

ECN230 SRP session 15. Government Intervention in Mature Economies

STRATEGIC POLICY INTERVENTION

Subsidisation and promotion of exports

THE promotion of international competitiveness has led governments down many roads that economists shudder to tread. Import substitution, with its distortion of domestic investment and its intense protectionism, has long fallen out of fashion. However, export subsidies of all shapes and sizes have become tolerable stand-ins. Research demonstrates that the theoretical basis for export subsidies is dubious, and that their empirical effects can be downright scary [1].

Political leaders nowadays often double as a commercial traveller. France's President de Gaulle once refused to meet a Japanese prime minister, dismissing him as a "transistor salesman". Leaders now make exports a central part of their foreign policy. A US president puts in a word with a Saudi prince and snatches an order for Boeing from under the nose of Europe's Airbus. A European president flies to Beijing and returns with trade deals; other westerners fume – outwardly about human rights, inwardly about lost businesses. In the UK, the government stirred up a parliamentary squall by promising to spend £60m (\$97m) on a new yacht for the royal family, arguing that a gracious chat with Her Majesty will so impress "foreign potentates" that business will flow to UK companies wherever *HMS Buybritish* docks [2].

There are several justifications on offer for the existence of export subsidies. They include the need to nurse infant industries; to compensate for protectionism abroad; to overcome capital-market problems faced by firms in small countries; to promote employment; and to keep trade balances positive. The subsidies can range from simple ad valorem payments to companies based on the size of their export sales, to complex systems of tax credits, loans, insurance policies and price supports [1].

How do governments promote exports? In principle, there are four main methods at their disposal: (1) subsidising exports, directly or indirectly; (2) manipulating the exchange rate; (3) trade activism; and (4) trade promotion.

1. The simplest is to subsidise exporters, directly or indirectly. A direct subsidy, the crudest measure, is illegal for use on industrial goods and constrained on agricultural products under the rules of the World Trade Organisation (WTO). If WTO members industries are injured by others' industrial subsidies (even if these are not related to exports), then a case can be brought before the WTO's dispute-settlement system: the result may be an end to the subsidy or compensation [2].

Indirect subsidies can be legal means around WTO prohibitions on subsidies. Governments can still find channels down which to pump money for exporters. They can instead subsidise research and development. Under WTO rules, governments may pay up to 75% of a firm's industrial-research costs, or half the costs of product development. There is a respectable economic argument for this: a firm undertaking research may not secure all the benefits from it; these can accrue to everyone, in the form of better-educated scientists or a new product (e.g., a pharmaceutical or drug) becoming available. Governments have an interest to encourage this. The trouble is that in practice they are poor at picking good research projects; markets are rather better [2].

Governments wanting to grow their national economies more quickly think that, with a well-chosen subsidy here or a finely judged tax break there for research and development (R&D), they can give their industries a

friendly shove and so speed their economies along. Economists are usually more sceptical [3].

Yet even sceptical policy-makers often claim that high-tech industries are an exceptional case. Such industries, they say, have a "strategic" value to the economy because new technology is an engine of long-run productivity growth; a country can get ahead economically if with a technological edge. It makes good economic sense for governments to promote technological advance: left to itself, a market fails [3].

Why? One possible reason is that in some high-tech industries, such as semi-conductors, firms "learn by doing". The more they produce, the fewer mistakes they make and hence production costs fall. The snag is that a firm may not be able to capture all of the benefits of this. Some benefits "spill over" to other firms when, say, good workers change jobs. Similarly, some of the benefits of the firms' R&D spending may go to rivals, who adapt it to their own ends. Such spillovers blunt firms' incentives to learn and to spend on R&D. Moreover, the benefits of technology promotion are unlikely to rest in the domestic economy; firms abroad benefit as well [3].

Governments can finance exports through "export credit guarantees", which insure exporters against the risk of default by their customers. In the past, governments used to subsidise exporters by guaranteeing loans at below-market interest rates. OECD countries have signed a self-denying ordinance, intended to eliminate such beggar-my-neighbour subsidies on credits of two years or more. Many European governments have also increased private-sector involvement in their short-term export-credit operations, bringing market discipline to bear on them. [2].

Governments can also offer "tied aid", requiring the recipient of aid to buy goods from companies in the donor country. The aid is often given for foreign policy as much for commercial reasons, and might be categorised as "aid" not "trade". In December 1996, the OECD adopted new guidelines on tied aid, as they did with provision of loans at below-market interest rates, aimed at ensuring that only projects that cannot be commercially financed benefit from such aid. Governments have used these means of subsidising exporters to a lesser extent than in the past [2].

2. Manipulating the exchange rate is the second broad way in which governments can boost exports. By devaluing, a government makes exports cheaper in foreign-currency terms. This helps exporters in the short run, but not in the long. Devaluation raises import prices, and if workers maintain the purchasing power of their wages, labour costs rise, too. Eventually much, if not all, of the initial gain is lost through inflation [2].

3. The third form of government assistance for exporters is trade activism, which amounts to simple information-gathering activities to facilitate trade. Commerce departments and trade ministries spend lots of time and trouble gathering business information of every sort on foreign markets. Firms can do this for themselves singly (if big enough) or collectively – and many do, but small firms, especially, get a sort of free ride from embassies set up for other reasons. Diplomats spend time gathering information about local markets, showing the flag at trade fairs and arranging business meetings [2].

4. Trade activism greatly overlaps with the last area, trade promotion, which is exemplified by the high-profile trade missions. European politicians and diplomats have long acted as export boosters. Asian tigers, too, are making big efforts. The (South) Korean Trade-Investment Promotion Agency has a network of offices round the world. The

Hong Kong Trade and Development Council, which stages some 350 events a year around the world, is unusual in the it recoups 70% of its HK\$1 billion (\$130m) budget by charging participants fees. Assuming a firm pays only for services it finds useful, the HKTDC probably does a better job than most of its foreign counterparts. Japan is an exception to the rule of Asian boosterism. Having being bullied for decades by the Ministry of International Trade and Industry (MITI) to “export or die”, big Japanese manufacturers now need no encouragement, financial or otherwise [2].

The allocation of export-boosting cash can make little sense. In the late 1990s, roughly two-thirds of the funding went to promoting food exports, reflecting the food lobby’s clout, rather than its needs. At one point, California’s raisin growers secured \$4m to advertise their raisins in Japan – a sum exceeding the US Commerce Department’s entire Japan budget. With greater transparency in annual reporting on export promotion, the US Trade Promotion Coordinating Committee has reduced such misallocation. Money has slowly shifted from the food lobby to other industries [2].

Rich and poor countries alike have used export subsidies to enhance their presence on world markets, perhaps doing more harm than good. These policies bring with them some huge problems. Any company coddled by a subsidy has less incentive to improve its bottom line (and hence make the subsidy unnecessary). Tax revenues used for subsidies are distributed in a way that makes them regressive. Export subsidies, in general, take money from broad-based tax revenues and are transferred to corporate shareholders. Artificially low prices depressed by subsidies can force more efficient producers in importing countries out of business. Besides harming domestic producers in poor importing countries, export subsidies may crowd out competing trade from other countries whose governments are too poor to retaliate [1].

Such retaliation may not be desirable, in any case. Arvind Panagariya¹ of the University of Maryland demonstrates that a small country facing subsidised competitors should not necessarily respond in kind; although exports may expand, overall welfare may well decline. The same goes for export subsidies designed to counterbalance tariffs—if tariffs are applied at different rates for different goods, no combination of export subsidies can effectively neutralise them. Mr Panagariya accuses the World Bank and the IMF of accepting export subsidies as a substitute for true liberalisation of trade, which is always welfare-enhancing in the long run. Whether trade subsidies are complex or as simple as *ad valorem* payments, their perpetuation relies on the interests of industries whose scope and lifetime they have extended. Inefficiency therefore begets inefficiency [1].

Even if a government seeks to promote exports (or the share of manufacturing goods in exports—a favourite of emerging economies) at all costs, export subsidies may not be successful everywhere. With the exception of South Korea, Mr Panagariya notes, developing countries that have used export subsidies have not expanded their exports faster than those that have pursued less interventionist policies. Other initiatives, such as the promotion of growth in total factor productivity, have proved more successful and less distortionary in the developing world [1]

Governments fond of subsidising industrial research and development might be less eager if they knew where the benefits went. Although international spillovers of R&D and learning-by-doing are hard to measure precisely, some studies should give policy-makers pause for thought. Douglas Irwin and Peter Klenow, University of Chicago, find that there are large spillovers in the US’s semiconductor industry (one favoured by that country’s industrial policy).² They reckon that when a US firm makes an extra semiconductor, the spin-offs for others are worth about one-third of the first firm’s gains. Japanese firms gained just as much as other US ones. Thus, it would seem pointless to favour US semiconductor companies on nationalistic grounds [3].

David Coe, an IMF economist, and Elhanan Helpman, of Tel Aviv University, studied the relationship between R&D and productivity in 22 industrial economies between 1971 and 1990.³ They linked increases in “total factor productivity” (TFP) – ie, gains in output which cannot be explained by extra labour or capital – to changes in the stocks of R&D (estimated by cumulative R&D spending less depreciation). They found, predictably, that an increase in a country’s R&D stock boosted its own TFP. On average, a 1% increase in a G7 country’s R&D stock increased its TFP by 0.23%. Oddly, the 15 smaller economies studied gained proportionately less: a 1% increase in their domestic R&D stocks lifted their TFPs by only 0.08% [3].

Research spending also raised productivity in foreign economies. The authors reckon around a quarter of the global benefits of R&D investment in G7 countries went to foreigners. The biggest spillovers came from the US, which has the biggest R&D stock. A 1% rise in its stock lifted TFP in the other 21 countries by an average of 0.04% [3].

Small economies benefited more from foreign R&D than big ones. So much so, say Coe and Helpman, that in small industrialised economies foreign R&D spending may have a bigger effect on productivity than home-grown research. A 1% rise in the foreign R&D stock (measured by the sum of foreigners’ R&D stocks, weighted by their share in the home country’s imports) in 1990 would have increased TFP by 0.26% in Belgium and 0.16% in Ireland. Had 1% been added to the US’s foreign R&D stock, its TFP would have been a paltry 0.03% higher (see chart) [3].

In a study of 77 developing countries, Coe and Helpman, and another IMF economist, Alexander Hoffmaister, looked at how much poorer countries gain from rich-country R&D.⁴ Most produce very little R&D themselves, but foreign R&D boosted their productivity: during 1985-90, a 1% rise in the US’s R&D stock increased the TFP of the 77 by 0.04%, on average. Singapore’s TFP was boosted by 0.22% [3].

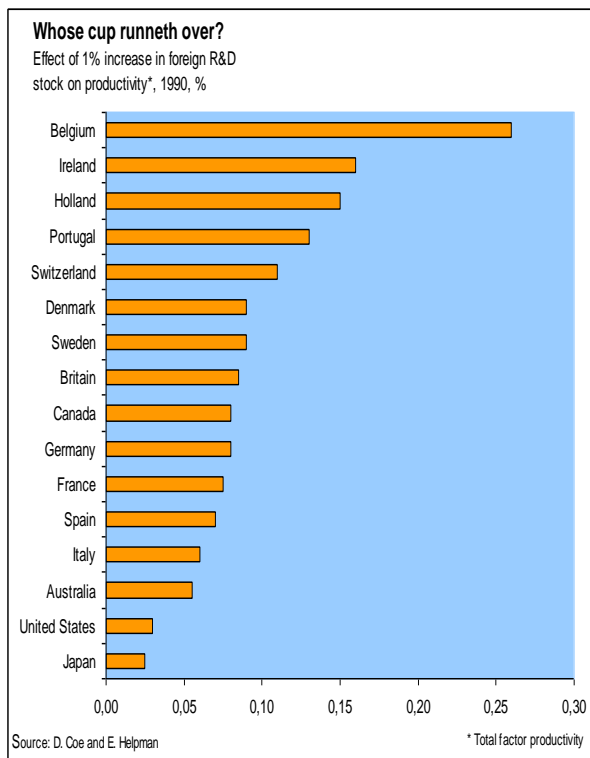
How can one country’s R&D benefit foreigners? Mainly, suggest the authors, through international trade. By importing from technologically advanced economies, countries acquire higher-tech inputs that make their own industries more efficient. Furthermore, importers may be able to work out and then copy the technology developed by foreign firms. Less directly, international trade forces economies to become more efficient: as a by-product, companies should become better at developing new technology and imitating foreign methods [3].

¹ <http://wbln0018.worldbank.org/Research/workpapers.nsf/12e6920265e1e0d3852567e50050df1f/d322a72fe343f48a85256872005b7c86?OpenDocument>

² “Learning-by-Doing Spillovers in the Semiconductor Industry”. *Journal of Political Economy*, December 1994

³ “International R&D Spillovers”. *European Economic Review*.

⁴ “North-South R&D Spillovers”. Centre for Economic Policy Research Discussion Paper No. 1133, February 1995



Thus the more open an economy is to imports, the more it should benefit from foreign research. Smaller economies tend to import more than bigger ones, so they tend to gain proportionately more. Belgium's imports were worth nearly 90% of GDP in 1990; the US's were only 11%. Governments have another reason to beware spurious "strategic" arguments for dishing out help to firms. Positive spillovers cannot be kept within national boundaries: subsidising locals often means subsidising foreigners too [3].

It may also seem odd that governments should be putting so much effort into promoting exports just when they are cutting back on other forms of interference in trade, such as tariffs, under the auspices of the WTO. One plausible explanation is that most of their energy goes into helping small firms, which cannot afford to set up their own offices overseas. The US Commerce Department, for instance, reckons that 90% of its work is on behalf of small companies. Is it successful? [2]

A second explanation is that, especially when big infrastructure contracts are at stake in emerging markets, governments are afraid to abandon their national companies because other governments are committed to backing their own champions. At the same time, the purchaser itself is usually a government, or state-owned company. Winning a contract is harder without the personal endorsement of a minister [2].

Other governments' support for their national firms was a prime reason why the US joined the battle so fiercely. "In the best of worlds", says Mr Garten, the dean of Yale School of Management, "governments ought to get out of this business altogether. The marketplace is corrupted by the presence of government. So do you sit on the side and pontificate about Adam Smith, or do you enter the fray?" [2]

Will governments ever get out of the export-promotion business? When pigs fly, perhaps. Clearer government-

⁵ "The Environment and Directed Technical Change", by D. Acemoglu, P. Aghion, L. Bursztyn and D. Hemous, forthcoming in the *American Economic Review*.

procurement procedures (long a US priority) have been an item on the WTO's agenda for some time. Governments love to think, usually mistakenly, that their economies will be better off if they help things along than if they leave well alone [2]. ♦

Economists reconsider the merits of industrial policy, but some flaws are hard to fix

Crises have a way of getting people to reassess tarnished ideas. The policy of fiscal stimulus languished in the intellectual wilderness until the financial meltdown of 2008-09 forced governments to start spending as a way of propping up aggregate demand. As rich countries struggled with an anaemic economic recovery, it was the turn of industrial policy. The idea of government intervention to influence the composition of a country's output has long been derided by economists for breeding inefficiency, reducing competition, encouraging lobbying and saddling countries with factories producing products nobody wants. But in the aftermath of the crisis, industrial policy gathered some vocal champions [4].

Justin Lin, the chief economist of the World Bank, believes that policies of this sort are a useful way for governments in developing countries to speed up structural transformation. Dani Rodrik of Harvard's Kennedy School of Government reckons that Chinese rules requiring a significant chunk of intermediate goods (ie, inputs used to make other goods) to be locally produced helped the growth of supplier industries. He also believes that export incentives aided Chinese companies in gaining a foothold in competitive global markets, and credits active industrial policy with much of China's recent success [4].

Theorists' thinking about industrial policy is acquiring greater nuance. Daron Acemoglu of the Massachusetts Institute of Technology (MIT), Philippe Aghion and David Hemous of Harvard University, and Leonardo Bursztyn of the University of California, Los Angeles (2011)⁵ explore the use of green industrial policy. The authors develop a theoretical model to show that if a product is made using two substitutable inputs, one of which is "dirtier" but also cheaper than the other, then the market will not only tend to generate too much pollution but also produce a self-reinforcing cycle of innovation in the dirty product as researchers build on previous breakthroughs. To solve these problems, it helps to have two instruments to hand: a carbon tax to discourage pollution directly, and subsidies or other incentives to encourage innovation around the cleaner input [4].

Defenders of industrial policy also have a new answer to the long-standing critique that it hampers competition. By focusing subsidies and tax breaks on a set of industries or companies, argue opponents, governments open themselves up to being captured by these firms. Firms expend energy, time and talent not on innovating and creating better products, but on securing government help, often to ensure that potential rivals are kept at bay [4].

Another paper⁶ co-written by Mr Aghion—along with Mathias Dewatripont and Patrick Legros of the University of Brussels, and Luosha Du and Ann Harrison of the University of California, Berkeley—turns this argument on its head. They say that when companies focus on the same industry, they compete more intensely and generate more innovation and growth as each tries to outperform the other. It may, therefore, be tempting for a firm to find a new area to produce in which it is less competitive: even if it ends up doing better as a result, the outcome for the

⁶ "Industrial Policy and Competition", by P. Aghion, M. Dewatripont, L. Du, A. Harrison and P. Legros, working paper June 2011.

economy as a whole could be less competition, less innovation and lower growth. This suggests that, rather than pushing companies to explore some new area which the government in its wisdom or folly has decided is the sector of the future, industrial policy should encourage competition instead, thus reducing firms' tendency to seek out less contested arenas [4].

Does this work in practice? There is probably no better place to look for the effects of industrial policy today than China, and it is to data on the performance of medium-sized and large Chinese companies between 1998 and 2007 that the economists turn to test their ideas. The firms in question are in industries with varying degrees of competition, but all of them benefit from some of the Chinese government's plethora of industry- and sector-level tariff rebates and subsidies. The authors find that when subsidies are given to competitive sectors and distributed in a way that maintains or increases the level of competition within the industry, then the net impact of these subsidies on productivity, productivity growth over time and also the share of new products in total sales (which is a measure of how innovative a firm is being) is positive. If subsidies go to industries with fewer competitors, they do not aid innovation or productivity growth [4].

Mr Rodrik would be pleased with this finding: he thinks that industrial policy can work if it is designed cleverly.⁷ But that is a big if. None of these studies addresses a deeper problem with the way industrial policy tends to develop over time. Earlier efforts have tended to degenerate into rent-seeking, lobbying and cosy deals between incumbent firms and bureaucrats, stifling innovation and the process of creative destruction. Indeed, Mr Rodrik is well aware of these problems when he lays out his principles for "sensible industrial policy", arguing for instance that governments should avoid open-ended incentives that in time entrench incumbents and raise consumer prices. Like patents, he reckons, industrial policies should eventually expire. Similarly, he thinks that what matters is not whether governments can pick winners—they cannot—but whether they have the good sense to let losers fall by the wayside [4].

The problem, of course, is that this rarely happens. In effect, Mr Rodrik and others are arguing that industrial policy requires disinterested, benevolent policymakers who can do it well. Unfortunately, they do not yet have a recipe for how such policymakers can be created. Policy is made by real people with political and personal motivations. What they come up with is unlikely to be as well designed as the ones in the models [4].

DE-INDUSTRIALIZATION AS AN EXTERNALITY FROM NORTH-SOUTH TRADE

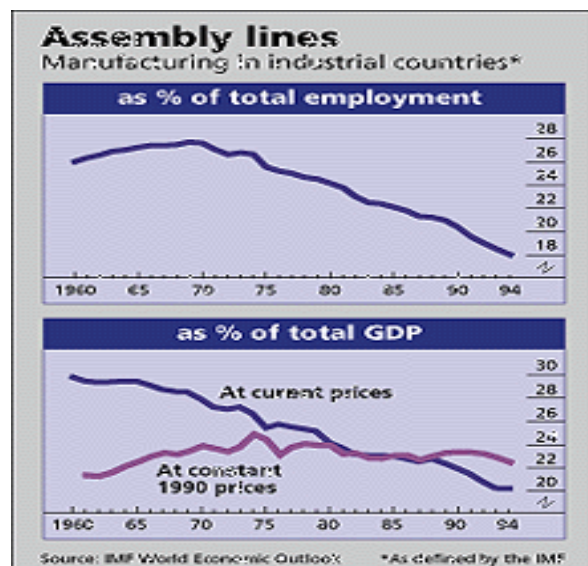
Is deindustrialisation evidence of economic decline or a consequence of economic progress?

Talk of "deindustrialisation" can strike fear into the hearts of workers, manufacturers and politicians in rich economies. The reason for this phenomenon, the relative decline in manufacturing jobs in rich countries, is widely misconstrued. This decline in jobs has coincided with the rapid increase in manufactured exports from developing countries, e.g., China and Brazil. Rich-country voters assume that these upstarts are stealing their jobs, and that the solution lies in job subsidies and trade barriers [5].

There is no doubt that manufacturing provides fewer jobs than it used to. The share of manufacturing in total employment in the rich economies fell from 28% in 1970 to 18% in 1994. In the US, less than one worker in six (and falling) works in manufacturing; in the EU one in five does. Even in Japan, a country cited as fostering its manufacturing sector, less than a quarter of the workforce is in manufacturing. More than 70% of US workers are employed in services, and growing [5].

The trend is clear. Its causes less so. Two explanations commonly offered for deindustrialisation are: (1) as a country becomes richer, its consumers buy relatively fewer manufactured goods and relatively more services; and (2) there is an alleged migration of manufacturing jobs from rich countries to poorer ones. In a careful new analysis of the numbers⁸, the IMF suggests that neither explanation captures what is really going on. A bigger cause of change by far is that productivity is growing much faster in manufacturing than in services [5].

Manufacturing's share of GDP measured in current prices has fallen, suggesting that deindustrialisation reflects a shift in spending from goods to services. The rise in the nominal value of services in GDP reflects a rise in the relative price of services. In constant prices the share of manufacturing output turns out to have remained broadly stable over the past three decades in the rich economies as a whole (see chart) [5].



There are differences between rich countries. The share of manufacturing in GDP fell in the US since the 1970s. The losses in the US were offset by a rise in Japan. This, according to the IMF's analysis, was not due to shifts in domestic spending, but to changes in US-Japan manufacturing trade: the US has had a widening trade deficit while Japan's trade surplus widened [5].

Have increased imports from developing countries played a big role? The IMF concludes that trade has had only a small impact on manufacturing jobs in rich countries as a group, mainly because their overall trade balance in manufactures has hardly changed: their increased imports from low-wage countries were matched by increased exports. Trade between developed and developing countries may have affected the mix of manufacturing jobs—reducing unskilled jobs relative to skilled ones—but the net effect was probably modest [5].

⁷ "The Return of Industrial Policy", by D. Rodrik, April 2011.

⁸ *World Economic Outlook*, April 1997. This subject is treated in more detail in "Deindustrialization: Causes and Implications", by

Robert Rowthorn and Ramana Ramaswamy, IMF Working Paper, April 1997.

Instead, argues the IMF, the decline in manufacturing jobs mainly reflects sectoral differences in productivity growth. In 1960-94, service-sector output and manufacturing output grew at roughly the same pace in rich economies. Productivity in manufacturing, however, rose more than twice as fast as in services. This shifted employment from the more productive manufacturing sector, where fewer workers are needed to produce a given increase in output, to service industries where labour is needed and is more intensive. Improvements in farming productivity caused the same thing to happen in agriculture over the past century. Having made up 50% of all US jobs in 1860 farming now employs only 3% [5].

As a country gets richer, it is inevitable that a smaller proportion of workers are needed in manufacturing. This trend, which began in the US and spread to Europe and Japan, is now visible in the Asian tigers. The share of manufacturing jobs fell in Hong Kong in the 1970s, and in Singapore, South Korea and Taiwan in the 1980s [5].

The IMF estimates that faster productivity growth in manufacturing relative to services could account for two-thirds of the drop in the manufacturing's share of employment in rich economies since 1970. Official figures can exaggerate deindustrialisation: manufacturing firms that once employed their own accountants or cleaners now hire them from outside firms – jobs that are reclassified as part of the service sector [5].

If the popular explanations for the relative decline of manufacturing employment are wide of the mark, so are the conclusions commonly drawn from it. Those fretting over the “decline” of manufacturing portray service jobs as inferior, unskilled affairs. In fact, many such jobs are increasingly likely to be in highly skilled areas such as teaching, financial services or information technology [5].

Deindustrialisation causes problems in economies unable to absorb the workers released by manufacturing. Those making calls for subsidies or trade barriers miss the point. As manufacturing continues to shrink in an economy, overall growth will increasingly depend on boosting productivity in services. Policy should therefore focus on removing obstacles (such as trade barriers and regulation) to such productivity growth, and creating a labour market in which workers can move freely from factory employment to services. Protection and subsidies push just the wrong way [5]. ♦

China's Graduation: Industrial Policy and SOEs

Industrial policy involves the use of tax, subsidies, trade policy measures and other programs to support, encourage investment and production in targeted sectors.

China's industrial policy has worked better than critics think, but the state-led model is creaking. Despite a truce in the US-China trade war in Dec 2019, China announced that the government would do more in 2020 to support strategic sectors, ranging from robotics to biomedicine. Having seen its vulnerability to US export controls, China is more determined to build up its domestic abilities. But, does industrial policy work? In principle industrial policy looks attractive. When markets are highly imperfect—a fact of life in developing countries—governments can use their muscle to stimulate activities that would otherwise be unthinkable for private entrepreneurs. When such policies succeed, the targeted sectors flourish, as South Korea's chemicals industry did in the 1970s. That, in turn, can lead to technological advances and productivity gains for the wider economy [6].

But in practice industrial policy is hard to get right. Helping companies is as likely to promote laziness as competitiveness. Moreover, officials may be no better—and perhaps much worse—than businesspeople in choosing which industries to support [6].

China is far from alone in deploying industrial policy, but it stands out for the sheer scale of its efforts. Since the 1980s it has produced dozens of plans and lavished public spending on sectors from solar power to film-making. The electricity and telecommunications sectors are natural candidates for government intervention, given the high cost of building power grids and phone networks, plus the benefits to society. But China has done more than build basic systems; it has also tried to reach the frontier of global innovation [6].

One tentative conclusion is that China's industrial policy works better when natural monopolies are involved. There is a clear role for a central authority with strong organising power to develop a power-transmission system or a high-speed rail network. Yet that same authority can stifle competition in sectors that need it. Alternatively, as often occurs in China, if lots of provincial governments try to foster their own champions, nominally in pursuit of national objectives, the outcome is extreme over-capacity, which undermines the targeted sector [6].

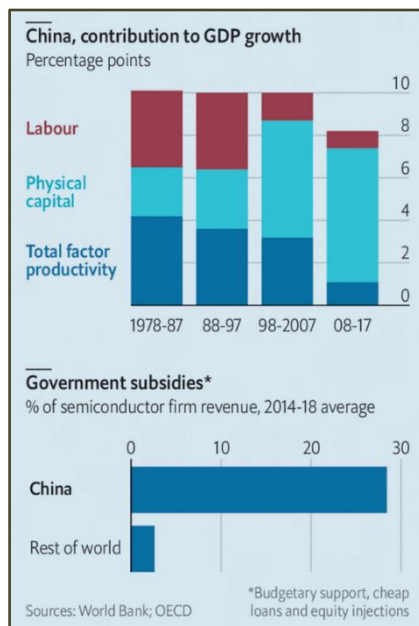
China's shipbuilding industry provides a textbook example. Panle Jia Barwick and Nahim Bin Zahur, both of Cornell University, and Myrto Kalouptsi of Harvard University (2020) estimate in a paper that between 2006 and 2013 the government directed policy support worth 550bn yuan (roughly \$80bn at the time) to shipbuilders. Most went as subsidies for entrants to the sector, attracting subpar firms. China became the world's biggest producer of ships. But the increase in net profits was just a fifth of the subsidies. Even the electricity sector, an ostensible success, is plagued by excess. A well-run power network should have back-up generating capacity equivalent to about 15% of peak load. The average among China's provinces is more than 90% [6].

That, though, is not the end of the story. Ultimately, the value of industrial policy is in its wider economic impact. In a separate paper, Ernest Liu of Princeton University argues that state support is most effective when it targets those sectors that make the most essential inputs for others. Generally, these are upstream; turning raw materials into products used in a range of industries. Subsidies for them, even via state firms, can raise overall efficiency. As it happens, China has focused its support on the right sectors in Mr Liu's calculations, such as steelmaking and machinery. China, put bluntly, might never have become the economic power that it is today without ambitious industrial policy [6].

Mr Liu's model does not indicate when subsidies are too high, nor does it set out how best to design policies. There is evidence that China's heavy-handed intervention is becoming increasingly ineffective. Total factor productivity growth in China in recent years has been a third of what it was before the 2008 global financial crisis (see chart, GDP growth). Productivity has also slowed in other countries, but the World Bank, in a recent book about Chinese innovation, notes that China's slowdown has been unusually sharp [6].

After conducting extensive case studies of the vehicle and renewable-energy sectors, among others, the bank ascribes some of the blame to Chinese industrial policies that undermine fair competition. It argues that rather than targeting support at specific firms, China should shift to more market-oriented policies. Even-handed regulations and incentives, which treat state firms no differently from

private companies or foreign investors, would do more than lavish subsidies to promote entrepreneurship [6].



No government controls more of an economy worth controlling than China's does. Some 51,000 state-owned firms employ about 20m people and are collectively worth \$29trn, according to analysis in 2017 by the OECD, a club of mainly rich countries. Many private Chinese firms claim that they receive no state support, and in strictly monetary terms that is often true, but free land from provincial governments and a side hustle in property management is the norm. The Communist Party's ability to ensure the successful deployment of a technology is not restricted to funding. The state hedges risk, squashes NIMBYism and pays for infrastructure [7].

But two other factors are taking over from raw state power as the motor of Chinese technological development. One is that companies occupy important supply chains in the world, giving them easy access to all sorts of technological know-how. As workshop to the world, China—and particularly the Pearl River Delta region—makes components for almost everything, understands how to assemble them, and is set up to bring together the right ones as quickly as possible. This geoeconomic advantage explains why the only successful smartphone companies founded since 2010 have been those set up around Shenzhen. (They are all non-state firms.) Their success has spread to new markets based on similar components. The consumer-drone market is dominated by China because drones are basically phones with rotors [7].

Secondly, the size and particularities of the Chinese market have become spurs to innovation in their own right. WeChat and Alipay, which use QR codes to make payments with phones, emerged and took hold in China because payment cards were not yet established; as a result Chinese cities are becoming cashless. The Communist Party's need for social control has stimulated an entire industry of machine-learning technologies catering to the security services. The West does not like the applications to which China's AI companies—mostly, also, non-state firms—turn their algorithms, but there is no denying the scale of their ambition (though their success has some under-appreciated foundations) [7].

Not every peculiarity of the Chinese system is a benefit. State support is often doled out to firms or industries based on non-commercial factors. Ignorance and corruption mess things up; so does a thirst for prestige. In the crucial battleground of semiconductors, Beijing's investment

policy is largely based on chasing after the highest-value sections of the supply chain by pumping money into Chinese versions of the foreign firms now commanding those heights. Truly innovative and effective semiconductor businesses sometimes suffer merely because they are less coveted by party officials [7].

Examining Chinese tech development reveals things not just about China, it illuminates global trends. A government able to shape and ignore public opinion can do things that governments forced to listen to the people—including vocal minorities—cannot. If China's technocrats want nuclear power and genetically modified organisms, they will get them [7].

Some trends are subtler. China's failure to catch up in technologies like internal-combustion engines, civil aviation and, to date, semiconductors shows how hard it is to make humanity's most complex mechanisms. The organisations which manage to do so depend on arcane insights and baroque procedures carefully nurtured by corporate hierarchies over decades. That even an economy as mighty as China's can scarcely catch up should give pause for reflection about the possibilities for innovation elsewhere [7].

The potential for new technologies to enhance and project Chinese power, and the threat that poses to a global order led by the US, hangs over China's technological development. But these are not its sole inspiration. China is grappling with an ageing population, environmental degradation and a slowing economy. The strengths and weaknesses of its attempts to solve these problems technologically will have lessons for other countries in similar straits, and for those which see China not just as a competitor but as an ever more sophisticated market [7].

For countries which wish to co-exist with China, its weaknesses reveal good places to invest in developing one's own capabilities. For those who wish to reduce or curtail Chinese technological power, knowing its strengths and vulnerabilities is vital [7].

Auto sector

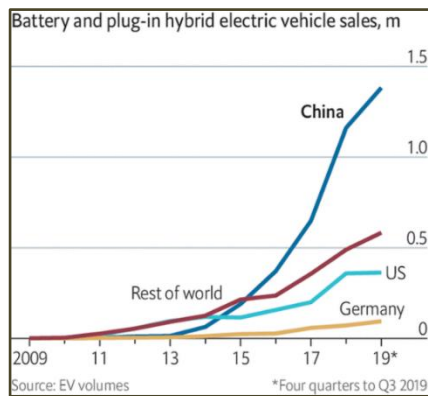
Though China may now make nuclear-power plants able to dominate the world market, its domestic internal-combustion-engine cars cannot dominate even the Chinese market. The best-selling manufacturers are VW and Honda, whose vehicles are built by local joint ventures. This is because nuclear reactors, although they need extremely strong and carefully engineered components, are basically souped-up kettles. A car, and especially its engine, is something much finer, its pistons and valves continuously dancing, the string of explosions in each cylinder perfectly timed, the right amount of torque transferred through the crankshaft to the wheels [8].

No amount of technology transfer, legitimate or otherwise, can boost a country to pole position in such an industry. As Japan and South Korea have shown, it takes decades of intense investment, hard graft and astute leadership to develop the engineering know-how and the intricate supply chains that make such things possible. China does not have the patience for that. "You would have to invest billions of dollars for another 20 years, and maybe then we would be getting close to the Germans," says Freeman Shen, WM's founder [8].

Tapping into existing supply chains might make things easier; but although China has the access this takes in electronics, in cars it does not. And the car industry's supply chains are lines of co-operation as well as commerce. To make affordable, high-quality cars you do not just need the likes of Bosch to sell you off-the-shelf

components. You need their active co-operation in creating just the right parts. If providing that co-operation means risking established business with bigger, better incumbents, it is unlikely to be completely forthcoming [8].

In electric vehicles (EV), Chinese firms think they can do an end-run around the internal-combustion incumbents because it depends on electronic components. They can take the lead in a new industry rather than play catch up in an old one. Despite cuts to the government subsidy programme in 2019, the government still wants a quarter of all cars sold by 2025 to be electric. In 2020, they account for only 7% of the market. But that still works out as 1.5m vehicles a year, making it the largest EV market in the world (see chart EV sales) [8].



The market is dominated by Chinese incumbents moving from internal-combustion vehicles to EVs. Getting high-tech factories built for nothing gives some firms a chance to achieve something that China's combustion-engine car companies never managed: develop core technology that is globally competitive. Mr Shen, a car-industry veteran, says he has had 1,000 engineers dedicated to working on electric vehicles for the past four years. "I guarantee that the largest car company in the world, Volkswagen, does not have 1,000 engineers dedicated to electric vehicles," he says [8].

Mr Shen's focus is on the EV's battery packs and the power-management systems that distribute electricity around the vehicle. The battery pack is the most expensive part of the car, squeezing the same range out of less battery is a competitive advantage, what the innovative battery-cell configurations are meant to do [8].

Mr Shen says he expects the best electric-car companies to start building their own batteries eventually. Big car companies would never source their engines from third parties; integrating them closely into the design and production process improves overall performance [8].

China is set to be a large market for EVs long before any other country, and that will benefit the industry as a whole. Because the government demands that all cars sold in China are made with Chinese components, the country will come to host the world's most important supply chains for electric cars. This opens up the possibility that Chinese supply chains will eventually be used to provide components for the rest of world, as with smartphones [8].

It also suggests that such a strategy could see Chinese EV makers capture a lot of the value from vehicles made elsewhere. Their simplicity, compared with cars powered by internal combustion, makes EVs easier to manufacture in sections. Because there are no cooling fluids to pump around the vehicle, no drivetrain to run through the floor of the cabin, the top and the bottom of the car can easily be separated out and produced independently. The bottom part, which contains the complexity of battery and power-

management electronics, is called the "skateboard", and embodies the lion's share of the value of the car [8].

Microprocessing sector

China is slowly moving up the microprocessing value chain. Failure to make cutting-edge chips is not exactly China's fault. It is a difficult industry to kick-start. The factories that produce the chips are phenomenally expensive. The technology itself is even more complex than an internal-combustion engine. The intellectual property behind cutting-edge processes is fiercely guarded. In many ways the manufacturing of chips represents the supreme technological challenge for China [9].

The Chinese government is trying hard (the country's biggest chip factory, SMIC, a private firm, has settled many suits over IP theft). In October 2019 the government raised 204bn yuan (\$29bn) from the finance ministry, state-owned firms and local governments for its domestic chipmaking efforts. That followed 139bn yuan raised in 2014. The problem is that the government's chip programme is optimising for the wrong thing. Instead of trying to stimulate a domestic chip industry to meet China's huge market needs, the funds are being spent on trying to reach parity with chip companies like Intel [9].

Chips are a vital product to China because they are fundamental to any technology-led growth that the country desires for its future, as well as for making weapons. PwC, a consultancy, estimates that the global market for chips will grow by 4.6% a year, to be worth \$575bn in 2022, driven by the requirements of cars, AI systems and communications networks [9].

Currently a huge share of that market value moves through China, but is not captured by it. The 418bn chips the country imported in 2018 cost \$312bn, a quarter more than it spent importing crude oil. And beyond grabbing a larger part of the value chain for itself, controlling the production of chips would also give China indirect control over myriad other industries, from social networking to personal computing [9].

Although Chinese firms are still behind in the manufacture of chips, they have recently achieved some success with designing them for AI applications. In late September 2019 the nerdier corners of Silicon Valley were abuzz after Alibaba, a Chinese tech-giant, released Hanguang 800, a chip designed specifically for carrying out machine-learning tasks. Even though Alibaba relied on TSMC in Taiwan to fabricate the chips, AI engineers in the Valley remarked on the Hanguang's performance, stating that it had beaten all other chips in its class. This was not supposed to happen, as China was thought to be well behind US chip companies [9].

If catching up on internal-combustion engines was hard, doing so on traditional semiconductor manufacturing will be close to impossible. The market for chips is changing fast. Instead the government would do well to focus on stimulating both design and manufacture of chips aimed at middle-end markets such as the internet of things, and emerging areas like AI [9].

In one way, China's challenge with chips is even harder than the problem it faced with combustion-engine cars. There is no completely new technology arriving which will free China from the need to catch up with the rest of the world. But China's chip companies should still listen to the market, not chase prestige [9].

Manufacturing and designing chips for the internet of things and AI applications offers an opportunity to leapfrog less agile chip companies, even if it is not the wholesale

opportunity that electric vehicles present. If they can focus on these new areas and be patient, it is likely that the scale and depth of the country's resources could end up winning its companies a permanent spot high on the global supply chain for semiconductors [9].

US-China tech rivalry

The deepening distrust of China has become a bipartisan norm in the US government. A plan called "Made in China 2025" issued by China's State Council in 2015 made clear the intention to become a global powerhouse in ten high-tech fields from artificial intelligence (AI) to aviation. High-tech is seen as how commercial competition is turning into a zero-sum contest in which one side wins at the other's expense [10].

China hawks in Washington say the zero-sum game is about broken laws. China steals it way up the economic ladder at the US expense. Between March and November 2018, the Department of Justice indicted a dozen individuals and entities it says were directed by the Chinese government to obtain commercial secrets from 15 companies, predominantly in aerospace and high technology [10].

The views of US businesses in China are a bit more nuanced, as shown by the 2019 business-climate survey of the American Chamber of Commerce there, issued in February. Nearly 70% of firms say they are profitable. Still, there are warning signs. In the AmCham survey, half of all US technology firms say they limit investments in China because of inadequate protection of intellectual property (IP), even after years of Chinese promises to get serious about it [10].

China has become tougher on acts of piracy, from fake consumer goods to breaches of patents. But foreign executives still tell horror stories about pressure to share secrets with local partners and cyber-attacks on company servers back home. Depressingly, 13% of member firms in the AmCham survey said that their greatest IP risk was theft by their own employees [10].

There are several ways in which economic competition can become zero-sum, and all can be seen in China today. Theft is just one. Another is the pursuit of import substitution, aiming to replace imports with domestic alternatives, by fair means or foul. America is in a funk about losing its edge, but it is still home to global champions from aerospace and semiconductors to software and self-driving vehicles. Its officials worry that "Made-in-China 2025" (MIC2025) commits China to being world-class in all those sectors [10].

Since 2015 supporting plans and road maps published by government research agencies set out hundreds of market-share targets for Chinese firms, declaring, for instance, that 80% of electric or hybrid "new energy" vehicles sold in China must be domestically produced by 2025. Chinese officials, facing a worldwide backlash, now downplay those targets. Strictly-censored state media have stopped using the term MIC2025. But the policy itself has not been repealed. Speeches by party chiefs ring with calls for "self-reliance" and "indigenous innovation". Other Chinese technology sectors are being encouraged to comply with a policy called "civil-military fusion", a national strategy backed by top leaders and funding from opaque national-security budgets [10].

Americans have watched China stealing and reverse-engineering one generation of technology, says Mulvenon, an expert on Chinese cyber-policy and espionage, then having to steal the next after failing to master the underlying science. "That model is incredibly inefficient."

China will discover that making autarky work is difficult in practice [10].

China is willing to spend what it takes, showering would-be champions with billions of dollars in subsidies and prodding local firms to place orders. Among the beneficiaries is the Commercial Aircraft Corporation of China, whose C-919 commercial airliner is intended as a direct competitor to Boeing's 737. **State planners have set a goal of a 10% domestic market share for Chinese airliners by 2025.** The C-919 has had teething troubles, making that timetable ambitious. But **success for China could quickly feel zero-sum in the US, whose top export category to China in 2017 was civilian aircraft, worth \$16.3bn. Some in the US lament the fact that at least 10 US firms supply vital parts to the C-919** [10].

China has created big brands in such fields as electric vehicles and batteries, in part by shutting foreign rivals out. Protectionist barriers have also allowed Chinese internet firms to grow. In 2009 the ten largest internet companies by revenue were from the US. Several are now Chinese [10].

Still, it is a mistake to exaggerate China's strengths in big-data analysis and AI, according to Dieter Ernst of the East-West Center, a think-tank in Hawaii. **A near-total lack of privacy protection may help sweep up lots of data, but US firms are better at advanced algorithms that make AI less dependent on big data sets,** Mr Ernst wrote. Big Chinese applications are still mostly powered by US-designed chips, which remain world-beating [10].

Some forms of competition can be fair but still end with the gains going mostly to one side. Notably, some technological fields give a "first-mover advantage" that **offers huge rewards to countries or businesses that take an early lead, allowing them to set standards that later entrants have little choice but to follow.** In April 2019 the Defence Innovation Board, a Pentagon advisory committee of Silicon Valley luminaries, issued a report warning that China is on track to pull off this feat in the race to dominate 5G mobile telecommunications. This next generation of wireless technology promises to revolutionise existing industries and invent whole new ones with data speeds about 20 times those of 4G [10].

A decade ago, **US firms took an early lead in 4G, setting standards for new handsets and applications that spread worldwide. That dominance helped Apple, Google and other US businesses generate billions of dollars in revenues. China learned its lesson,** investing \$180bn to deploy 5G networks over the next five years and assigning swathes of wireless spectrum to three state providers. In the US the same part of the spectrum is largely off-limits commercially because it is used by the federal government. US firms are experimenting with a different part of the spectrum that has some advantages under laboratory conditions but is easily blocked by buildings and trees. For this reason, in spite of US pressure on allies, **much of the world is likely to adopt China's handsets, chips and standards,** the Pentagon board concludes. Since the US's armed forces are expected to operate worldwide, they must prepare to send data through a "post-Western" world of wireless technology and through "zero-trust" networks, studded with components from such Chinese firms as Huawei. That will mean more focus on encryption and security [10].

The Belt and Road Initiative (BRI)

In 2013 China's president Xi first began talking about new silk roads under a scheme entitled: Silk Road Economic Belt and the 21st-Century Maritime Silk Road. In 2017, the

BRI became the centerpiece of foreign policy when it was written into the Communist Party's constitution.

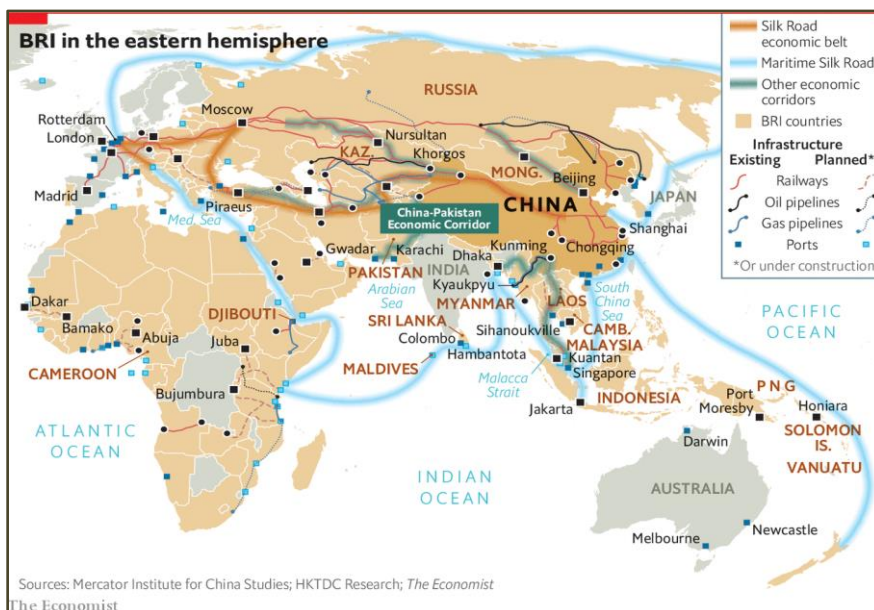
The BRI is an all-encompassing foreign policy – the “project of the century” as Xi calls it. But what exactly is it? Is it mostly aid or trade? Is it a Chinese Marshall Plan? Does it have real substance or is it just a branding exercise for China's international rise? And why is the land part called a belt, and the sea part called a road [11]?

The World Bank has an elemental definition of the BRI: “a China-led effort to improve connectivity and regional cooperation on a trans-continental scale through large-scale investments”. That is a good summary as far as it goes, and helping poor countries build infrastructure is an important component. The global need for new infrastructure is immense. The Asian Development Bank (ADB) estimates that Asia alone needs to invest \$26trn between 2016 and 2030, or \$1.7trn a year, if it is to maintain economic growth, eradicate poverty and respond to climate change [11].

For China's leaders, it represents a prototype for an emerging geopolitical bloc at a time when the rules-based order is/was under shaky US management. It is a way to help knit together continents through improved infrastructure and a catch-all phrase to make anything China does abroad look unthreatening [11].

The BRI was launched in two speeches in 2013. The first, in Kazakhstan, presented the policy's overland component, the “Silk Road economic belt”. It links China to Central, South-East and South Asia, and on to Europe. The word “belt” has that curious name to imply something more than mere transport, energy or other nodes. Rather, an interconnected network of infrastructure would grow into something thicker: industrial zones and economic corridors with manufacturing, logistics, construction and more [11].

Soon after, Mr Xi presented the maritime component in the Indonesian capital, Jakarta. A “21st century maritime Silk Road”, a network of port cities in the South China Sea, the Indian Ocean and the Mediterranean would tie China closer by sea to these regions. Mr Xi has unveiled further dimensions to the plan: a “polar Silk Road” to develop Arctic shipping routes; a “digital Silk Road” of undersea cables, 5G telecoms and cloud computing; and even a “space information corridor” to open up satellite- and space-launch capabilities (see map).



The debates about the BRI began from the outset. At one level, it merely extended a trajectory China had followed

for some time, meshing with its major resource suppliers worldwide, as well as its European markets. At another, it was a response to the global financial crisis of 2007-9, which removed a large source of demand for Chinese goods. The lesson was that in future China had to make its own markets abroad. At a third level, it represented an internationalisation of Chinese industrial policy. Faced with overcapacity in steel, cement and more, a party-state whose legitimacy hangs on creating jobs and investment could hardly shut down capacity, as Western countries might do. Instead it must try to export it. Lastly, at a time when the West appeared to be stumbling, both in terms of growth and global leadership, here was a bend in the historical road with China's moment to be seized [11].

Strategic benefits might come from developing ports and cementing dominance in the global shipping industry. They could be stepping stones to China one day projecting naval power far from home—with big implications for Japan, South-East Asia, India and other countries that depend on the world's busiest sea lanes. By rolling out infrastructure across the Eurasian land mass, China becomes the indispensable power in an emerging supercontinent. Crucially, the state directs giant enterprises to do the national bidding, and state banking institutions to provide the financial firepower [11].

From a Communist Party perspective, cultivating political relationships, and what the party likes to call “people-to-people” ties, bends the world, bit by bit, to China's will. As Bruno Maçães, a former Portuguese foreign minister, puts it in “The Dawn of Eurasia”, the spillover effects from infrastructure, trade and finance into politics, culture and security are not “a bug in the project”, but its most fundamental feature [11].

Above all, the BRI is the world's greatest branding exercise. A foreign country or leader usually signs up to the brand in the form of a vague memorandum of understanding lauding “win-win co-operation”. After that, it is very hard to be disloyal. Praise the plan and you will be rewarded. Criticise it, and not only have you offended China. You have offended the cosmos, or at least the “Silk Road spirit” of “peace and co-operation, openness and inclusiveness, mutual learning and mutual benefit.” This branding, with sanctions, is powerful and it works. Foreign loyalty, in turn, reinforces the brand for a domestic Chinese audience: look what a peaceable, open and future-facing country China is, ready to join in endeavours for mutual benefit [11].

Not everyone buys it. The harshest criticism comes from the incumbent superpower, whose global dominance the project is challenging. Western critics argue that China applies dodgier lending criteria than do members of the Paris Club of major sovereign lenders. Nearly every major project meets bumps along the way. Out of sight, deals often get renegotiated, with lower interest rates and longer grace periods and repayment terms [11].

China knows flexibility serves its image best. It offers development money and diplomatic support not available elsewhere. If there is to be any

US-led pushback, it must work by attraction, too, by offering developing countries better options than China

does. The new connectivity must work well for client states [11].

Infrastructure Investment under BRI

So far, most Chinese investment has gone into commercial ports. The maritime push is being led by a handful of giant state enterprises with close links to the Communist Party’s leaders. China Communications Construction Company (CCCC) is the biggest company on the belt and road. COSCO, a shipping behemoth, is the world’s third-biggest container line and has investments in 61 port terminals around the world. China Merchants, founded as a patriotic enterprise in 1872 to attract Chinese capital to take on Western shipping lines, manages 36 ports in 18 countries. Since 2010 well over \$20bn of Chinese money has been poured into foreign ports [12].

One dimension is the “port-park-city” concept: a port is more likely to thrive with a hinterland in the form of industrial zones and a growing city. Another plan is for major ports to serve as regional hubs at which the biggest container ships can dock; their cargoes are then unloaded and despatched on smaller vessels serving other regional ports [12].

The most notable success of a hub port is COSCO’s involvement in Piraeus, Athens’s ancient harbour. China arrived when the financial crisis of 2008 had brought Greece to its knees. COSCO took a long lease on two terminals of the container port with a promise to build a third. Soon, the contrast in productivity between those and the remaining Greek-run one, plagued by inefficiency and powerful unions, was stark. The left-wing government of the day had refused the sale of that pier. But in 2016, needing funds demanded by the EU in return for a third bailout, it offered COSCO control of the whole port. COSCO has invested \$5bn, with more promised for everything from a ship-repair business to turning warehouses into hotels for cruise passengers [12].

COSCO is also investing in a rail route for sending freight from Piraeus to the Balkans and beyond to the German-led manufacturing cluster in eastern Europe. The railway neatly connects the land-based approach with that by sea [12].

In discussing BRI, China’s president, Xi Jinping, peppered a speech with proverbs. “The ceaseless inflow of rivers makes the ocean deep,” was one—a reference to how his scheme, involving huge spending on infrastructure in other countries, would promote the global flow of goods, capital and technology and with them, economic growth. Amid the pandemic, many countries may be wishing this were so. But some BRI projects are stalling as countries struggle to repay related debts [13].

Since 2013, when Mr Xi first began talking about these new silk roads, China has given or promised hundreds of billions of dollars in loans and grants for power plants,

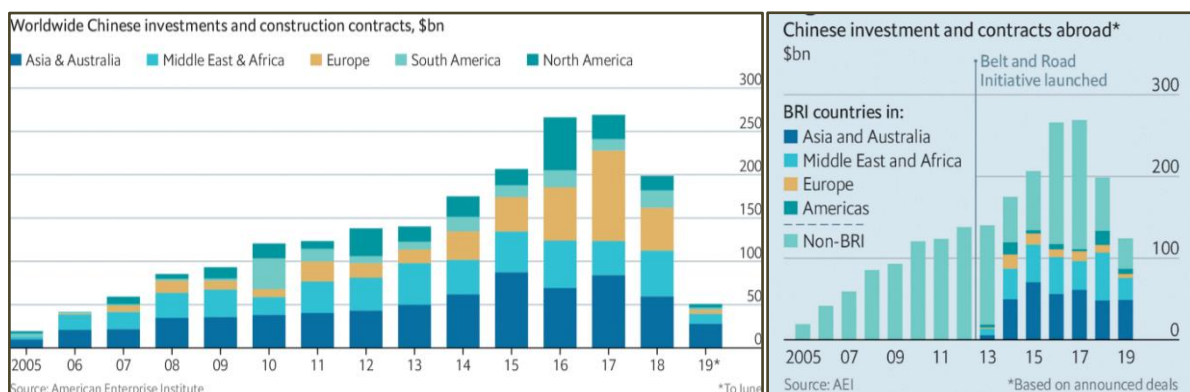
ports, railways, roads and other infrastructure in Africa, Latin America, South-East Asia, Central Asia and Europe (see chart Chinese investment and contracts). But as a result of covid-19, work on some projects has come to a halt. A few have been scrapped. Several that seemed of dubious worth even before the pandemic now look like white elephants. Many of the loans are on the brink of technical default, as debtor countries—hammered by covid-19—seek to defer payments that are coming due [13].

Pakistan asked China for easier repayment terms on \$30bn-worth of power projects. In April 2020 Tanzania’s president, John Magufuli, said he would cancel a \$10bn port project at Bagamoyo because it was signed (by his predecessor) with conditions that “only a drunkard” would accept—chiefly, that China would gain full control of the port with a 99-year lease. And in May, Nigerian legislators voted for a review of all of China’s loans for Chinese projects amid concerns that financing may have been agreed on unfavourable terms. African leaders have called for emergency debt-forgiveness from sovereign creditors including China, which was owed about \$8bn in 2020 in payments on about \$145bn in loans to African countries, many involving BRI projects [13].

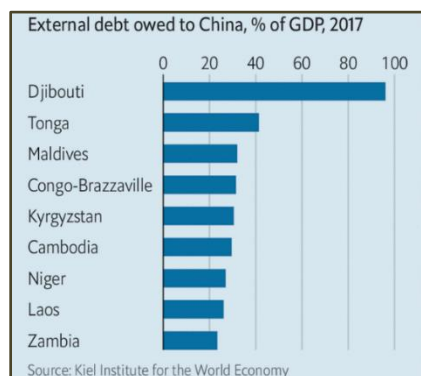
First, there will be financial losses. Many countries raise the cash for BRI projects by exporting commodities. But the pandemic has hit demand for them. Should China reduce the amount owed, as sovereign lenders sometimes do in response to a financial crisis? Or should it try to preserve as many loans and BRI projects as it can by delaying payments and extending terms (its typical approach)? Either way, experts say, a wave of defaults is inevitable [13].

In April 2020, amid debtors’ growing calls for help, the G20, which includes China, broadly agreed to allow up to 73 countries to suspend debt-service payments totalling about \$12bn-14bn until the end of 2020. But the devil is in the details. The G20 warns that applying for a suspension of debt-service payments could breach other terms to which a country may have agreed. Unlike members of the Paris Club of big sovereign lenders, who do not require collateral for their development loans, China’s banks do for about 60% of their lending to developing countries, says Carmen Reinhart, the World Bank’s incoming chief economist. In theory a country could apply for debt relief only to find that China could claim the rights to a mine, a port or money held in escrow. This is one reason why China’s banks prefer to renegotiate sovereign loans bilaterally, and in secret. They have leverage, and can choose how to apply it [13].

But this is where diplomatic risk will loom large for China. Claiming assets from defaulting countries would create a furore. It would damage China’s image in countries that the BRI was intended to help, and strengthen suspicions among Western hawks that China is using the BRI to saddle countries with debt (see chart external debt owed China)



and thereby gain control of infrastructure that could help it strategically. “If they thought they were facing a backlash now, it would be really severe for them” if they were to seize collateral, says Scott Morris of the Centre for Global Development, a think-tank in Washington. China may decide to tread warily. Until the global economy recovers, there will certainly be fewer new BRI projects [13].



However, given the political importance China attaches to the BRI at home, and the effort it has made to persuade countries to sign documents endorsing it (more than 130 have, most of them non-Western), it is unlikely to let the idea drop. Fortunately for China’s propagandists, the BRI is a shape-shifting concept that allows them to adapt it to changing circumstances. Hitherto its focus has been on building hard infrastructure. But the term is often applied to almost any activity abroad involving big Chinese firms that can be touted as helping to create a “Silk Road of Peace”—in other words, it means anything the Chinese government likes. Amid the pandemic, officials can easily play down the pouring of concrete and stress other kinds of Chinese largesse [13].

If done right, without drowning countries in debt, BRI projects may yet provide a welcome boost to the global economy. Before the pandemic the World Bank estimated that BRI transport projects in Asia, including high-speed railways, would boost the GDP of participating countries by up to 3.4% overall. Some of those rail projects have stalled, and China is now preoccupied with its own hard-hit economy. But Daniel Rosen of Rhodium Group, a research firm, argues that China’s policy banks have ample capacity to maintain the present level of BRI lending. It just is not economically prudent for them to do so, especially before a global recovery is on track [13].

When that happens, the BRI may revert to its original focus. And many countries in desperate need of better infrastructure will welcome this. They have few other options. In November America, Japan and Australia announced an alternative to the BRI called the “Blue Dot Network” to fund infrastructure projects in the developing world. But, as with multilateral lenders such as the World Bank, the financial muscle behind it looks puny in comparison. “The BRI has the best promise of meeting the glaring infrastructure gaps in the global economy,” Mr Gallagher says. “There’s no global infrastructure surge without the BRI” [13].

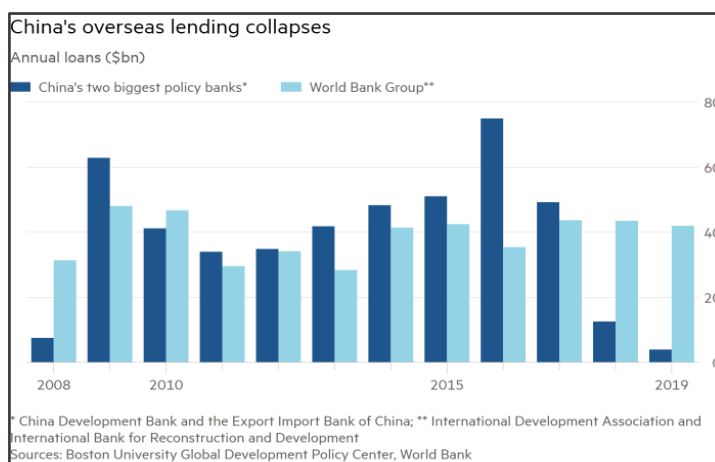
Effect of the pandemic

When China’s leader Xi Jinping stood in Beijing in May 2017 before heads of state and proclaimed “a project of the century”, he promised to spend about \$1tn on building infrastructure in mainly developing countries around the world — and finance almost all of this through its own financial institutions. Adjusted for inflation, this total was roughly seven times what the US spent through the Marshall Plan to rebuild Europe after the second world

war, according to Jonathan Hillman, author of *The Emperor’s New Road* [14].

The reality is deviating sharply from Mr Xi’s script. What was conceived as the world’s biggest development programme is unravelling into what could become China’s first overseas debt crisis. Lending by the Chinese financial institutions that drive the Belt and Road, along with bilateral support to governments, has fallen off a cliff, and Beijing finds itself mired in debt renegotiations with a host of countries. “This is all part of China’s education as a rising power,” says Mr Hillman, a senior fellow at Washington-based think-tank CSIS. “It has taken a flawed model that appeared to work at home, building large infrastructure projects, and hubristically tried to apply that abroad” [14].

“Historically, most infrastructure booms have gone bust,” he adds. “Whether China can avert that fate may depend on its ability to renegotiate loans with countries now in urgent need of debt relief. If China is unable or unwilling to provide sufficient relief to its borrowers, it could find itself at the centre of a debt crisis in developing markets.” The data that describes China’s predicament comes from researchers at Boston University who maintain an independent database on China’s overseas development finance. They found that lending by the China Development Bank and the Export-Import Bank of China collapsed from a peak of \$75bn in 2016 to just \$4bn in 2019 (see chart, overseas lending collapses). The context around this is crucial. The two banks fall under the direct control of China’s state council (cabinet), so they function as arms of the state. They provide the overwhelming majority of China’s overseas development lending and the funds they disburse rival in scale those of the World Bank, the world’s largest multilateral lender [14].



Between 2008 and 2019, the two Chinese banks lent \$462bn, just short of the \$467bn extended by the World Bank, according to the Boston University data. In some years, lending by the Chinese policy banks was almost equivalent to that by all six of the world’s multilateral financial institutions — which along with the World Bank include the Asian Development Bank, the Inter-American Development Bank, the European Investment Bank, the European Bank for Reconstruction and Development and the African Development Bank — put together. In global development finance, such a sharp scaling back of lending by the Chinese banks amounts to an earthquake. If it persists, it will exacerbate an infrastructure funding gap that in Asia alone already amounts to \$907bn a year, according to Asian Development Bank estimates. In Africa and Latin America — where Chinese credit has also formed a big part of infrastructure financing — the gap between what is required and what is available is also expected to yawn wider [14].

'Dual circulation' is China's retreat from overseas development finance which derives from structural policy shifts, according to Chinese analysts. "China is consolidating, absorbing and digesting the investments made in the past," says Wang Huiyao, an adviser to China's state council and president of the Center for China and Globalisation, a think-tank [14].

Yu Jie, senior research fellow on China at Chatham House, a UK think-tank, says Beijing's recently-adopted "dual circulation" policy represents a step change for China's relationship with the outside world. The policy, which was first mentioned at a meeting of the politburo in May 2020, places greater emphasis on China's domestic market — or internal circulation — and less on commerce with the outside world. "Volatile Sino-US relations and more restrictive access to overseas markets for Chinese companies have prompted a fundamental rethink of growth drivers by Beijing's top economic planners," says Ms Yu [14].

"Naturally, if state-owned enterprises decide to switch back to the domestic market to follow the leadership's wishes, the budgeted financial resource for overseas investments will reduce accordingly." All this is leading to a fundamental rethink by China towards both the Belt and Road and its overseas lending profile, analysts believe. Mr Wang says that one strand of a new approach would be to pursue more lending through multilateral bodies such as the Asian Infrastructure Investment Bank. In addition, Chinese financial institutions may co-operate more with international lending agencies, he adds [14].

Debt sustainability — or the ability of debtor countries to repay their loans — had to be part of any reassessment of the Belt and Road Initiative, says Kevin Gallagher, director of the Boston University Global Development Policy Center, which compiled the data on Chinese overseas lending [14].

"This has to be the time for a rethink," he says. "It's been such a priority for Xi Jinping, he's invested so much in it that he's not going to just turn the lights off. But they need to seriously implement their own debt sustainability analysis and their own social and environmental impact tools" [14].

The propensity for China's credit-fuelled engagement of diplomatic allies to come unstuck is most spectacularly portrayed by Venezuela. Between 2007 and 2013, the China Development Bank lent Venezuela nearly \$40bn, cementing a relationship that Hugo Chávez, the former president of Venezuela, characterised as "a Great Wall" against US hegemonism. Much of the lending to Venezuela was tied to oil resources, but even before Mr Chávez died in 2013 it was clear that things were going awry. Yet Beijing was in so deep that it felt compelled to keep supporting Nicolás Maduro, successor to Mr Chavez, even after evidence of his ineffectual economic management became clear. It lent another \$20bn between 2013 and 2017 and is now picking through the country's pile of \$150bn in defaulted debt, pushing its claims against rival creditors. The whole episode carries crucial lessons for Beijing, says Matt Ferchen at Merics, a Berlin-based think-tank [14].

"Chinese foreign policy and policy bank officials entered into their outsized economic and political relationship with [Venezuela] with a combination of hubris, ambition and naïveté," Mr Ferchen wrote. "[This] has contributed to the region's worst economic, humanitarian, and political crisis in decades." Debt renegotiations proliferated as the pandemic clobbered emerging economies in Africa and elsewhere. A report by Rhodium Group, a consultancy, says at least 18 processes of debt renegotiation with China took place in 2020 and 12 countries were still in talks with

Beijing as of the end of September, covering \$28bn in Chinese loans. So far, Beijing appears keen to pursue a soft touch, deferring interest payments and rescheduling loans. But the experience is reinforcing a growing sense of wariness that now infuses Mr Xi's big project. China is finding out, says Mr Hillman, that "risk runs both ways along the Belt and Road and the damage can return to Beijing" [14].

"Dual Circulation"

For years officials have declared that China must grow more innovative and more resilient. To a certain extent it has achieved this naturally, as a result of its fast-paced economic development. But these goals have taken on far greater urgency as tensions with the US have mounted. US restrictions on exports of critical components, notably semiconductors, have shone a harsh light on the gaps in China's industrial abilities. Xi Jinping, China's leader, has described the creation of fully domestic supply chains as a matter of national security [15].

The question is how to build them. Chinese officials know that they cannot turn their backs on the world. Exports are still an important source of revenue for many firms. And China must attract technology and investment from abroad. Pushing too transparently for "indigenous innovation", a term once bandied about by the government, only makes foreigners wary. Striking the right balance is tough [15].

Enter the newest of China's big economic policies: the "dual-circulation" strategy. At its most basic it refers to keeping China open to the world (the "great international circulation"), while reinforcing its own market (the "great domestic circulation"). If that sounds rather vague, it is: the government has not spelled out the details. Nevertheless, it has fast emerged as the most talked-about economic policy in China, with analysts and businesspeople jostling to put their spin on it. The strategy lies at the heart of the five-year plan for 2021-25, an outline of which was released by the Communist Party in November 2020. Its implementation—especially how China resolves the tension between the two kinds of circulation—will be critical to the way that China's economy develops [15].

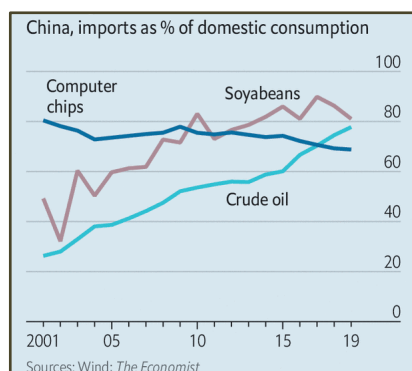
The term "international circulation" was coined in 1988 by Wang Jian, a government researcher who argued that China should pursue an export-led growth strategy, plugging its vast pool of cheap labour into global production networks. Well into the early 2000s, this was a guiding principle for China's economic planners. Yet circumstances have changed. Exports have shrunk as a share of GDP—from 36% in 2006 to 18% in 2019. The government has repeatedly vowed to make consumption within China a bigger engine of growth. So scholars have been turning their attention more to the domestic kind of circulation [15].

Some were tempted to dismiss this as just another way of phrasing the long-stated goal of rebalancing towards domestic demand. But it has become clear that something bigger is afoot. Comments by Mr Xi on the economy have been less about promoting consumption and more about bolstering China's defences. China needs "self-developed, controllable" supply chains, with at least one alternative source for vital products, he said in a speech published in Oct 2020. Even more striking was his inversion of the idea of international circulation. Instead of talking about it in terms of the economic benefits China reaps from globalisation, he emphasised only the strategic purpose of opening China's doors to foreign firms, ie that making them more dependent on the Chinese market would deter foreign powers from putting pressure on the country [15].

That combination—the pursuit both of economic self-reliance and of greater economic leverage over foreign countries—now describes much of what China is doing. Mr Xi refers to changes “unseen in a hundred years” sweeping the global order—a way of saying that, while China is rising, the US is declining and trying to stop the new power. “Where linkages with the global economy create vulnerabilities, China wants to minimise them,” says Andrew Polk of Trivium China, a research firm. “Where the linkages create benefits, China wants to expand them” [15].

Chinese officials tailor their remarks on dual circulation to please foreign ears. In a video address on November 4th at the opening of the China International Import Expo, an annual jamboree in Shanghai, Mr Xi said the concept would involve opening China more widely to the rest of the world. “This is not just what China needs for its development, but something that will enrich the people of all countries,” he said. But businesses in China see the concept more as an indication that the government will step up support for favoured industries at home, says Zhu Ning of the Shanghai Advanced Institute of Finance [15].

The party referred more generally to a need to develop critical technologies at home. But other policies already in train suggest that China will prop up any high-tech sector threatened by global vicissitudes. In August it announced tax breaks and loan support for semiconductor and software firms. China currently produces about 30% of the chips it consumes (see chart, imports). Its goal is to reach 70% by 2025. Another focus is on green technology and renewable energy. That is not just for the sake of the environment (China recently pledged to halt the rise of its carbon emissions by 2030). Investment in such businesses will also limit China’s thirst for imported oil [15].



In the past, when publishing outlines of five-year plans the party announced a goal for average annual GDP growth during the plan period (see chart, China GDP). For 2021-25 there was no such figure. China has good reason to abandon such targets. They lead to an overemphasis on investment in infrastructure and other short-term measures to boost growth, rather than on social policies such as those relating to health care or education which can promote growth but may take longer to show results. But de-emphasising targets may relate to the new dual-circulation



strategy in a way that the government has left unspoken. Making the economy less reliant on global supply chains could crimp its ability to grow [15].

Arguably China has been the world’s main beneficiary of globalisation, which has enabled it to dominate ever-bigger segments of manufacturing. Turning inward could be costly. It may result in less foreign technology flowing into China, less of the competition that has spurred on Chinese firms, and more wasteful investment as the government throws money at favoured industries. Shaun Roache, an economist with s&p, a credit-rating agency, forecasts that China’s average annual growth will be 4.6% in the 2020s. But he reckons it could be about 3% if the drive for self-reliance is overdone. The country’s “tolerance for slower growth may well be tested in the years ahead”, he says. The party, ever fearful that a stagnating economy could trigger social unrest, may find it hard going [15].

Optimism is a stubborn trait, so some inveterate China-bulls think that emphasising domestic circulation may create a new wave of reforms aimed at making the country’s markets function more efficiently. Take the semiconductor industry. *Caixin*, a Chinese financial magazine, reported in Oct 2020 that Huawei, a tech giant, was rushing to create a “not-made-in-America” supply chain by 2022. Initially, however, that would enable it to make chips with transistors spaced 28 nanometres (billionths of a metre) apart, far less dense than the most advanced ones [15].

West’s Counter Strategy on China

The commercial and geopolitical power of industrial protocols has long been recognised. Werner von Siemens, the 19th-century German industrialist and innovator who gave his name to the Siemens conglomerate he founded, said: “He who owns the standards, owns the market.” Standard-setting has for decades largely been the preserve of a small group of industrialised democracies. Everything from the width of train tracks, to software, satellites, the frequencies that mobile phones use and a whole gamut of rules about how electronic gadgets work and process data have been decided by western-dominated standards organisations [16].

But China now has other ideas. “Industrial standards are an important area of contestation in the new cold war, with both Beijing and Washington gearing up to shape the development and implementation of global standards,” says Adam Segal, director of the digital and cyber space policy programme at the Council on Foreign Relations, a New York-based think-tank. He and other experts say an intensifying US-China battle to dominate standards, especially in emerging technologies, could start to divide the world into different industrial blocs. In the same way that rail passengers who travel from western Europe to some former Soviet bloc countries must to this day change trains to accommodate different track widths, strategic competition between the US and China raises the spectre of a fragmentation of standards that creates a new technological divide [16].

Mr Segal says it is possible, for example, that 5G mobile telecoms — a bedrock technology that enables the “internet of things” — may be divided into two competing stacks to reflect US and Chinese influence. Some measure of division is also possible in semiconductors, artificial intelligence and other areas where US-China rivalry is intense, he adds [16].

“In some sectors, there will be two stacks that are relatively incompatible,” says Mr Segal. “But in others, there is likely to be some demand that they co-operate. It is possible that

large markets that make it clear they do not want to choose between China and the US may be able to pressure Chinese and US tech firms to ensure some degree of compatibility” [16].

In Washington, the battle for influence over technology standards is seen in some quarters as crucial to defending democracy from the influence of China, which Madeleine Albright, a former secretary of state, describes as “the world’s leading pioneer of what we call techno-authoritarianism”. Mark Warner, Democratic vice-chair of the US Senate intelligence committee, sees the threat from China in equally unambiguous terms. Beijing is intending to control the next generation of digital infrastructure, he says, and, as it does so, to impose principles that are antithetical to US values of transparency, diversity of opinion, interoperability and respect for human rights [16].

“Over the last 10 to 15 years, [the US] leadership role has eroded and our leverage to establish standards and protocols reflecting our values has diminished,” Mr Warner told a webinar in September. “As a result others, but mostly China, have stepped into the void to advance standards and values that advantage the Chinese Communist party” [16].

From a US perspective, China’s challenge derives from three main areas. First, it is developing world-beating technology in several emerging areas, such as 5G telecoms and AI. Second, as it exports this technology — often to more than 100 countries that participate in the Belt and Road Initiative — it is nurturing adherence to a distinctly Chinese set of standards and protocols. Third, Beijing is boosting its influence in the UN and other standards-setting bodies to enhance the interests of its own companies [16].

Yang Guang, a Beijing-based senior analyst at Strategy Analytics, a consultancy, says China has long been interested in raising the profile of its technology standards. “It is just that foreigners didn’t pay attention before,” he says, naming as examples TD-SCMA and WAPI, two telecoms standards that largely failed to catch on more than a decade ago [16].

The Chinese government is working towards a standards master plan — China Standards 2035 — which Beijing was expected to publish before the end of 2020. The strategy is expected to set out standardisation goals for crucial next-generation technologies. It is also due to emphasise the imperative to strengthen China’s role in standards organisations, analysts say. “The strategy will also focus on standards to facilitate civil-military fusion — a concept that has gained considerable traction in China and has caused a stir in strategic communities overseas, particularly in Washington,” wrote research fellow John Seaman in a report for the French Institute of International Relations and the Policy Center for the New South [16].

Mr Xi heads the Commission for Military-Civil Fusion Development which is believed to target civilian advances in “dual use” areas such as quantum computing, big data, semiconductors, 5G and AI, but concrete initiatives are shrouded in secrecy. “China’s greatest potential lies in areas where standards have yet to be collectively developed and defined,” Mr Seaman says. “It can roll out technologies using Chinese standards in foreign markets, creating ‘facts on the ground’.” Crucial to the goal of popularising Chinese standards overseas is the Belt and Road Initiative, which Mr Zhao described in a blog on the ITU’s website as holding “so much promise” [16].

The BRI is generally seen as a huge Chinese programme to build roads, railways, ports, airports and other forms of infrastructure in mostly developing countries. But this portrayal overlooks a key point. The BRI is also a means of

diffusing Chinese technologies — and the standards they operate on — across the developing world by constructing what Beijing calls a “digital silk road” [16].

“The Chinese government has been actively promoting its internet and cyber governance playbook in many developing countries, most recently by leveraging 5G connectivity and smart city projects along the digital silk road,” says Rebecca Arcesati, an analyst at Merics, a Berlin-based think-tank. “Smart cities” are a focus of this standards diffusion effort because they incorporate so many emerging technologies. The facial recognition systems, big data analysis, 5G telecoms and AI cameras that go into creating smart cities are all technologies for which standards remain up for grabs. Thus smart cities, which automate multiple municipal functions, represent a big prize for China’s standards drive [16].

“China is setting standards from the bottom up through widespread export and foreign adoption of its technology,” says Jonathan Hillman, an analyst at CSIS, a Washington-based think-tank. “A country such as Serbia might not sit down and decide they want to adopt Chinese standards, but after enough purchases and deals, they might end up with Chinese standards. There is the risk of lock-in, a point after which switching becomes too costly.” Serbia is just one of many countries that has signed up to a Chinese-installed smart city package complete with surveillance cameras supplied by Hikvision, a company blacklisted by the US because of suspected human rights abuses in Xinjiang [16].

Indeed, the smart city package is proving immensely popular for governments that wish to automate services such as traffic management, sewage systems and public safety while keeping a close eye on what its people are up to. According to research by RWR Advisory, a Washington-based consultancy, Chinese companies have done 116 deals to install smart city and “safe city” packages around the world since 2013, with 70 of these taking place in countries that also participate in the Belt and Road Initiative. The main difference between “smart” and “safe” city equipment is that the latter is intended primarily to surveil and monitor the population, while the former is primarily aimed at automating municipal functions while also incorporating surveillance functions [16].

Alongside these export moves designed to inculcate its technology standards, China is also active in signing political agreements to the same end. The 2019 China Standardisation Development annual report, an official document, makes clear that promoting Chinese technology standards is a BRI priority. As of 2019, some 85 standardisation co-operation agreements with 49 countries and regions had been signed, though scant literature exists on the depth and specific contents of such agreements [16].

Not content with forging bilateral agreements along the Belt and Road, China is also trying to persuade multilateral standards agencies to recognise its growing clout. As recently as 2007, China was a minnow in the International Organization for Standardization, one of the world’s leading standards-setting bodies, with 164 member countries. Back then, it had sparse representation on the all-important technical committees and subcommittees that do much to decide which standards to adopt. But in 2008, Beijing managed to win a place as the sixth permanent member of the ISO’s council and in 2013 it became a permanent member of its technical management board, alongside the US, Japan, the UK, Germany and France [16].

In 2015, the organisation got its first Chinese president when Zhang Xiaogang, a former steel industry executive, was chosen for a three-year term. It has been a similar story

at the 88-member International Electrotechnical Commission, an organisation that publishes standards on all electronic items. China's influence at the IEC has grown steadily, culminating in the appointment in January of Shu Yinbiao — who is also chairman of the State Grid Corporation of China — as president of the IEC. Mr Zhao completes the picture as head of the ITU, which he is due to lead until 2023. The increased representation has had a marked effect on China's standards-setting clout. As of March 2019, for instance, China had proposed 11 standards for the internet of things within the ISO/IEC framework, of which five had been adopted and published and six were still pending review, Mr Seaman said. State Grid Corporation of China has also pulled off a coup [16].

The IEC has agreed to take on co-ordinating standards for a concept called Global Energy Interconnection, which essentially aims to create huge grids of power cables that run between countries and continents. If the idea gets off the ground it could directly benefit State Grid, which is the global leader in making ultra-high voltage transmission lines. The build-up of such institutional firepower in these standards-setting bodies is a sure sign that China is set to wield much more influence over global technological standards. But equally as sure is that the backlash from Washington is building. Europe, for its part, is likely to be squeezed by competing superpower ambitions [16].

“The non-transparent and authoritarian way in which China is going about data security management at home undermines trust in its standards and platforms abroad,” says Merics analyst Ms Arcesati. “On the other hand, the current US strategy is essentially equating data security with a total and unilateral decoupling from Chinese technology in the digital domain. “This puts Europe in an extremely difficult position,” she adds. The worst-case scenario, as described by Mr Seaman, is of a growing technological divide. If international collaboration on standards grinds to a halt, it could create opposing technology blocs that do not talk to each other. “Think of it almost like trying to connect with someone on [Tencent’s] WeChat by using Facebook, but on an industrial scale” [16].

The US-EU grand bargain

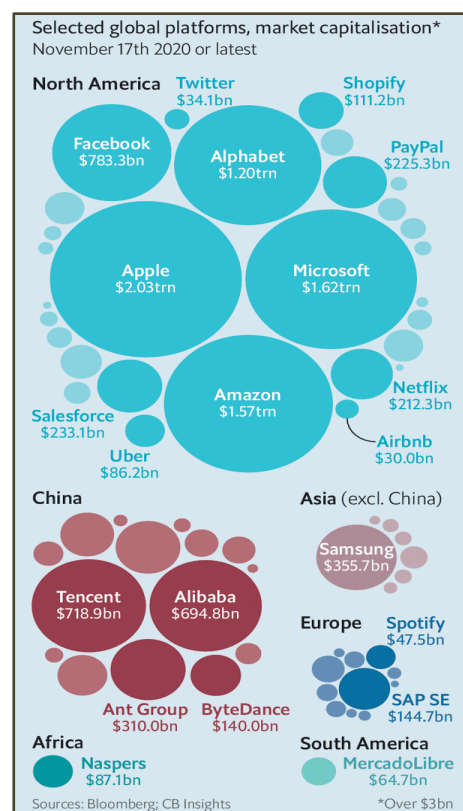
There is talk of a new cold war. Consider how the cold war against China is different from the first one. The rivalry with the Soviet Union was focused on ideology and nuclear weapons. The new battlefield today is information technology: semiconductors, data, 5G, mobile networks, internet standards, artificial intelligence (AI) and quantum computing. The new advantages stem from the network efficiencies of many tech businesses, which reward size and spread. It reflects how hard it is for any one country to master the full range of specialisms in the tech economy. In chips, say, US or UK designs may be made in Taiwanese plants, using Japanese and Dutch equipment and German lenses forbore being assembled in Chinese factories [17].

China is touting its technologies by securing export contracts, promoting itself as a digital power using the BRI and waging a campaign of pro-China standards-setting in global bodies. Mr Trump’s abrasive solo response had some successes by browbeating some allies to stop buying gear for 5G networks from Huawei, a Chinese firm, and by threatening sanctions on chipmakers who supply Huawei. The downside is that the approach accelerated China’s effort to create its own world-class chip industry. Any US bullying toward its own narrow interest makes Europe less willing to cooperate with the US line on tech [17].

A grand bargain between the US and Europe would turn conflict with Europe into collaboration. The allies could share an approach to issues like taxation, takeover rules

and supply chains. For example, Europe’s General Data Protection Regulation (GDPR) is on the way to becoming a de facto standard outside Europe. By coordinating their efforts, they could specialize rather than duplicate research. By diversifying supply chains and vetting each link they can protect themselves from accidental or malevolent disruptions. By working together on technical standards such as Openran, which uses mostly off-the-shelf hardware for 5G networks, then can create a favourable environment for their own companies [17].

The US has long dominated the world in information technology (IT). One of Silicon Valley’s tech giants is worth over \$42trn; three more are worth \$1trn. The contribution technology makes for the buoyancy of its market is without equal. But China has digital resources in abundance too. Its huge population of 1.4bn means it will eventually boast an even deeper pool of data and experts to develop AI models. The country’s digital giants, from Alibaba to Tencent, have already become AI and cloud-computing powers in their own right (see chart, global platforms) [18].



President Trump saw China as a serious challenger to US digital supremacy. His humbling of Huawei, a Chinese telecoms-equipment maker, began a decoupling of Chinese and American IT infrastructures and of the supply chains between China and America that will continue [18].

Many device-makers have already moved part of their production out of China and some will end up with two separate supply chains. Apple’s contract manufacturers, for instance, are setting up plants in India. TSMC, a Taiwanese chip firm, announced in May 2020 that it will build a facility in Arizona. Feeling its dependence on US semiconductor technology, China is doubling down on efforts to build its own. In software and other areas, too, bifurcation has begun—and not just because of bans against Chinese apps [18].

What Mr Trump was unable or unwilling to understand, though, was that China and US are not the only economies that matter in this contest, and that fact provides the US with a potentially decisive advantage. India, the EU, Japan and others all play crucial roles in the world’s IT system—

as do tech giants such as Alphabet, Apple and Microsoft [18].

All these entities, whether national or corporate, are at odds with the US government and often with each other over something or other in the IT world, whether it be visas, privacy rights or competition complaints. But they would also all prefer a world in which international agreements, practices and expectations for it embody the values and interests they share with the US, rather than those of China. And if democratic countries cannot agree on common rules in the digital realm, China could end up setting the rules for large swathes of the world. The result would be a technosphere engineered for the comfort and support of autocracies [18].

A partial catalogue of disagreements in 2020 shows the fractiousness that stops the free world coming together on this—and how many opportunities for dealmaking there would be if it decided it should. The US's commerce department told foreign firms they could sell no more chips made using US technology to Huawei; its justice department filed an antitrust lawsuit against Google. The US pulled out of talks at the Organisation for Economic Co-operation and Development (OECD), a club of mostly rich countries, about how to tax the tech giants. India blocked dozens of Chinese apps, including TikTok, a popular video-sharing service, which the US government also wants to ban. The European Court of Justice (ECJ) struck down the "Privacy Shield" agreement between US and the EU, thus throwing the legal basis on which personal data flows across the Atlantic into doubt [18].

Europe has been trying for some time to carve out its own space in the digital realm as a protector of the citizenry—a noble goal made easier by the fact that the companies from which its citizens are being protected are mostly based on the other side of the ocean. This has heightened tensions between Brussels, Washington and Silicon Valley. The ECJ's ruling on the Privacy Shield is one example. The European Commission is drafting legislation that would weaken the power of the US's tech giants. Its proposed Digital Services Act would outlaw some of the firms' business practices, such as bundling their services to take over new markets or displaying them more prominently than competing ones [18].

Some of the EU's member states have also begun defending their right to rule their own digital roost, something now called "digital sovereignty". There is talk of creating a European cloud within the US one. GAIA-x is a step down that road—a federation of clouds, launched by Germany and France in June, whose members agree to certain rules, such as allowing customers to choose where their data are stored and move freely to providers' competitors if they wish. There is more to come: a "data strategy" on the table in Brussels would, if fully implemented, create "data spaces" ruled by European law and give people more rights on how their data are used [18].

These disputes offer ample space for mutually beneficial trade-offs. If America and its allies can reach good enough accommodations on the most contentious issues—notably privacy and competition—and find ways to live with the smaller contradictions and conflicts which remain, they can become a force to be reckoned with—one that others will need little encouragement to join. An insular America can remain a technology superpower. A connected America cemented into the rest of the world by means of a grand technopolitical bargain could be the hub of something truly unsurpassable [18].

There is a range of ideas about how to do this. In a 2020 report for the Council on Foreign Relations, a think-tank,

Robert Knake imagines such a grand bargain taking the form of a "digital trade zone", complete with a treaty organisation. America would "weaponise its digital trade relationships" in order to promote such things as cybersecurity, privacy protection and democratic values on the internet. Only countries that comply with the organisation's rules on such matters would be able to become members and only members would be allowed fully to trade with each other digitally. Violations would be dealt with by imposing sanctions and tariffs. "If the digital trade zone grows strong enough, China might see more benefit to co-operative engagement than to continued disruptive behaviour," writes Mr Knake [18].

Others prefer to imagine something less formal, rules-based and punitive. In October 2020 three other think-tanks—the Centre for a New American Security (CNAS), merics of Germany and the Asia-Pacific Initiative of Japan—outlined a less exclusive construction. They propose that democratic countries form a "technology alliance" not subject to a formal treaty. It would be like the G7, which consists of America, Britain, Canada, France, Germany, Italy and Japan, and could one day, perhaps, include India and other countries from the Global South. It would hold regular meetings, as the IMF and World Bank do, and issue consensus opinions, and it would invite other stakeholders—from NGOs to tech firms—to pitch in [18].

Decoupling

The US and Chinese economies have become deeply intertwined since 2000. The interconnectedness was a lightning rod for the Trump administration's "America first" theme. Decoupling has since come to mean the process of disentangling parts of economic relationship between the US (and more broadly US allies) and China.

The worst relations between the US and China for decades have not prompted decoupling in Asia. What might? Regulatory and technological shifts could eventually end US dominance in finance and drag Asia more firmly into China's orbit. The opening of China's capital markets would ultimately be as consequential in finance as its membership of the WTO in 2001 was for trade [19].

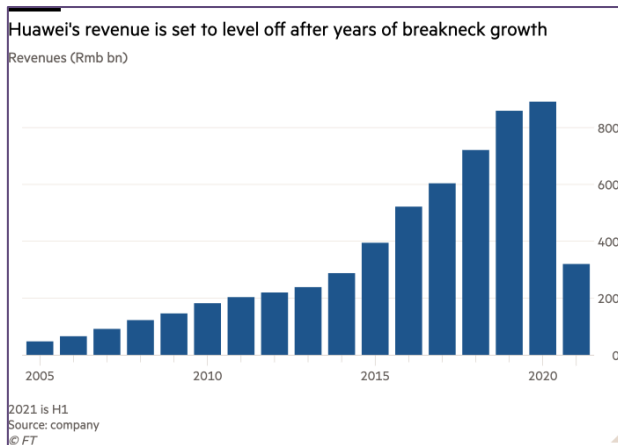
Asia matters because of its size, with 36% of the world's GDP, 31% of its stockmarket capitalization, and 11% of the sales of S&P 500 firms. The region is still likely to grow faster than the rest of the world. But it is where the struggle between the US and China is to pay out overtly, with the two systems competing side by side. China dominates trade. Of the 20 major Asian economies, 15 have China as their largest goods-trading partner. Yet most still rely on the US, particularly as their defense partner. The dollar is the currency in which most Asian trade and capital flows take place (in contrast to Europe which has the euro) [19].

One response to estrangement is separation. The US's Trumpian right and progressive left would like their country to be more self-sufficient, while China through Mr. Xi's "dual circulation" campaign is aimed at producing more goods at home. There are some signs that Asia's investment patterns are shifting and becoming less centered on greater China. TSMC, the world's largest semiconductor company plans to build a new plant in Japan in co-operation with Sony. Many banks are wary of expanding in turbulent Hong Kong [19].

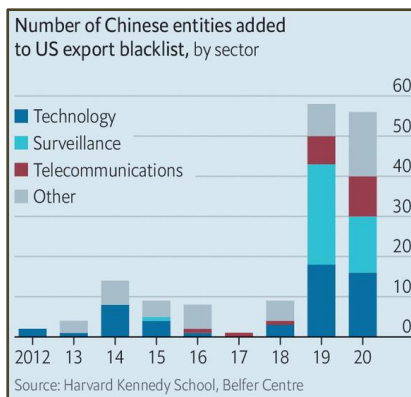
However, the overall picture is still one of intense interdependency. China has 75% of global battery manufacturing capacity. Even after its new investments, TSMC will have over 80% of its plant in Taiwan, which China claims as its territory. The impossibility of Asia decoupling from China is brought home by a tech boss who

reckons 80% of goods sold on SE Asia’s booming e-commerce platforms are from China. Most international firms want to be geopolitical hybrids that hedge their bets [19].

The rise of China in terms of manufacturing, GDP and trade coupled with Xi’s stated strategies (Belt and Road Initiative, “Made in China 2020”, “China Standards 2030) drew attention to China’s technological prowess. Some concluded that it posed a threat to the West and to global security. To the US, Huawei, a successful manufacturer of telecoms equipment, became the face of that threat. The Trump administration accused the firm of acting as a conduit for Chinese government surveillance and control. In 2018, the US banned the export to the firm of US microchips essential for its products. This had the desired effect of hitting Huawei’s revenue for the first time in a decade, reducing revenues by a third in 2021 (see chart, Huawei’s revenue) [20].



The number of Chinese firms that were blacklisted increased fivefold in 2019 (see chart, Chinese entities added to US export blacklist).



The Trump administration acted without cooperating closely with America’s fiends. This prompted investors from far and wide to add missing links to parts of the semiconductor supply chain that are beyond the reach of US law. Japanese firms, among others, quietly marketed their products in such a way as to evade the US Export Administration Regulations, qualifying them as “EAR-free”. US firms, many of which sell billions of dollars of equipment to China every year, began looking for neutral territory from which they could continue to export supplies. Singapore and Malaysia led the way [20].

Chinese firms, spurred by billions of dollars of investment by the state, redoubled their efforts to develop their own versions of chip technologies that had previously been imported along supply chains linked to firms in the US. It looked as if the US government would steadily lose its grip over the chip supply chain. The Biden administration has raised the issue of chip controls whenever they talk to

foreign allies. Governments and firms have set up forums to align policy over the trade in chips and the equipment and material used to make them. These are the first steps toward creating a mechanism to control the export of semiconductors, in hope of retaining a technological edge over China [20].

Agreements forged between the governments of the leading countries in the chip supply chain – the US, Japan and the Netherlands – still matter more than any talking shop. That trio produces the lion’s share of the machinery used to make chips. A consensus between them over trade in chips marked the first step towards constraining China towards the end of Mr. Trump’s presidency [20].

US officials with a more hawkish stance on China want a clean break in the supply chains favor a narrow coalition-of-the-willing approach to diplomacy. But the more robustly the US wants to respond to China, the harder it is to get the US’s Western and Asian allies to come along. Without the US’s friends on board the US hard line on exports threatens to weaken its own companies. This is because it could steer investment to places outside the US’s reach, but which still suit Chinese chipmakers. The US is caught between choosing a softer set of controls which may work better in the long run, or a harsher set that could hurt Chinese technology more in the short run but might harm US industry overall. Worse, it might ruin the prospect of the US-China chip trade ever reviving in the event that better relations one day resume [20].

Controlling exports of specific machines and components is unwise because no net of controls can be drawn tightly enough to stop a determined, powerful country from somehow getting the tools. Governments, instead of constraining semiconductor supply chains, should focus on protecting trade secrets. Western semiconductor companies could sell their most advanced chipmaking services to the Chinese market, yet still be able to prevent Chinese firms from developing the most sophisticated manufacturing capacity themselves. An awkward fact is that the US’s own semiconductor toolmakers still could China as one of their biggest markets [20].

Meanwhile China keeps making progress. The proportion of global chips sold by China is rising (see chart, semiconductor sales). That is not true for any other major chipmaking country, despite Mr Trump’s campaign to snuff out China’s indigenous industries and Mr. Biden’s more multilateral attempts to achieve the same end. The US and its allies may yet agree on how to contain China’s semiconductor ambitions. But it may prove impossible for one state to control such a complex industry [20].



Xi Jinping, China’s president, signified the start of a new era through a revolution in which dozens of cities will be producing breakthroughs in robotics, cloud computing and automation. This is consistent with his “common prosperity” campaign, a plan to redistribute

wealth from richer coastal regions to poorer one in the interior of the country, and from dominant internet platforms to consumers and workers [21].

Past Chinese leaders focused their reforms on coastal cities, where manufactured goods could easily reach ports, giving rise to China as the factory of the world in the 1990s. Xi's time in power first focused on boosting consumption as part of a rebalancing of the macroeconomy in response to the global financial crisis's dampening effect on global trade [21].

The shift in Mr Xi's strategy is best understood as a weighty bet that China is on track to become the world's centre of innovation over the next decade. It is a reorienting of the economy back towards manufacturing and away from consumer-internet tech, or soft tech, as the 5-year plan published in 2021 made clear. Instead, the emphasis was on rapid development in hard tech, e.g., AI, semiconductors, industrial software and big-data processing, none of which requires access to ports [21].

In doing so he is also signalling a premature break with the technological convergence that has served China well since the 1980s, when foreign companies began setting up factories using advanced technologies. This tech was eventually transferred to local firms or reverse-engineered at little cost, a model of "convergence" that realized productive efficiencies with few risks. China continued to liberalise and foreign firms continued to bring in capital and high-tech gear [21].

But the era of convergence is drawing to a close. China's total-factor productivity growth languished at just above 1% per year between 2010 and 2019. Tech transfers are now far more restricted by US. Mr Xi can surely imagine the sanctions devastating Russia being aimed at China. The response has been to end reliance on foreign tech and to refocus the growth model on what can be created at home [21].

A shift towards homegrown tech is altering the geographical layout of China's manufacturing machine. New investment and migration are being rerouted from rich coastal hubs to inland cities such as Zhuzhou. A second feature is an unprecedented rise in the number of new tech companies. The government is nurturing thousands of groups, big and small, in the fields of data science, network security and robotics. Mr Xi and his advisers are also taking firmer control over markets. Their ability to direct capital flows is already evident in how private-equity groups invest in China [21].

China's support for Russia since its war in Ukraine has raised the potential for more sanctions on Chinese firms. This ever-present condition seems to strengthen Xi's desire for self-reliance. So, Mr. Xi is building an incubator state: an economy that relies heavily on government nourishment to create productivity gains with domestic research and technology.

Migration is essential if the new tech firms are to be staffed. Firms dealing in big data, AI, the internet of things, robotics, cloud computing and clean energy are setting up at an unprecedented pace in China's interior. Smaller cities, such as Zhuzhou, are experiencing explosive growth in tech firms (see chart). The rapid growth in these cities is connected to local-government planning and the offer of generous tax and land incentives. Nevertheless, the rerouting of migrants does not take into account that the talent that is needed to power the boom has not kept up the pace of the industrial shift. Almost 70% of the labour force has not had one day of high-school instruction.



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