanics and other effects. This includes unique physical, chemical, mechanical and optical characteristics which are related to the particles’ size. Engineers can capture some of those properties by incorporating nanoparticles into their materials.

Christina Lomasney, a physicist, is using nanoparticles to make nanolaminates, a completely new class of material. She is the co-founder of Modumetal, a Seattle firm developing a type of electrolytic deposition. This works a bit like electroplating, in which a metal, usually in a salt form, is suspended in a liquid and deposits itself on a component when an electric current is applied.

Modumetal has come up with a way to do this with great precision, using a variety of metals in the liquid. By carefully manipulating the electric field, it builds up veneers of different metals over a surface and controls how those layers interact with one another. “In effect, we grow a material, controlling its composition and microstructure,” says Ms Lomasney. The company reckons it can do this at an industrial scale, cheaply and with conventional materials, such as steel, zinc and aluminium.

Its first products—various pumps, valves and fasteners—are treated with corrosion-resistant



Nanoparticles can take on new or greatly enhanced properties

Solid-state technology will offer about double the energy density

layers that are more durable than conventional treatments, lasting up to eight times longer. Some of them are already being used by oil and gas companies. Modumetal is now expanding production and, in time, plans not just to coat structures but actually grow them.

One of the more important applications for engineering the microstructure of materials is in batteries. These have been made from various materials, such as lead-acid and nickel-cadmium. Apart from being highly toxic, some of these ingredients are also bulky and heavy, hence mobile phones in the 1980s were brick-like. The rechargeable lithium-ion battery helped slim them down.

Scientists had been working on using lithium as a battery material for decades, because it is light and highly conductive. The difficult bit was shifting from the laboratory to large-scale production. Lithium is inherently unstable, so instead of using the material in its metallic form, researchers turned to safer compounds containing lithium ions. In 1991 Sony successfully launched a commercial version of the lithium-ion battery, helping transform portable consumer electronics.

Such batteries now power all manner of devices, not just smartphones and laptops but also power tools, electric cars and drones. Manufacturing faults and overcharging can cause them to overheat and even burst into flames, but after a series of early laptop-battery recalls and a number of fires in cars and aircraft, manufacturers now seem to have got on top of these problems.

Yet the search for a better battery is still on. For some applications, such as electric cars, this would be transformative. Until recently the battery for an electric car could cost \$400-\$500 per kilowatt hour, representing perhaps 30% or so of the overall cost of the vehicle, but costs are falling (see chart, next page). In October General Motors said it expected the battery in its new Chevy Bolt electric car, due to go on sale in 2016, to cost around \$145 per kilowatt hour. The industry believes that once the cost comes down to around \$100 per kilowatt hour, electric vehicles will become mainstream because they will be able to compete with petrol cars of all

sizes without subsidy.

Getting there will require some clever materials science. Lithium-ion batteries are usually made as a laminated structure with a material called an electrolyte at their centre, typically a liquid or gel-like substance through which the lithium ions shuttle back and forth between electrodes.

Lithium-ion batteries have been steadily getting better. Jeffrey “JB” Straubel, chief technology officer of Tesla, a Californian maker of electric cars, says that the battery cells for the company’s present Model S are made on equipment similar to that used a decade ago for the firm’s first car, the Roadster. But with improved chemistry and production techniques, the energy stored in them has increased by 50%. Tesla has teamed up with its Japanese battery supplier, Panasonic, to build a \$5 billion factory in Nevada that should push car-battery costs lower. It will also make a new Tesla battery called Powerwall (pictured), which can be used to store solar electricity generated at home.

Lay it on thin

Other companies are looking at a more radical change in the technology. One of them is Sakti3, a Michigan startup, which is trying to commercialise a lithium-ion battery with a solid electrolyte. Solid-state lithium batteries already exist, but mostly in the form of coin-sized back-ups in electrical circuits. Scaling up production processes to make them big enough to power devices such as phones would be hideously expensive.

Sakti3, however, has found a way to make a solid lithium battery with a thin-film deposition process, a technique already widely used to produce things such as solar panels and flat-panel display screens. “Solid-state technology will offer about double the energy density—that’s double the talk time on your phone; double the range in your electric car,” says Ann Marie Sastry, the firm’s chief executive. The battery cells will also have a long service life and be safer, she adds.

So why has the technique not been used to make batteries before? The firm’s purported edge is knowing what materials to use and how to make the process cost-effective. Everything, including the complicated physics, was worked out and extensively tested virtually before the company built a pilot production line. Ms Sastry explains that as the firm selected materials and developed processes, the virtual computer tests enabled it to forecast the cost of scaling up production. When built in large volumes, the solid-state batteries should come in around \$100 per kilowatt hour, and there is scope for further improvement.

Initially Sakti3 expects its solid-state cells to be used in consumer electronics, which seems all the more likely since Dyson, a British maker of electrical appliances, bought the company for a reported \$90m in October. Dyson, which invented the bagless vacuum cleaner, is expanding into domestic robotics, for which it reckons it needs good batteries. But with further engineering, the batteries might migrate to electric cars and grid storage too. A number of research groups around the world are hoping for battery breakthroughs, including 24M, a Massachusetts startup, which is using nanotechnology to develop what it calls a cost-effective



Tesla's bright idea

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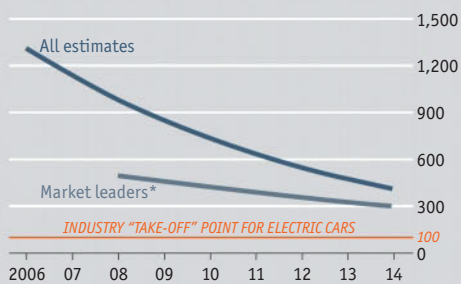
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Charge of the lithium brigade

Lithium-ion battery costs, \$ per kWh



Source: "Rapidly falling costs of battery packs for electric vehicles", by B. Nykvist and M. Nilsson, March 2015 *Nissan and Tesla

▶ "semi-solid" lithium-ion battery.

"I think batteries will change the world," says Mr Ceder at Berkeley, "and that is purely a materials issue." He has worked on nearly every battery technology, but lithium remains his favourite, not least because so much effort has been put into it. Once industry has invested a lot in a particular technology, the sunk cost gives established materials a huge advantage. "But that doesn't mean we won't try to find new materials," he adds.

There is a parallel here with silicon. This is not the best semiconductor, but it is readily available, cheap and well understood, and an entire chip-making industry has been built around it. What

has driven the industry is Moore's law: the doubling of computing power on a chip every two years at no extra cost. Proposed in 1965 by Gordon Moore, one of Intel's founders, the law has remained in operation ever since. But some think it is coming to an end as the features packed onto a chip approach the size of atoms. At this scale, problems such as power leakages and instability start to crop up. One day silicon may well make way for other materials that promise superior electrical properties, such as gallium arsenide, titanium trisulphide or possibly graphene.

Unclaimed treasure

Much hyped as a "wonder material", graphene is a form of carbon discovered in 2004 at Manchester University in Britain by Andre Geim and Kostya Novoselov, who won the Nobel prize in physics for their work. It is one of a number of two-dimensional materials, so called because they are only an atom or so thick. Lots of researchers and startups have moved into graphene because it is extremely light yet strong; it is transparent; and it can be made to work as a semiconductor. So far, though, most graphene is used in research labs, which are still looking for a "killer app". Beside computer chips, potential uses might include membranes for water purification, more efficient solar cells and invisible electrodes in glass. Meanwhile, though, carbon in other forms is already big business in two of the world's largest manufacturing industries. ■

Graphene is still looking for a killer app

Carbon fibre: Dark arts

Carbon-fibre composites are making light work of aeroplanes, and now cars too

THE central building of BMW's car factory in Leipzig is a strikingly modern structure by Zaha Hadid, an architect renowned for her neo-futurist designs. The factory produces a variety of vehicles, so it is no surprise to find a group of robots in one area, moving in perfect synchrony as they assemble body sections with a precision no human could hope to match. But the place is unusually quiet, without any thundering metal-stamping machines or showers of welding sparks. The clue to what is going on is the colour of the components. Instead of the usual silver of steel or aluminium, these parts are black. They are made from a composite material called carbon fibre.

This factory is different in other ways, too. "We do not weld; we have no rivets, no screws and no bolts. We just glue components together," says Ulrich Kranz, the head of the division that since 2013 has been making BMW's i3 and i8 electric and hybrid vehicles in Leipzig. Since the carbon-fibre body provides the vehicle with its strength, the outer panels are mainly decorative and made from plastic. These are simple to spray in a small paint booth, whereas metal requires elaborate anti-corrosion treatment in a giant and costly paint shop. In all, the i3 factory uses 50% less energy and



70% less water than a conventional facility.

The i-series are upmarket cars, but still produced in volume. BMW has succeeded in taking a new material hitherto used in low-volume specialist applications, such as aerospace and defence, and turning it into something close to mass-produced. That called for radical changes. When in 2007 the BMW board asked Mr Kranz to come up with an electric city car and a low-energy production system, he and his team went into hiding to allow ideas to flow freely.

Mr Kranz's material of choice was carbon fibre, not least to offset the weight of the battery. The material is made from thin filaments of carbon woven into a cloth. This is cut and pressed into the shape of a part and the fibres bound together with a plastic resin, cured by heat and pressure. The

Lighter aircraft burn less fuel and thus have lower emissions



Look, few hands

- ▶ molecular structure of carbon compounds produces strong chemical bonds, much like those in diamonds, and by aligning the fibres at different angles the strength of a component can be reinforced exactly where needed.

The resulting structure, although stronger than steel, is at least 50% lighter, and also about 30% lighter than aluminium. Nor does it corrode. But in the past the production process was expensive, slow and labour-intensive. That may not matter too much when making fighter jets or Formula 1 racing cars. But even aircraft-makers had to speed things up and bring down costs when they started making passenger jets from carbon fibre.

These days carbon fibre makes up about half the weight of aircraft such as the Boeing 787 Dreamliner or the Airbus A380 and A350. Lighter aircraft burn less fuel and thus have lower emissions. They can also carry more passengers and fly farther. There are economies in manufacturing, too, because large sections of the aircraft can be made in one go instead of having to join together lots of smaller aluminium panels. Aircraft-makers have found ways to speed up some of the production process, but it is still too slow and expensive for high-volume carmakers.

The answer that BMW came up with was a different sort of factory and a new supply chain. It begins in Otake, Japan, with a joint venture between SGL group, another German company, and Mitsubishi Rayon. This produces what is called a precursor, a

polyacrylonitrile thermoplastic, which looks a bit like fishing line wound onto large spools. This is shipped across the Pacific to Moses Lake in Washington state, the site of another joint venture, this one between BMW and SGL. The location was chosen because it uses locally generated emission-free hydroelectric power.

Black carpet

The precursor is passed through a series of heating stages in which it is carbonised into blackened filaments only around 7 micrometres (millionths of a metre) in diameter. Some 50,000 of these filaments are bundled together into a thicker strand and wound onto reels, much like a yarn in a textile factory. The tows, as the carbonised yarns are called, then cross the Atlantic to another BMW-SGL joint venture, at Wackersdorf near Munich. Here they are woven into sheets and layered into stacks that resemble carpets.

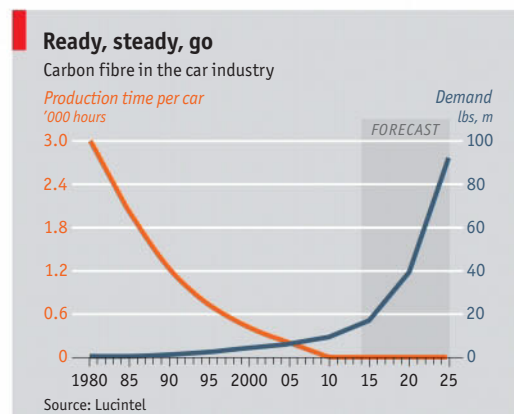
When the stacks arrive at the Leipzig factory, they are heated and pressed into a three-dimensional “preform”. Various preforms are placed together to make up large structures, which together are pressed again, but this time resin is injected into the mould, bonding and curing the final component inside the press tool. This usually happens within minutes, though in some aerospace factories the curing can take the best part of a day and requires a pressurised oven called an autoclave. Robots move the parts around and glue them together to make the main body structure of the car. Further along the production line the body is mated to the drive module, which incorporates an aluminium chassis, electric motor, battery and other components.

Mr Kranz expects carbon fibre to be used more widely in cars, but thinks they will always contain a mix of materials. BMW’s new 7 series executive car now has some carbon-fibre parts as well. Other carmakers are starting to use the material, and Apple, which has hinted that it plans to build an electric car, has reportedly been talking to BMW about carbon-fibre construction. Anthony Vicari, an analyst with Lux Research, a Boston consultancy, predicts that by the mid-2020s carbon fibre will be widely adopted in carmaking.

But not without a battle. As in other industries, traditional materials are getting better, too. Aluminium suppliers are developing new alloys. “Aluminium is the incumbent and these guys are pushing like hell or they will lose their entire industry,” notes Jean Botti, the chief technical officer of Airbus. Alcoa, a leading producer of aluminium, is developing a number of lightweight alloys. One of them, Micromill, is easier and faster to shape into intricate forms. Ford has begun using it to replace some steel components in its F-150 pickups, one of its best-selling models in America.

The upshot is that manufacturers are being offered a wider choice of materials than they had before, says Mr Botti. Carbon fibre has done wonders in aerospace, he reckons, but it is used largely in the bigger, long-range aircraft, of which only a handful might be built every month. To increase the use of carbon fibre in smaller aircraft, aerospace firms have to speed up production and bring down costs further, but “there are new techniques ▶▶

By the mid-2020s carbon fibre will be widely adopted in carmaking





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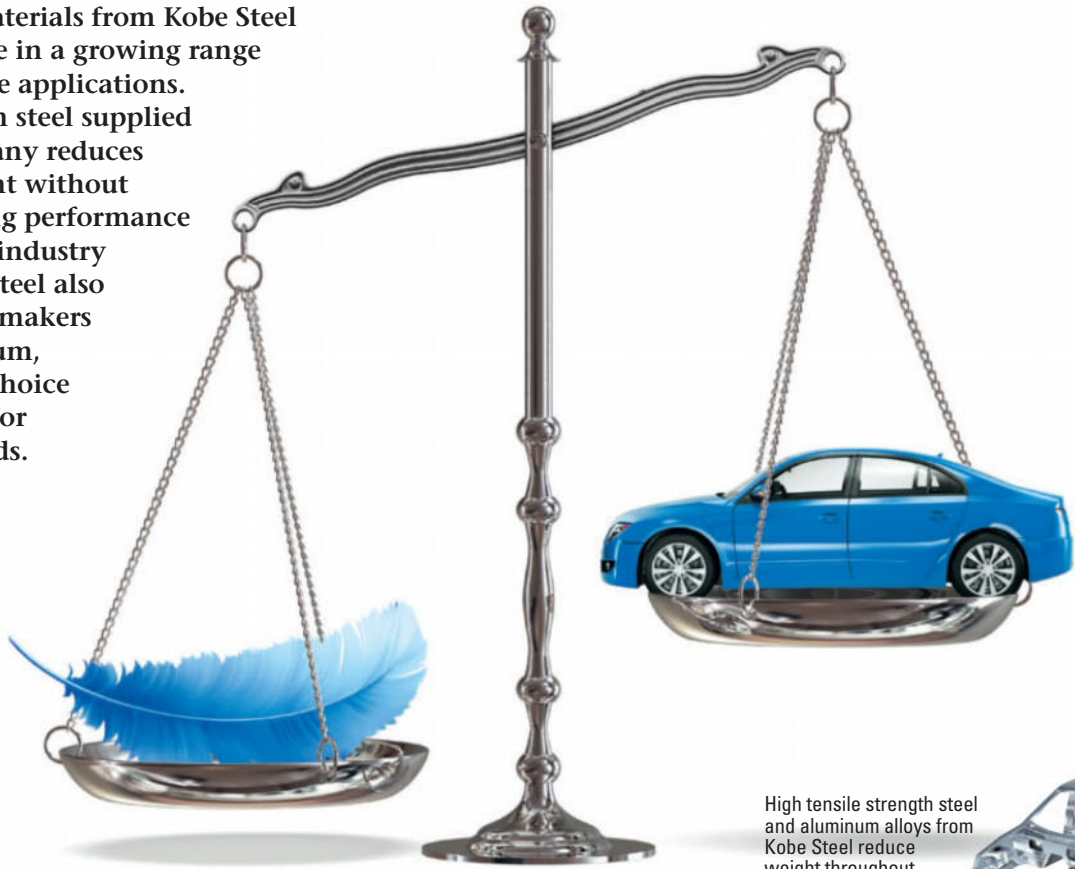
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High tensile strength steel and aluminum alloys from Kobe Steel reduce weight throughout vehicles.



Kobe Steel has long been a leading supplier of steel for vehicle bodies and for springs, for nuts and bolts, and for other automotive components. Recently, it has captured attention with advanced high tensile strength steel that permits reductions in vehicle weight and thus contributes to lower fuel consumption and decreased output of carbon dioxide.

"Our weight-reducing steel," explains Kobe Steel president and CEO Hiroya Kawasaki, "combines exceedingly high tensile strength with excellent formability. The steel's formability allows for using it in components of complex shapes, traditionally unamenable to high tensile strength steel. We expect this steel to permit further weight savings."

More breakthroughs are in the offing at Kobe Steel, according to Kawasaki. He cites a promising advance in welding technology.

"We've developed technology," reports Kawasaki, "for welding steel and aluminum together. And we are working with

automakers to put that multimaterial breakthrough onto the road."

Global partnering

Joint ventures with US and Chinese partners anchor Kobe Steel's manufacturing presence in the world's largest automobile markets. Ohio-based PRO-TEC Coating Company, a 50:50 joint venture with United States Steel Corporation, uses Kobe Steel technology for galvanizing and annealing automotive steel.

In China, a Kobe Steel joint venture with Angang Steel Company Limited will supply automakers in China with cold-rolled high-strength steel sheet. Production will get under way at a plant in Anshan, Liaoning Province, in 2016.

Aluminum is also a focus of Kobe Steel's vehicle-related manufacturing in the United States and China. Kobe Aluminum Automotive Products, LLC, produces forged suspension parts in Kentucky. And Kobelco Automotive Aluminum Rolled Products (China) Co.,

Ltd., will begin producing aluminum sheet for vehicle bodies in Tianjin in 2016.

KOBELCO

Kobe Steel, which posted net sales of ¥1.9 trillion in the year ended March 31, 2015, is a leader in its namesake industry and in non-ferrous metals. It has also built large positions in industrial machinery, in construction equipment, and in engineering services.

Better known in some product sectors as KOBELCO, Kobe Steel supports customers in diverse industries with continuing technological advances. In the automobile industry, that means lighter, more fuel efficient vehicles. And that's good news for car owners and for the global environment.

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▶ we are thinking about which could tremendously reduce the cost of carbon fibre.” Airbus and Boeing both have plans to raise production of their workhorse short-haul aircraft, respectively the A320s and 737s, to an astonishing 60 or so a month to meet order backlogs. Still, he cautions, companies should always take care to select the best material for a particular job. If Airbus were to replace the A320 with a new model, he says, he would have to look carefully to see if carbon fibre provided the best value in a short-haul aircraft.

Airbus is also developing its own new materials. One of these is a proprietary aluminium-magnesium-scandium alloy called Scalmalloy. It is particularly good for making lightweight high-strength components. It is being commercialised by an Airbus subsidiary and is already used in some racing cars. In powder form, Scalmalloy can also be employed in a revolutionary form of manufacturing that is ideally suited to working with many new materials: additive manufacturing, popularly known as 3D printing. ■

Traditional materials are getting better, too

3D printing: Print me a pavilion

Additive manufacturing is a perfect way of using new materials

CARMAKERS can spend a year building a working prototype for a new car. Setting up machines for a production run of one is laborious and costly, since much of the work is done by hand. But researchers in Tennessee have an automated system endearingly known as BAAM (Big Area Additive Manufacturing). Most people would call it a 3D printer, albeit a particularly large one—and it is used to print cars.

The researchers work at the Oak Ridge National Laboratory, which is exploring a number of advanced manufacturing methods. BAAM was cobbled together from various bits of factory kit in partnership with Cincinnati Inc, a machine-tool company. In one experiment it made most of the body and chassis for an electric replica of a Shelby Cobra, a classic 1960s sports car. The printed parts that went into the vehicle were built up using a mixture of 80% polymer and 20% carbon fibre and weighed a mere 227kg. It took the team just six weeks to design, print and assemble the car.

A few companies, such as Local Motors, a firm based in Phoenix, are using additive technologies to make limited runs of cars, but 3D printing is still too slow for mass-produced vehicles. Even so, it will quickly become part of the automobile industry, says Thom Mason, director of Oak Ridge, not just for prototyping or customising vehicles but also for making moulds, tools and dies. That business had been largely offshored to low-wage countries. “Now we can print these things overnight,” explains Mr Mason.

Making things with 3D printers has captured the public imagination. In recent years, improved hardware and software has turned the basic technology—which is about 20 years old—into a broad assortment of different processes. They all rely on building up layers of material additively, using plastics, metals, ceramics and even biological feedstocks. Such printers range from desktop machines that cost a few thousand dollars to hulking monsters to print metal parts that cost over \$1m.

The size of what could be printed used to depend on what would fit inside the machine. Now some printers, such as BAAM, are coming out of the box, so to speak. MX3D, a Dutch startup, plans to



Strand by strand

print a 15-metre (49-foot) footbridge across a canal, using robots fitted with steel-printing equipment. Winsun, a Chinese firm, uses a fast-drying mixture of cement and recycled construction waste to print prefabricated sections of buildings, and Achim Menges at the University of Stuttgart is printing strands of carbon fibre to make one-off architectural structures such as pavilions (pictured).

One of a kind

One advantage of producing something additively is that material is deposited only where needed, so there is little waste. In traditional manufacturing perhaps 80% of the material is cut away. Moreover, the software used to design a product can also run the printer. And software is easy to tweak, so a different design can be produced every time without having to reset machines. The technique also lends itself to making complex shapes in new materials that can lead to dramatic performance gains. And although 3D printing is still slow compared with mass-production processes such as

A NEW APPROACH TO CYBER SECURITY

Changing the economics of cyberattacks to improve security and enable innovation



Davis Hake

Director of Cybersecurity Strategy

Today's cybersecurity landscape is marked by news of one data breach after another, each seemingly bigger than the one that preceded it. "It's happening partially because the economics of the problem aren't being addressed," says Davis Hake, Director of Cybersecurity Strategy at Palo Alto Networks.

Given the value of business and personal data held in IT networks and the increasing connectedness of the Internet of Things, cyber criminals are becoming more aggressive. At the same time, improving technology is arming those criminals with tools that are ever less expensive and more powerful.

Against that backdrop, too often businesses' cybersecurity response is to fix problems once the damage is done.

"The adversaries are getting more aggressive, they're using these advanced tools and they're working together to try to get things right," Hake said. "But from our view, we haven't really changed our approach." Against those adversaries, the right course, he said, is to make the playing field less favorable for the attackers. "You actually need to change the economics of the situation," Hake said and, "make it increasingly expensive for adversaries to launch successful attacks." Essentially, if you make it too difficult and expensive for the criminals to attack your networks, they'll go elsewhere.

The Palo Alto Networks approach delivers breach prevention along the attackers' lifecycle, providing numerous points at which an attack can be thwarted by the company's integrated security platform, which includes a Next-Generation Firewall, Advanced Endpoint Protection, and Threat Intelligence Cloud. The platform is designed to learn from attacks as they happen, as well as applying intelligence gathered from attacks on other Palo Alto Networks clients. Forcing attackers to try new attacks, rather than rely on their existing infrastructure, makes their

efforts more difficult and costly, prompting them to seek easier targets.

In building its platform, Palo Alto Networks looked not just at security for security's sake, but at how security can enable innovation. While board members and C-level executives are increasingly aware of their responsibility for cybersecurity, many are still trying to understand how to make their organizations secure. Meanwhile, few see the link between effective cybersecurity and business opportunity, according to Hake.

"Where we feel that the conversation still lacks is getting that message up to the officer and director level and translating those technical risks into not just risks but business opportunity," he said. "If you can do something more securely than you'd been able to in the past that allows new business opportunities," and the ability to use technology such as SaaS.

To address those issues, Palo Alto Networks is working with the New York Stock Exchange to bring the conversation to the board room level. A major element of that effort is a new book, *Navigating the Digital Age*, an anthology of works by more than 30 CEOs, consultants, and technical practitioners sharing their views on how to effectively address cyber threats. The anthology is meant as a reference guide and, along with a vendor agnostic portal Palo Alto Networks is launching to build a community around cybersecurity best practices and advice, a resource for board members.

"We hope that this is the start of the conversation around best practices and expert use case advice," said Hake. "The other part of it is enlisting those board members to go back out there and engage in that conversation with their peers."

Ultimately, the goal is not just security but opportunity. "Securing innovation really should be our key goal here," says Hake. "It's not just saying no. It's about getting to yes and seeing security as strategic to an organization's livelihood and growth."

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Making things with a 3D printer has captured the public imagination

▶ pressing steel and plastic injection moulding, in some industries that may not matter too much. “Additive techniques give you a whole new degree of freedom,” says Mr Idelchik at GE Research. The company has spent \$50m installing a 3D printing facility at a plant in Auburn, Alabama, to produce fuel nozzles for the new LEAP jet engine it is making in partnership with Snecma, a French company. GE will begin by printing 1,000 nozzles a year, but eventually the number could reach

40,000. The fuel nozzle in a jet engine is a complex part that has to withstand high temperature and pressure. Normally it is made from 20 different components. GE instead prints the part in one go, with a laser fusing together layers of a powdered “super alloy” made up of cobalt, chrome and molybdenum. The resulting nozzle is 25% lighter and five times more durable than the old sort, and conventional manufacturing methods might not have been able to cope with the material at all. ▶▶

Brain scan: Carl Bass



The boss of Autodesk reflects on the future of manufacturing

“I DON’T think I would go quite as far as ‘the golden age of materials’ yet,” says Carl Bass. “But we might be in the gold rush part of it.” And what he sees over the horizon is a completely different way of using materials and making things.

As the chief executive of Autodesk, a Californian company that produces computer-aided design (CAD) software, Mr Bass tries to work out where manufacturing is going. But he does so with the plain-speaking practicality of a New Yorker who is as handy with a chisel and welding torch as he is with a piece of CAD software.

Autodesk’s best-known product, AutoCAD, is part of a suite of programs used to produce things such as the recently completed 128-floor Shanghai Tower (China’s tallest building), bridges, roads, Tesla’s electric cars, Statoil’s offshore oil rigs, watches, shoes, blockbuster movies and video games. The link between them is the ability to manipulate high-resolution graphics. These days, products increasingly begin life in a virtual form.

Software from Autodesk and its rivals can also be used to test prototypes and production processes. As the results can be evaluated long before something physical is made, this greatly speeds up and lowers the cost of development.

Along with advances in machine tools, CAD software has helped people get much better at manufacturing with traditional materials, says Mr Bass. But there is a long way to go with new materials: “Right now people are pretty good with steel and aluminium; they are much less good with things like carbon fibre.” Many companies are still at what he calls the “black aluminium” stage: taking a part designed to be made from aluminium and making it in carbon fibre instead, but without allowing for the difference in the properties of the two materials or taking advantage of the new design possibilities that offers.

The latest engineering software incorporates material properties, making it possible to simulate producing something in a different way with a new material, explains Mr Bass. “The more you can digitally simulate it, the more you develop an intuition about how to use it.”

New processes such as 3D printing greatly

increase the options by allowing previously impossible designs to be realised. This includes elaborate structures inside a solid object, says Mr Bass. But he does not see 3D printing taking over manufacturing wholesale or invading every home. Often a combination of traditional subtractive manufacturing and additive manufacturing will work best.

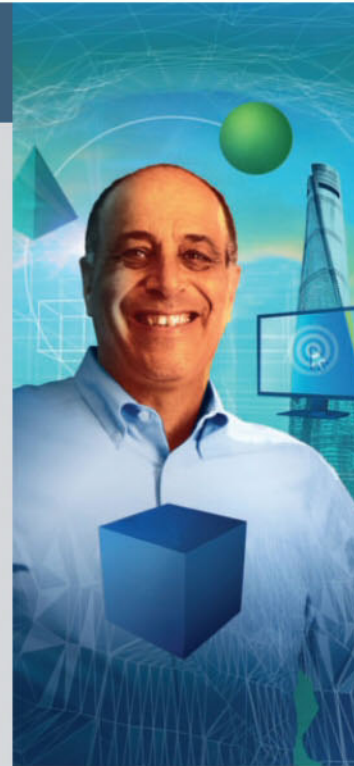
After studying at Cornell University (and building boats and furniture in between), Mr Bass in 1981 co-founded a computer-graphics company which was acquired by Autodesk in 1993. He left in 1999 to form an online company, but soon returned and in 2006 took over as Autodesk’s chief executive. That was a time of transition, from making two-dimensional design software to 3D programs.

Now Mr Bass is overseeing another transition: a move from selling a perpetual licence for most software to a subscription model. That has made some investors jittery about its short-term impact on earnings. At the same time much of the software is moving into the cloud. This will cut users’ upfront costs and provide more of a “pay-as-you-go” service with access to a greater variety of software tools. It is a big change, but Mr Bass is sure that is the right way to go.

In the real world

Mr Bass has also introduced consumer design software, such as SketchBook, which in a basic form is free, and he provides schools and colleges with free software. In addition, Autodesk runs a website called Instructables where people exchange ideas about making things. It gets 30m unique visitors a month. Mr Bass still has his own workshop, where he recently converted an electric go-kart he built with his teenage son Willie into a self-driving one, using kit from a drone.

Such pursuits have helped make Mr Bass something of a cult figure in the Silicon Valley-inspired “maker movement”, an eclectic group of hobbyists, artists and the like that has spread round the world. To begin with he was a bit sceptical of the makers, if only because they seemed to be claiming it was all their idea: “A bunch of hipsters woke up in 2007 and said we are going to call it the maker movement, as if we are the first people who have ever made anything.” Still, he says, “I love the fact that millions of people are getting out from behind their computers and making things.” ■



Over the horizon, Mr Bass sees a completely different way of using materials and making things



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NEW MATERIALS FOR MANUFACTURING

▶ “Additive manufacturing will definitely win a lot of ground at the expense of existing processes,” says Henrik Runnemalm, the head of engines for GKN Aerospace, a British company. Some of GKN’s 3D-printed components are already in aircraft and jet engines. The technology is also used alongside traditional techniques. Mr Runnemalm cites an example in which a fine wire of material is melted to build up shapes on a component that has been cast in a conventional manner. In yet another process, a 3D printer creates a component in its “near-net shape” (close to its final form), which is then finished conventionally with machine tools.

Additive manufacturing has plenty of potential left, not least because it can change the properties of materials as it goes along. At Oak Ridge, researchers are working on specifying the crystalline structure of a metal in different parts of a compo-

nent by fine-tuning the heat as the layers are built up, hoping to obtain different performance characteristics. “This is totally new,” says Mr Mason. “It is one of those things that is not in our design vocabulary right now.”

3D printing is capable of even more. Modumetal’s nanolaminates are also produced by additive manufacturing. The process takes place close to room temperature, which means metal could be added to a 3D-printed plastic shape, creating hybrid plastic-metal composites, says Ms Lomasney. And the process could run in reverse, dissolving the metal in a component back into a solution so that it could be used again. “We haven’t got into the business of recycling because parts are not yet being returned to us,” explains Ms Lomasney, “but in theory it’s possible.” With many new materials, recycling may become an essential requirement. ■

The technique lends itself to making complex shapes in new materials

What next: Bright angelic mills

Though recycling will become more complicated, a much wider choice of materials will transform manufacturing

MANUFACTURERS are coming under growing pressure to take responsibility for the life cycle of their products. This involves an obligation to consider all the energy, environmental and health effects of every stage, from materials extraction to production, distribution and, eventually, recycling or disposal. As materials become more complex, that is becoming trickier.

The traditional way of gauging what effects a new material will have on the wider world is to go by the elements. If something has lead in it, for instance, it is probably not good for you. If it has a bit of manganese, it is probably safe. “That is so old-fashioned,” says Berkeley’s Mr Ceder. “Very often what these things do to your body depends on the form, not the chemistry.”

That makes nanoparticles particularly difficult. A lot of research is being done on their environmental and health implications, but much of it is inconclusive. A big five-year study of nanoparticles led by the Swiss National Science Foundation is due to be published in 2016. One example of its work, from Australia, illustrates the concerns.

Being a highly developed region, South Australia gets plenty of nanoparticles in products, some of which are washed into the drainage system. It is a dry place, so much of the wastewater is recycled, and treated sewage is used to fertilise fields. That allowed researchers from the Swiss Federal Laboratories for Materials Science and Technology to study the area as something of a closed system. From field and water deposits, they calculated the amounts of four nanomaterials that ended up in the environment every year: 54 tonnes of nano titanium dioxide (used in sunscreens); 10 tonnes of nano zinc oxide (found in cosmetics); 2.1 tonnes of carbon nanotubes (hollow tubes used instead of fibres in some composites); 180 kilograms of nano

silver (for anti-bacterial use); and 120kg of fullerenes, another nano form of carbon, made up of hollow spheres known as “buckyballs”.

The final destination of these particles varied. The nano carbons remained embedded in the parts they came in, which ended up in rubbish dumps. The zinc oxide and silver were chemically converted into normal compounds in sewage-treatment plants, so did not seem to present a risk. But the nano titanium oxide from sunscreens went walkabout. Just over 5% ended up in the sea, the rest on fields. In its normal form titanium dioxide is not toxic (it is used in toothpaste as well as sunscreen), but the researchers say they do not know what the long-term effects of the nano versions will be, especially in high concentrations.

Going dotty

Certain nanoparticles undoubtedly have nasty effects. Some LEDs use quantum dots—tiny crystals which when excited by an external light source glow brightly, a process called luminescence. This produces richer lighting and brighter colours in LED televisions and other displays. The dots, though, are often made from a toxic cadmium compound. That provides a commercial incentive to come up with safer materials.

Nanoco, a firm based in Manchester, has developed cadmium-free quantum dots. The Dow Chemical Company has licensed the technology to make dots at a new factory in South Korea. And Prashant Sarswat and Michael Free of the University of Utah have made quantum dots out of carbon obtained from food waste. This is put into a solvent and heated under high pressure. The process still needs to be scaled up, but as the raw ingredients are free and relatively safe, the idea has promise.

For larger items, the end-of-life problems are just as challenging—and rather more visible. Both Airbus and Boeing have programmes for recycling their carbon-fibre aircraft. In that industry at least the numbers are limited to a few thousand, but if



Looking for the perfect LED



► carmakers were to adopt carbon fibre on a larger scale, millions of old carbon-bodied cars would eventually have to be disposed of. In some cases the material can be shredded and used in lower-grade components.

Recycling exotic materials might become a necessity. Some elements are expensive and hard to find; they may come from only a handful of countries, such as China, which could restrict supply. Others, including some rare earths, are not found in large quantities and are hard to mine. Such substances are being increasingly used in electric and hybrid cars. As these become more widespread, new methods of dismantling and recovering materials will have to be found.

Marion Emmert and H.M. Dhammika Bandara at Worcester Polytechnic Institute in Massachusetts have developed a new and energy-efficient way to extract rare-earth elements from electric cars, in particular neodymium, dysprosium and praseodymium. They sliced up and shredded the motor and other drive components from an all-electric Chevrolet Spark and used a two-stage chemical-extraction method to separate the rare earths and other useful materials. The technology, they say, could be used for other products that contain motors and magnets, such as wind turbines and medical imaging equipment.

Some firms use a process called life-cycle assessment (LCA) to work out environmental impacts. “The idea is to evaluate, cradle to grave, a product or service,” says Christian Lastoskie, an expert in the field at the University of Michigan. LCA used to be carried out when a product had been on the market for a while and plenty of data were available. Now it can be done in advance with computer modelling. That means making and testing a number of assumptions about a new material or process, but the analysis can be a useful guide to possible environmental concerns and help a company with its selection of materials, Mr Lastoskie explains.

One project he has worked on, with backing from Sakti3, was a comparison of the life cycle of conventional lithium-ion batteries and solid-state ones. The results, published in 2014 in the *Journal of Cleaner Production*, suggested that even after allowing for uncertainties about the properties of the cells and the efficiency of the process used to make them, the use of solid batteries in electric vehicles would bring down energy consumption and reduce global warming.

All this points to the conclusion that manufacturing will become ever more complex and that the days of “me-too” factories, making similar products in much the same way, are numbered. Pro-

cesses such as 3D printing make economies of scale irrelevant, allowing low-volume production and rapid customisation. As labour costs shrink in relation to total production costs, there is less pressure to move production to low-wage countries. That does not mean foreign companies will give up making things in China, but that more of the things they make there will be for the Chinese.

With computing costs falling all the time, being able to model the manufacturing process and the life cycle of a new material opens up markets to new entrants with new ideas. Only a decade ago it was widely thought that the world’s car industry would consolidate into less than half a dozen groups because the barriers to entry were so high. Now new carmakers are appearing everywhere; not just Tesla and, possibly, Apple, but also many small, specialist ones such as Local Motors.

Big companies, too, will increasingly compete by using exclusive recipes for new materials and customised production techniques. “If you just do a great design and use a manufacturing process which everyone else can use, you will run out of steam,” says Mr Idelchik at GE Research. “But if you have a proprietary manufacturing process which applies to proprietary materials, you are creating a long-lasting competitive differentiation.”

Trade secrets

Mr Idelchik is not alone in that view. BMW’s factory in Leipzig uses standard industrial equipment and robots. What makes it special is the company’s intimate knowledge of exactly how its materials are made and how to control the processes that turn them into cars. This goes to the heart of materials science. “We think we are pretty much ahead of our competitors because we have the complete process and material development in our hands,” says BMW’s Mr Kranz.

In future more firms will need to be on top of their materials. The days of trial and error are coming to an end as powerful research tools deliver scientific data of unprecedented depth. The tumbling cost of computer power makes that information available to companies of all sizes just as new production process, such as 3D printing, transform the economics of manufacturing into something lighter and swifter.

Mastering the greater complexity of materials, as well as their design, engineering, production, supply-chain and life-cycle management, will require new skills and plenty of entrepreneurial talent. It may attract more people into an industry that is still trying to shake off an image of dark satanic mills. Manufacturing is entering a new age. Edison would have heartily approved. ■

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The war in Syria

The search for boots on the ground

To defeat Islamic State, the West needs Sunni Arab allies. The price will be a clearer commitment to getting rid of the Assad regime

ON DECEMBER 2nd the House of Commons voted by an emphatic majority to let British planes bomb Islamic State (IS) in Syria as well as Iraq. It was a symbolic step, aimed at showing solidarity with allies against barbarism. Although British Tornado fighters boast highly accurate Brimstone missiles and a sophisticated intelligence-gathering pod, no one imagines that air power alone can defeat IS.

The problem remains what it has been in Syria since air strikes against IS first began in September last year: the absence of competent, politically acceptable forces on the ground to work with, other than the Kurdish YPG (People's Protection Units), who seldom venture outside what they see as Kurdish territory. David Cameron was derided for claiming that there are "about 70,000 Syrian opposition fighters... who do not belong to extremist groups" and who might be potential allies of the coalition against IS. The Kurds are not included in that count.

In fact, most experts agree with the prime minister's intelligence-derived assessment. Charles Lister of Brookings Doha Centre reckons that there are over 100 armed factions with a total of 75,000 fighters, many of whom operate under the Free Syrian Army umbrella, who could be considered "moderate" by Syrian standards. Many of these have already been "vetted" by the CIA and are receiving weapons and other assistance, albeit on a

fairly small scale. They do not yet remotely resemble a cohesive force. But with time and the right political incentives they could perhaps be formed into one.

The YPG militia, which numbers around 55,000, has shown its mettle by pushing IS out of Kobane and moving west to take on IS at Jarabulus, the last border town with Turkey it holds. But despite the YPG's success when helped by coalition air power, its main interest is in carving out a

contiguous area of control along the border with Turkey. Despite talk of it joining up with Sunni tribes and driving south to the IS stronghold of Raqqa, it has little appetite for doing so. Even if it did, the political consequences of helping Kurds to seize an Arab town would hardly be positive.

Even more problematic from a Western point of view is the idea of partnering with either Ahrar al-Sham or Jaish al-Islam, two big Salafist groups that have connections with Jabhat al-Nusra (JAN), al-Qaeda's increasingly powerful Syrian affiliate, but who are opposed to IS and who can field between them up to another 30,000 fighters. Opinion is divided as to whether Ahrar al-Sham and Jaish al-Islam should be considered jihadists who are beyond the pale or potential allies against IS.

Both are supported by Saudi Arabia and Qatar and will be at a conference bringing together all the elements of the "legitimate" (ie not JAN or IS) Syrian opposition to be held under Saudi auspices in Riyadh, probably next week. Ahrar itself appears to be split between pragmatists, who want to reassure potential Western allies by distancing themselves from JAN, and those still clinging to its jihadist roots. The label "moderate" that used to be attached to groups the West could support is being quietly replaced by a more flexible term, "mainstream", which broadly means genuinely Syrian factions that have no interest in exporting jihadism. It is an important and necessary shift, says Jennifer Caffarella, who covers Syria for the Institute for the Study of War in Washington, DC.

The Russian military intervention two months ago "massively complicates" an already confused situation, according to Emile Hokayem, a Syria analyst at the International Institute for Strategic Studies. By concentrating their air strikes on some of the groups the West sees as potential al- ▶▶



lies, the Russians are not only shoring up the regime of Bashar al-Assad, Syria's brutal president, but they are also indirectly assisting IS, since IS is also fighting some of these groups.

A peace process involving all the states that are party to the conflict will continue into a third round in Vienna next month. But it is hard to see how the differences between Russia and Iran on one side and the American-led coalition on the other can be resolved. Barack Obama's attempts at this week's Paris climate conference to convince Russia's Vladimir Putin to make destroying IS the priority rather than saving his client, Mr Assad, fell on deaf ears.

Jordan has been given the unenviable task of deciding which parts of the Syrian opposition should be defined as terrorists and thus excluded from the peace process, but it is clear that Russia puts virtually all rebel groups other than the Free Syrian Army and the Kurds into that category. Mr

Hokayem thinks it is ironic that nobody is suggesting putting the regime's forces on the terrorist blacklist, given its continued use of barrel bombs against civilians.

For the West, over-investing in this process risks alienating Syrian Sunni opinion even further, especially when Mr Assad's survival, at least for a period, remains on the table in Vienna. Ms Cafarella warns that Russia is fuelling Mr Assad's narrative of a struggle against terrorists and is manipulating the Vienna talks to that end.

Fight the tyrant and the terrorists

The disconnect with the political reality on the ground is stark. However much most of the opposition militias loathe IS, their priority is still to complete the revolution and topple the hated regime. Mr Hokayem says: "If you want to mobilise forces against IS, you have to deal with Assad on a parallel track. They see themselves as liberators, not mercenaries." ■

gitimacy of Iran's theocracy or the qualifications of its incumbent, Mr Khamenei, to be Shia Islam's chief *faqih*, or jurist. "Sistani is emphatic. He doesn't want a religious state, he wants a civil state," says a senior cleric close to him.

Key Iraqi figures have already switched allegiance to Mr Khamenei. They include Nuri al-Maliki, Iraq's former prime minister and the leader of Dawa, the country's largest Shia party. Dawa's military arm, Badr, widely regarded as the most powerful of the Shia militias with some 20,000 men under arms, plasters its barracks with portraits of the Iranian leader. In a country where the militias have more firepower than the army, Iran's pawns dominate most areas of Iraq that lie outside the control of the Kurds or Islamic State (IS). Mr Sistani has repeatedly sought to roll back their influence. He stymied Mr Maliki's bid for a third term after the 2014 elections, and has given unqualified backing to attempts by the current prime minister, Haider al-Abadi, to rein in the militias.

Aside from the battle against IS, Mr Sistani has shied away from joining Iran's other regional adventures, says an aide. The ayatollah has declined the demands of Hizbullah, the Iranian-backed Shia militia that is Lebanon's most powerful force, for a religious decree endorsing their multiple struggles. He opposes Shia intervention on behalf of the Houthi militia that took up arms against Yemen's government. And he has doggedly refused to endorse the idea that his supporters should fight Sunni rebels in Syria as well as in Iraq, joining Iran and its friends in buttressing the regime of Bashar al-Assad. Shias who die fighting in Syria "are not martyrs", a cleric says he heard him saying.

For now, most Iraqis continue to offer Mr Sistani their allegiance. "The *marja* still holds the keys of Najaf," says the cleric, using the honorific (which means "source of emulation") many Shia use for their religious authority. But since he has no apparent successor, real questions surround the future of Najaf's seminaries when Mr Sistani dies. Two of the strongest contenders both live in Iran, including Mr Maliki's preference, Mahmoud Hashemi Shahroudi. Though born in Najaf, he is a senior figure in Iran's theocracy and a staunch supporter of Mr Khamenei. He headed Iran's judiciary for a decade, and serves on Iran's powerful Council of Guardians, which vets new laws and parliamentary candidates. A Najaf cleric voiced scepticism about the prospects of a Shahroudi succession: "Najaf is too small for him. He wants to succeed the supreme leader."

For now, Ayatollah Shahroudi keeps his distance, but his followers are putting the finishing touches to what could be Najaf's largest seminary. Its turquoise-tiled portico towers over the otherwise modest academies on adjacent streets. Just across the ▶▶



Iraq's Shia Muslims

The ailing ayatollah

NAJAF

Ali al-Sistani is Iraq's best hope of curbing Iranian influence. But he is 85 and has no obvious successor

FEW Muslim sites are more serene than the resting place of Ali ibn Abi Talib, the seventh-century caliph who was the first Shia leader, in Najaf, the Shia world's spiritual capital. Its cupola glitters with gold leaf, its marble floors gleam in the sunlight, and pilgrims throng prayer halls that shine with a million mirrored mosaics. But in their seminaries surrounding the shrine, the ayatollahs and their 13,000 students are engaged in a less-than-holy struggle to

block an Iranian takeover bid.

As their financier and weapons supplier, Iran already holds sway over Iraq's main Shia parties and their allied militias. But control of Najaf would be its greatest prize. Standing between Iran's supreme leader, Ayatollah Ali Khamenei, and his aspirations for spiritual leadership of the world's 200m Shias is an ailing 85-year-old, Grand Ayatollah Ali al-Sistani. Mr Sistani has refused to recognise either the le-

► way from Mr Sistani's rented lodgings, more champions of Iran's theocracy are preparing to open a museum in the richly restored garret where Ayatollah Ruhollah Khomeini, the father of the Islamic Revolution, lived and lectured for 15 years. "If Sistani dies, we'll be... subsumed under the leadership of the *faqih*," says Saad Saloum, an academic and keen observer of Iraq's religious affairs.

Beyond Iraq, neighbouring Arab states also show signs of alarm at the prospect of Iran's move into yet another Arab landmark and Iraq's steady transformation into an Iranian satellite. Under King Salman, Saudi Arabia is quietly overcoming its own religious qualms and is reaching out to Arab Shias. It invited Mr Abadi to visit earlier this year. Western capitals too look on Mr Sistani as one of the country's few positive post-2003 constants, and a buttress against the country's sectarian slide. "Thank God Sistani is here," says a western diplomat in Baghdad. For how much longer, though, no one knows. ■

Lebanon

546 days without a president

BEIRUT

Multiple crises in a tiny country

WHEN is a crisis really a crisis in Lebanon? It can be hard to tell. With the country's vibrant commerce, entrepreneurial buzz and relatively liberal social scene, it can be easy to overlook the rot underneath. The tiny nation of 4m regularly goes for stretches without a functioning government. Since the civil war ended 25 years ago residents have endured power shortages and woeful public services. And things are getting worse.

On the country's Independence Day on November 22nd, marking 72 years since French rule ended, protests, which had just about ground to a halt after a summer high, drowned out the celebrations. Lebanon broke its own record for longest period without a president—546 days. Local papers now use the plural, writing of the country's "crises" rather than "crisis".

Hitherto the most obvious breakdown has been in public services. Water tankers line the streets since the piped stuff reaches few areas of the capital. No community will accept the government's proposed new landfill sites for the rubbish that has accumulated on the streets for the past few months. Now the rains have come, the refuse, which includes used toilet paper, is floating in all directions before being washed into rivers.

The economy has been buffeted by the

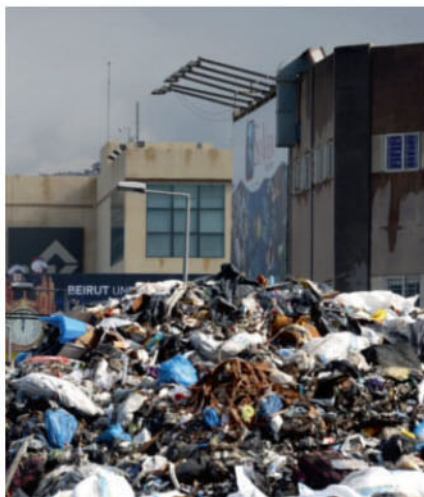
conflict next door in Syria, Lebanon's only neighbour other than Israel, with which it is nominally still at war. Partly because of the strain of housing over 1m refugees—one for every four Lebanese—debt now stands at 131% of GDP.

Even more worrying is the security situation. Islamic State (IS) claimed its first attack in the country on November 12th when it detonated two bombs in a suburb of the capital. The country is awash with guns and disillusioned young men. Up in Mount Lebanon, a Christian stronghold, locals fret over the jihadists' reach.

The underlying problem is politics. Under Lebanon's system, seats in parliament and posts in government are shared out by sect rather than competence. This has, unsurprisingly, produced incompetent government. And now the system is under pressure. Partly that is because, despite the lack of a census, everyone knows that the make-up of the country is very different from what it was when the system was set down. Muslims are reckoned to far outnumber the Christians now, though they are allocated the same number of parliamentary seats.

Political talks continue, but few Lebanese are holding their breath. A large part of the problem is that the many warlords now reincarnated as politicians seem more interested in protecting their own power bases than in the good of the country. Last month, in a remarkable show of political immaturity, one of the main parties threatened to shut Beirut's water off.

The security services, the one vaguely functional part of the state, are carrying out raids and have arrested those suspected of planning terror attacks. But many fear the terror plots will be used as an excuse to crack down on Syrian refugees. It is easy to sympathise with the difficulty of trying to host 1m guests. Yet if Lebanon's politicians spent more time focusing on their own failings rather than blaming others, things might work out better for all. ■



It's even worse when it rains

South African universities

The ivory tower is too white

STELLENBOSCH

South African universities are arguing over race and language

TWENTY-ONE years into South Africa's democracy, a bronze plaque honouring Hendrik Verwoerd, the mastermind of racial apartheid, still hung by the entrance of the Accounting and Statistics building at Stellenbosch University. Only in May was the plaque finally taken down, after a wave of protests.

Unhappiness over symbols such as these—earlier in the year a revolt at the University of Cape Town led to the removal of a hulking statue of Cecil Rhodes, the British colonialist—underline deeper concerns among South Africa's educated youngsters. The first is that a limping economy is struggling to provide good jobs for black graduates. Adam Habib, vice-chancellor of Johannesburg's University of the Witwatersrand, says students' unease is a symptom of a "broader demoralisation" at a time when the economy is in trouble.

A second concern is that it is taking black South Africans longer than they had hoped to catch up with white levels of prosperity. The faculty at the country's elite universities are still mostly white. Their curricula, traditions and culture are also largely European. Activists complain that this makes black students and academics feel unwelcome. They demand, among other things, fewer classes on Shakespeare and more books by African authors.

Stickier still is language, and in few places more so than the oak-lined streets of Stellenbosch, the intellectual cradle of apartheid and a bastion of Afrikaans. Verwoerd was an alumnus, as were most other apartheid-era prime ministers. Today the university is far whiter than its counterparts in Johannesburg and Cape Town. The student body is 62% white (compared with just 8.3% of the country's population), as are about 83% of professors. According to the activist group Open Stellenbosch, there are more professors named Johan (a common Afrikaans name) than there are black ones. Students have campaigned to have English become the main language of instruction, arguing that Afrikaans marginalises students from black backgrounds. The Vice-chancellor Wim de Villiers agrees, as do some 220 members of staff. But the powerful university council disagrees, saying English and Afrikaans should have equal status. Removing statues and plaques is one thing, but even many liberal Afrikaners splutter at being told that they may not have their children taught in their mother tongue. ■

Zimbabwe

Light at the end of a long, dark tunnel

HARARE

Robert Mugabe's era is drawing to a close. But what comes next?

DRIVING after sunset through the once pristine streets of suburban Harare, Zimbabwe's capital, is hazardous. Street signs have been stolen for their metal, so your map doesn't help. Streetlights are mostly bust. Traffic lights are often on the blink, even at the busiest crossroads. Potholes, some a foot deep, pockmark the roads, so cars swerve wildly to miss them. Predatory police are ever ready to bid for a bribe (the going rate is \$10-20) for traffic transgressions, however imaginary.

An aura of decrepitude shrouds the entire country. Electricity and water even in the poshest parts of Harare are often off. Only 700,000 people have formal jobs, a lot fewer than at independence in 1980; since then the population has soared from 7m to nearly 14m, excluding several million who have fled abroad for a better, safer life. Agriculture has collapsed since the confiscation of more than 90% of the farms owned by whites in the past 15 years, and with it the manufacturing that largely depended on it. In the words of a Western diplomat, "The country is on its knees."

Yet a light may at last be flickering at the end of the tunnel. At 91 President Robert Mugabe's physical and mental decline is quickening. His stumbles, his sleepiness at public events, his impervious reading of the wrong speech, testify to his dimming powers. "Nobody is running the country any more" is a mantra uttered even by people once loyal to him. Few now think he will last through 2016.

A vicious battle to succeed him is raging mainly inside the ruling Zanu-PF party, along with a faction ejected from it a year ago. The current first vice-president, Emerson Mnangagwa, a 69-year-old former longtime head of the security service known as the crocodile, is the favourite; but he is far from home and dry. Mr Mugabe's wife Grace, aged 50, whose recent denial that she wants to succeed her husband rings hollow, is backed by a particularly nasty group supposedly standing for a younger generation of 40-year-olds, hence its nickname, G40.

Then there is Mr Mnangagwa's predecessor as vice-president, Joice Mujuru, whose husband, a former head of the army, was burnt to death in a mysterious fire in 2011, just when the couple were said to be talking both to the then prime minister, Morgan Tsvangirai, and to the West. Mrs Mujuru was brutally evicted from her post at a congress a year ago. Mrs Mugabe

**Bob, dear, you're repeating yourself again**

accused her of witchcraft, corruption and seeking to kill the president. If left for dead on the road, even "dogs and fleas would not disturb her carcass", she said.

Since that humiliation, Mrs Mujuru has dangled the prospect of forming a new party, to be called People First. But she has bided her time. She still has a following in Zanu-PF. In the country at large she is respected, whereas Mrs Mugabe is widely derided. Moreover, Mrs Mujuru may still have some powerful backers in the army, though its commander, General Constantine Chiwenga, is thought to have weighed in behind Mr Mnangagwa.

Mr Tsvangirai is a busted flush. In 2008 he managed despite Zanu-PF's rigging and brutality to win a general election for his Movement for Democratic Change (MDC) as well as the first round of the presidential poll. He was forced to bow out before the second round after 200 of his people were killed. But since then his reputation has been wrecked by his poor performance as prime minister in a unity government from 2009-2013 and by his unwise decision to compete in the subsequent election, which was duly rigged more cleverly than before. Having now split into at least five parties, the MDC has fizzled. Still, if Mrs Mujuru's lot teamed up with all or any of the MDC factions at the next election, due in 2018, and were in addition joined by a third-way party led by a decent ex-Zanu-PF finance minister, Simba Makoni, together they could together add up to a winning coalition—if Zanu-PF were ever to allow a

truly fair election.

Meanwhile, Western governments and the EU are acting as if the transition has begun. The IMF is negotiating for Zimbabwe to clear its arrears and let it gradually borrow again in the international markets. But this depends on Zimbabwe's government sorting out two of its most toxic issues: an "indigenisation" law, which deters foreign investment because it calls for all business to be at least half-owned by black Zimbabweans; and the question of commercial farmland, whose owners, black or white, have no security while the policy of confiscation still continues and ousted owners get no proper compensation. Moreover, the West will not fully re-engage until there is more freedom, culminating in a properly observed and perhaps internationally supervised election in 2018.

The old man just won't go

Mr Mnangagwa, whom some Western diplomats see as the man to do business with, however thuggish his past, hints that he would give ground on all these fronts. But there are two big snags. Mr Mugabe, however frail, can still block things—and may well insist that indigenisation prevails and land grabs continue. "Nothing will happen till the old man goes," warns Ibbo Mandaza, a prominent local analyst.

The second snag is the hectic fluidity of politics as Mr Mugabe fades. Next week an annual party conference may witness new ructions. The national constitution says the vice-president should serve out the term of a president who resigns or dies in office. But the succession procedure is itself open to wrangling. A compromise candidate, perhaps Sydney Sekeramayi, the veteran defence minister, could yet emerge. Mr Mugabe may finally endorse a successor—or not: his habit of keeping rivals at each other's throat dies hard. Few insiders think he will step down before his death.

If Mr Mnangagwa prevails, it is hard to imagine him coaxing the country back to democracy. He was largely responsible for the Gukurahundi campaign in the early 1980s, when 20,000 or so disgruntled Ndebele, mostly civilians, were murdered by Mr Mugabe's army. He helped orchestrate the shenanigans after the first round of the election in 2008. He is feared but not loved, even within the ruling party. He twice lost his own parliamentary seat. "He is unelectable [as president] in a fair election," says a former fellow cabinet member.

In any event, the post-Mugabe struggle is in full swing. It could turn violent. The outcome is uncertain. The least awful plausible scenario is that, once Mr Mugabe goes, a sensible path towards economic re-engagement can be charted, perhaps under the aegis of Mr Mnangagwa or another Zanu-PF figure, leading to a proper election in 2018—and Zimbabwe's return from hell. But there is a long way to go. ■



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Poland

The return of the awkward squad

LUBLIN AND WARSAW

Two weeks in, Poland's new government is making Europe nervous

POLAND is one of the European Union's biggest success stories. Since it joined the EU in 2004 its GDP per head has almost doubled. Poles are more likely to be fond of Brussels than most other big members of the club. But since Poland's new government, led by the populist Law and Justice party (PiS), came into power on November 16th, the cosy relationship between Poland and the rest of Europe is in danger. Increasingly, the poster child for European integration seems more like a moody teenager.

Much of PiS's success can be explained by the unpopularity of the previous government, led by Civic Platform (PO). After eight years of PO many Poles were fed up; the party was seen as careerist, aimless and out of touch. But PiS also broadened its appeal, running a campaign that made it appear far more moderate. Older, rural voters still make up the core of its support (see chart). But during the election it came first among 18-29 year olds too. And since winning the election in October with over 37% of the votes, its popularity has surged. One recent poll puts its support at 42%.

Since taking office PiS has dropped all pretence of moderation. Beata Szydło, the prime minister, has little clout. The real power is in the hands of Jarosław Kaczyński, the party's divisive leader (pictured above, with Ms Szydło), who was prime minister during PiS's incompetent term in government in 2005-7. Before the election

Ms Szydło pledged not to give the defence ministry to Antoni Macierewicz, one of the party's kookiest conspiracy theorists. (Like many in PiS, he believes that a 2010 plane crash that killed Mr Kaczyński's brother Lech, Poland's president at the time, was a Russian plot, and that a government investigation that found it was an accident was a cover-up.) Nevertheless Mr Macierewicz, a longtime crony of Mr Kaczyński, was made minister of defence. The government now says it will reopen the investigation into the crash.

PiS is consolidating its control over other levers of power, too. It has sacked the heads of the security and intelligence services and put in its own men. It annulled the appointment of five constitutional judges approved under PO and substituted ideological allies, disregarding a court that warned the move may be unconstitutional. Andrzej Duda, the president, pardoned Mariusz Kamiński, a friend of Mr Kaczyński sentenced to three years in jail for abuse of power when he headed an anti-corruption bureau. He now has the even more powerful job of intelligence co-ordinator. The new culture minister tried to axe a highbrow theatre production featuring on-stage nudity; a state TV journalist who pressed him about the botched decision was briefly suspended.

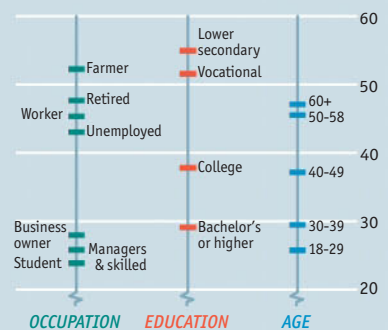
Such domestic developments are troubling, but the government's attitude to Eu-

rope and foreign policy appears to be worse. The morning after the attacks in Paris, its minister for Europe wrote an editorial pronouncing the hard-won EU agreement to distribute migrants among member states to be a dead letter. Ms Szydło has backed off that stance but still seems unable to commit to the refugee scheme; in an interview, she was optimistic that Europe would now take a more "rational" approach to the migrant crisis. The government has mooted cancelling defence contracts with French and American companies, preferring ones which use factories in Poland. PiS has redoubled Poland's opposition to Europe's climate policies; 85% of Polish electricity already comes from coal-fired power plants, yet the new government obstinately vows to build even more.

This all threatens Poland's international credibility, says Piotr Buras of the European Council on Foreign Relations, a think-tank. After eight years in opposition, most PiS politicians have few international con- ▶▶

Profiles in outrage

Support for Poland's Law and Justice party
Exit polls, October 2015, % of vote



Source: Ipsos MORI

tacts. Besides, the government is more concerned with domestic matters. Ms Szydło plans to start paying parents monthly child benefits, increase the standard tax deduction, and lower the retirement age to 60 for women and 65 for men. Those over 75 will get free medication, and the state health-care budget will be boosted.

While PiS's denunciations of immigrants draw headlines, it is the economic policies that its voters really care about. In Lublin, a poor town in Poland's agricultural east that is a stronghold of PiS support, a party activist does mention the fight against "genderisation", the party's catch-all term for feminism and gay and transgender rights. But among local voters, the talk is all of scant pensions and low wages.

How the new social policies will be funded is unclear. The changes, especially on pensions, are very costly. Proposed taxes on banks and supermarkets cover only a fraction of their cost, according to Polityka Insight, a think-tank. The budget deficit could hit 4% of GDP next year. With an ageing population and many young people leaving for elsewhere in the EU, lowering the retirement age seems disastrous.

European diplomats are publicly taking a restrained approach to Poland's new government. Privately, many are worried. The productive Polish-German relationship could break down over migrants. To judge by its previous term, PiS may grow wilder with time rather than tamer. What is certain is that Europe has a new awkward country to deal with. ■

Russian-Turkish politics

Tsar v sultan

ISTANBUL AND MOSCOW

Russia does not want a shooting war with Turkey. A trade war, maybe

TWO portraits flanked by red roses and candles rest on a bench outside the Russian defence ministry. The makeshift memorial honours the soldiers killed last month by "accomplices of ISIS"—Russia's new nickname for Turkey. After Vladimir Putin declared Turkey's downing of a Russian jet near the Syrian border to be a "stab in the back", a chill has descended over Russian-Turkish relations. Mr Putin accused Turkey's Recep Tayyip Erdogan of protecting and profiting from the Islamic State's oil trade; Mr Erdogan promised to resign if Russia could provide proof. On December 2nd Russia's defence ministry presented information it says does just that. Mr Erdogan called it "slander".

In a few seconds, the missile a Turkish plane fired last month undid years of diplomacy. Until the incident, the Kremlin



Less fruit to throw at politicians

saw Turkey as a strategic partner. Ordinary Russians knew it as a place to go on cheap beach holidays. Bilateral trade flourished, especially in energy, and Turkish construction firms helped build up Sochi for the winter Olympics. Last year Mr Putin paid Mr Erdogan perhaps his ultimate compliment, calling the Turkish leader "strong" for supporting ties with Russia even as the West had turned away because of the conflict in Ukraine.

Now, Turkey has suddenly become Russia's main enemy. The Kremlin's chief propagandist, Dmitry Kiselev, spent most of his Sunday night broadcast slamming the country, accusing Mr Erdogan of complicity with terrorists and fascists. Turkey "is now truly dangerous," he warned viewers. At the climate summit in Paris this week, Mr Putin met in private with Barack Obama, but shunned Mr Erdogan. The Russian government has also unveiled economic sanctions against Turkey, focused on agriculture and tourism.

The tension is not limited to politics. Russia's minister of sport instructed football clubs not to hire Turkish players during the upcoming transfer period. Dozens of Russian universities have cut ties with their Turkish counterparts, and Russian exchange students have been recalled from Turkish schools. Turkish trucks have been held up at the Russian border and lawyers have been fielding complaints from Turks in Russia who find themselves facing harassment from migration officers. "It's happening all over, from Vladivostok to Kaliningrad," says Murad Musayev, a Moscow-based attorney. "Collective responsibility according to nationality has become the rule."

Both sides stand to lose from sanctions, though the economic effects will be more of a pin prick than a stab. Embargoes on

Turkish food and bans on charter flights will hurt some Turkish firms. But Turkish exposure to Russia amounts to only 1% of GDP, says Fatma Melek, an economist at Akbank in Turkey. Losses related to sanctions will be even less. Russia, in turn, can expect a bump in inflation of 1%-1.5%, says Natalia Orlova, an economist at Alfa Bank in Russia. The embargo seems designed to look bolder on television than in reality. Turkish lemons, which account for as much as 90% of all lemons in major retail chains, were left off the list of banned products. Gas supplies, the pillar of bilateral trade, have so far remained untouched, though Turkish Stream, a joint pipeline project, looks likely to be frozen.

Relations between Ankara and Moscow will not improve any time soon. The shooting down of the plane has exposed deep and bitter disagreements over Syria that had been smouldering for some time. As Turkish-backed Syrian opposition groups take an increasingly anti-Russian stance, Syrian peace talks look ever more shaky, says Vitaly Naumkin, director of the Institute of Oriental Studies at the Russian Academy of Sciences. The conflict with Russia has also forced Turkish officials, who had often engaged in fiery anti-Western rhetoric in the past couple of years, to revise their priorities. "Now they understand that Turkey's security interests are with the West, with NATO," says Suat Kinklioglu, director of the Centre for Strategic Communication, an NGO. "They've reverted to default mode." ■

Italian tax evasion

Show me the money

ROME

Matteo Renzi wants to encourage people to use more cash. Bad idea

MOST people agree that big piles of cash are nice things to have. But not everyone thinks it is good for a country if its citizens conduct their business with big piles of cash. Specifically, some Italians object to a move by the prime minister, Matteo Renzi, to triple the limit on cash transactions to €3,000 (\$3,200). The existing ceiling was introduced in 2012, at the height of the euro crisis, when the European Union was pressing Italy to crack down on tax evasion. Since credit-card payments are easier to trace, the thinking went, a cash limit would force shopkeepers and others to declare more of their turnover. Mr Renzi has already raised from €50,000 to €150,000 the amount of tax that can be evaded without criminal sanctions. Both moves raise the question of what exactly Italy's young prime minister, praised for his ►►

Artful dodgers

Tax lost to the shadow economy
2009 estimate, % of national tax income



Source: Tax Research UK

▶ reformist agenda, is up to.

Mr Renzi's critics, including some in his own centre-left Democratic Party (PD), accuse him of trying cynically to win support from small-business owners and the self-employed (including many doctors and lawyers), who have traditionally voted for the right. Unlike salaried employees of large firms or the state, they find it laughably easy to submit tax returns that understate their earnings. Pier Luigi Bersani, Mr Renzi's predecessor as leader of the PD, said it insulted voters' intelligence to pretend that someone able to pay €3,000 in cash might not possess a credit card. Mr Renzi counters that cash transactions can also be monitored with digital technology.

But Mr Renzi's main contention is that encouraging the use of cash would spur consumption and accelerate Italy's recovery from the longest recession in its history. How? Certain visitors to Italy might be happier to splash out in cash than with credit cards (perhaps for tax-related reasons of their own). The unspoken point, though, seems to be that if Italians pay even less tax, they will have higher disposable incomes.

The view that indulging tax evasion is good for the economy has a long history in Italy. It was common among the Christian Democrats who dominated Italian governments until the 1980s. Whether Mr Renzi shares that belief is impossible to say. But he certainly feels passionately about the issue: in October he said he was ready to gamble the future of his government on it by putting the increased cash threshold to a confidence vote in parliament.

For Mr Bersani encouraging tax evasion would be like pouring gasoline on a bonfire. Italy, he said, has "a shadow, 'black' economy, and [levels of] tax evasion and money-laundering that no other country in the West has." According to a 2012 study for the social democratic group in the European Parliament, EU governments in 2009 spent €860 billion to tax evasion. Of that, €180 billion—almost a fifth—was dodged in Italy, by far the biggest figure for any member state. As a proportion of overall tax revenue Italy ranked tenth, behind Greece

Bosnia 20 years on

Dating Dayton

Bosniaks, Croats and Serbs agree on nothing except that the war is over

THE Bosnian war ended either on November 21st 1995, when a peace accord was reached in an American air force base in Dayton, Ohio, or on December 14th, when the accord was signed in Paris. The actual date matters little: there have been no official events marking the 20th anniversary. That is largely because, when it comes to remembering the war, Bosnia's Serbs, Croats and Bosniaks (Muslims) have three utterly different versions of what happened.

The Dayton deal allowed the Bosnian state to survive, but divided. One part is the predominantly Serbian Republika Srpska (RS). The second is the Federation, a predominantly Bosniak and Croat union divided into ten cantons. Then there is Brcko, an autonomous town that muddles along by itself. On paper, Bosnia is no more complicated than Belgium. In practice it is even more dysfunctional, because being divided has kept the scars of war fresh.

The divisions reproduce themselves in how the anniversary of Dayton is celebrated. If November 21st does not fall on a weekend, as it did this year, only residents of RS get the day off. Bosniaks (but not Croats) celebrate not the 21st but the 25th, the date modern Bosnia was founded by anti-fascist partisans in 1943. That holiday is ignored in RS; it celebrates January 9th, the date it was founded in 1992—precisely in order to divide Bosnia and create a Greater Serbia.

On November 26th Bosnia's Constitutional Court annulled that holiday on the grounds that it was also a Serbian Orthodox religious one, and thus discriminated against Catholic Croats and Bosniaks. Milorad Dodik, the pugnacious Bosnian Serb leader, dismissed the court as a Muslim one, and invited it to "stick this decision you know where."

Not only do Bosnians disagree over celebrating the war's end, they cannot agree on when it started. For Serbs it was the murder of a Serb at a wedding in Sarajevo in March 1992. For Bosniaks and

Croats it was the murders of two women, one Bosniak and one Croat, five weeks later. Each side mourns only its own victims. Sarajevo, which is now mostly Bosniak, is peppered with memorials to those who died at the hands of "Serbian criminals" during its siege. Serbian civilians murdered by Bosnian forces during the siege and tossed down a nearby ravine still have no official memorial. Authorities in Prijedor in RS refuse to allow a memorial to the mostly Bosniak children killed there during the war.

Separate education systems replicate the divisions for new generations. Eric Gordy, a sociologist, says all three sides are "selling the story of themselves as the biggest victims". Yet despite voting mainly for ethnically based parties, Bosnians are far less nationalist than is often thought. Bojan Solaja of the Centre for International Relations in Banja Luka, the capital of RS, says Serbs, Bosniaks and Croats agree the war was a mistake, and tend to get on well in private: "It is not a matter of people but of politics."

For 20 years gloom-mongers have predicted that Bosnians would go back to fighting. It has not happened. Dayton, for all its flaws, succeeded in ending the war even if it failed to bring Bosnians together into a single nation. Their dysfunctional state looks set to limp on for many anniversaries of Dayton to come.



and several eastern European states, but in western Europe it was the worst offender.

Italy's problems are common in southern Europe. The region combines high tax rates with lax enforcement and poor public services. Since the euro crisis, austerity policies have pushed those tax rates even higher. Paying one's full whack is thus both painful and avoidable. Cheating seems rational, given that everyone else is doing it

and the state offers lousy value for money. Businesses stay small to avoid the taxman's eye; workers are self-employed for the same reason. A brave Italian government might try to fix this mess by lowering rates, improving enforcement and broadening the tax base. Instead, by making it easier to cheat, Mr Renzi would guarantee that the burden of paying for the state will fall on fewer shoulders. ■

Air pollution

Choking on it

KRAKOW

While Paris focuses on climate change, air pollution kills 400,000 Europeans a year

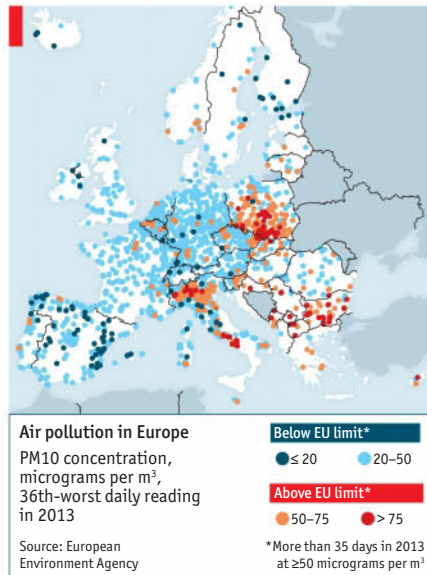
IN WIELICZKA, near Krakow, a handful of locals have gathered in a hotel conference room to bemoan air pollution. One woman complains of sinus problems caused by soot; another worries about her children playing outside. A man grumbles that police rarely prosecute residents for burning rubbish. It is a tiny gathering compared with the huge climate-change conference that kicked off in Paris on November 30th. But the issue is as big as the sky.

Europe's air is less corrosive than it once was, and much less foul than China's or India's. Industrial decline and clean-air policies since the 1950s have brought levels of many pollutants, such as sulphur dioxide, fine particulate matter (a dust that can irritate lungs), and nitrogen oxides down over the past few decades. Yet more than 400,000 Europeans still die prematurely each year because of air pollution, according to the European Environmental Agency. In 2010 the health-related costs were thought to be between €330 billion (\$437 billion) and €940 billion, or 3%-7% of GDP.

Nine out of ten European city-dwellers are exposed to pollution in excess of guidelines produced by the World Health Organisation (WHO). Some of the highest levels of nitrogen dioxide are found in London; several cities in Turkey are choked with high levels of PM10 (particulate matter of at most 10-micron diameter). But some of the worst pollution is in Eastern Europe (see map). Coal-fired power stations are still common there, and some pollutants blow in from the rest of Europe. The commission is prosecuting 18 governments for infringing pollution limits.

Researchers at King's College London have found that a child born in London in 2010 can expect to have his life cut short by nine months as a result of breathing its high levels of PM2.5—the very finest particulate matter—if pollution levels do not change. Work by Xi Chen of Yale University shows that exposure to high levels of PM10 in China can stunt fetal growth. Preliminary findings from Jonathan Grigg at Queen Mary University in London show that pollution can change the immune systems in children's lungs. The poor suffer most, both because they live in more polluted places and because they are more likely to be unhealthy in general.

Air pollution used to be a visible killer. The "great smog" that accumulated over London in the winter of 1952 was so bad that people had to feel their way home



along railings. Thousands died, driving politicians to pass a Clean Air Act in 1956. In the 1970s acid rain caused by burning fossil fuels had an obvious environmental effect, notes Christer Agren of Air Clim, a Swedish research group. But air pollution is now mostly invisible, and the harm it causes is not immediately obvious. As a result, it is not a burning political issue.

Some government efforts to cut greenhouse-gas emissions have made matters worse. In Britain, diesel cars have been promoted by successive governments because they emit less carbon dioxide than

cars that run on petrol. In 2001 only 14% of British cars ran on diesel; by 2014, 36% did. But diesel vehicles emit even more damaging pollutants—and sometimes more than tests suggest, as shown by the discovery that many Volkswagen vehicles had been designed to fool testers.

Another problem is that farmers have resisted much regulation. Emissions from agriculture, such as ammonia, contribute to particulate matter. But politicians—particularly French and British ones—have been loth to impose tougher rules on rural folk. This means that while levels of most pollutants have fallen by around half since 1990, emissions of ammonia have fallen by only a quarter.

There is no strong political drive to tackle air pollution, as there is to cut greenhouse gases. Despite the Volkswagen scandal, new limits for diesel cars have been delayed until 2019. When the European Parliament voted in October to revise air-quality standards, some sources of methane were left out after lobbying by farmers. The revised standards are less stringent than those of the WHO.

While national politicians have dithered, a few local ones have tried to clean up dirty air. Boris Johnson, the mayor of London, plans to start charging drivers of older diesel cars £12.50 (\$19) extra to enter the city in 2020. Anne Hidalgo, the mayor of Paris, intends to ban diesel cars entirely by then, and has already tried to limit their numbers. In 2013 Krakow's regional assembly banned coal fires in households (this was deemed unconstitutional, but will be allowed under a new anti-smog law).

But small-scale schemes are useless if other countries fail to act. Pollution is not a local issue: around a third of Britain's dirty air is swept over from the continent. For all the talk of a greener, cleaner future in Paris this month, unless governments act together to cut air pollution, much of Europe will be unable to breathe free. ■



Unmasking Europe's pollution problem

Charlemagne | Bridge of sneers

The strange spectacle of Sweden and Denmark sniping at each others' immigration policies



JUST 25 miles and a spectacular bridge separate Copenhagen from Malmö, Sweden's third-largest city. Denmark and Sweden share bonds of history, language and culture. Each has a fondness for open labour markets, high taxes and a generous welfare state. But on immigration policy, the two countries are worlds apart.

Take this year's migration crisis. Denmark's centre-right government, propped up by the anti-immigration Danish People's Party (DPP) since an election in June, has taken the bared-teeth approach to asylum. In September it placed advertisements in four Lebanese newspapers warning would-be migrants of the hardships they would face if they came. It grudgingly offered to take in 1,000 refugees from other European countries, then changed its mind. Sweden, by contrast, has opened its arms. This year some 150,000 Syrians, Afghans and others have sought asylum in this country of 10m people (most of them travelling via Denmark). Proportionally, that is more than Germany.

All that changed on November 24th, when Stefan Lofven's Social Democratic government buckled under the pressure of numbers. Asa Romson, the deputy prime minister, was close to tears as she announced measures designed to stem the refugee flow into Sweden. From April 2016 most refugees will enjoy only temporary protection, and their right to bring family members to Sweden will be curtailed. For a country that has long seen itself as the conscience of Europe, that was quite a reversal.

As a result there is more than a whiff of *Schadenfreude* in the Danish corridors of power. Since 2001, under the influence of the DPP, successive governments have tightened asylum and citizenship policy. (A rule barring foreign spouses younger than 24 from moving to Denmark is one of the world's toughest.) Sweden's new measures are old hat in Denmark, which passed its latest round of restrictions in July and is considering more, including a proposal to strip asylum-seekers of valuables to pay for their care. "People have been looking to Sweden and laughing," says a Danish official. "[The Swedes] were naive."

Danes would do well to restrain their mirth. Despite the obvious need, EU countries have preferred games of beggar-thy-neighbour over a co-ordinated migration policy. Just as border closures in Hungary caused havoc for Croatia and Slovenia, Sweden's unilateral changes will rebound on Denmark. Danish asy-

lum claims, already at record levels (some 20,000 are expected this year), are climbing further, months before the Swedish measures take effect.

That will further strain the countries' relations. Sweden has urged Denmark to follow its lead and implement border checks, but Lars Lokke Rasmussen, Denmark's prime minister, refuses, saying that could trap more asylum-seekers inside Denmark. In September the two governments failed to mesh their responses after refugees surged into Denmark seeking to reach Sweden. Lykke Friis, a former Danish minister, says relations have not been this bad for years.

Fears over asylum coloured a referendum held on December 3rd, as *The Economist* went to press. The ballot paper presented Danes with a baffling choice: should their government convert its "opt-out" on the EU's justice and home affairs matters to a Britain-style "opt-in" (meaning it could choose which policies to adopt)? Inevitably this arcane question was crowded out by whether a "yes" vote would allow Brussels to dump asylum-seekers on Denmark. The government vowed it would not. But as elsewhere in Europe, Danes have lost faith in politicians' promises.

Many Danes think political correctness has smothered the migrant debate in Sweden—unlike Denmark, where no opinion is off-limits. This, they charge, has allowed the far-right Sweden Democrats, an anti-immigrant outfit with roots in neo-Nazism, to rise to the top of Swedish opinion polls as the only alternative to the soggy pro-immigration consensus.

There is something to this. Yet Denmark's hard line on asylum has not defanged the populists either. Over the years the DPP (which began as an offshoot of an anti-tax insurrection) has dragged moderate parties in its direction: even the Social Democrats are immigration hardliners these days. But dancing to the tune of the DPP has not blunted its appeal. The party came second in June's election, with 21% of the vote. The Sweden Democrats, whom other Swedish parties shun, poll only a little higher.

My policy is better than your policy

Each country struggles with integration. Some Swedish cities are stratified by ethnicity; racist mobs have firebombed refugee centres. The 31 areas on the Danish government's "ghetto list" hardly resemble Detroit, but nor are they trouble-free. In February a Palestinian-Danish gunman killed two people in Copenhagen, one at a free-speech event and another outside a synagogue. It is getting harder to counter the siren calls of Islamist groups. Although local authorities, including Copenhagen's, try hard to integrate minorities, they sometimes seem to be tugging in a different direction from their national masters.

The prosperous lands of Scandinavia seem a long way from the seas that carry migrants to Europe's shores, or the tense borderlands of the Balkans through which they trek. Yet Sweden and Denmark have still managed to replicate some of the problems of Europe's more troubled areas. Like many other European countries they have jealously guarded their right to act alone in the teeth of a continental crisis—hang the consequences for others.

Their respective differences on the benefits of immigration, or obligations to refugees, used to be little more than a Nordic curiosity. Today, with thousands of migrants looking to one country or the other, they are part of the problem. It is disputes like these that explain why Europe has struggled to get on top of its migration crisis. That they afflict two of the EU's most successful countries shows how hard they will be to resolve. ■



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Britain and the Middle East

In Iraq's shadow

Parliament votes to extend British action against Islamic State to Syria

THEY all alluded to it. David Cameron warned the House not to “use past mistakes as an excuse for indifference or inaction”. The prime minister was echoed by Tim Farron, the Liberal Democrat leader, who cautioned against “learning the wrong lessons from history”. Jeremy Corbyn, Labour’s leader, was more blunt, stating: “The spectre of Iraq, Afghanistan and Libya looms over this debate.”

So it was that MPs spent over ten hours on December 2nd grappling with past conflicts and present realities in the Middle East and on the streets of Britain. Ultimately most brooked their many concerns and endorsed the extension of British air strikes against Islamic State (IS) from Iraq to Syria, home to the group’s headquarters and the source of most of its oil revenue. In total 397 MPs to 223 approved the motion, a larger margin than expected.

Mr Cameron has wanted to extend the action to Syria for months. Opening the debate, he cited a recent incident when Syrian opposition forces needed urgent air support but could not be helped by the British planes just eight minutes across the Iraqi border. Yet the vote was always a risk and the prime minister, wary after his humiliating defeat over proposals to bomb Bashar al-Assad’s forces in 2013, refused to act until he was confident he had the numbers—jumping into action following the terrorist attacks in Paris on November 13th,

which had moved the public mood.

Unlike the motion to intervene against IS in Iraq, which passed last year by 524 votes to 43, Britain’s engagement in Syria does not come at the behest of that country’s sovereign government and will not primarily act in support of its armed forces. Instead Mr Cameron hopes to strengthen America and France in their efforts to tilt the messy balance in the Syrian civil war away from IS and towards its more moderate opponents. Such are the risks that even a minority of Tory MPs were opposed (seven voted against the motion). Even so, Mr Corbyn, who is not popular in his parliamentary party, saw only 153 of his 229 MPs join him in voting against—fewer than had

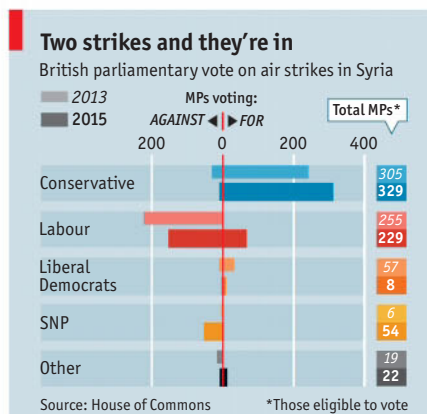
been anticipated.

The debate turned on seven tests issued last month by the Foreign Affairs Select Committee. Each bore the imprimatur of the Iraq war: action should have a real impact on IS and contribute to a transition plan for Syria; it should be backed by a UN resolution, enjoy regional support and involve adequate ground forces; Britain needs to have clear objectives and contribute new military capabilities.

Those in favour claimed these had been largely fulfilled. The prime minister noted that the strikes against IS in Iraq had contributed to reducing its territory by 30%, that the group was already trying to carry out terror attacks in Britain (seven attempts in the past year) and that some 70,000 non-extreme Syrian opposition fighters could help to push out IS. The opposing case was essentially to say—as indeed the select committee did—that the tests had not been met. Opponents, including Mr Corbyn, insisted that the strikes would increase the terrorist threat, questioned the 70,000 figure and considered the risk of extensive civilian casualties too great.

Hours after the vote British Tornados, already integrated into the coalition’s command structures in Qatar, began strikes on IS in Syria. Priorities are likely to include supporting Kurds in northern Syria and striking IS’s oil supplies and other infrastructure, particularly with the Brimstone missiles repeatedly cited by the prime minister as examples of Britain’s ability to precision-target attacks.

At home the immediate outcome is political division. The minority of Labour MPs who voted for the strikes fear becoming targets for deselection attempts by anti-war campaign groups (see Bagehot). The drama in the days before the vote—as Mr Corbyn vacillated over whether to give



Mega-basements

Subterranean home-slip blues

As house prices go through the roof, Londoners explore beneath the floor

ARCHITECTS' drawings show a home cinema, wine room, gym and pool table. Now the proposed basement extension of a Georgian villa in Barnes, south-west London, contains only rubble. The house collapsed on November 26th as builders were doing it up. Inspectors are still working out the culprit; local residents suspect the basement.

"Iceberg homes", ordinary-looking properties with luxurious subterranean storeys, are surfacing more often in posh London neighbourhoods. On November 27th Jon Hunt, a property billionaire, won a legal battle with his neighbour, the French ambassador, over the former's proposed five-storey, 180-foot (55-metre) basement, which will include a "museum" for his Ferraris, illuminated via a glass-bottomed swimming pool.



London's only property crash

The basement boom has two causes. New damp-proofing technology means cellars no longer need smell of drains. And ludicrous house prices mean they make economic sense. A basement costs about £500 (\$750) per square foot to install, says Simon Haslam, whose firm, Basement Force, has dug a couple of hundred of them in the past decade. Property in Chelsea costs four times that much, making a new storey (or two) irresistible. Kensington and Chelsea council received 393 basement applications last year, three times 2009's total.

The associated noise and mess, as well as occasional subsidence and nasty accidents, have mobilised NIMBYS. In January Kensington and Chelsea limited new basements to a single storey no longer than 50% of the garden. (Those with prior permission can go ahead.) Westminster did the same last month; Camden will soon. Applications in Kensington and Chelsea have since halved.

But at the low end of this millionaires' market, incentives to dig are rising. In once-middle-class Barnes, property now costs over £1,000 per square foot. Richmond, the local council, gets 200 applications a year for basement developments. Extending has looked even shrewder since stamp duty, a property-transaction tax, was rejigged last year. Buying a £2m house now triggers a £153,750 tax bill—almost as much as a new basement. "Stamp duty is so large that people are saying, 'Let's not move, let's improve,'" says Richard Barber of JLL, an estate agent. There will be no more mega-basements, but many more mini ones.

Little angels

Children under the age of 18 in custody
England and Wales, '000



for a year costs the taxpayer at least £60,000 (\$90,500)—nearly double the price of a year at Eton College.

In 2009 England and Wales locked up more of their youngsters than almost any other rich country. But since then the number in custody has fallen by 64% (while the adult jail population has not budged). The turnaround has three likely causes.

First, police have dropped many of the arrest-targets they used to chase. These had encouraged the detention of children, since it was easier to catch spray-painting teenagers than burglars. The demand in 2010 by Theresa May, the home secretary, that police stop using them was heeded. Second, children who are arrested are less likely than before to end up in custody. A law passed in 2009 by Labour gave judges more flexibility in sentencing; another passed in 2012 by the Tory-led coalition made judges consider local-authority care before choosing custody.

Third, the use of antisocial-behaviour orders (ASBOs), civil injunctions for yobs that led to jail time if repeatedly violated, has ended. ASBOs were scrapped this year, their use having fallen steadily from a peak in 2005. Their abolition has been accompanied by earlier intervention in the lives of young troublemakers by partnerships of police, local authorities, probation and health services. The number of under-18s arrested dropped from around 250,000 in 2010 to 112,000 in 2014.

With only serious offenders ending up in custody, rates of self-harm, assault and staff's use of physical restraint in youth-prisons have risen since 2009. And as small, local jails have closed, young inmates have been held farther from relatives. In 2013-14 one-fifth of boys (who make up 97% of the youth-prison population) went unvisited by friends or family.

But the transformation is welcome—and it may yet bring other benefits. The number of 18- to 20-year-olds in custody has recently begun to fall, too. As Juliet Lyon of the Prison Reform Trust notes, "The surest way to build the prison population of the future is to lock up children." It may be that the opposite is also true. ■

▶ them the free, unwhipped vote that they wanted, but his supporters opposed—has increased the gulf between the Labour leader and his shadow cabinet and bolstered the standing of Hilary Benn, his pro-strikes shadow foreign secretary.

Mr Cameron has spent some of his political capital; he retains much good will in his party for leading it to a majority in May, but a handful of his right-wing critics, already restless over Europe, defied the whip and opposed strikes. The public, too, has its doubts; according to a YouGov poll 48% of voters approve, down from 59% last month. A repeat of Iraq, and its political fallout, this will not be, but the vote nonetheless leaves the standing of both Britain's main party leaders dependent, in different ways, on events in mountains, towns and deserts over 2,000 miles away. ■

Children in prison

A welcome jailbreak

Britain's addiction to child imprisonment ends in dramatic style

THERE are few worse places to grow up than a young-offender institution. Gangs are rife, staff lack training, violence is common and education rudimentary (a lawyer says that, during a security lockdown, her client once received nothing more than a crossword slipped under the door). Seven in ten inmates reoffend within a year of their release. And it is an expensive form of neglect: jailing a young person

Bagehot | Marching forth with Stop the War

Britain's left must reject the anti-West reactionaries at the heart of its movement



“DO WE have Syrians?” interjects a woman. A brief silence. The gathering in Manchester’s Central Library is pondering who might take the microphone at its upcoming protest against plans to bomb Islamic State in Syria. On the list so far: Labour Party MPs, MEPs, councillors, the Green Party, the Campaign for Nuclear Disarmament, musicians, poets, trade unionists and “definitely a student of some sort”. Phone messages have been left, e-mails fired off and brains racked for names of old-time peaceniks. Only now has the idea of asking a Syrian arisen.

“There’s a big Syrian group,” murmurs one. “But they’re not anti,” continues another, disgusted: “They were lobbying for Britain to bomb Assad.” Those present sigh as one. On to the logistics of the event. It is decided that stewards should guard the mic, poised to fend off any “pro-war Syrians or imperialists”. After all, notes the chairman: “We know what we’re talking about here.” Would that BBC Manchester possessed such discernment. The station is interviewing pro-war Kurds tomorrow, to the group’s disdain: “They dig ‘em up.” “Amazing how they find them!”

Such is the eye-swivelling world of Stop the War, the organisation that, though not the same as the anti-war movement (dominated by decent, mild-mannered types), is its main organising force and has a record of sidelining the very peoples in whose interest it professes to act. Rethink Rebuild, the Syrian society in Manchester, requested a speaking slot at its Don’t Bomb Syria meeting there in October, but was ignored. It claims: “The Syrian voice was marginalised throughout the event.” Other Stop the War gatherings have followed that pattern. At one in Westminster Syrians criticising the unrepresentative panel were jeered at and the police called; in Birmingham a Syrian invited to speak was disinvented and branded a supporter of imperialism for backing a no-fly zone. This knack for alienating its notional beneficiaries goes all the way back to Stop the War’s foundation in 2001 by (among others) the Socialist Workers Party, an authoritarian far-left outfit. At one of its first conferences Iraqi and Iranian delegates quit when their motion condemning “Islamic terrorism” was defeated.

That is the thing with Stop the War. It is not anti-war so much as anti-West; a permanent howl of relativist anguish at NATO and its members. For example, the group could hardly be more indul-

gent of Vladimir Putin’s wars. It defended the invasion of Georgia as a reaction to “the ambition of the USA to exercise global hegemony”, called many of the Maidan protesters in Kiev neo-Nazis and excused Russian aggression in eastern Ukraine and the Crimea. Tellingly, at its “anti-war” demonstration in London on December 1st a poster emblazoned with Syrian flags and the slogan “Support For Bashar Al-Assad” was brandished above the crowd.

Euston, we have a problem

The phenomenon has precedent. In 1941 George Orwell described part of the left as “sometimes squashily pacifist, sometimes violently pro-Russian, but always anti-British.” In 2007 “What’s Left?”, a book by Nick Cohen, charted the latter-day manifestations of the same instinct: cozing up to Milosevic’s Serbia, blaming America for the 9/11 attacks and, in debates on the Iraq war, conspicuously overlooking Baathism’s horrors. The book was part of a push by those lefties dismayed by their Stop the War-ish comrades to remake the case for Western engagement in the name of egalitarian and Enlightenment values. Another was the Euston Manifesto, a call (so named as it was devised in a pub on the Euston Road) for the left to make “common cause with genuine democrats, whether socialist or not”. The election of Jeremy Corbyn, Stop the War’s chairman, as Labour’s leader in September confirmed the manifesto’s marginalisation.

Mr Corbyn has handed over the reins of Stop the War, but to say he remains close would be an understatement. He declined to condemn it or pull out of a fundraising event when, after the Paris attacks, the group inevitably proclaimed: “Paris reaps whirlwind of Western support for extremist violence in Middle East”. One of his shadow foreign ministers appeared to suggest that Labour would consult Stop the War ahead of the parliamentary vote on air strikes. The organisation has also engaged with Momentum, the pressure group created out of Mr Corbyn’s leadership campaign. The two bodies collaborated in the run-up to the vote, inviting each other’s speakers to events and promoting each other’s efforts to lobby MPs. Together they form the institutional hub of the Labour leader’s inner circle.

And this is just the start. When Mr Corbyn, under pressure from his shadow ministers, decided on November 30th to offer his MPs a free vote on Syria, Stop the War condemned the move and sent its march past Labour’s headquarters. With moderate Labour MPs under threat of deselection by new, Corbynite party members, the impending publication of Sir John Chilcot’s report on the Iraq war (which unravelled into a disaster on Tony Blair’s watch) and the ongoing battle against Islamic State, this group—“a madcap coalition of Trots, Islamists and anti-West fury chimps”, as one former Labour MP puts it—will continue to play a central role in the politics of Britain’s main opposition party.

This is a dismal state of affairs. Britain’s left has a rich tradition, dating to the Spanish civil war and beyond, of treating tyranny in one country as a crime against all; of heeding the bell that “tolls for thee”. True to that tradition, some Labour MPs used a Commons session on the Paris attacks on November 17th to decry Stop the War and its influence. “Does the prime minister agree that full responsibility for the attacks in Paris lies solely with the terrorists?” asked Emma Reynolds. Such pointed comments were a good start, but only that. Now, this wing of Labour must assert itself: providing cover for MPs targeted for deselection, a platform for those denied one by Stop the War and an emphatic rebuttal of its anti-West rhetoric. It is time for the left to return to Euston. ■

Invasive species

Day of the triffids

Nobody likes an interloper. But invasive species are more benign than is generally thought—and much harder to eradicate

HIMALAYAN BALSAM is a wonderful plant. It grows fast, shooting up flimsy stems that can rise ten feet high. Its pretty pink flowers are adored by bees. Best are its seeds, which explode dramatically when touched. A clump growing by a stream will keep a young child happy for half an hour.

Wonderful, too, are the men and women who gather twice a week in the Otter Valley, in south-west England, to destroy this plant. Tramping through woods and swamp, they pull it up before its seeds mature. Patrick Hamilton, their leader, declared war on balsam in 2010 and beats it back a little farther every year. It is an obsession: one morning he woke at 3am, unable to shake a vision of a monster plant.

Himalayan balsam and rhododendron in Britain; garlic mustard and kudzu in America; rats and possums in New Zealand—all are invasive species, meaning that they were introduced by humans to new places and then multiplied. All are held to be worse than the most trouble-

some native weeds and vermin, and are persecuted. Plants are pulled up, sprayed with herbicide or deliberately infected with fungus. Birds and mammals are trapped, poisoned or shot.

Despite a squeeze on budgets, the war is heating up. The European Union is poised to approve a list of 37 plant and animal species that member-states must eradicate if possible. Some, like the Asian mongoose, have caused big problems elsewhere. Others are familiar but unpopular. One is the ruddy duck, a 1940s American import whose sole crime is that it mates with rare white-headed ducks in Spain.

Before the 20th century many countries could not get enough foreign species. Europeans imported plants from Asia and the Americas: Himalayan balsam was introduced to brighten British gardens in 1839 and went wild. Colonists took familiar plants and animals with them to eat and hunt, or just to help them feel at home. America has lots of starlings today because

in the 1890s the American Acclimatisation Society tried to introduce every bird mentioned by Shakespeare (starlings appear in *Henry IV*, part I).

Attitudes changed partly for political reasons. Colonists began to treasure native species as a way of asserting a new national identity: in New Zealand gardeners began to favour native plants in the late 19th century, about the same time that Queen Victoria's head was removed from postage stamps. New Zealanders, who call themselves Kiwis after a bird that is menaced by introduced stoats, now persecute invaders with special zeal.

The scientific justification for going after interlopers is that they can harm or displace valued locals. Some munch native species to oblivion, as the Nile perch has done to cichlids in Lake Victoria. Others compete for food and space. Some are too friendly with the natives, producing fertile hybrids that dilute bloodlines. Invasive plants are especially hated because they can disrupt entire food webs. A database of villainous species managed by the International Union for Conservation of Nature lists 3,163 plants and 820 animals.

But invasive species are not held to be objectionable just because of the way they behave. They are also disliked because they are foreign and reflect human meddling. Even well-mannered ones are sometimes likened to a fifth column. Daniel Simberloff, an influential invasion biologist at the University of Tennessee, points out that they can co-exist happily with natives for years before turning rampant, perhaps prodded by another newly arrived species. He argues, therefore, that if it is possible to eradicate an introduced species this should be done on the precautionary principle—though he would pardon many species that invaded at least a century ago.

Not all biologists would go so far. But many advocate attacking invaders on tiny, remote islands, especially if these are home to species that exist nowhere else. Small islands are less biologically diverse than bigger ones, and the animals that live on them are therefore often naive. Rare birds on Gough Island have been devastated by carnivorous mice, and in Hawaii by mosquito-borne diseases.

In such places eradication is possible, though hardly easy. Macquarie Island, south of Australia, contains important bird colonies. It was invaded by rats, rabbits and cats in the 19th century (the rats jumped off ships; the rabbits were put there for food; the cats were supposed to go after the rats). By the mid-20th century rabbits were eating too much vegetation, so conservationists killed most of them with a virus. The cats, which had dined on rabbit, then went after the birds. So conservationists eradicated them. The result was a boom in rabbits and rats, and many more ►►



Clockwise from top left: a brushtail possum, kudzu, a starling, tamarisk, a Nile perch en route to somebody's dinner plate. Circled: a grey squirrel



Clockwise from top left: a little owl, a brown tree snake, lots of zebra mussels, the once-loved, now-persecuted ruddy duck. Circled: Himalayan balsam

▶ dead birds. It took seven years, ending in 2014, to wipe out all mammals.

Removing troublesome foreigners from bigger islands is far harder. A concerted campaign against brown tree snakes in Guam, which has involved dropping thousands of dead mice laced with paracetamol, a common painkiller that is lethal at high doses, out of helicopters, has failed to turn the tide. One study found that snake populations in study areas rebounded within six months of a mouse drop. Poison is dropped from helicopters in New Zealand, too—again without decisive effect on the rats, possums and stoats that eat birds there. Kill some mammals and the survivors benefit from reduced competition for food and nesting places. Besides, mammals learn to avoid poison. “They’re crafty little buggers,” says Jamie Steer, an expert on biodiversity at the Greater Wellington Regional Council.

Just how crafty is shown by an unintentionally comic experiment. In 2004 a Norway rat was brought to Motuhoropapa, a small New Zealand island, and released on the beach. The researchers gave it a few weeks to settle in, then tried to kill it. First they set dozens of traps baited with main courses and desserts. Salami, salmon, peanut butter, chocolate: the rat ignored them all. The researchers then laid poison, and finally sent dogs after the creature. It vanished. It was eventually tracked to another island, 400 metres away across open wa-

ter. Finally, after 18 weeks, it walked into a trap and was killed. And this rat was at a disadvantage, because the researchers had fitted it with a radio-tracking collar.

Mr Simberloff predicts that eradicating invasive species will become easier. Advances in genetics make it possible to design creatures that produce only male offspring, or are more vulnerable to poison. In theory, a harmful gene could be spread through an entire population, making it easy to exterminate. Before firing such extraordinary weapons, though, it is worth asking whether it would be a good idea.

Mark Davis, a biologist at Macalester College in Minnesota, thinks most eradica-

tion campaigns are misguided. Some invasive species turn out to be benign, he says. Tamarisk, a tough plant that Americans have tried to eradicate for more than 70 years, turns out to be the favoured nesting site of the southwestern willow flycatcher, an endangered bird. Mr Davis’s research on garlic mustard, a loathed invader in the Midwest, suggests that it does not crowd out the natives to any great extent.

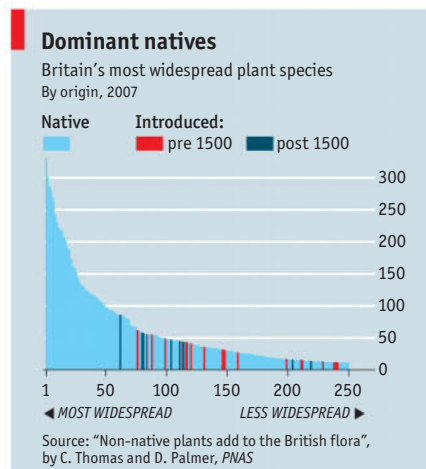
That is also true of invasive plants in Britain. Chris Thomas, a biologist at the University of York, has calculated that of the country’s 677 most widespread plant species, 68 were introduced by humans before 1500 and another 56 after that date. Not one of these introduced species ranks among the 50 most widespread plants in the country (see chart). Himalayan balsam is so rare that it barely even makes the list.

When foreign species spread quickly, it can be a sign of underlying problems. Zebra mussels, natives of the Caspian Sea that were probably brought to America in ballast water, may have swept through Midwestern lakes and rivers partly because they can tolerate higher levels of pollution than other species. They can grow so densely that they clog water-intake pipes for power stations. Other invaders thrive where few natives can: a good place to spot invasive plants is in railway sidings and along motorway verges.

Sometimes newcomers become less troublesome without conservationists intervening. In the mid-19th century European rivers were thick with Canadian waterweed. Rowing was impossible; at least one swimmer was said to have become entangled and drowned. The plant then suddenly declined; nobody is sure why. The poisonous cane toads now hopping across Australia have killed many predators, especially crocodiles. But some species have learned to avoid them, or to munch around their poisonous glands.

And natives can evolve quickly in response to new threats. Some Australian snakes have developed smaller heads, which make it harder to eat the lethal toads and therefore more likely that the snakes will survive. In America, it took mussels less than 15 years to gain thicker shells that invading Asian crabs could not crack.

Perhaps the most rapid evolution can be in attitudes. The little owl, introduced to Britain in the 1870s, was once loathed; these days some fret about its decline. Many birders were dubious about the British government’s campaign to eradicate the ruddy duck, even though it was endorsed by the Royal Society for the Protection of Birds. “A total nonsense,” says Lee Evans, a champion birder, who points out that hybridisation among birds is normal. To thwart the marksmen, many birders stopped recording sightings of the duck. The last breeding pair was shot earlier this year. But the species might come back. ■





Corporate crime

The age of the whistleblower

Life is getting better for those who expose wrongdoing, but companies continue to fight back—often against their own interests

LISTEN carefully and you can hear the sound of corporate lawyers rummaging through dirty laundry. Volkswagen, caught up in two devastating emissions scandals, is belatedly embracing whistleblowers. Desperate to put the mess behind it, the carmaker set a deadline of this week for employees to come forward with information, even if self-incriminating, in return for avoiding dismissal or damages claims (but not protection from prosecution). Whistleblowers have already played a part in exposing the company's exaggerated claims on carbon-dioxide emissions—though no one from within vw lifted the lid on its other scandal, the fiddling of its vehicles' output of nitrogen oxides during tests. That was uncovered by an NGO, possibly with help from leakers in the European Commission.

As vw began to process the results of its amnesty, whistleblowers were making headlines elsewhere, too. It was reported that Takata, a Japanese firm mired in scandal over defective airbags, might have avoided the worst of its problems if it had paid more attention to American employees who rang alarm bells a decade ago. An investigation aired this week by BBC Television alleged that British American Tobacco had bribed officials from a World Health Organisation tobacco-control programme. Its conclusions were supported by documents provided by a manager who had participated in the alleged palm-greasing.

BAT said it does not tolerate corruption.

Whistleblowing has been on the increase since the 2007-08 financial crisis sparked a crackdown on corporate corruption and collusion. The number of tips received by the "Whistleblower Office" of America's Securities and Exchange Commission (SEC) has risen steadily since it was opened in 2011, to nearly 4,000 a year. "We live in the age of the whistleblower," says Jordan Thomas, a former SEC official now at Labaton Sucharow, a law firm. Surveys by the Association of Certified Fraud Examiners, a global group for financial sleuths, consistently find tips to be the leading mechanism for unearthing wrongdoing, well ahead of audits or regulatory reviews (see chart 1).

Despite this, companies have often punished rather than praised whistleblowers. "The institutional equivalent of animal instinct is to strike back," says Tom Devine, legal director of the Government Accountability Project, who has worked

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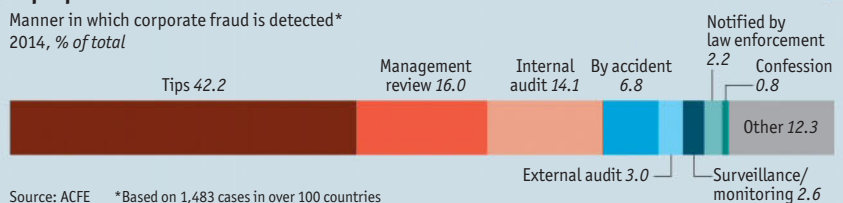
with 6,000 whistleblowers in the public and private sector since the 1970s.

Take the case of Paul Moore, who was sacked as head of regulatory risk at HBOS in 2004 after warning that the British bank was lending recklessly, and then took his complaints public. The scrutiny that followed caused Mr Moore to battle depression and alcoholism; he has said he "wouldn't have had the courage to do it" if he had known the misery it would cause. He was vindicated last month, with publication of a stinging official report on the failures that led to the bail-out of HBOS. Partly in response to that debacle, Britain's financial regulator now insists that the firms it oversees explicitly tell staff they can complain directly to regulators, and that they nominate a senior manager as a "whistleblower's champion".

According to one recent study, Britain is the third-best of the G20 large economies in terms of legal protection for whistleblowers (see chart 2, next page). Enforcement of laws matters, too, of course. Few would say Turkey is a kinder climate for whistleblowers than Canada, which has weaker protections but applies them more assiduously. Europe is "where the action is" when it comes to improving protections, says Mr Devine. What has helped is a strong set of "best practice" guidelines from the Council of Europe, a club of 47 western and eastern European states, as ►►

Top tips

Manner in which corporate fraud is detected* 2014, % of total



Source: ACFE *Based on 1,483 cases in over 100 countries

▶ have pro-whistleblower rulings from the council's judicial arm, the European Court of Human Rights. Newer entrants to the 28-country European Union, such as Romania, had to adopt high standards as a condition of joining. The situation among older members is patchier. Protections are particularly weak in Germany, where whistleblowers who go public after failing to get a response internally face defamation suits, says Anja Osterhaus of Transparency International. Non-EU Switzerland is another with an unforgiving climate (see box).

America is the best place for whistleblowers. The SEC's programme, created by the Dodd-Frank financial-reform act of 2010, is arguably the strongest of the more than 40 federal whistleblower-friendly laws on the books. It rests on three pillars: job protection, anonymity and bounties. It has handed out 22 awards, averaging \$2.5m; these can rise to 30% of any fines that get levied on the employer. Though the programme is not marketed abroad, it has taken on a global hue: tips have come in from 96 countries, and several of the awards have gone to foreigners. In October a court ruled that whistleblowers can sue individual board members as well as the firm, if these were personally involved in any mistreatment of them.

America is not always kind to whistleblowers. It has given some public-sector and national-security leakers a torrid time. And it sometimes acts inconsistently. Bradley Birkenfeld, who provided American authorities with vital information about Swiss banks and their tax-evading clients, won a (taxable) \$104m award from the IRS. But the Department of Justice prosecuted him. His 66 months of prison and probation ended on November 28th.

Europeans have debated but so far rejected the idea of American-style bounties. "The mentality here is different," says a London-based lawyer. "The Wild West, bring-me-the-head approach would undermine rather than bolster support" for

whistleblowers. The SEC has admitted to having a problem with "serial submitters", who file dozens of spurious claims in the hope that one will lead to a payout.

Though official encouragement of whistleblowers is growing, corporate retaliation remains a problem. Of those who report internally first, the number who perceive that they suffered retribution has been steady at around 20% since 2011 and is higher than in 2007, according to America's National Business Ethics Survey.

Whistleblowing in Switzerland

Rough terrain

Two court cases illustrate the struggles of employees who allege wrongdoing

THE last thing a food-industry giant wants is for the safety of its products to be questioned in public. Nestlé is still recovering from a scare earlier this year, when it was forced temporarily to withdraw a popular brand of noodles in India after a regulator said they contained unsafe levels of lead. Court-ordered tests showed this to be untrue but the scare hit sales. Now the Swiss firm has to contend with the claims of a whistleblower being aired in court.

Yasmine Motarjemi, a former food-safety manager (pictured), alleges that she was harassed and then pushed out in 2010 after the company ignored her repeated warnings about lapses. These, she says, included an inadequate process for validating the nutrient content of infant formula, biscuits that could choke babies and incorrectly labelled packaging. She is claiming SFr2.1m (\$2m) compensation plus an allowance for lost earnings. The two sides failed to agree on a settlement, and the case went to trial in Lausanne on December 1st.

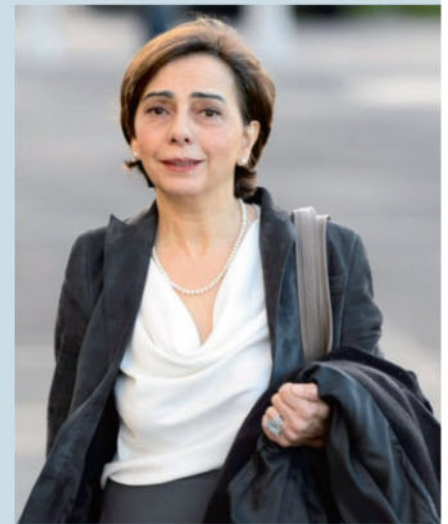
In the opening hearing, Ms Motarjemi, her voice trembling, said that her repeated calls for an audit of her department were turned down, and she was "treated like a child". She has claimed that she was humiliated when colleagues felt she had become difficult—for instance, by being made to sit at the back of a conference in which she was supposed to be a key participant, and having to endure her presentation being given to someone else to read out.

Nestlé's boss, Paul Bulcke, will give his version of events at the next hearing, on December 16th. The company rejects Ms Motarjemi's allegations and has counter-sued her for breach of confidentiality clauses in her employment contract.

To take on Nestlé in its own backyard is plucky, to say the least. Home to many multinationals and generally friendly to management interests, Switzerland is

The confidentiality agreements that many firms ask employees to sign are another disincentive. Examples include preventing them from consulting outside lawyers, requiring notice before they report anything to an outside body and demanding waivers of any future whistleblower awards. In one survey almost a fifth of respondents felt their employer's confidentiality policies obstructed the reporting of potentially illegal activity to law enforcers.

In America, such agreements are legal ▶▶



rocky terrain for whistleblowers. On November 27th a federal criminal court sentenced Hervé Falciani to five years in prison, in absentia, for industrial espionage. His crime was to leak details of large-scale tax evasion by clients of HSBC's Swiss arm. The bank has maintained that he is a thief, motivated by greed. In France, where Mr Falciani lives, he has been embraced; his supporters everywhere see him as the Edward Snowden of banking.

A Swiss whistleblower law was first proposed in 2003 and has been meandering through various consultative processes since 2008. It came closest to being passed earlier this year, but the parliament eventually sent it back to the government, saying it was too convoluted. It was not very powerful anyway: the draft offered no guarantee of anonymity, protections for going public only in extreme circumstances, and scant compensation for employees who suffer retaliation. So weak was it, in fact, that even a group of multinationals—including Nestlé—suggested it needed toughening up.

Protecting the messenger

Rating of private-sector whistleblowing laws
Selected countries, 2014, lowest score=best



Source: "Whistleblower Protection Laws in G20 Countries", by Simon Wolfe et al, Transparency International Australia, 2014

unless they are designed to stifle whistleblowing, as opposed to, say, protecting trade secrets. The SEC considers this area a priority and this year brought its first cases against firms deemed to have gagged or retaliated against workers. Among those fined was KBR, an engineering group, for making staff sign agreements which said they could be sacked if they discussed an internal investigation with outside parties without the firm's approval. "The SEC has sent a strong message about restrictive language. It isn't messing around," says Mr Thomas. But Mr Devine fears that companies are growing more creative in how they craft agreements to sidestep restrictions. "If there's one thing I've learnt in over 30 years, it's that it is fatal for whistleblowers' legal rights to remain static," he says.

Ideally, firms would put in place a formal system for hearing and noting complaints—for their own sakes, as well as those of whistleblowers. When people fail to report wrongdoing, the main reason is often not the fear of retaliation but the suspicion that nothing will be done about it. Companies often see whistleblowers as motivated by revenge or greed. But studies consistently show that most are driven to right a wrong. That is why more than 90% of them sound the alarm internally first, rather than running straight to the authorities or newspapers. Given the choice, they would rather warn than accuse.

So, to stifle whistleblowing is to harm the business. Bad news tends to come out eventually, and looks worse if it appears that bosses tried to suppress it. Apart from which, wrongdoing is less likely to occur in the first place if employees know that their bosses are more inclined to hug a whistleblower than to put him in a headlock. ■

Chinese companies

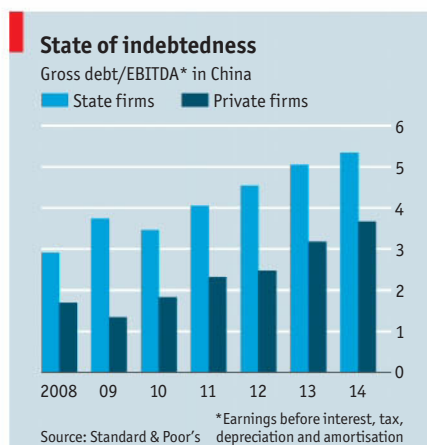
Red chips, red faces

SHANGHAI

The creditworthiness of China's big state firms is worsening

THERE was a time when China's biggest state-owned enterprises were seen as the country's crown jewels. The government cleaned up the balance-sheets of the best of the firms, and listed their shares on stockmarkets at home and abroad. The firms were dubbed "red chips", the supposed blue chips of state capitalism, by fawning analysts.

In fact, China's big state firms were largely a bloated, inefficient and cosseted lot. The real dynamism in the Chinese economy has long come from its entrepreneurial private firms, which now account for perhaps two-thirds of the country's en-



tire economic output.

Thanks to weak commodity prices, a troubled property market and slowing economic growth, the outlook for all Chinese corporations is dimmer than it was a few years ago. But debt is a much bigger problem at the largest state firms. A report released on November 30th by Standard & Poor's, a credit-rating agency, looks at 200 public and private Chinese firms in 18 industries and warns that the creditworthiness of many big state firms has worsened significantly. S&P found that the average ratio of gross debt to earnings (before interest, tax, depreciation and amortisation, or EBITDA) at state firms rose from roughly 3 in 2008 to over 5 last year.

The worries are most acute among metals firms, such as Hebei Iron & Steel, and transport companies, such as China COSCO, a shipping line. The agency gives both of those companies a maximum financial-risk rating of 6. The main exceptions to the trend, the report notes, are state firms in industries such as telecoms and energy, which the government protects from serious competition.

Private firms are not without their problems, although the ratio of gross debt to EBITDA at such firms remains below 4 on average. The property sector and "bricks-and-mortar" retailers have been hit hard of late, and private firms with exposure to them—such as Fosun, one of China's largest private conglomerates—are also seeing a deterioration in their creditworthiness. But most private firms are in e-commerce, consumer businesses and technology services, which are less politicised industries that are still doing well.

The conventional wisdom has long been that China's biggest and best-known state firms will never be allowed to default, no matter how weak their finances. But doubts are now creeping in. Christopher Lee of S&P, an author of the agency's report, says, "there is a growing sense that the weakest are not default-free." The question for officials now, he reckons, is "how to let them go without sparking a systemic meltdown." ■

Pipelines in America

Running on empty

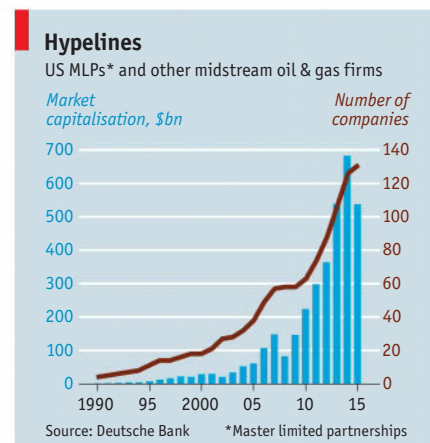
An overhyped business model is heading for trouble

IN 2012 Barack Obama drew attention to a boom taking place in America, linked to—but vastly overshadowed by—the country's shale revolution. In the course of his administration, he said, "we've added enough new oil and gas pipeline to circle the Earth and then some." Of course, it was not the government laying those pipes. It was an array of relatively obscure companies which raised money on the stock-market to finance an infrastructure-spending spree reminiscent of the 19th-century railway boom.

Energy Transfer, a Texas-based firm that had 200 miles (320km) of pipelines in 2002, now has 71,000 miles, and will own another 33,000 after its \$37.7 billion purchase of Williams, an Oklahoman firm, is completed next year. It says the acquisition will give it a debt-plus-equity value of \$141 billion, making it only a bit smaller than BP and Total, two European oil majors.

The bid for Williams, announced in September, is one of the biggest in America's energy markets this year. But it comes as the pipeline industry is going through unprecedented turbulence. Many pipeline firms are "master limited partnerships" (MLPs). These are a distorted version of the conventional joint-stock company. They retain few earnings, paying most of them in dividends, which means they regularly have to raise fresh debt and equity; and they are exempt from income tax.

In recent months the combined market capitalisation of pipeline MLPs and other "midstream" oil and gas distributors has fallen by a fifth to \$535 billion (see chart). Over the past year an index of listed MLPs has performed twice as badly as a basket of energy shares belonging to the S&P 500 ▶▶



▶ index; for several prior years it had outperformed them. Over a similar period the MLP index's dividend yield has risen by three percentage points to above 8%, suggesting doubts about future payouts. On November 30th Breitburn Energy Partners, a debt-laden oil, gas and pipeline MLP, suspended its dividend to common shareholders. Its shares fell by a quarter.

Though not shut out of capital markets, MLPs are finding it harder to tap them. Deutsche Bank estimates that they raised \$11 billion of debt and equity in the third quarter, 39% below the average quarterly amount since 2013; in October and November, they raised just \$2 billion. The cost of financing is rising, too. Kinder Morgan, a Houston-based firm that helped pioneer MLPs (and spent \$44 billion consolidating them before turning into a normal company last year), said in October that the high cost of issuing new shares had forced it to look for other funding options.

Champions of the pipeline operators had argued that, since they tend to sign long-term contracts with fixed fees, they should be reasonably well insulated from any weakness in the prices of the commodities. But as American gas prices have stayed weak, and the global price of oil has slumped since mid-2014, worries have grown among investors that "upstream" production firms may seek to renegotiate their pipeline contracts. And as those upstream firms have scaled back their exploration projects, demand for new pipelines has fallen. The fewer that are laid, the harder it is for MLPs to meet a promise to investors to keep increasing their payouts. Kevin Kaiser of Hedgeye, a financial-research firm, says that retail investors, who do not fully understand the companies' business model and were lured in by the promise of big dividends at the tail-end of the boom, are "getting completely fleeced."

The last straw could be an interest-rate rise by the Federal Reserve, which is widely anticipated later this month and which would reduce the appeal of risky but high-yielding assets. However, pipeline firms are trying to stay optimistic. Some executives argue that future demand for their assets is assured by an increasing need for gas to burn in power stations, cross-border shipments to Mexico and the prospect of America exporting oil and liquefied natural gas to other countries. Trisha Curtis, a midstream specialist at the Energy Policy Research Foundation, a think-tank in Washington, DC, says that pipelines may have been "overhyped" and there may be overcapacity in some parts of the country, but there are private-equity firms eager to buy them if the MLPs are forced to sell.

Like the railways before them, America's network of pipelines could continue to serve the country for many decades to come. But the companies that built them may not survive anything like as long. ■

The rise of hackathons

What the hack?

SAN FRANCISCO

A tech-industry tradition has entered the corporate mainstream

FUELLED by curiosity, coding know-how and caffeine, "hackathons" have been a pastime for tech geeks for a decade. In lengthy sessions often stretching through the night, software engineers fix bugs and come up with new ideas. Facebook's "like" button was born during such a late-night coding session.

However, hackathons are no longer the exclusive domain of techies. Several hundred big companies in other industries now have them, reckons Rob Spectre of Twilio, a software firm, up from only a handful two years ago. These include firms in industries as diverse as airlines, cars, telecoms, beer and banking.

Last month a group of British railway companies held a 48-hour session on board a train. One of the teams came up with a way to scan carriages and alert passengers to where they might find vacant seats. On December 5th-6th MasterCard, a credit-card processor, is holding its 13th hackathon of 2015: a season finale, of sorts, following a dozen regional "championships" around the world.

Hackathons differ in their scope, but most require participants to devise a solution to a problem within a day or two; the winning team is typically awarded some sort of prize. Though the ideas are off-the-cuff, they can sometimes be impressively original. Some hackathons are internal events, which offer employees the opportunity to work with new teams and to broaden their experience. Every year Dropbox, a cloud-storage

company, hosts a "hack week" when employees can work on any project they like. Disney, a media firm, holds four internal hackathons a year.

The majority of hackathons, however, are external events aimed at enhancing a firm's reputation in the eyes of software developers. Some firms consider hackathons essentially as good PR, and pay for them out of their marketing budgets. Others find them helpful with recruiting. Hackathons reveal which participants can focus and perform under pressure, which is a good way to identify talent, says Sebastien Taveau of MasterCard.

Hackathons held by universities have become loaded with corporate sponsors, eager to reach young coders. "Job fairs no longer have any significance" for engineers, says Jerry Filipiak of Comarch, a software firm. "The hackathon has become the job fair." To disguise their corporate agenda, the representatives of the sponsoring firms often call themselves "developer evangelists".

As hackathons go mainstream, they are evolving to accommodate a wider audience. Some firms are experimenting with holding shorter gatherings, providing healthier food and offering child care so as to attract more female participants, says Susan Danziger of Ziggeo, a video-software firm. Purists will doubtless scoff that hackathons are abandoning their nerdy roots, but others are more open-minded. What's wrong, after all, with hacking the hackathon?



Caffeinated inspiration

Commercial drones

Airborne innovation

PARIS

The most successful drone firms could be those that do not make them

A LOT of flying toys will appear first under, then over, Christmas trees later this month. Most drones sold today are for fun, and produced by the likes of DJI (a Chinese firm), 3D Robotics (American) or Parrot (French). Niche firms such as AirDog (of Latvia) offer outdoor narcissists ones that will follow and film them as they surf, ski or cycle. In Christmases to come, some of them may be brought not by Santa but by a delivery drone like Amazon's latest prototype, which it demonstrated in a video on November 29th.

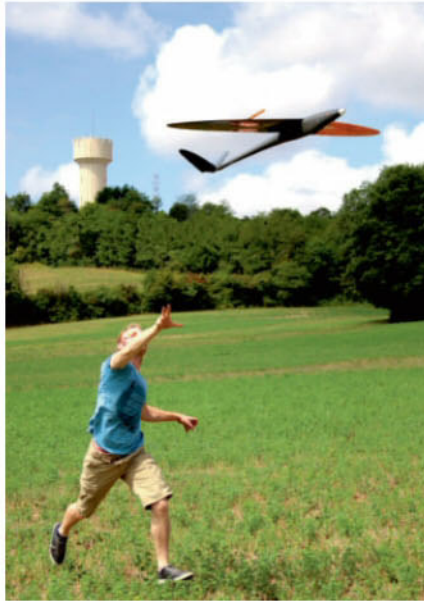
A second, more grown-up set of civilian-drone companies is also rising. These supply services to industry, agriculture and governments, and deploy both off-the-shelf flying machines (in essence, toy drones with extra sensors or cameras attached) or specialist-made ones. New technology, often adapted from smartphones, makes their use remarkably easy.

There is a proliferation of such startups in Europe, where regulations on the use of drones in public places have been passed in many countries—thereby providing legal certainty for operators—and are mostly more permissive than those in America, for example. Andrew Charlton, of the Small UAV Coalition, a lobby group for the industry, argues that this is a big reason why “over 50% of the world's drone activity, its new systems, is happening in Europe—big business is emerging.”

Take Delair-Tech, a French outfit with 50 staff, part-owned by Parrot. It builds long-range (50km or more) unpiloted craft in Toulouse. “We think of drones as DIY satellites, and of ourselves as closer to the space industry,” says Benjamin Benharrosh, one of its founders. French regulation limits such drones to 2kg (4.4 pounds) if flown out of sight of an operator. So far it is the only firm in France that is certified to fly such craft commercially.

Mr Benharrosh says annual turnover is €3m (\$3.2m), but growing “by 200%”, after four years in business. Clients are varied. An American miner hired the firm to record the topography of a copper mine in Congo. France's state rail company, SNCF, uses it to check its lines, for example to keep them clear of overhanging branches. Total, an energy firm, uses its drones to sniff for leaks along its gas pipelines. Rémy Martin, a cognac producer (and another investor in Delair-Tech), relies on its devices to check when its vineyards need watering.

“Agriculture, we think, will be the big-



The farmers' new friend

gest market,” says Mr Benharrosh. The firm is researching how to use drones to monitor crops for disease, assess yields and identify where fertiliser is needed. It charges farmers 15 euros a hectare, but they can save five times as much, he says.

Willem Jan Boer of a Dutch firm, Omniworkx, says all sorts of industrial firms are learning that drones can save them money. Some of its 28 staff were recently hired by Tata Steel to send drones to look inside massive ovens. They have also been flown into oil tanks to look for rust or cracks, and up to the “flame tips” of oil rigs, where gas is flared, reducing inspection times from days to hours. Drones can be used in polluted indoor areas—with asbestos, or radioactive spots—too risky for humans.

The Rotterdam-based firm is expanding to Britain, Ireland, Germany and Malaysia and aspires to be a world leader in inspection and monitoring. But flying the drones

is only “20% to 30% of the business”, says Mr Boer. Storing and analysing the huge quantities of data that are gathered during inspections is the bigger opportunity. Mr Benharrosh concurs: Delair-Tech records and processes billions of images, and “we realise the value might be in this in future.” A harvest of data, collected over years from the same field, enables the most efficient “machine learning”, he says, to maximise the benefit gained by the farmer.

Indeed, some firms are keeping out of the businesses of building and flying drones altogether, concentrating on data services or acting as intermediaries. Altitude Angels, a firm based in Britain, offers information services to the country's 1,000-plus registered civil-drone pilots, on such things as regulations, terrain, and the locations of hazards, both fixed (cranes, say) or mobile (other aircraft).

The firm's aim is to help customers to make their drone use safer by acting as a sort of air-traffic control, allowing the aircraft to keep updating their trajectories as they fly. But it is also seeking other buyers for the masses of data it collects, such as insurers, who as yet have little idea how to judge the risks of drone use, and thus how to price cover.

How fast the industry will grow depends on how fast regulators keep up with it. Britain is unusually permissive, but most European Union countries allow some public, commercial flying of drones. A problem is that national differences—on maximum weights, certificates for operators and so on—risk fragmenting what could be a single, EU-wide market. So, European firms are also looking farther afield. Delair-Tech's Mr Benharrosh calls France “a wonderful experiment field”, but says scaling up requires bigger markets, and raising capital in America. Already three-quarters of his firm's turnover is from outside Europe, and it is opening offices in Mexico, Congo, China and America. ■

Cosmetics

A shake-up in make-up

MILAN

Kiko is applying fast-fashion principles to the cosmetics business

COPYING can be a form of innovation when a company pinches ideas from a different industry and applies them to its own. This is what Kiko, a Milanese cosmetics company, is doing. It is adopting the principles already used to great success by “fast-fashion” clothing chains such as Zara and H&M: constantly changing the line-up of products in its stores to encourage customers to visit frequently; responding rap-

idly to the latest consumer trends; and keeping prices low. Its success is encouraging some of the industry's bigger brands to rethink their distribution model.

Worldwide, the cosmetics market (including cleansers and skin creams as well as make-up) grew by 3.6% to €181 billion (\$240 billion) in 2014; it is expected to double over the next 10-15 years, according to EY, a consulting firm. Thus far, the industry ►►

▶ has essentially been divided in two. More expensive brands tend to be sold in specialist beauty-store chains or in concessions in department stores, where shoppers can try them and get beauty tips before buying. Cheaper brands are sold in chemists' shops or supermarkets, with little customer service. Kiko's chain of own-label stores offers the best of both worlds: cheap prices plus makeover advice.

Kiko's revenues have risen to €432m since it was founded in 1997 by Percassi, an Italian retail group. According to Kantar Worldpanel, a research firm, French 15-24-year-olds now buy as much from Kiko, in volume terms, as they do from Sephora, a cosmetics multi-brand retailer with revenues said to be around €4.6 billion which is part of LVMH, a luxury-goods giant.

Much of Kiko's success draws on Percassi's experience in fashion retail. Antonio Percassi, the group's boss, who also owns several other brands, a restaurant and a football club, began working with Benetton, an Italian clothing chain, in the 1970s to develop its shops around the world. In 2001 he entered a joint venture with Inditex, the Spanish group which owns Zara, to bring its brands to Italy. This year Percassi partnered with Victoria's Secret, an American underwear firm which has driven sales of lingerie out of department stores and into its smaller shops, to open its first Italian outlets.

Kiko operates all the outlets where its products are sold, which all have the same modern design. This makes it easier to provide a consistent level of service, says Mr Percassi. Being vertically integrated also makes it easier to ensure the shops remain well-stocked. The chain has two distribution centres: one in Bergamo, Italy, for European outlets, and one opened recently in New Jersey for North America.

Kiko's growth seems to be encouraging



An affordable new you

other firms in the cosmetics and beauty business to reconsider their business models. Higher-end brands like Benefit (part of LVMH) and L'Occitane (which is mostly in the skincare end of the business) are putting more emphasis on their own outlets and less on selling through other retailers. Nocibé, a big French retailer, last year began testing stores that stock mainly its own cosmetics brand, which it developed two years earlier. L'Oréal, the world's largest cosmetics group, is opening "derma-centres", outlets which sell its skincare brands, such as Vichy and La Roche Posay. It is also developing the retail network of Nyx, a Los Angeles-based cosmetics firm

with annual sales of \$200m, which it bought last year.

So far most customers of Kiko, as at other cosmetics firms, are women. But men who moisturise are becoming less rare, and in South Korea there is a brisk trade in masculine make-up (see box). Kiko's parent company has taken a cautious step towards this market, opening a chain called Womo (as in *uomo*, "man" in Italian), which sells men's clothes and toiletries. As male grooming continues to evolve into male preening, it would be no problem for these stores to slip in a few discreet lines of cosmetics, to spare men's blushes as they try their first dab of blusher. ■

Male grooming in South Korea

The east is rouge

SEOUL

How local cosmetics brands are getting under men's skin

IT HAS become the "essential item for every man's bag", says Kim Jin-ho, who runs IOPE, a high-end skincare line owned by AmorePacific, South Korea's biggest cosmetics firm. Its male "Air Cushion" compact, launched last year, encloses a sponge steeped in tinted moisturiser and sunscreen, patted onto the face with a puff to cover blemishes and oiliness. IOPE is selling over 100,000 of the compacts a year—almost three times as many as it sells of its regular sunscreen products for men.

According to one survey, South Korean men use 13 grooming products on average a month, almost half the number that their female peers use (South Korean women follow multi-step skincare routines, involving cleansers, essences and ampoules). Almost all big South Korean brands have men's lines. The country's male skincare market doubled in value from 2009 to 2014, according to Euromonitor, a research firm. Its men are the leading consumers of male cosmetics per capita (and buy four times more than the next-vainest, the Danes), making up one-fifth of worldwide sales.

On the face of it, such preening is at odds with South Korea's macho, socially conservative culture. Yet it is during their two-year military service that many men first dabble in make-up: girlfriends offer them camouflage face-paint kits, and moisturisers for the country's dry winters and sizzling summers.

Innisfree, a high-street brand also owned by AmorePacific, has launched a range of Extreme Power Military Masks, facial sheets soaked with a gel that relieves skin, to be used "After field work" (soothing) or "Before going on leave" (whitening, long a popular beauty trend with women). Innisfree hands out sam-

ples of its male products at baseball games. The Face Shop, a cosmetics brand owned by LG Healthcare, advertises its "Neo Classic Homme" line in the *Guk-bang Ilbo*, a defence daily.

Yet many men still hesitate to go beyond moisturising. Few feel comfortable perusing shelves in department stores (and few sales assistants know how best to apply foundation to a stubbled face). Olive Young, a health and beauty retailer, has set up male product zones in-store. IOPE says it has focused on how to market its men's products to sisters and wives, but is now beefing up its online store too. On "Every Man Is", a forum showcasing LG Healthcare's lines, men exchange tips. One asks: are you supposed to switch your make-up according to the seasons?

Most beauty firms also push their products through metrosexual brand ambassadors, celebrities from the world of K-pop or Korean television dramas. In the modish streets around Hongik University in Seoul, your correspondent glimpsed one male student looking fabulous in black eyeliner, eyebrow mascara and silver eyeshadow. But Wondin, a 16-year-old who gives male make-up tutorials on YouTube, says few South Korean men want to mimic the stars. He says they "just like to primp": a polished look is seen as a prerequisite for success in work.

Wondin's most popular tutorial is a six-minute clip on applying daily make-up. He is focusing on eyebrow tips at the moment because current male hairstyles reveal the forehead. In particular, he advises opting for a transparent brow mascara, which is more natural and easier to apply than a pencil. Male readers, you're very welcome.

Schumpeter | Reluctant heirs

Getting children to take over the family business can be hard



FAMILY firms are fashionable. Management thinkers like them because they are reckoned to take a longer-term view than other firms. Politicians like them because they provide lots of relatively secure jobs. And the public like them because they think such firms are more in touch with local communities than ones owned by anonymous shareholders.

This chorus of praise has some notable absentees, however: the next-generation family members who are supposed to inherit these businesses. Whenever the heads of family businesses gather, they complain about the difficulty of getting their children to take over from them. A recent survey by Peking University found that 80% of potential Chinese heirs were reluctant to follow in their fathers' footsteps.

There are some good reasons for the younger generation to be hesitant. A successful patriarch or matriarch can be a hard act to follow—and may be a bothersome back-seat driver long after relinquishing the steering-wheel. Even an heir who lifts the business to new heights may still suffer sniping that he got where he is simply by belonging to the “lucky sperm club”, as Warren Buffett calls it. In other cases the heirs may genuinely not be right for the job: they may be more extensively and expensively educated than their parents, but lack the managerial skills to command a big organisation. Joachim Schwass of IMD, a Swiss business school, argues that the most common characteristic of failed successions is that the family marks out the eldest son for the top job from an early age, and hands it to him regardless of ability.

The list of companies that have ended up being sold, or handed over to professional managers, for want of a suitable family member willing or able to take over, include two of the world's biggest hotel chains, Hilton and Marriott; and one of its biggest toymakers, Lego. To avoid this fate, and increase the chances of producing a strong successor, business families need to grasp two things. The first is that inheritance is a process, not an event. That process involves giving potential heirs a chance to prove their worth. Bernard Arnault, the boss of LVMH, and Rupert Murdoch, the boss of News Corp, have both given their children bits of their empires to run. Samsung created the role of “chief customer officer” for Jay Lee, the son of its boss, Lee Kun-hee, to give him experience in handling all-important partnerships with other tech

firms, such as Apple. Another Lee family, which owns Lee Kum Kee, a Hong Kong-based maker of sauces, have created a “family learning and development centre” to prepare the next generation to take over.

Another way to ensure that heirs are ready for the jobs they inherit is to make them prove themselves outside the family firm. This can broaden their experience, boost their self-confidence and prove to doubters that they are more than just daddy's pet. George Stalk of the Boston Consulting Group says he knows of one company that refuses to interview members of its founding family unless they have earned a master's degree in business or engineering and have won two promotions within five years while working for a non-family firm. In the meantime a firm could hire a CEO from outside the family but still keep open the option of some day going back to having a family member run the show—as seems possible, for example, at Pictet, a Swiss bank. An alternative is to have a non-family CEO and give the chosen heir the job of chairman. This is Mr Buffett's plan for Berkshire Hathaway when he eventually retires.

The second thing that business founders must grasp is that behind a successful family firm lies a successful family. A striking proportion of businesses spring from minorities which have had to rely on strong and cohesive families to survive in a sometimes unfriendly climate: the Jews in Europe; the Parsis in India; the Chinese in South-East Asia. Successful business dynasties work hard at reinforcing family ties. They hold regular gatherings; and they prepare for disagreements by creating family constitutions, including such things as guidelines on when and how family members may be hired by the firm. Business families need to persuade the younger generation that taking over the company is an opportunity, not a burden. Mr Schwass notes that successful families tend to have “informal curriculums” which are designed to teach younger members not just about how the family firm works but about why it matters.

Sticky batons

No amount of sugar-coating will work unless the retirement problem is solved. A striking number of patriarchs suffer from “sticky-baton syndrome”. Melvin Gordon, boss of Tootsie Roll, an American confectioner, died in office in January, aged 95. Serge Dassault, boss of Dassault Group, a French conglomerate, is 90. Viacom, a media conglomerate, is floundering in part because Sumner Redstone, aged 92 and in poor health, has resisted handing over to his daughter, Shari. Christophe Bernard of KPMG, a consulting firm, says families need to devote as much thought to getting the former boss to move on as they do to training his successor. One “golden rule”, he says, is to give the retiring patriarch something big to fill his days, such as running a family charity.

There are signs that business families are getting better at all this. More of them are drawing up formal family constitutions. More of them are seeking outside advice on managing a generational transition. There is now quite an industry of providing family firms' heirs with training and networking opportunities. IMD has a course that mixes members of European family dynasties with Chinese princelings. Loyola University in Chicago has a Next Generation Leadership Institute. Family capitalists like to proclaim that “A family business is not a business you inherit from your parents, it is a business you borrow from your children”. But making a reality of this charming adage requires hard work, careful planning and a willingness to let go. ■



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Emerging-market banks

Stressful times

The problems of banks in the developing world are more chronic than acute

IN FINANCE, things that grow very fast have an irksome tendency to blow up. American subprime mortgages prior to 2008, southern European sovereign debt in the run-up to 2010 and Japanese banks in the 1980s are but recent examples. So it is worrying that bank lending in emerging markets has ballooned in recent years, from about 77% of GDP in 2007 to 128% at the beginning of this year, according to JPMorgan Chase, a rich-world bank (see chart). That 51-percentage-point jump dwarfs the mere 20-point rise in credit in the rich world in 2002-07.

Now that the economic prospects of emerging markets have dimmed, banks from Shanghai to São Paulo are in the spotlight. Trouble in such places would once barely have registered in global financial circles. In 1990 only three of the world's 100 biggest lenders by assets were in developing countries. Now the world's four biggest banks are in China, and the fifth-biggest, HSBC, does much of its business from Hong Kong. More than a third of the world's biggest banks have their headquarters in emerging markets, and plenty of rich-country firms (such as Standard Chartered, based in London, or BBVA, a Spanish bank) operate there.

Banks that have expanded at such a rapid clip in the past have typically issued

more than a few dud loans along the way, and stretched their balance-sheets beyond comfort. Happily, regulators have learned the lessons of past crises in most emerging markets, so systemic turmoil is unlikely. It is the banks' ability to finance a return to rapid economic growth that is in doubt.

The Institute of International Finance, a trade group, predicts that 2015 will be the first year of net capital outflows from emerging markets since 1988. The good news is that emerging-market banks have little trouble funding themselves. Many

emerging economies, especially in Asia, have high savings rates. That leaves most lenders with more deposits than loans, even though loans have been growing faster of late. Rich-country banks, in contrast, have to make up for a shortage of deposits by tapping fickle wholesale markets, leaving them more vulnerable to sudden changes in sentiment.

If liquidity is not an issue, solvency may be. Banks in emerging markets tend to be profitable: the listed ones generated net income of \$563 billion last year, up from \$94 billion a decade ago. Unlike their Western peers, few have investment-banking arms, which have attracted profit-sapping regulation and fines from watchdogs.

But profits can also be wiped out by dud loans, which must eventually be written off. Though lending to consumers is growing, emerging-market banks lend mainly to companies. Unfortunately, troubled industries such as property (a Chinese speciality), infrastructure development (India) and commodities (Brazil, Chile and Nigeria, among others) feature prominently in loan books. In India non-accounting or restructured loans now account for more than 14% of the assets of public banks, which control three-quarters of the market. In China they are low but growing fast.

Currency mismatches are another concern. The prospect of higher interest rates in America, plus declining commodity prices tied to a slowdown in the Chinese economy, has pushed most emerging-market currencies down relative to the dollar. Collectively, they have fallen by around 30% against the greenback since early 2013.

That can affect banks directly, if they have borrowed dollars to finance loans in local currencies—a trick that is very profit- ▶▶

Borrowing binge

Bank lending* as % of GDP



Sources: Thomson Reuters; Haver Analytics

*To individuals, firms, some public entities

able when currencies are steady. Regulators in Asia, whose banks were caught in this trap in 1997, now monitor banks' exposure to currency movements. But their counterparts in Nigeria and Turkey, in particular, have not been so exacting.

Even if banks have avoided currency mismatches, their customers are not always so prudent. Low interest rates in America have sent some developing countries on a dollar-denominated borrowing spree: external corporate debt in emerging markets amounts to \$1.3 trillion, according to the Bank for International Settlements. Dollar-denominated loans make up 25% of

corporate lending in Russia, perhaps 30% in Turkey and probably even more in Nigeria (the data are fuzzy). Firms will struggle to repay those dollars with devalued roubles or naira. Commodity producers would normally be immune to this problem, since their income is in dollars, but the plunge in commodity prices has ensnared them, too.

Inflation, which has been stoked by devaluations in several emerging markets, will also cause problems. Rising prices sap consumers' purchasing power and prompt rises in interest rates (they are in double digits in Brazil and Russia). That can make it

hard for borrowers to service their debts. The share of household income going to debt service seems to be rising in Brazil, China and Turkey, among other places.

There is little sign yet that bad debts will reach catastrophic levels. But unless banks face up to them, their long-term consequences could nonetheless be grim. Lenders often try to sweep their problems under the carpet. One common strategy is to "extend and pretend"—giving companies with little prospect of paying back a loan years of forbearance. This ties up scarce capital in zombie firms, which can lead to years or even decades—in the case of Ja- ▶▶

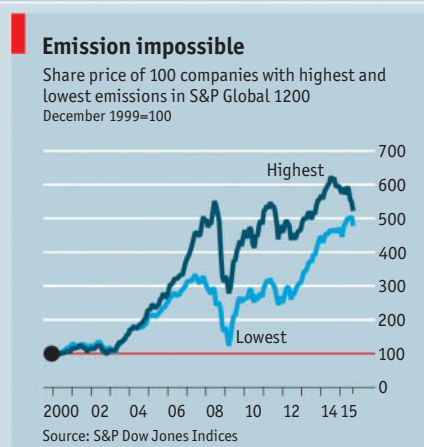
Buttonwood | Weatherproof

The risks mean investors have to take climate change seriously

FEW people place great store in the ability of negotiators to reach a meaningful deal during the conference on climate change that began in Paris this week. One problem is that some politicians refuse to admit the problem is real. But those who work in the financial markets have to take the issue seriously: ever since being hit by losses from Hurricane Andrew in 1992, insurance companies have been modelling climate risks. Bank of America Merrill Lynch (BAML) just weighed in with a 332-page report on their economic and financial impact.

A changing climate, and the eventual efforts of governments (however reluctant) to deal with it, could have a big impact on investors' returns. Companies that produce or use large amounts of fossil fuels will face higher taxes and regulatory burdens. Some energy producers may find it impossible to exploit their known reserves, and be left with "stranded assets"—deposits of oil and coal that have to be left in the ground. Other industries could be affected by the economic damage caused by more extreme weather—storms, floods, heatwaves and droughts. "Investors have to worry about a material and unexpected loss of capital," says Ewen Cameron Watt, chief investment strategist at BlackRock, a fund-management group.

Moody's, a rating agency, has tried to quantify the impact for bond markets. It puts three industries (deregulated power generation, coal mining and coal terminals) at "immediate and elevated" risk from climate change; between them, these sectors have \$512 billion in rated debt. Another eight sectors (including carmakers, miners and oil refiners), with \$1.5 trillion of rated debt, have "emerging, elevated" risk. A further 18, with \$7 trillion of debt, face risks over the medium term, de-



finned as more than five years ahead. That leaves the vast majority of the corporate-bond market, encompassing \$59 trillion of rated debt, in the low-risk category.

Broadly speaking, investors who are concerned about the issue follow three approaches. The first is an outright boycott of the dirtiest industries. The latest example is Allianz, a German insurance group, which said it would no longer invest in companies that "derive more than 30% of revenue from coal mining or generate over 30% of their energy from coal." The result will be a divestment of €225m (\$238m) in the shares of coal groups; Allianz will continue to hold its €3.9 billion of bonds in such companies, but not buy any more. More than 400 investment institutions have made similar commitments, according to 350.org, a green lobby group.

The second approach is to maintain stakes in carbon-producing firms but to try to engage with their management in an attempt to change their behaviour. Research by BlackRock shows that companies that have reduced their carbon intensity (defined as emissions divided by sales) have

outperformed the market since March 2012, when proper data on corporate emissions first began to be collected.

A third approach is to skew portfolios towards the companies that will do well out of attempts to curb carbon emissions. Some low-energy technologies have already had success. Light-emitting diode (LED) bulbs consume less than 15% of the energy of incandescent bulbs. They had just 1% of the lighting market in 2010. This year their market share is 28%; Goldman Sachs forecasts it will be 95% by 2025. Then there is renewable energy. So far, it generates only a small proportion of global power. But BAML says that, globally, wind and solar power made up nearly half of the additional energy-generating capacity installed in 2014 and may comprise 70-80% of new capacity between now and 2030.

There is little evidence that following these strategies has had a big positive impact on returns so far. Standard & Poor's has identified the 100 highest and lowest emitters in its index of 1,200 global stocks. As the chart shows, the highest emitters have done marginally better since 1999. That reflects the strong performance of energy companies during the period of rising commodity prices; in recent years, as the oil price has dropped, the low emitters have caught up. But falling energy prices have also hit the shares of renewable energy producers, many of which need high power prices to be competitive: over the past five years, S&P's Global Clean Energy Index has suffered an annual return of -9%.

Picking the right strategy will not be easy, therefore. But all investments have their pitfalls. Ignoring the climate issue altogether looks like the biggest risk of all.

▶ pan—of subpar growth.

There are signs that emerging-market banks are hiding losses in this way. Chinese ones, for example, put non-performing-loans at just 1.6% of assets, less than half the global average. Investors plainly don't believe them: their share prices imply dud loans of more than 8%, according to Barclays. By the same token, international banks that do business across emerging markets often disclose far higher levels of distressed loans than local banks.

Emerging-market banks are no longer the undersized tiddlers of global finance. The way they are run matters more than ever. Their balance-sheets are healthy enough to weather the aftermath of the credit bender they initiated. But whether they bounce back or limp along depends on how quickly they admit their failings. ■

The yuan joins the SDR

Maiden voyage

Reserve-currency status might make for a weaker yuan

PASSING through the Suez Canal became easier earlier this year, thanks to an expansion completed in August. Now it is about to become a little bit more complicated. Transit fees for the canal are denominated in Special Drawing Rights, a basket of currencies used by the International Monetary Fund (IMF) as its unit of account. This week the IMF decided to include the yuan in the basket from next year, joining the dollar, the euro, the pound and the yen.

If lots of things were priced in SDRs, the IMF's decision would have forced companies around the world to buy yuan-denominated assets as soon as possible, to hedge their exposure. That would have

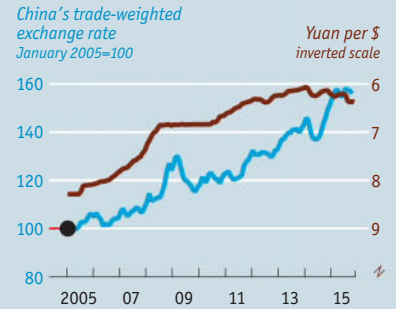
prompted China's currency to strengthen dramatically. But few goods or services are priced in SDRs. Instead, admission to the currency club is significant mainly for its symbolism: the IMF is lending its imprimatur to the yuan as a reserve currency—a safe, liquid asset in which governments can park their wealth. Indeed, far from setting off a groundswell of demand for the yuan, the IMF's decision may pave the way for its depreciation.

The reason is that the People's Bank of China (PBOC) will now find itself under more pressure to manage the yuan as central banks in most rich economies do their currencies—by letting market forces determine their value. In bringing the yuan into the SDR, the IMF had to determine that it is “freely usable”. Before coming to this decision, the IMF asked China to make changes to its currency regime.

Most importantly, China has now tied the yuan's exchange rate at the start of daily trading to the previous day's close; in the past the starting quote was in effect set at the whim of the PBOC, often creating a big gap with the value at which it last traded. It was the elimination of this gap that lay behind the yuan's 2% devaluation in August, a move that rattled global markets. Though the yuan is still far from being a free-floating currency—the central bank has intervened since August to prop it up—the cost of such intervention is now higher. The PBOC must spend real money during the trading day to guide the yuan to its desired level.

Inclusion in the SDR will only deepen the expectations that China will let market forces decide the yuan's exchange rate. The point of the SDR is to weave disparate currencies together into a single, diversified unit; some have suggested, for example, that commodities be quoted in SDRs to reduce the volatility of pricing them in dollars. But if China maintains its de facto peg to the dollar, the result of adding the yuan to the SDR will be to boost the dollar's

Strong and stronger



Sources: Thomson Reuters; Bank for International Settlements

weight in the basket, defeating the point.

What would happen if China really did give the market the last word on the yuan? For some time it has been under downward pressure. The simplest yardstick is the decline in China's foreign-exchange reserves, from a peak of nearly \$4 trillion last year to just over \$3.5 trillion now—a reflection, in part, of the PBOC's selling of dollars to support the yuan. Were it not for tighter capital controls since the summer, outflows might have been even bigger.

And the yuan does look overvalued. Despite China's slowing economy, its continued link to the surging dollar has put it near an all-time high in trade-weighted terms, up by more than 13% in the past 18 months (see chart). With the Federal Reserve gearing up to start raising interest rates at the same time as China is loosening its monetary policy, the yuan looks likely to come under more downward pressure, at least against the dollar.

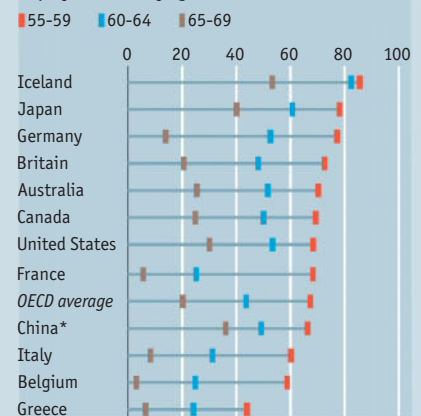
It would be foolhardy to predict that China will suddenly give the market free rein. That would go against its deep-seated preference for gradual reform. But while basking in the glow of its SDR status, China must also be aware of the responsibility to minimise intervention that comes with it. A weaker yuan may well be the result. ■

Making pensions sustainable

The state-pension age is no longer set in stone at 65 (or lower). Already 66 in America, it will rise to 67 by 2027. By the end of the 2020s it will also reach 67 in Britain and Germany. But the age at which workers can get full pension benefits and the age at which they retire are not necessarily the same. The effective retirement age is often much younger than the official one. Some older workers are unemployed; others receive disability benefits, private pensions or reduced state pensions under early retirement schemes. Though some money can be saved by raising the pensionable age, public finances will benefit much more if older people stay in work longer, boosting GDP and taxes. Improving health and promoting more flexible ways to work can help make this happen.

Current employment rates among those in their late 60s are typically very low, at 20% on average among the 34 members of the OECD. In many countries simply ensuring that people work until 65 will be an achievement in itself. Although the employment rate of 55-64-year-olds has generally risen in the past decade (Greece and Portugal are exceptions), the rate for 60-64-year-olds still averages just 43%. Some of the lowest employment rates for people in their early 60s are in the euro area, not just among southern members, such as Greece and Italy, but also in northern countries such as Belgium and France.

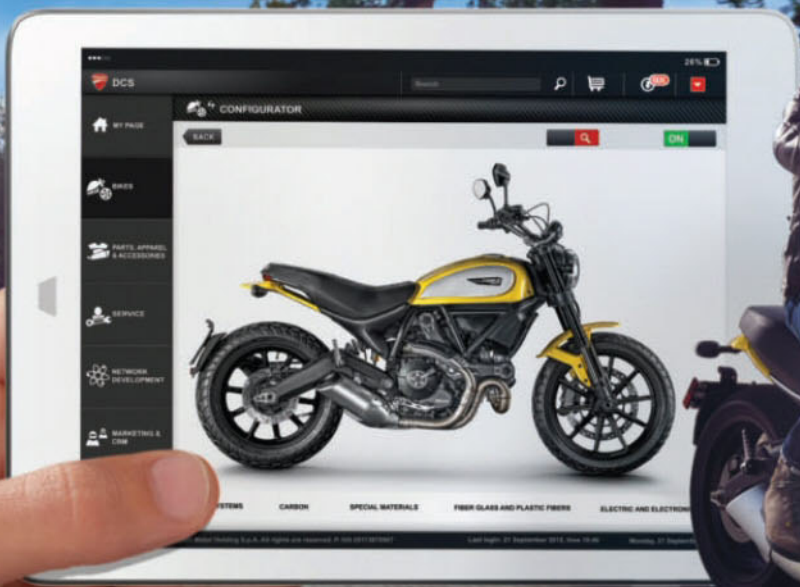
Employment rate by age, 2014 or latest, %



Source: OECD

*Non-OECD country

Our mobile expertise let Ducati riders order their perfect bike. And go from daydream to reality faster than ever.



Ducati's legendary motorcycles deserve an equally legendary customer experience. So in just six months, we helped design and implement a new operating model and mobile dealer system. Now dealers around the world can place and track orders, from production to delivery. And customers can order their dream bikes through a highly interactive experience. With dealer satisfaction up 25% and a 7% increase in sales, Ducati is now operating in top gear. That's high performance, delivered.

High performance. Delivered.





THE NEW YORKER

Where things get interesting.

American health insurers
Fit as fiddles

NEW YORK

Regulation may hurt other financial firms, but health insurers thrive on it

THE past few years have been tumultuous for American health insurers. Barack Obama's landmark health-care reform spawned a bevy of co-operatives to compete with them, among other measures intended to cut the cost of insurance. More than half of these have already gone bust—most recently Health Republic of New York. It had received \$265m in federal loans but closed on December 1st, leaving

200,000 people in search of a new insurer. That is partly because the exchanges on which co-operatives and private insurers alike were supposed to sell lots of new policies have proved a disappointment: last month UnitedHealthcare, America's biggest health insurer, announced that it may stop selling policies on them.

Meanwhile, presidential candidates are demanding tougher government scrutiny of pending industry mergers. The public is hostile too: a survey published in August by the Kaiser Family Foundation, a think-tank, found health insurers were even more disliked than other corporate punch-bags, such as banks and airlines.

Yet the share prices of America's five biggest health insurers—UnitedHealthcare, Aetna, Humana, Cigna and Anthem—have all roughly tripled over the past five years.

The big insurers have been consistently and highly profitable (see chart). Unlike most big American firms, the trend is still upward. All five will probably report record profits for this year, next year and several more to come, predicts Ana Gupte, an analyst with Leerink, a research firm. For that, they owe a debt of gratitude to an unlikely creditor. The results of most financial firms may have buckled under the weight of new regulation, but health insurers appear to be thriving in the complicated new regulatory environment.

When firms like Cigna and Aetna sold off other insurance businesses in the 1990s to concentrate on health care, it seemed that the dynamic businesses were being divested, leaving lumbering rumps. But in America, at least, health care turns out to be the most exciting corner of the industry. The vast expense and unintelligible complexity of American health care may be a national disgrace, but they are a huge opportunity for firms that can navigate the system and minimise costs.

Take Medicaid (government health care for the poor), which is run by the states. One by one they are coming to the conclusion that it is simpler to hand the whole sorry business to private contractors. In the past year Texas and Florida have done so; Michigan and Iowa will follow suit in 2016.

Medicare (government health care for the elderly) is an even bigger opportunity. The number of recipients is rising as baby-boomers reach the age of eligibility (65). In 2006 one in six received their coverage via a scheme called Medicare Advantage, which is farmed out to private firms. That number, says Ms Gupte, is now probably one in three, and may soon be one in two.

Consolidation has also boosted profits, and looks likely to go further still. Aetna wants to buy Humana and Anthem, Cigna (Cigna's shareholders were due to vote on the merger as *The Economist* went to press); both deals are under review by competition authorities. Shares of both targets are trading at roughly 25% below their agreed purchase prices, suggesting that investors doubt that the deals will be approved. Even if the giants do not merge with each other

Facebook and philanthropy

I'll give it my way

SAN FRANCISCO

Mark Zuckerberg finds another way to share

MANY people take to social media to share news of big events. On December 1st Facebook's boss, Mark Zuckerberg, followed in the tradition he helped create, when he and his wife, Priscilla Chan, announced the birth of their daughter on the social-networking site, along with news that they will give away the majority of their fortune during their lifetimes. Around 99% of the shares they own in Facebook, which today are worth around \$45 billion, will go into the Chan Zuckerberg Initiative (CZI). Their aim, they wrote, is to improve the world for their daughter and future generations.

For now, the move allows Mr Zuckerberg to relinquish wealth, but not control,

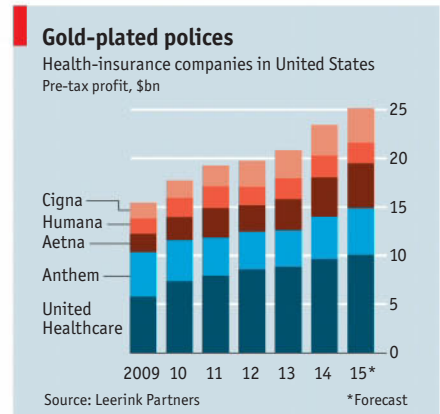
as he will retain the votes associated with any shares transferred to CZI. He anticipates remaining the controlling stakeholder of Facebook "for the foreseeable future", and plans to sell, or give away, no more than \$1 billion of Facebook stock each year for the next three years.

Mr Zuckerberg is far from the first tech titan to pledge billions to philanthropic activities, but he is following a slightly different path to Bill Gates, Microsoft's founder. Whereas the Bill and Melinda Gates Foundation is a registered charity, the Zuckerbergs' CZI will be a limited liability company (LLC). Although charitable status comes with alluring tax breaks, strings are attached. Unlike charities, LLCs can lobby without restriction; the Zuckerbergs have said that CZI will get involved in policy debates.

The other flexibility LLC status allows is the freedom to invest in for-profit ventures that have a big social impact. In this, the Zuckerbergs are following in the footsteps of Pierre Omidyar, founder of eBay, an online marketplace, who grew frustrated by the constraints of charitable status. Mr Omidyar now oversees the Omidyar Network, which has for-profit and non-profit arms. Will Fitzpatrick, designer of this hybrid structure, claims that the for-profit arm can more easily invest in things that can be scaled up quickly. He gives the example of an investment in a solar lantern that cost less than \$10 a unit, which meant people did not have to burn dangerous kerosene, and which he says would have been technically difficult to achieve through a private foundation.



Like!



▶ other, there are still many small health insurers for them to scoop up. Size may not result in better service for users, but it does provide negotiating leverage with the likes of hospitals, which are themselves bulking up through mergers, and a way to spread the cost of IT systems and lobbying.

Smaller rivals can try to fight back. The consulting arms of Mercer and Aon are creating networks to bundle offerings from smaller firms, allowing them to compete with the giants when offering corporate health-care schemes. Hospitals have begun to form their own insurance networks. But these efforts have not had much impact. As the experience of the co-operatives shows, the barriers to entry in the business are huge, even for outfits regulators intend to foster.

Scale is an advantage in most areas of finance, but regulators increasingly see it as risky, and so are discouraging further consolidation among banks, in particular. Health insurance is different: claims and costs rarely swing much during the life of a contract. What is more, many corporate customers retain the risk themselves, using the health insurer mainly to administer their schemes. That makes health insurers safer still, observes Gary Claxton of Kaiser. Instead, the risks of scale are that competition, and thus the customer, suffer. ■

Gulf currencies

Keeping it riyal

Despite jitters, the oil-rich countries of the Gulf are unlikely to devalue

MOST observers expect OPEC to leave production unchanged at its meeting on December 4th. If it does, there will be no end in sight for low oil prices. Saudi Arabia's strategy of opening the taps to put producers with higher costs out of business is proving painful. Prices are about half what they were a year ago. In 2013 the Gulf countries had a huge combined current-account surplus of 21.6% of GDP. But the IMF expects this to shrink to a deficit of 2.5% of GDP next year, thanks to the plunge in the value of their main export.

In October alone, Saudi Arabia's central bank spent \$7 billion of foreign reserves financing the kingdom's deficit. If it ran short, it would have no choice but to abandon the riyal's long-standing peg to the dollar. Sure enough, jitters about the peg are discernible in the futures market. On November 24th the price of buying a riyal in a year's time fell to its lowest level since 2002. Futures for other Gulf currencies have also sagged.

There is little reason for Gulf countries



A currency you can count on

to devalue if they can avoid it. Their main export is priced in dollars, so a devaluation would do little to boost competitiveness. De-pegging would lead to uncertainty about the exchange rate, which might discourage the diversification away from oil that Gulf governments are so desperate to foster. Moreover, other than Kuwait, which pegs the dinar to a basket of currencies, all of the Gulf countries have had the same fixed exchange-rate regime since at least 2003. It is not clear that they have the bureaucratic capacity to switch to a managed peg or a basket of currencies.

Happily, the jitters in the futures market notwithstanding, there is little chance of a wave of devaluations. The most comfortable are the United Arab Emirates and Kuwait, which will still be running current-account surpluses next year, of \$11 billion (3.1% of GDP) and \$8.9 billion (7% of GDP) respectively, according to the IMF. Things are looking a bit more dicey for the Saudi government. But it still has reserves of \$644 billion, or roughly 102% of GDP, compared with a current-account deficit of 3.5%.

Other currencies look more precarious. For Oman and Bahrain oil prices would need to be \$90 and \$77 a barrel respectively for their imports to equal their exports. At \$50 a barrel, the IMF forecasts that Bahrain will run a current-account deficit of 5.9% of GDP next year; Oman's deficit will be a staggering 24% of GDP. The pair also have the region's smallest reserves. Bahrain's will only cover its current-account deficit for three years; Oman's, for less than a year. Yet even if Saudi Arabia is harming its neighbours' finances by pumping oil with abandon, it can always help them in other ways. Its fellow Gulf monarchies can probably borrow from it if need be, if only because the failure of one peg would invite speculation against the others. ■

Banking and fintech

Love and war

An unlikely romance blossoms

STARTUPS in the world of financial technology, or "fintech", think of banks as hulking mediocrities ripe for disruption. Banks in turn look down on fintech outfits as little more than gadflies swarming over chicken feed. As any fan of romantic comedies would know, such apparent incompatibility is often the precursor to a close relationship. On December 1st JPMorgan Chase (JPM), America's biggest bank, announced it would make small-business loans through OnDeck Capital, a "marketplace lender" of the sort that usually claims to be on the verge of putting financial-services behemoths out of business.

The deal may seem odd at first: after all, banks like JPM have customers wanting to borrow and the money to lend to them. The catch is that their desire to make smallish loans—the pilot will focus on credits of \$250,000 or less—is limited by the cost and hassle of originating them. It is "the kind of stuff we don't want to do or can't do," said Jamie Dimon, JPM's boss.

OnDeck, whose share price spiked on the news, is one of hundreds of lending platforms active in America. Most of them started life by matching individuals or firms needing money with those with too much of it, dubbing themselves "peer-to-peer" lenders. But the relatively high returns on offer attracted banks and other financial institutions, which began to buy up the platforms' loans. For instance, plenty of American community banks, which garner lots of deposits but have few opportunities to lend beyond their immediate local area, have piled in.

This flirtation has since evolved into a full-on fling. British banks like RBS and Santander UK have been trying to shrink their balance-sheets, but denying loans to small businesses is a public-relations no-no. So they have been directing them to the startups instead. The latest phase of the courtship is even more intense. JPM is farming out credit assessment to the upstart, on lending that will be done in its own name. BBVA, another big bank, has a similar relationship with OnDeck.

Goldman Sachs, a Wall Street rival to JPM, is building its own marketplace platform focused on consumer credit. Meanwhile, the share prices of big marketplace lenders such as Lending Club are in the doldrums. That hints at the inevitable happy ending, when a bank plucks up the courage to buy a marketplace lender. It all spells wedding bells.

Free exchange | The best is the enemy of the green

To get politicians to put a price on carbon, economists will have to accept some inefficiency



ECONOMISTS have long championed a price on carbon as the ideal way to limit the greenhouse-gas emissions that cause global warming. So has this newspaper: it first embraced the idea in 1989. Yet the bitter truth is that the world is nowhere near the sort of carbon-pricing regime that would keep greenhouse gases at tolerable levels. The negotiations under way in Paris this week will not yield one. Economists are used to being ignored, yet the contrast between academics' enthusiasm for a carbon price and the rest of the world's disinterest is striking.

Carbon prices tackle the problem of emissions head on. When people engage in a carbon-intensive activity, such as driving a car, they impose a cost on others, often without even realising it: the emissions produced when petrol is burned contribute to global warming. Because that cost is not built into the price of petrol, people buy more of it than they otherwise would, atmospheric carbon goes up, and the world bakes. A carbon price that added the missing cost to the price of petrol (and coal and every other carbon-generating activity) would give people an incentive to emit less. To impose a price, a government can choose one directly, and apply it in the form of a tax. Or it can decide the level of emissions it is prepared to tolerate and issue a corresponding amount of tradable permits to pollute. In that case, the cost of permits on the open market determines the price.

Such schemes work when designed well. In the 1990s America used emissions trading to reduce the amount of sulphur dioxide produced by coal-fired power plants. Between 1990 and 2004 SO₂ emissions dropped by 36% even as electricity generated by the affected plants rose by 25%. In 2008 British Columbia, a province in Canada, implemented a carbon tax close to an economist's ideal. At C\$30 (\$24) a tonne it is high relative to others that have been adopted. Relatively few sources of carbon (only about a quarter) are exempted from the tax. Emissions are down by 5-15% since its adoption. The tax does not seem to have harmed the provincial economy, and is more popular now than at its inception. The new left-leaning government in neighbouring Alberta is preparing to beef up its tax to mimic British Columbia's.

Admittedly, carbon-pricing schemes have often been poorly designed. Europe's Emissions Trading System, introduced in 2005, initially allowed national governments to choose their

own emissions caps. Most opted for a high one to protect domestic industry, leading to the issuance of too many permits and thus to a crash in their value. They are currently hovering just above €8 (\$9) a tonne. Yet the bigger problem is that the vast majority of the world's emissions—nearly 80%, according to the World Bank—remain totally untaxed. Why?

Politics is the biggest obstacle. Opponents of a carbon price decry it as a job killer. Republicans in America are fond of noting that since very few activities involve no emissions, a carbon tax is a "tax on life". Since the cost of a carbon price falls most heavily on producers of dirtier forms of energy, they have a strong motive to lobby against it. The benefits of reducing warming, in contrast, are spread thinly, both geographically and temporally. Governments tend to appease green interests by showering renewable power with goodies rather than by socking it to big oil and electricity companies. Effective carbon-price regimes therefore tend to be limited to places with unusual politics: voters in British Columbia, for instance, are enthusiastic greens. In most of the world, raising the standard of living is a much higher priority.

There are nonetheless some ways to make carbon prices more politically palatable. First, the prospect of a steep carbon price will be less daunting if there are affordable, effective substitutes ready to be swapped in for coal plants and gas guzzlers. That requires innovation, which in turn suggests that more public money should be spent on energy research. Even some free-market types now call for such measures to help overcome the institutional advantages enjoyed by incumbent dirty technologies.

Second, the proceeds from carbon pricing should be used to compensate opponents of the policy. Such payouts reduce the economic efficiency of a carbon price, which would be maximised by using carbon-price revenues to cut other distorting taxes, such as those on income. But they may nonetheless be worth it if not having a carbon price would cause more economic damage—as would almost certainly be the case. Much as America's Department of Labour offsets the costs of free-trade agreements by providing special assistance to workers who lose their jobs when tariffs fall, governments could promise a cut of the carbon-tax revenue to those harmed by its introduction.

Non-barrier tariffs

Finally, it may even be worth considering carbon tariffs, which would be levied on imports according to the emissions involved in producing them, if they come from places which do not tax carbon. In theory, they would help prevent polluting manufacturers abroad from putting greener ones at home out of business. In practice, carbon tariffs would be enormously complicated to administer, and would not prevent all such "leakage" of dirty industry. Yet they might improve the politics of a carbon price all the same. Like carbon-based assistance to displaced workers, a credible promise to impose carbon tariffs would blunt domestic opposition to a carbon price. It should reduce the unfairness of some countries exploiting the conservation efforts of others. And it would give individual exporters to carbon-pricing countries an incentive to become greener, irrespective of whether their own government had adopted a carbon price.

As solutions go, these three can be criticised for lacking elegance and simplicity. But a functioning carbon price in the real world beats the textbook version every time. ■



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Climate diplomacy

Goal difference

PARIS

Limiting global warming to 2°C above pre-industrial levels is more a political target than a scientific one

“RESCUING our planet and our fellow man from impending catastrophe.” That was item one on Prince Charles’s to-do list for delegates attending the UN’s latest climate talks, which began in Paris this week. In his speech, he urged those present to think of their grandchildren, and to remember that they will pave “the road to a saner future”. Such sentiments have been heard many times since the inception of the United Nations Framework Convention on Climate Change (UNFCCC), an environmental treaty, in 1992. More than 190 countries have signed up to it. All agree therein to stabilise greenhouse-gas concentrations in the atmosphere so as to limit “dangerous anthropogenic interference within the climate system”.

Since 2010 they have also had an agreed target: to prevent planetary doom, global mean surface temperature must not rise more than 2°C above that of pre-industrial times. The prince reminded listeners of the fact in his speech.

That figure, 2°C, has become a touchstone. Stay beneath it, the feeling is, and all will be well—or, at least, wellish. Breach it, though, and the horsemen of the apocalypse will be unleashed in all their fury. But breached it almost certainly will be. Even if emissions do not increase from their present level (implausible in itself), enough pollution to bust through the 2°C barrier

will enter the atmosphere within a mere three decades. As the horsemen’s mounts snort, then, it is worth inquiring how so much significance has come to be invested in this particular number.

Into the sausage factory

Otto von Bismarck, the first chancellor of a united Germany, is supposed to have said that laws are like sausages: it is better not to see them being made. That aphorism might apply equally to the 2°C maximum, which is a hybrid of political need and scientific haze.

It was born in the 1970s, in papers written by William Nordhaus, now an economics professor at Yale. Back then, few had heard of the idea of global warming, and fewer cared. Mr Nordhaus, who had the foresight to realise something important might be happening, suggested that a reasonable precaution would be to stop temperatures exceeding their upper bound during the past 100,000 years—the period for which ice-core data are available and for which the correlation between temperatures and other environmental effects can thus be seen reasonably clearly. The cores suggested this upper bound was 2°C above pre-industrial levels.

Mr Nordhaus himself agreed this estimate was “deeply unsatisfactory”. It was based merely on the observation that it did

not push the climate into unknown territory, whose safety could not be assessed. So little was known about the impacts of warming at that stage, he wrote later, that his target was “a substitute” for balancing costs and damages.

Since then things have moved on. Some findings suggest even 2°C is too much. Other people argue that the limit is meaningless because it will surely be breached, and that more effort should go into adapting to a hotter world. Either way, once promulgated, the idea of a 2°C limit has taken on a life of its own. It received attention from European scientists at various workshops during the late 1980s. It was accepted in a report published by the Stockholm Environment Institute in 1990, even though this also found, based on its authors’ understanding of “the vulnerability of ecosystems to historical temperature changes”, that warming above just 1°C could trigger “rapid” and “unpredictable” consequences. Despite that, the report’s authors admitted it was too late to keep within such a limit, settling on 2°C instead. Pragmatic, certainly. But not strictly scientific.

Six years later, a meeting of the European Union’s Council of Ministers, which included Angela Merkel (now Bismarck’s latest successor, but then Germany’s environment minister), endorsed the limit, giving it political credibility. Thence it spread. By 2009 the G8 countries had signed on, and it was mentioned in the Copenhagen Accord—an agreement salvaged from the wreckage of the UNFCCC’s meeting that year. At the following get-together, in Cancun, Mexico, in 2010, a maximum rise of 2°C was established as the goal of international climate policy.

Despite its questionable past, the 2°C limit does have merits. By boiling the vast ▶▶

▶ complexities of the climate system down into a single, comprehensible number it gives politicians something simple to aim at, and against which they can measure the success of their endeavours.

But some worry that it is not simple enough, for taking the world's temperature is not as easy as it sounds. Different parts of the planet warm at different rates, as do different layers of the atmosphere, so all sorts of corrections have to be applied to arrive

at a single number. A truly simple, and arguably better, approach would be to use concentrations of greenhouse gases—the cause of the warming—as putative maxima. These gases mix rapidly into the atmosphere, so are easily sampled in ways that brook little dissent.

Others think the idea of a single-number limit is itself flawed. They would try to create some sort of index out of greenhouse-gas concentrations, measures of

soot (which absorbs heat), sulphate pollution (which reflects it) and the heat content of the oceans. Such arguments, however, rather miss the point. To quote Bismarck again, “politics is not an exact science”. The 2°C limit is certainly not perfect, and will almost certainly be breached. But its existence focuses minds. And, when the disparate interests of 190-odd countries have to be reconciled, a little mind-focusing is, perhaps, not such a bad thing. ■

Carbon capture and storage

On a hot-tin route

A new way to strip carbon from a fossil fuel

THERE is much talk in environmental circles of carbon capture and storage (CCS). This involves gathering up the CO₂ made by burning fossil fuels and stuffing it in underground caverns or bespoke crystalline materials where it cannot abet climate change. Such schemes tend to be complex, costly and risky. But Thomas Wetzel of the Karlsruhe Institute of Technology and his colleagues think they have, in the case of natural gas, found a way to capture the carbon directly from the fuel itself. Stripping carbon this way means it never gets burned, so the technique wastes too much of the energy stored in the gas to be of interest to power stations. But it does offer a method of turning methane, natural gas's main component, into hydrogen, an important industrial chemical and specialised fuel, without releasing any CO₂.

Dr Wetzel's idea is to crack the methane into its constituent elements, hydrogen and carbon, by heating it to the point where its molecules shake themselves

apart. That would permit the hydrogen to be piped away and the carbon, in the form of a black powder, to be collected and disposed of. In principle, cracking methane is easy. In practice, getting its molecules to break up in a controlled manner is not. This is because the liberated carbon clumps itself into particles that coat the surfaces of the reaction vessel. This blocks the heat transfer that keeps the reaction going.

Dr Wetzel therefore turned to an idea first put forward in the late 1990s, but which had fallen into disuse. The carbon-clogging only matters if the reaction vessel is a permanent, solid chamber. If it is a temporary, liquid one, new reaction vessels can be generated constantly. Heat transfer thus ceases to be a problem.

The liquid he and his colleagues chose was molten tin, which reacts with neither hydrogen nor methane nor carbon. The reaction vessels are bubbles filled with methane that rise through this tin. The molten metal provides the heat and, just as would happen within a larger vessel, the carbon is deposited on the bubble's inner surface.

When the bubble pops at the surface of the liquid metal, the hydrogen keeps rising and the particles of carbon float on the liquid. From here they are blown into a collecting vessel by jets of gas. Not only is the carbon thus locked up as a solid which poses no concerns in the atmosphere (see picture), it might even prove useful in its own right. Such “carbon black” is a material of interest to manufacturers of rubber, printer toner and battery electrodes.

Since the existing way of making hydrogen from methane, called steam reformation, turns the carbon in the gas into CO₂, Dr Wetzel's method is much cleaner. How it will stack up economically against steam reformation remains to be seen. But, in a world concerned about CO₂ emissions, it might well prove an elegant alternative.



Unreformed and pollution free

Astronomy

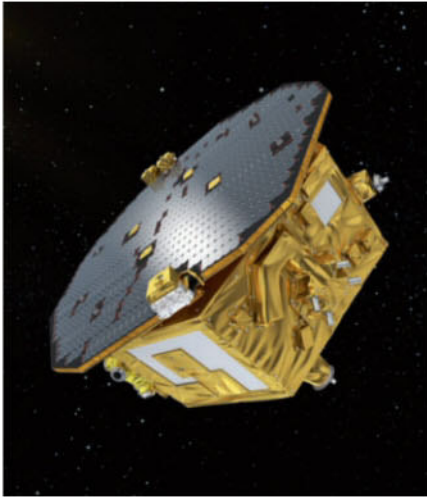
Gravity's rainbow

A novel approach to observing the heavens from orbit

MOST people have heard of *Hubble*, an American space telescope that, besides doing a lot of science, also provides NASA's public-relations department with an endless stream of pictures which show how beautiful the universe is. *Hubble*, however, is merely the best-known of a clutch of telescopes in orbit around Earth. These instruments all look at the cosmos in different ways, but they have one thing in common: their view is restricted to various parts of the electromagnetic spectrum (*Hubble* takes its pictures in and around the visible-light part of the spectrum). This is a fruitful way of looking at things, but it is not the only way. And on December 3rd, as *The Economist* went to press, the pioneer of another approach was scheduled to take off from French Guiana.

LISA Pathfinder (the acronym stands for Laser Interferometer Space Antenna) is intended to demonstrate the technology needed to detect waves of gravity, rather than light, x-rays or gamma rays. Gravitational waves are rippling distortions in space given off when massive bodies are accelerated. They are predicted by Einstein's general theory of relativity, which celebrates its centenary this year. Physicists have compelling indirect evidence that they are real. (The 1993 Nobel prize for physics was awarded for observations of a pair of superdense stars whose orbits around each other are decaying in a way that can be accounted for only if gravitational waves are carrying away some of their momentum.) But researchers have never seen a gravity wave directly.

Since gravity waves stretch and compress space, one way to spot them is to look for temporary changes in the distance between two fixed objects. Some Earth-based experiments, such as LIGO, an American detector, use exquisitely tuned lasers for this purpose, firing beams up a pair of long tunnels arranged at right-an- ▶▶



Looking for wrinkles in space

► gles to each other and sporting mirrors at their far ends. The idea is that passing gravity waves, by distorting the tunnels, will distort the beams' paths and produce a signal. The trouble is that the distortions such instruments are hunting for are tiny. That makes them both hard to see and hard to distinguish from other, more pedestrian effects. LIGO's operators must account for things like passing traffic, logging in distant forests and the constant, almost unnoticeable seismic grumbings of the Earth itself.

LISA Pathfinder takes this idea and moves it into space, where things are much quieter. The craft contains two cubes, made of an alloy of gold and platinum, that float motionless (at least with respect to the rest of the craft) in separate chambers. It also contains a laser system designed to measure the distance between the cubes to an accuracy of a few picometres (much less than the radius of a hydrogen atom). The idea is to isolate the cubes so comprehensively that gravity waves are the only things that can affect their positions relative to each other.

The European Space Agency, whose baby LISA Pathfinder is, therefore describes the cube-containing chambers as "the quietest places in the universe". The craft's body is designed to protect its payload from pressure exerted by sunlight and the solar wind, and is built from non-magnetic materials. The temperature of the interior is carefully controlled. The experiment also has to deal with the effects of cosmic rays—energetic particles that can zip right through the craft's skin—for, unchecked, these would cause a slow build-up of electric charge on the masses, which would cause them to move. Such a build-up can, however, be counteracted by using an ultraviolet light to strip electrons, and therefore electric charge, from the cubes.

Anticlimactically, all this sophisticated equipment will not actually be able to sense gravitational waves itself. As the craft's name suggests, it is indeed a path-

finder, designed to prove that such sensitive technology can work in space. If it does, the way will be clear for the next phase of the project, known as *Evolved LISA*. This is a far bigger experiment. It will employ a trio of spacecraft flying in formation in the shape of an equilateral triangle that has sides 1m kilometres long, with lasers shining between the craft.

Evolved LISA is not, though, scheduled to launch until 2034. This may seem a long time to wait, especially since ground-based experiments such as LIGO are almost certain to beat it to the first detection of a gravitational wave. But Paul McNamara, the project's boss, argues that the wait will be worth it. Ground-based detectors' relatively modest sizes (LIGO's tunnels are a mere 4km long, though the lasers bounce back and forth up to 400 times) means they will be sensitive only to the high-frequency waves caused by smallish objects such as modest black holes or pairs of sun-sized stars. *Evolved LISA*'s enormous dimensions will permit it to look at the lower-frequency waves given off by larger beasts, like the colossal black holes found in the centres of most galaxies. In this regard, says Dr McNamara, gravity-wave astronomy is rather like the traditional electromagnetic sort—you need different telescopes if you want to peer into different parts of the spectrum. ■

Microbes and thermoregulation

Cold-weather friends

Body temperature seems, in part, to be controlled by gut bacteria

WINTER is coming, in the northern hemisphere at least. Time, then, to break out the heavy coats, thick gloves and galoshes—but also time, if a study by Mirko Trajkovski of the University of Geneva is correct, for your gut bacteria to remodel your intestines and make them better at absorbing nutrients before the blizzards arrive. Dr Trajkovski's work, just published in *Cell*, was on mice. But previous experience suggests that in this area of biology what applies to mice applies to men as well. If that is true in this case too, it will mean an important part of the human body's thermoregulation is actually controlled by its companion microbes.

Dr Trajkovski's research group studies obesity and insulin resistance—the latter being the cause of the form of diabetes many people suffer from in later life. Past studies have shown that obese animals (people included) have different microbial mixtures, known as microbiomes, in their guts from those found in animals of nor-

mal weight. Moreover, in mice at least, modifying the mix can induce obesity without a change of diet. One line of inquiry the group is pursuing therefore involves studying murine microbiomes. And one question they asked themselves is what effect ambient temperature might have.

To find out, they put some mice into one or other of two sets of enclosures for a month. The first set were maintained at 6°C. The second were kept at 22°C (ie, room temperature). The team weighed the animals at regular intervals. They also saved the creatures' faeces and collected blood samples from which they could determine their subjects' sensitivity to insulin. Since insulin stimulates the burning by cells of glucose, the more sensitive an animal is to it, the more glucose it will burn, and the more heat it will generate.

Based on previous findings, Dr Trajkovski expected the mice in the cold enclosures to lose weight as they burned stored reserves to stay warm—and, for the first few days they did. After five to ten days, though, they did something unexpected. In spite of the fact that their rations had not increased, they began to put on weight.

To try to find out why, the team measured the calorific value left in the faeces, to assess how much nutrition the animals had extracted from their food. They also looked at the insulin-sensitivity data.

Mice exposed to the cold, they discovered, became 50% more efficient over the course of the study at absorbing nutrients from their food. Those held at room temperature, by contrast, showed no change in their digestive efficiency. The cold-dwelling mice also became 40% more sensitive to insulin, while those in the room-temperature enclosures did not. That suggested the mice in the chiller cabinets were not only extracting more value from their food, they were also becoming better at burning it, and thus generating heat.

Given its role in obesity, Dr Trajkovski suspected the gut microbiome might be playing a part in these unpredicted results. The team thus reran the experiments and sampled the animals' gut floras. They also looked at the rodents' intestinal walls, to see if the anatomy of these had changed in ways that would make it easier for them to absorb food.

The gut floras of the two groups were radically different. In particular, and intriguingly, the chilled mice lacked a species called *Akkermansia muciniphila* that is often absent from the guts of obese people—an absence that may be involved in their putting on extra weight.

The cold-dwelling mice also had different intestinal anatomy. Their villi, the tiny projections from the intestinal wall that absorb food into the body, were more than 50% longer than those of mice living at room temperature.

Dr Trajkovski and his colleagues then ►►



What's bugging you?

► arranged for mice that had been born and raised at room temperature, and in aseptic conditions (and which were thus germ-free), to have bacteria, collected either from cold-dwelling mice or from mice that came from room-temperature enclosures, transplanted into their guts.

After two weeks, those with transplants from cold-dwelling mice resembled the mice the transplants had come from in insulin sensitivity, cold tolerance and the lengths of their villi. The mice with transplants from “room-temperature” mice, by contrast, resembled those.

As a final experiment the team added

some *A. muciniphila* to the guts of the mice that had received transplants from cold-dwellers, to see how the bug's reintroduction would shape them. Remarkably, these mice started losing weight and, when the researchers examined their intestines two weeks later, they found that the villi had shrunk back to the size of those found in room-temperature mice.

How the bacteria cause all these changes Dr Trajkovski has yet to work out. But the bottom line is clear: in mice—and probably in human beings as well—partial control of the body's thermostat is in the hands of subcontractors. ■

Genetic engineering

Time to think carefully

WASHINGTON, DC

An international summit discusses the use of gene editing

“OVER the years the unthinkable has become conceivable and today we sense we are close to being able to alter human heredity.” These were the words of David Baltimore of the California Institute of Technology, on December 1st, when he opened a three-day meeting in Washington to discuss the ethics and use of human gene editing. Dr Baltimore is an old hand at these sorts of discussions, for he was also a participant in the Asilomar conference, in 1975, which brought scientists together to discuss a safe way of using the then-new technology of recombinant DNA, and whose recommendations influenced a generation of biotechnology researchers.

Four decades on, the need for a similar sort of chin-wag has arisen. The Interna-

tional Summit on Human Gene Editing has been convened by the national scientific academies of three countries—America, Britain and China. They are particularly concerned about whether gene editing should be used to make heritable changes to the human germ line, something Dr Baltimore described as a deep and troubling question. Like those of Asilomar, the conclusions of this meeting, which was due to end after *The Economist* went to press, will not be binding. But the hope is that, again like Asilomar, a mixture of common sense and peer pressure will create a world in which scientists are trusted to regulate themselves, rather than having politicians and civil servants do it for them.

The meeting is being held against a

backdrop of rapid scientific advance. Since 2012 research into a new, easy-to-use editing tool called CRISPR-Cas9 has blossomed. This technique involves a piece of RNA (a chemical messenger, which can be used to recognise a target section of DNA) and an enzyme called a nuclease that can snip unwanted genes out and paste new ones in.

Public interest was aroused in April, when Chinese scientists announced they had edited genes in non-viable human embryos, and again in November when British researchers said they had successfully treated a one-year-old girl who had leukaemia, using gene-edited T-cells. T-cells are part of the immune system that attack, among other things, tumour cells. The researchers altered T-cells from a healthy donor to encourage them to recognise and kill the patient's cancer, to make them immune to her leukaemia drug, and to ensure they did not attack her healthy cells.

In another recent development, a firm called Editas Medicine, which is based in Cambridge, Massachusetts, has said it hopes, in 2017, to start human clinical trials of CRISPR-Cas9 as a treatment for a rare genetic form of blindness known as Leber congenital amaurosis. Though other companies are already testing gene-editing therapies, these employ older, clunkier forms of the technology that seem likely to have less commercial potential. Moreover, researchers at the Broad Institute, also in Cambridge, said this week that they had made changes to CRISPR-Cas9 which greatly reduce the rate of editing errors—one of the main obstacles to the technique's medical use.

On the subject of germ-line editing, Eric Lander, the Broad's head, told the meeting it would be useful only in rare cases and said it might be a good idea to “exercise caution” before making permanent changes to the gene pool. The need for caution is advice that might also be heeded by those pursuing work in animals other than people, and in plants—subjects not being covered by the summit.

Last month, researchers at the University of California, Irvine, said they had used CRISPR-Cas9 to build what is known as a “gene drive” in mosquitoes. Gene drives can copy themselves and their associated gene directly into chromosomes that do not have them, meaning that all offspring of an organism will inherit a chromosome bearing the gene in question. This ensures the gene spreads through the population, even if it does not confer advantages. In mosquitoes, the idea is to spread genes that would make them resistant to the parasite that causes malaria. But some researchers worry that, once released into the wild, gene drives could induce unpredictable and irreversible effects. Whatever the outcome of this week's meeting, the debate over gene editing is only just beginning. ■



Books of the year 2015

Shelf life

Also in this section

84 Books by Economist writers in 2015

The best books this year are about North Korea, Detroit, Nagasaki and being a pilot

Politics and current affairs

Near and Distant Neighbours: A New History of Soviet Intelligence. By Jonathan Haslam. *Oxford University Press*; 400 pages; £20
A detailed appraisal of how the Soviet Union handled undercover operations from the communist revolution in 1917 until the end of the cold war. The most gripping chapters focus on the chaos that was unleashed by Josef Stalin.

Our Kids: The American Dream in Crisis. By Robert Putnam. *Simon & Schuster*; 386 pages; \$28 and £18.99

The most important divide in America today is class, not race, and the place where it matters most is in the home. In a thoughtful and persuasive book, the former dean of Harvard's Kennedy School of Government analyses the growing gulf between how the rich and the poor raise their children, adding a liberal voice to long-standing conservative complaints about family breakdown.

North Korea Confidential: Private Markets, Fashion Trends, Prison Camps, Dissenters and Defectors. By Daniel Tudor and James Pearson. *Tuttle*; 224 pages; \$19.95
Two knowledgeable journalists offer a bird's-eye view of everyday life that teases out how the famine of the 1990s prompted

unexpected change in the attitudes, governance and lives of ordinary North Koreans, giving the lie to the simplistic view that Koreans are a homogenous people under the thumb of a power-crazed dictator.

Ghettoside: Investigating a Homicide Epidemic. By Jill Leovy. *Spiegel & Grau*; 384 pages; \$28. *Vintage*; £16.99

Black men are still dying at alarming rates in the toughest urban pockets even though, overall, America's murder rate is down. A study of one neighbourhood in Los Angeles has the power to change how people think about policing in America.

Once in a Great City: A Detroit Story. By David Maraniss. *Simon & Schuster*; 464 pages; \$32.50

One of America's finest non-fiction writers, a son of Detroit, offers a lively and meticulously researched account of how the city, once the engine room of America, began sputtering.

History

Nagasaki: Life after Nuclear War. By Susan Southard. *Viking*; 416 pages; \$28.95. *Souvenir*; £20

The searing account of five teenage *hibakusha* ("explosion-affected people"): how

they survived the atom bomb that was dropped on Nagasaki in 1945, and the terrible price they paid in the aftermath of the war.

Waterloo: The History of Four Days, Three Armies and Three Battles. By Bernard Cornwell. *Harper Collins*; 352 pages; \$35. *William Collins*; £25

A great and terrible story of a battle that was fought 200 years ago, told with energy and clarity by a writer who has a deep understanding of men in combat and why they do what they do. "Waterloo" proves that Bernard Cornwell's non-fiction is as fine as his novels, if not finer.

The Fall of the Ottomans: The Great War in the Middle East. By Eugene Rogan. *Basic Books*; 512 pages; \$32. *Allen Lane*; £25
How a multinational Muslim empire was destroyed by the first world war, by a historian of the 20th century who is director of the Middle East Centre at Oxford University.

Black Earth: The Holocaust as History and Warning. By Timothy Snyder. *Tim Duggan Books*; 462 pages; \$30. *Bodley Head*; £25
A historian at Yale University has made a detailed study of where Jews were in most danger during the second world war. In France and Italy, three-quarters of the Jews survived. In eastern territories, which



► suffered “double occupation”, first by the Soviets and then by the Nazis, at least 90% of them perished.

SPQR: A History of Ancient Rome. By Mary Beard. *Liveright*; 608 pages; \$35. *Profile*; 606 pages; £25

A masterly new chronicle, by Britain’s most engaging historian of the ancient world, about Rome from its myth-shrouded origins to the early third century. She shows that the key to its dominance was granting citizenship to so many people.

Empire of Cotton: A Global History. By Sven Beckert. *Knopf*; 640 pages; \$35. *Allen Lane*; £30

By focusing on a sector that until 1900 was the world’s most important manufacturing industry, Sven Beckert offers a fine account of 900 years of globalisation.

What the Eye Hears: A History of Tap Dancing. By Brian Seibert. *Farrar, Straus and Giroux*; 612 pages; £35

How tap-dancing entertained many, even as it had clear racist overtones. An engaging, warts-and-all history of one of America’s greatest creative inventions by a dance critic at the *New York Times*.

Towards the Flame: Empire, War and the End of Tsarist Russia. By Dominic Lieven. *Allen Lane*; 448 pages; £25

How Russia went to war. A gripping, poignant and in some respects revolutionary contribution to European history by a distinguished British scholar who is descended from several of the protagonists he describes.

Biography and memoir

Kissinger: The Idealist, 1923-1968. By Niall Ferguson. *Penguin Press*; 1,008 pages; \$39.95. *Allen Lane*; £35

The magisterial first instalment of a two-part biography about a man who towered over American foreign policy for more than two decades, and still divides opinion as no one else does.

Skyfaring: A Journey with a Pilot. By Mark Vanhoenacker. *Knopf*; 352 pages; \$25.95. *Chatto & Windus*; £16.99

A highly readable account, as moving as it is unexpected, of what flying means, by an airline pilot with a gift for words. Antoine de Saint-Exupéry lives again.

Ted Hughes: The Unauthorised Life. By Jonathan Bate. *Harper*; 662 pages; \$40. *William Collins*; £30

It is hard to write a literary account of Ted Hughes without writing about the life, as many authors have found. Five years in the making, this biography began as an authorised life only to become unauthorised when the author fell out with Hughes’s widow, Carol, over how much personal detail to include, prompting the poet’s estate to withdraw its co-operation.

The Invention of Nature: Alexander von Humboldt’s New World. By Andrea Wulf. *Knopf*; 496 pages; \$30. *John Murray*; £25

Explorer, polymath, friend of Johann Wolfgang von Goethe, Thomas Jefferson and Simon Bolívar, Alexander von Humboldt was one of the greatest scientists of the 19th century. His ideas are as relevant today as they ever were.

Economics and business

The Public Wealth of Nations: How Management of Public Assets Can Boost or Bust Economic Growth. By Dag Detter and Stefan Fölster. *Palgrave Macmillan*; 244 pages; \$40 and £24.99

Governments have trillions of dollars in assets, from companies to forests, but they are often poorly managed. Two investment experts explain how things could be improved by ring-fencing assets from political meddling in independent holding companies. Professional managers could sweat them as if they were privately owned.

Other People’s Money: The Real Business of Finance. By John Kay. *PublicAffairs*; 352 pages; \$27.99. *Profile*; £16.99

If the world is to avoid future banking collapses, or at least limit their economic impact, people need to think clearly about what the finance sector is for. This book does the job.

Inequality: What Can Be Done? By Anthony Atkinson. *Harvard University Press*; 384 pages; \$29.95 and £19.95

A crunchy book that analyses policy discussions in detail but avoids dullness, thanks to its unapologetic support for robust government intervention.

Misbehaving: The Making of Behavioural Economics. By Richard Thaler. *Norton*; 432 pages; \$27.95. *Allen Lane*; £20

Why people don’t behave the way economic models predict lies at the heart of this brilliant intellectual history by the founder of this once-obscure blend of psychology and economics.

Economics Rules: The Rights and Wrongs of the Dismal Science. By Dani Rodrik. *Norton*; 272 pages; \$27.95. *Oxford University Press*; £16.99

Economists still have a lot of explaining to do. Dani Rodrik reassures those outside the profession of the helpfulness of economists, and also removes some of the wishful thinking from his colleagues.

Circus Maximus: The Economic Gamble Behind Hosting the Olympics and the World Cup. By Andrew Zimbalist. *Brookings Institution Press*; 174 pages; \$25 and £18.50

Any country thinking of hosting an international sporting jamboree should read this book to see what a bad deal the IOC and FIFA seek to foist on them. Hamburg has just voted against bidding for the 2024 Olympic games. Clever move.

Culture, society and travel

The Road to Character. By David Brooks. *Random House*; 300 pages; \$28. *Allen Lane*; £17.99

The author, a columnist for the *New York Times*, clearly thinks people are too full of themselves. A thoughtful polemic on why the self-regarding Facebook generation should move from narcissism to thoughtfulness. They’d be much happier.

Unfinished Business: Women Men Work Family. By Anne-Marie Slaughter. *Random House*; 352 pages; \$28. *Oneworld*; 352 pages; £16.99

Why organisations will have to change radically to make work-life balance a reality, by a respected foreign-policy expert who left her high-octane government ►►



▶ job to spend more time with her two teenage sons. A rational, well-argued call to arms. Move over Sheryl Sandberg.

Between the World and Me. By Ta-Nehisi Coates. *Random House*; 176 pages; \$24

In a homage to James Baldwin's "The Fire Next Time", a father writes a warning letter to his teenage son about growing up black. The year's most talked-about book on race relations in America.

Schubert's Winter Journey: An Anatomy of an Obsession. By Ian Bostridge. *Knopf*; 544 pages; \$29. *Faber and Faber*; £20

One of Britain's foremost tenors, Ian Bostridge has performed Schubert's "Winterreise" more than 100 times. He knows every last nuance of the work and his book offers many fresh insights that will inform the enjoyment of both old admirers and newcomers to the music.

Plucked: A History of Hair Removal. By Rebecca Herzig. *NYU Press*; 287 pages; \$29.95

Most of Earth's mammals possess luxurious fur. Only one seeks to remove it. A curious account of hair-erasing, and why people have tried clamshell razors, lasers, lye depilatories, tweezers, waxes, threading and electrolysis to try and free themselves from hairiness. Self-enhancement or oppression?

Nemesis: One Man and the Battle for Rio.

By Misha Glenny. *Bodley Head*; 338 pages; £18.99. *To be published in America by Knopf in February*, \$27.95

How Antonio Francisco Bonfim Lopes, better known as Nem of Rocinha, became a drug-dealer after his daughter was diagnosed with a rare disease and he needed the cash—and how he eventually took over an entire Brazilian shantytown.

Science and technology

Superforecasting: The Art and Science of Prediction. By Philip Tetlock and Dan Gardner. *Crown*; 352 pages; \$28. *Random House*; £14.99

A scientific analysis of the ancient art of divination which shows that forecasting is a talent; luckily it can be learned. You need a healthy appetite for information, a willingness to revisit predictions in light of new data, and the ability to synthesise material from sources with very different outlooks on the world.

Neurotribes: The Legacy of Autism and the Future of Neurodiversity. By Steve Silberman. *Avery*; 544 pages; \$29.95. *Allen & Unwin*; £16.99

How a widely contested condition grew out of conflicts between Nazi psychiatrists anxious for career advancement. The descriptions of how autistic children were treated in the 20th century is especially shocking. Winner of the 2015 Samuel Johnson prize for non-fiction.



The Vital Question: Why Is Life the Way It Is? By Nick Lane. *Norton*; 368 pages; \$27.95. *Profile*; 352 pages; £25

A persuasive and demanding attempt, by a thought-provoking British scientist, a biochemist at University College London, to answer some of the most fundamental questions in biology. It posits a new theory of how life came to be.

Humans Need Not Apply: A Guide to Wealth and Work in the Age of Artificial Intelligence. By Jerry Kaplan. *Yale University Press*; 256 pages; \$35 and £20

An intriguing, insightful and well-written look at how modern artificial intelligence, powering algorithms and robots, threatens jobs and may increase wealth inequalities, by a Silicon Valley entrepreneur and AI expert.

Things to Make and Do in the Fourth Dimension. By Matt Parker. *Farrar, Straus and Giroux*; 464 pages; \$28. *Particular Books*; £16.99

Officially described as "a riotous journey through the possibilities of numbers, with audience participation", this is an unusual, in-depth but highly accessible popular-maths book by a member of the London Mathematical Society who also has a sideline in stand-up comedy.

Seven Brief Lessons on Physics. By Carlo Rovelli. Translated by Simon Carnell and Erica Segre. *Allen Lane*; 83 pages; £9.99

A startling and illustrative distillation of centuries of science by an Italian theoretical physicist. Simon Carnell and Erica Segre, a poet and a translator, have preserved the book's lyrical and stripped-down prose.

The New Wild: Why Invasive Species Will Be Nature's Salvation. By Fred Pearce. *Beacon Press*; 272 pages; \$26.95

A carefully researched, analytical look at

the effects that new species have on different environments into which they are introduced. The book debunks poor science and the cherry-picking of statistical examples to feed hysteria about keeping invasive species out and protecting an imaginary perfect past.

Adventures in Human Being. By Gavin Francis. *Basic Books*; 272 pages; \$26.99. *Profile*; 256 pages; £14.99

A Scottish doctor, once the medical officer on a British research mission near the South Pole, takes a delightful journey closer to home, through the wondrous human body, from top to tail, inside to out.

Spirals in Time: The Secret Life and Curious Afterlife of Seashells. By Helen Scales. *Bloomsbury*; 304 pages; \$27 and £16.99

A marine biologist-turned-science writer describes coming face-to-shell with a giant clam on the Great Barrier Reef, enjoying a bag of smoked oysters in Gambia and meeting a sea-silk seamstress in Italy. She makes an impassioned and convincing argument that, contrary to expectations, molluscs have much to teach us.

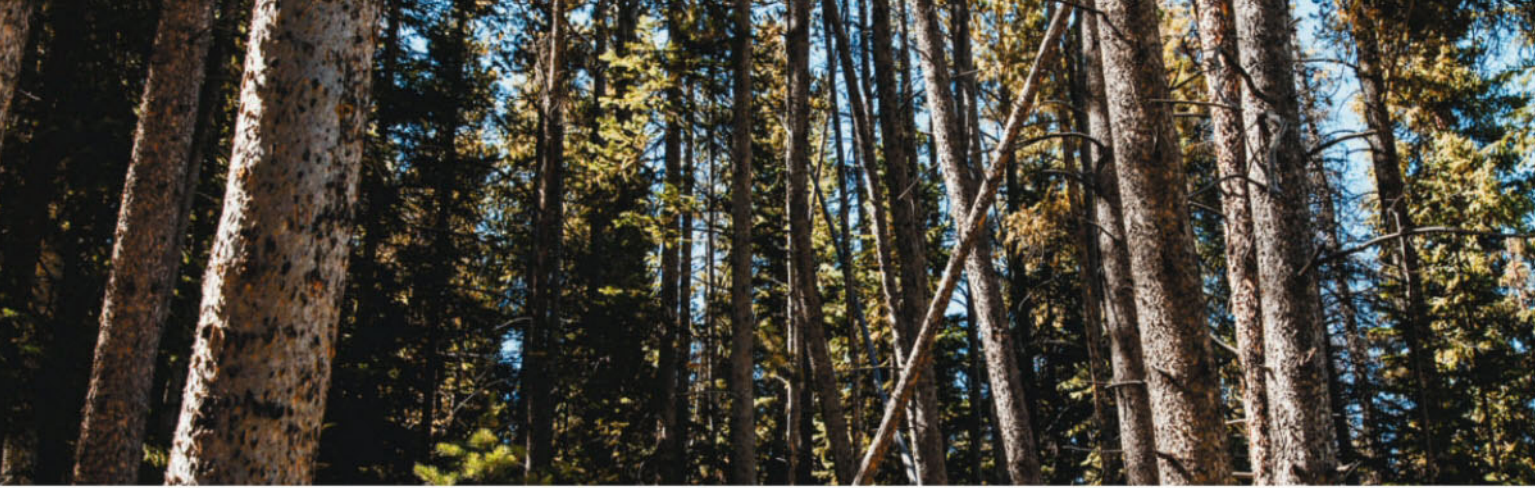
How to Talk about Videogames. By Ian Bogost. *University of Minnesota Press*; 208 pages; \$70

Some say video games are the great sport of the 21st century, the summit of art and entertainment. Others call them mindless. Meditative essays on the meaning of gaming, by a game designer and professor of interactive computing.

Fiction

A Brief History of Seven Killings. By Marlon James. *Riverhead*; 688 pages; \$28.95. *One-world*; £18.99

A failed assassination of Bob Marley becomes a prism through which to see ▶▶



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▶ Jamaica's history from the early 1970s to the early 1990s. Violent, lurid, scabrous, hilarious and beautiful, this novel teems with life, death and narrators. A deserving winner of this year's Man Booker prize by the first Jamaican to carry off the award.

The Fishermen. By Chigozie Obioma. *Little, Brown*; 304 pages; \$26. One; £14.99

A lyrical retelling of the Cain-and-Abel story in which four Nigerian brothers play truant from school, go fishing and meet a soothsayer who predicts that one brother will kill another. Not yet 30, Chigozie Obioma is a writer to watch.

Seiobo There Below. By Laszlo Krasznahorkai. Translated by Otilie Mulzet. *New Directions*; 464 pages; \$17.95. *Tuskar Rock*; £16.99

Seventeen stories by a Hungarian modernist whose sentences wind and unwind and rewind, creating what one translator described as "a slow lava-flow of narrative, a vast black river of type". A fitting winner of the 2015 Man Booker International prize.

Submission. By Michel Houellebecq. *Farrar, Straus and Giroux*; 256 pages; \$25. *William Heinemann*; £18.99

No other French novelist knows how to stir trouble quite like Michel Houellebecq. This account of France under Muslim rule is set in 2022. It came out on the day of the *Charlie Hebdo* attack and has been called scaremongering. Its fans say it speaks to France's deepest secret fears.

A Little Life. By Hanya Yanagihara. *Double-day*; 720 pages; \$30. *Picador*; £16.99

On the surface a story about four university graduates trying to make it in New York, at heart Hanya Yanagihara's second novel is a fairy-tale about child abuse, pitting good against evil, love against viciousness, hope against hopelessness. It has divided critics, but readers love it. Hypnotic despite its length and considerable flaws.

An Account of the Decline of the Great Auk, According to One Who Saw It. By Jessie Greengrass. *JM Originals*; 192 pages; £10.99

Restraint and a formal writing style, by a philosophy graduate from Cambridge University, give a tone of melancholy to this spectacularly accomplished, chilly debut collection of short stories about thwarted lives and opportunities missed. The strongest are also the most ordinary.

The Story of the Lost Child. By Elena Ferrante. Translated by Ann Goldstein. *Europa*; 464 pages; \$18 and £11.99

This four-volume narrative, with all its operatic overtones, is a tribute to feminism and female friendship in mid-20th-century Naples. Written by a pseudonymous author whose real identity remains unknown and translated by an editor at the *New Yorker*, it is a wild and unlikely hit on both sides of the Atlantic. ■

Books by Economist writers in 2015

What we wrote...

...when we weren't in the office

Blood, Dreams and Gold: The Changing Face of Burma. By Richard Cockett. *Yale University Press*; 296 pages; \$35 and £18.99

How Burma, once one of the richest countries in the region, descended into decades of civil war and authoritarian government before embarking on a surprising attempt at political and social reform, by our former South-East Asia correspondent.

The Italians. By John Hooper. *Viking*; 336 pages; \$28.95. *Allen Lane*; £20

Corrupt, infuriating and beloved: it is not easy to explain Italy. A new take on Luigi Barzini's 1964 classic of the same title, by our Rome bureau chief.

Gifted. By Donald Hounam. *Corgi*; 416 pages; £7.99

The bishop of Oxford is dead and someone has made off with his head. A 15-year-old forensic sorcerer is in charge of finding it. So begins this thriller for young adults, by one of our software developers.

Foolproof: Why Safety Can Be Dangerous and How Danger Makes Us Safe. By Greg Ip. *Little, Brown*; 336 pages; \$34. *Headline*; £20

Over the past century people have learned much about how to deal with disaster, and yet they keep having car crashes and financial crises. Our former us economics editor explains why.

In Wartime: Stories from Ukraine. By Tim Judah. *Allen Lane*; 288 pages; £20

Two years on from the *maidan* protests in



Kiev, a longtime writer on eastern Europe tells the human story behind the headlines about the conflict in Ukraine.

Science of the Magical: From the Holy Grail to Love Potions to Superpowers. By Matt Kaplan. *Scribner*; 256 pages; \$26

A scientific inquiry into elements of mystical places and magical objects—the philosopher's stone, love potions and the oracles—from ancient history, mythology, and contemporary culture, by one of our science correspondents.

Cyberphobia: Identity, Trust, Security and the Internet. By Edward Lucas. *Bloomsbury*; 336 pages; \$28 and £20

On the dangers of cybercrime and its potentially catastrophic consequences, by a senior editor who writes on energy and eastern Europe.

The Faithful Couple. By A.D. Miller. *Little, Brown*; 288 pages; £12.99

A novel about male friendship, from a first meeting in a California youth hostel to, years later, a bond stronger than marriage, by our southern us correspondent and former *Bagehot* columnist.

The Planet Remade: How Geoengineering Could Change the World. By Oliver Morton. *Princeton University Press*; 440 pages; \$29.95. *Granta*; £20

Could planned human interventions slow down climate change? A survey of the science, politics and engineering behind this revolutionary, controversial idea, by our essays and briefings editor.

The Invention of Russia: The Journey from Gorbachev's Freedom to Putin's War. By Arkady Ostrovsky. *Atlantic*; 383 pages; £20. *To be published in America by Random House in June*

How a country liberated itself from 70 years of Soviet rule only to end up as one of the biggest threats to the West, by our Russia editor.

Smart Money: How High-Stakes Financial Innovation is Reshaping our World—For the Better. By Andrew Palmer. *Basic Books*; 320 pages; \$27.99

Our business affairs editor argues that the finance industry offers powerful methods for solving some of the world's most intractable social problems.

The euro Experiment. By Paul Wallace. *Cambridge University Press*; 326 pages; £24.99

Six facets of the euro crisis and the complex political and economic challenges behind it, by our European economics editor.

Black Dragon River: A Journey Down the Amur River at the Borderlands of Empires. By Dominic Ziegler. *Penguin Press*; 368 pages; \$27.95

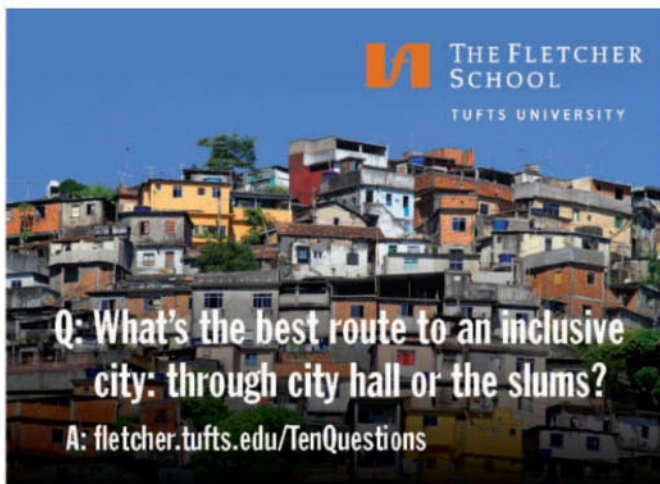
An adventure by our Asia editor along one of the world's great rivers, on the Russian-Chinese border, which reveals the region's essential history and culture. ■



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We need an open and informed discussion on digital ethics, on how the EU can both realise the benefits of technology for society and the economy and at reinforce the rights and freedoms of individuals, particularly their rights to privacy and data protection.

As part of the EDPS Strategy for 2015-2019, we intend to set up an external, cross-disciplinary ETHICS Advisory Group on the ethical dimension of data protection (the Advisory Group). The Advisory Group will consist of a maximum of six eminent, independent thought-leaders with a proven track record in one or several relevant areas, including philosophy, sociology, psychology, technology and economics. It will work openly and involve other relevant experts in its activities.

If you are interested in being part of the EAG, please write an email to the European Data Protection Supervisor (to: EDPS-ETHICS@edps.europa.eu) no later than 18 December 2015, 12 PM CET, explaining what you believe you can bring to the Advisory Group.

The EDPS will choose the members of the Advisory Group in early 2016. More information, also on how to react to this call for expression of interest, can be found on the EDPS website (www.edps.europa.eu).

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Appointments



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EXPRESSION OF INTEREST FOR THE IMPLEMENTATION OF THE NNPC BIOFUELS PROGRAMME IN NIGERIA

1.0 INTRODUCTION

The Nigerian National Petroleum Corporation (NNPC) through its Renewable Energy Division (RED) is re-positioned to seek Core-Investors to implement Nigeria's Automotive Biofuels Industry Programme through a series of planned Special Purpose Vehicles (SPVs). The Automotive Biofuels Industry Programme aims at leveraging the vast agricultural potentials with abundant skilled and unskilled labour in the Country; and the synergy of NNPC Downstream assets, capabilities and infrastructural facilities. The rationale for the Automotive Biofuels Industry Programme is to develop Low-Carbon Energy for the Transportation Sector with significant financial returns, mitigate Climate Change, create wealth and employment and attain Sustainable Development across the Country.

NNPC has secured suitable Land portions to develop Fuel-Ethanol and Biodiesel Projects from Local and State Authorities and has completed Site-specific, bankable, detailed Feasibility Studies using International Experts and registration with appropriate Public Institutions. The Corporation is seeking to create Special Purpose Vehicles with strategic Core Investors having proven operational and managerial expertise in Large-scale Integrated Biofuels Plantations and Plants envisaged for the Programme. **While NNPC will indicate its negotiable shareholding of 20-30% in each of the Partnerships, the Core Investor(s) would be expected to undertake 100% funding of the Project(s) under a Carry Agreement in the first Phase.**

To demonstrate the feasibility, the Corporation intends to start with the proposed Sugar cane Fuel-Ethanol Project in Agasha-Guma area of Benue State, Nigeria.

Investors being sought must have the following characteristics:

- Ability to take majority equity ownership, as sole investors or, as a leader or group of investors;
- Proven competence in the following:
 - Ownership/or management of large-scale Sugar cane Plantations;
 - Ownership/or operation of large-scale Sugar cane mill, Fuel-Ethanol processing, Refined Sugar production, Bagasse cogeneration under a zero-waste concept.
 - Commodity trading (Ethanol, Sugar, etc.)
- Clean Development Mechanism Projects Activities;
- Joint Venture partnering track records.

2.0 BRIEF DESCRIPTION OF THE PROJECT (SCOPE OF WORK)

The first Phase of the Project will cover at least 50,000 hectares of Sugar cane Plantations in close proximity, fitted with:

- Fuel-Ethanol processing Plant;
- Cane Mill and Refined Sugar Plant;
- Bagasse Cogeneration Plants;
- Carbon Dioxide recovery and bottling Plant, and
- Other Utilities as appropriate.

3.0 PRE-QUALIFICATION REQUIREMENTS

NNPC in compliance with the Provisions of Public Procurement Act 2007 request interested Companies to submit the detailed requirements listed below in their Pre-qualification bid documents:

- 3.1** Full details of Company Profile with Certificate of Incorporation, certified true copies of memorandum and articles of Association of the Company and CAC form CO2 and CO7 (particulars of Directors) – where applicable;
- 3.2** Company Tax clearance Certificate for the last three (3) years (2012, 2013, and 2014)
- 3.3** Evidence of VAT Registration
- 3.4** Evidence of current registration with PENCOM and section 1(2) Pension Reform Act 2004
- 3.5** Evidence of compliance with the Industrial Training Fund (ITF) amendment act 2001 by inclusion of copy of compliance certificate from the industrial training fund
- 3.6** Audited account for the past three (3) years (2012, 2013 and 2014)
- 3.7** Nigerian content plan that demonstrates full utilization of Nigerian labour and services with detailed description of role, work scope and man-hours in order to achieve maximum target as set out in the requirement of the NOFICD Act, 2010
- 3.8** Current and in-place organizational structure with detailed experience and skills of key management personnel with names. Provide evidence (personnel

list and position organizational chart) percentage of managements that are Nigerian Nationals and the percentage of total workforce that are Nigerians

- 3.9** Detail past/present commitment to staff training and development of Nigerian Personnel.
- 3.10** Evidence of Financial capability
- 3.11** Bank reference letter from credible bank
- 3.12** Evidence of relevant verifiable investment/partnership experience in Biofuels Projects anywhere in the world over the past five (5) years. Please attach reference letters.
- 3.13** List of verifiable similar service detailing companies that the service was rendered to: Company full address (not P.O. Box), functional phone numbers and email addresses.
- 3.14** Company's CASHES and QA/QC Policy and detail of safety records for accidents, incidents, injuries and damages for the past three years, e.g. lost time incident, down time, etc.
- 3.15** Any additional information that will enhance the potential of the company.

4.0 SUBMISSION OF EXPRESSION OF INTEREST

All prospective companies wishing to express their interest to tender for the procurement of the works described in 2.0 above shall submit relevant documentation for the pre-qualification as stipulated in 3.0 above. The requested information and any supporting document in respect of these requirements should be submitted in ONE original plus ONE hard copy and two electronic copies (CD ROM). The document which should be in separate packages shall be sealed and clearly marked **"EXPRESSION OF INTEREST: INVESTOR PARTNERSHIP FOR NNPC BIOFUELS PROJECTS** to reach the address below on or before **Six (6) Weeks** from the date of publication. **The closing for the expression of interest is on the 4th of January, 2016 at 12noon.** The bids shall be opened immediately after the due date

**THE SECRETARY,
 R&T DEXCOM TENDERS BOARD,
 1st FLOOR, Block D, ROOM 45B,
 HERBERT MACAULAY WAY
 NNPC TOWERS, CENTRAL BUSINESS DISTRICT
 ABUJA, F.C.T. NIGERIA**

5.0 IMPORTANT INFORMATION

It must be noted that:

- 5.1** Only shortlisted companies will be contacted
- 5.2** Late submission shall be rejected
- 5.3** Registration at the NIPLEX portal shall be an added advantage
- 5.4** Your company shall provide NNPC with a letter of authority to verify claims made in your submissions
- 5.5** Please note that this is not an invitation to tender; only companies adjudged qualified by NNPC under this pre-qualification procedure will be invited to participate in the competitive tender.
- 5.6** All claims must be adequately substantiated and verifiable. NNPC shall deal with only authorized officers of the interested companies and not through individuals or agents (ownership is therefore essential).
- 5.7** All cost incurred by your company as a result of this pre-qualification exercise and any subsequent request for information shall be to your account.
- 5.8** The expression of interest and any other related process neither creates any commitment by; NNPC nor any legal relationship.

NNPC is now inviting eligible firms to indicate their interest in creating a Special Purpose Vehicle (SPV) with the Corporation to develop a thriving Biofuels Industry in Nigeria. Interested firms must provide information indicating that they are qualified to become Core Investors in the proposed **SPV** and possess the relevant expertise and financial capacity for a **Carry Agreement**.

All requests for clarification, which must be concluded not later than 21st of December, 2015 should be addressed to:

**Group General Manager,
 Renewable Energy Division,
 Block B; 6th Floor; Room 06.04,
 Nigerian National Petroleum Corporation, Herbert Macaulay Way,
 Central Business District, Abuja,
 NIGERIA.**

Signed: Management

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Economic data

% change on year ago

	Gross domestic product			Industrial production latest	Consumer prices		Unemployment rate, %	Current-account balance		Budget balance % of GDP 2015 [†]	Interest rates, % 10-year gov't bonds, latest	Currency units, per \$	
	latest	qtr* 2015 [‡]	2015 [‡]		latest	2015 [‡]		latest 12 months, \$bn	% of GDP 2015 [‡]			Dec 2nd	year ago
United States	+2.2 Q3	+2.1	+2.4	+0.3 Oct	+0.2 Oct	+0.2	5.0 Oct	-429.0 Q2	-2.5	-2.6	2.16	-	-
China	+6.9 Q3	+7.4	+6.9	+5.6 Oct	+1.3 Oct	+1.5	4.1 Q3 [§]	+279.0 Q3	+3.1	-2.7	2.91 ^{§§}	6.40	6.15
Japan	+1.0 Q3	-0.8	+0.6	-1.4 Oct	+0.3 Oct	+0.7	3.1 Oct	+121.9 Sep	+2.6	-6.8	0.30	123	119
Britain	+2.3 Q3	+1.9	+2.4	+1.1 Sep	-0.1 Oct	+0.1	5.3 Aug ^{††}	-149.2 Q2	-4.5	-4.4	1.88	0.67	0.64
Canada	+1.2 Q3	+2.3	+1.1	-3.7 Sep	+1.0 Oct	+1.2	7.0 Oct	-54.1 Q3	-3.2	-1.8	1.52	1.33	1.14
Euro area	+1.6 Q3	+1.2	+1.5	+1.7 Sep	+0.1 Nov	+0.1	10.7 Oct	+348.8 Sep	+3.0	-2.1	0.48	0.95	0.81
Austria	+1.0 Q3	+1.9	+0.8	+0.3 Sep	+0.7 Oct	+0.9	5.6 Oct	+10.7 Q2	+1.7	-2.1	0.74	0.95	0.81
Belgium	+1.3 Q3	+0.9	+1.3	-2.4 Sep	+1.5 Nov	+0.6	8.7 Oct	-5.8 Jun	+0.1	-2.6	0.83	0.95	0.81
France	+1.2 Q3	+1.4	+1.1	+1.8 Sep	+0.1 Oct	+0.1	10.8 Oct	+0.2 Sep [‡]	-0.3	-4.1	0.79	0.95	0.81
Germany	+1.7 Q3	+1.3	+1.6	+0.2 Sep	+0.4 Nov	+0.2	6.3 Nov	+277.8 Sep	+7.9	+0.7	0.48	0.95	0.81
Greece	-0.9 Q3	-3.5	+0.5	+3.0 Sep	-0.9 Oct	-1.1	24.6 Aug	-2.8 Sep	+2.5	-4.1	7.77	0.95	0.81
Italy	+0.8 Q3	+0.8	+0.8	+1.7 Sep	+0.1 Nov	+0.2	11.5 Oct	+38.5 Sep	+1.9	-2.9	1.40	0.95	0.81
Netherlands	+1.9 Q3	+0.5	+1.9	+0.8 Sep	+0.7 Oct	+0.4	8.4 Oct	+85.3 Q2	+10.6	-1.8	0.62	0.95	0.81
Spain	+3.4 Q3	+3.2	+3.2	+4.0 Sep	-0.3 Nov	-0.6	21.6 Oct	+19.1 Sep	+0.9	-4.4	1.49	0.95	0.81
Czech Republic	+3.9 Q3	+2.2	+3.4	+0.6 Sep	+2.0 Oct	+0.3	5.9 Oct [§]	-2.4 Q2	-0.1	-1.8	0.50	25.6	22.3
Denmark	+0.9 Q3	-0.6	+1.6	+2.3 Sep	+0.4 Oct	+0.5	4.5 Oct	+22.7 Sep	+6.8	-2.9	0.75	7.06	6.00
Norway	+3.0 Q3	+7.3	+0.7	+3.3 Sep	+2.5 Oct	+1.7	4.6 Sep ^{††}	+37.3 Q3	+9.3	+5.9	1.51	8.65	7.00
Poland	+3.5 Q3	+3.6	+3.4	+2.4 Oct	-0.5 Nov	nil	9.6 Oct [§]	-2.7 Sep	-1.4	-1.5	2.68	4.05	3.36
Russia	-4.1 Q3	na	-3.8	-3.4 Oct	+15.6 Oct	+15.2	5.5 Oct [§]	+64.3 Q3	+4.7	-2.8	9.45	66.9	53.9
Sweden	+3.9 Q3	+3.4	+3.0	+6.3 Sep	+0.1 Oct	nil	6.7 Oct [§]	+31.8 Q3	+6.4	-1.2	0.75	8.70	7.50
Switzerland	+0.8 Q3	-0.1	+0.9	-2.8 Q3	-1.4 Oct	-1.1	3.4 Oct	+60.9 Q2	+8.1	+0.2	-0.36	1.03	0.97
Turkey	+3.8 Q2	na	+3.0	-7.9 Sep	+7.6 Oct	+7.6	10.1 Aug [§]	-40.6 Sep	-5.0	-1.6	10.10	2.89	2.23
Australia	+2.5 Q3	+3.8	+2.3	+1.9 Q3	+1.5 Q3	+1.6	5.9 Oct	-49.5 Q3	-4.1	-2.4	2.80	1.37	1.18
Hong Kong	+2.3 Q3	+3.5	+2.4	-1.2 Q2	+2.4 Oct	+3.1	3.3 Oct ^{††}	+7.4 Q2	+2.8	nil	1.51	7.75	7.75
India	+7.4 Q3	+11.9	+7.3	+3.6 Sep	+5.0 Oct	+5.1	4.9 2013	-25.9 Q2	-1.2	-3.8	7.74	66.6	61.9
Indonesia	+4.7 Q3	na	+4.7	+0.7 Sep	+4.9 Nov	+6.3	6.2 Q3 [§]	-18.4 Q3	-2.4	-2.0	8.46	13,798	12,270
Malaysia	+4.7 Q3	na	+5.4	+5.1 Sep	+2.5 Oct	+2.5	3.2 Sep [§]	+7.8 Q3	+2.5	-4.0	4.21	4.23	3.42
Pakistan	+5.5 2015**	na	+5.7	+2.3 Sep	+2.7 Nov	+3.9	6.0 2014	-1.1 Q3	-0.7	-5.1	9.00 ^{†††}	105	102
Philippines	+6.0 Q3	+4.5	+6.4	+3.6 Sep	+0.4 Oct	+2.4	6.5 Q3 [§]	+11.7 Jun	+4.1	-1.9	4.07	47.1	44.7
Singapore	+1.9 Q3	+1.9	+2.9	-5.4 Oct	-0.8 Oct	+0.2	2.0 Q3	+68.6 Q3	+21.2	-0.7	2.48	1.41	1.31
South Korea	+2.7 Q3	+5.3	+2.5	+1.5 Oct	+1.0 Nov	+0.7	3.1 Oct [§]	+105.6 Oct	+7.3	+0.3	2.25	1,164	1,107
Taiwan	-0.6 Q3	-1.2	+3.2	-6.2 Oct	+0.3 Oct	+0.1	3.8 Oct	+77.2 Q3	+12.8	-1.0	1.14	32.7	31.1
Thailand	+2.9 Q3	+4.0	+3.4	-4.2 Oct	-1.0 Nov	+0.8	0.9 Oct [§]	+31.2 Q3	+2.4	-2.0	2.67	35.8	32.9
Argentina	+2.3 Q2	+2.0	+1.1	-2.5 Oct	— ***	—	5.9 Q3 [§]	-8.3 Q2	-1.8	-3.6	na	9.70	8.53
Brazil	-4.5 Q3	-6.7	-3.1	-10.8 Sep	+9.9 Oct	+9.3	7.9 Oct [§]	-74.2 Oct	-3.8	-6.0	15.60	3.86	2.57
Chile	+2.2 Q3	+1.8	+2.8	-0.6 Oct	+4.0 Oct	+3.9	6.3 Oct ^{§††}	-2.7 Q3	-1.2	-2.2	4.60	703	615
Colombia	+3.0 Q2	+2.4	+3.3	+2.0 Sep	+5.9 Oct	+4.2	8.2 Oct [§]	-20.8 Q2	-6.7	-2.1	8.12	3,174	2,292
Mexico	+2.6 Q3	+3.0	+2.4	+1.7 Sep	+2.5 Oct	+2.8	4.4 Oct	-29.9 Q3	-2.5	-3.4	6.20	16.6	14.1
Venezuela	-2.3 Q3~	+10.0	-4.5	na	+68.5 Dec	+84.1	6.6 May [§]	+7.4 Q3~	-1.8	-16.5	10.51	6.31	6.35
Egypt	+4.3 Q4	na	+4.2	-5.5 Aug	+9.7 Oct	+10.0	12.8 Q3 [§]	-12.2 Q2	-1.4	-11.0	na	7.83	7.15
Israel	+2.4 Q3	+2.5	+3.3	-4.5 Sep	-0.7 Oct	-0.2	5.3 Oct	+10.2 Q2	+4.9	-2.8	2.13	3.88	3.97
Saudi Arabia	+3.5 2014	na	+2.7	na	+2.4 Oct	+2.7	5.7 2014	-1.5 Q2	-2.7	-12.7	na	3.75	3.75
South Africa	+1.0 Q3	+0.7	+1.4	+0.4 Sep	+4.7 Oct	+4.7	25.5 Q3 [§]	-15.6 Q2	-4.3	-3.8	8.62	14.4	11.1

Source: Haver Analytics. *% change on previous quarter, annual rate. †The Economist poll or Economist Intelligence Unit estimate/forecast. ‡Not seasonally adjusted. §New series. ~2014 **Year ending June.

††Latest 3 months. †††3-month moving average. §§5-year yield. ***Official number not yet proven to be reliable; The State Street PriceStats Inflation Index, August 27.01%; year ago 38.49% ††††Dollar-denominated



Markets

	Index Dec 2nd	% change on		
		one week	Dec 31st 2014	
			in local currency	in \$ terms
United States (DJIA)	17,729.7	-0.5	-0.5	-0.5
China (SSEA)	3,703.5	-3.1	+9.3	+5.9
Japan (Nikkei 225)	19,938.1	+0.5	+14.3	+10.9
Britain (FTSE 100)	6,420.9	+1.3	-2.2	-6.3
Canada (S&P/TSX)	13,463.8	+0.5	-8.0	-20.2
Euro area (FTSE Euro 100)	1,155.6	+0.2	+11.4	-2.6
Euro area (EURO STOXX 50)	3,468.7	+0.2	+10.2	-3.7
Austria (ATX)	2,488.2	+1.9	+15.2	+0.6
Belgium (Bel 20)	3,732.9	+0.7	+13.6	-0.7
France (CAC 40)	4,905.8	+0.3	+14.8	+0.3
Germany (DAX)*	11,190.0	+0.2	+14.1	-0.3
Greece (Athex Comp)	626.2	-2.6	-24.2	-33.8
Italy (FTSE/MIB)	22,551.9	+0.9	+18.6	+3.6
Netherlands (AEX)	467.1	-0.2	+10.0	-3.9
Spain (Madrid SE)	1,043.7	+1.1	+0.1	-12.5
Czech Republic (PX)	959.4	-1.7	+1.3	-9.2
Denmark (OMXC20)	915.8	+3.2	+35.6	+18.3
Hungary (BUX)	23,681.2	+0.3	+42.4	+26.3
Norway (OSEAX)	673.6	+1.3	+8.7	-5.8
Poland (WIG)	47,803.6	-0.3	-7.0	-18.4
Russia (RTS, \$ terms)	833.9	-5.1	+17.5	+5.5
Sweden (OMXS30)	1,533.9	+1.8	+4.7	-5.7
Switzerland (SMI)	9,016.6	+0.9	+0.4	-3.1
Turkey (BIST)	76,394.9	-0.6	-10.9	-27.9
Australia (All Ord.)	5,304.7	+1.1	-1.6	-11.7
Hong Kong (Hang Seng)	22,479.7	-0.1	-4.8	-4.7
India (BSE)	26,117.9	+1.3	-5.0	-10.0
Indonesia (JSX)	4,545.9	-0.9	-13.0	-21.9
Malaysia (KLSE)	1,676.8	-0.5	-4.8	-21.4
Pakistan (KSE)	32,392.9	-2.4	+0.8	-3.9
Singapore (STI)	2,883.6	-0.3	-14.3	-19.6
South Korea (KOSPI)	2,009.3	nil	+4.9	-1.0
Taiwan (TWI)	8,457.4	+0.8	-9.1	-12.2
Thailand (SET)	1,339.5	-3.0	-10.6	-17.9
Argentina (MERV)	12,706.0	-1.1	+48.1	+29.2
Brazil (BVSP)	44,914.5	-4.2	-10.2	-38.2
Chile (IGPA)	17,808.6	-3.6	-5.6	-18.6
Colombia (IGBC)	8,221.3	-1.8	-29.3	-47.1
Mexico (IPC)	43,417.1	-1.6	+0.6	-10.6
Venezuela (IBC)	12,867.5	-1.8	+234	na
Egypt (Case 30)	6,649.7	+4.0	-25.5	-32.0
Israel (TA-100)	1,359.6	+0.9	+5.5	+5.8
Saudi Arabia (Tadawul)	7,347.4	+1.9	-11.8	-11.8
South Africa (JSE AS)	51,159.1	-1.5	+2.8	-17.3

The Economist poll of forecasters, December averages (previous month's, if changed)

	Real GDP, % change				Consumer prices		Current account	
	Low/high range		average		% change		% of GDP	
	2015	2016	2015	2016	2015	2016	2015	2016
Australia	1.9/2.5	2.1/3.0	2.3	2.6 (2.5)	1.6 (1.7)	2.4 (2.5)	-4.1 (-3.8)	-3.8 (-3.6)
Brazil	-3.3/-2.5	-3.5/-0.7	-3.1 (-2.8)	-1.9 (-1.2)	9.3 (8.9)	7.1 (6.6)	-3.8	-3.0 (-3.1)
Britain	2.3/2.7	1.7/2.7	2.4 (2.5)	2.2 (2.3)	0.1	1.2 (1.3)	-4.5 (-4.6)	-4.0 (-3.9)
Canada	1.0/1.3	1.2/2.3	1.1 (1.2)	1.9	1.2 (1.3)	1.9	-3.2 (-3.1)	-2.4
China	6.8/7.1	5.8/6.8	6.9	6.4	1.5 (1.6)	1.8 (2.0)	3.1	3.1 (3.0)
France	1.0/1.2	0.9/1.7	1.1	1.3 (1.4)	0.1	1.0	-0.3 (-0.5)	-0.3 (-0.4)
Germany	1.4/1.8	1.3/2.1	1.6	1.7 (1.8)	0.2	1.3 (1.4)	7.9 (7.8)	7.5 (7.4)
India	6.9/7.7	6.8/8.0	7.3	7.6	5.1 (5.0)	5.2 (5.4)	-1.2 (-1.1)	-1.3 (-1.2)
Italy	0.6/0.9	0.9/1.6	0.8 (0.7)	1.3	0.2 (0.1)	1.0 (0.9)	1.9 (2.0)	1.8 (2.0)
Japan	0.5/0.9	0.6/1.7	0.6 (0.7)	1.2	0.7	0.9	2.6 (2.7)	2.7 (2.8)
Russia	-4.5/-3.5	-2.0/1.5	-3.8 (-3.9)	-0.3 (-0.4)	15.2 (15.0)	7.3 (7.5)	4.7 (5.5)	4.5 (5.3)
Spain	3.0/3.8	2.3/3.1	3.2 (3.1)	2.7 (2.6)	-0.6 (-0.5)	0.8 (0.7)	0.9 (0.8)	0.8 (0.5)
United States	2.1/2.5	1.6/3.0	2.4	2.5	0.2 (0.3)	1.8	-2.5	-2.6 (-2.7)
Euro area	1.4/1.6	1.3/2.1	1.5	1.6 (1.7)	0.1	1.1	3.0 (2.8)	2.8 (2.6)

Sources: Bank of America, Barclays, BNP Paribas, Citigroup, Commerzbank, Credit Suisse, Decision Economics, Deutsche Bank, EIU, Goldman Sachs, HSBC Securities, ING, Itau BBA, JPMorgan, Morgan Stanley, Nomura, RBS, Royal Bank of Canada, Schroders, Scotia Capital, Société Générale, Standard Chartered, UBS. For more countries, go to: Economist.com/markets

Other markets

	Index Dec 2nd	% change on		
		one week	Dec 31st 2014	
			in local currency	in \$ terms
United States (S&P 500)	2,079.5	-0.4	+1.0	+1.0
United States (NAScomp)	5,123.2	+0.1	+8.2	+8.2
China (SSEB, \$ terms)	383.5	-0.3	+36.0	+31.9
Japan (Topix)	1,602.3	+0.5	+13.8	+10.5
Europe (FTSEurofirst 300)	1,512.8	+0.7	+10.5	-3.4
World, dev'd (MSCI)	1,710.1	+0.7	nil	nil
Emerging markets (MSCI)	825.5	-1.3	-13.7	-13.7
World, all (MSCI)	411.2	+0.5	-1.4	-1.4
World bonds (Citigroup)	865.7	+0.3	-4.1	-4.1
EMBI+ (JPMorgan)	714.0	-0.4	+3.2	+3.2
Hedge funds (HFRX)	1,189.9 [§]	nil	-2.3	-2.3
Volatility, US (VIX)	14.9	+15.2	+19.2 (levels)	
CDSs, Eur (iTRAXX) [†]	69.1	-1.9	+9.8	-4.1
CDSs, N Am (CDX) [†]	82.6	-2.3	+25.0	+25.0
Carbon trading (EU ETS) €	8.5	-1.5	+16.4	+1.7

Sources: Markit; Thomson Reuters. [†]Total return index. [‡]Credit-default-swap spreads, basis points. [§]Nov 30th.

Indicators for more countries and additional series, go to: Economist.com/indicators

The Economist commodity-price index

2005=100

	Nov 24th		Dec 1st*		% change on	
	Nov 24th	Dec 1st*	one month	one year	one month	one year
Dollar Index						
All Items	125.4	126.2	-3.6	-19.0		
Food	148.9	148.8	-3.0	-14.6		
Industrials						
All	101.0	102.7	-4.6	-24.8		
Nfa [†]	107.5	108.9	+0.1	-12.3		
Metals	98.2	100.1	-6.6	-29.5		
Sterling Index						
All items	151.4	152.5	-1.4	-15.8		
Euro Index						
All items	146.6	147.6	-0.7	-5.5		
Gold						
\$ per oz	1,074.9	1,066.0	-5.2	-11.1		
West Texas Intermediate						
\$ per barrel	41.4	41.6	-13.1	-38.0		

Sources: Bloomberg; CME Group; Cotlook; Darmann & Curl; FT; ICCO; ICO; ISO; Live Rice Index; LME; NZ Wool Services; Thompson Lloyd & Ewart; Thomson Reuters; Urner Barry; WSJ. ^{*}Provisional [†]Non-food agricultural.

EPISODE FIVE

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At Igor's side

Robert Craft, conductor, musicologist and amanuensis of Stravinsky, died on November 10th, aged 92

THE letter was businesslike, and Robert Craft never intended it to work out as it did when he sent it, in 1947, to Igor Stravinsky in Los Angeles. He was already “ensorcelated” by his music, ever since hearing “The Rite of Spring” as a boy—and possibly ever since, at 18 months, he had enjoyed dropping saucepans on the kitchen floor. In 1947, at 24, fresh out of the Julliard School and starting as a conductor, he needed scores for the “Symphonies of Wind Instruments”, but could find none. He wondered whether Stravinsky, then 65, could help. The reply, to “Bobsky”, started a friendship and a mutual dependence that lasted not only to the end of Stravinsky’s life, in 1971, but also to the end of Mr Craft’s.

Within a few months, Stravinsky was signing off his letters “Love—kisses”. Not much later, Mr Craft was absorbed into the composer’s household in Hollywood, together with 10,000 books, antiques, icons and curios on every surface, Stravinsky’s warm and ebullient second wife, Vera, Celeste the cat, and an all-Russian staff fed on *pirozhki* and samovar tea. His life now revolved around the composer’s routine, which began with a 15-minute headstand each morning; involved ferocious bans on any sound, or cooking smell, reaching the room where he worked on a surprisingly second-rate upright piano; and which was

liberally lubricated with Scotch, *marc* and ice-cold *eau-de-ginèvre* swigged from terracotta bottles. Mr Craft, often praised by Stravinsky as the best interpreter of his works, found conducting the “Symphony in C” pretty hair-raising after his first initiation in hard-core Russian drinking.

Over their 23 years together, his job was never really defined. “Factotum” would have done, though with his fondness, like Stravinsky’s, for reading dictionaries (he was using “adscititious”, correctly, in letters home from his military academy at 17), he preferred the Byzantine *paracoemomene*. He had to answer letters (“Please clear it up, dear Bob”), and chase up music publishers; copy out scores; accompany Igor and Vera on all music tours in America and beyond, as a “trio con brio”; rebuff intrusive interviewers; book venues for concerts, as well as hotels; conduct for him if he was indisposed; sit in the control booth to check pitches (“Robert is my ears”), during recordings; read to him; and answer the telephone *immediately* it rang. At times he felt like a dogsbody for his tiny, witty, bantam-like boss, and mutual friends noticed that he often looked wrung out with worry as he hovered, pale, elegant and tall, at his right hand. But he admired his genius too much—and loved him too much—to leave.

He could be of use to him artistically,

too. Because he spoke no Russian, Stravinsky had to make efforts with his English, which helped him to compose more confidently on English themes, notably “The Rake’s Progress”. And because Mr Craft liked his rival Schoenberg’s music as much as his, Stravinsky was gently introduced by him to the 12-tone serialism that came to colour his later works. The amanuensis liked to think that he had led the great man to something stimulating and new.

Blessings and pills

Besides, the helpfulness was not all one way. Though Mr Craft’s own musical career, anticipated to be brilliant, had now been half-hijacked, Stravinsky encouraged his conducting of Bach and Monteverdi and his rescue from obscurity of the works of Gesualdo, even filling in the lines of some of the missing part-books for him. Mr Craft’s greatest musical achievement was to record, for a largely indifferent world, all the works of Schoenberg’s pupil Webern; Stravinsky came to every rehearsal, and put pressure on Columbia when the company got cold feet. Co-conducting concerts—often humiliating for Mr Craft, whose crisp, cool, bird-like style pleased audiences less than Stravinsky’s graceful, emotional sweep—the ever-hypochondriac composer would slip him pills for nerves, and bless him in the Orthodox fashion before he took the stage.

Naturally, after his death, Mr Craft appointed himself the keeper of the flame. He became Vera’s escort round the world, fought the Stravinsky children for a share of the estate, catalogued the manuscripts, tended the grave and acted as gatekeeper for all aspirant biographers. He had always ridiculed any interviews with Stravinsky other than his own, since only he, he said, could transform those eccentric words into English that made sense. Only he—who had lived with him, knew his habits, had worked bar by bar through the scores—was qualified to speak for him. Stravinsky, he reported, had wanted no biography. But he himself produced six books of conversations, several volumes of memoirs of their friendship, photographic albums, filling with fierce determination the space the composer required. All other attempts he dismissed, as interlarded with errors.

In “An Improbable Life” (2002) several pages were devoted, harrowingly, to Stravinsky’s last days. The fading and silent composer, for once, was less prominent than Mr Craft, who was permanently at his side. He fielded visitors, exhorting them to kiss the dying man: “He wants you to.” He urged him to eat—“*Mangez, mangez!*”—as if his own life depended on it. And at the very end he noticed that Stravinsky made his fingers into little hooks to catch on to Vera and himself, gathering him up into his death never to let him go. ■



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