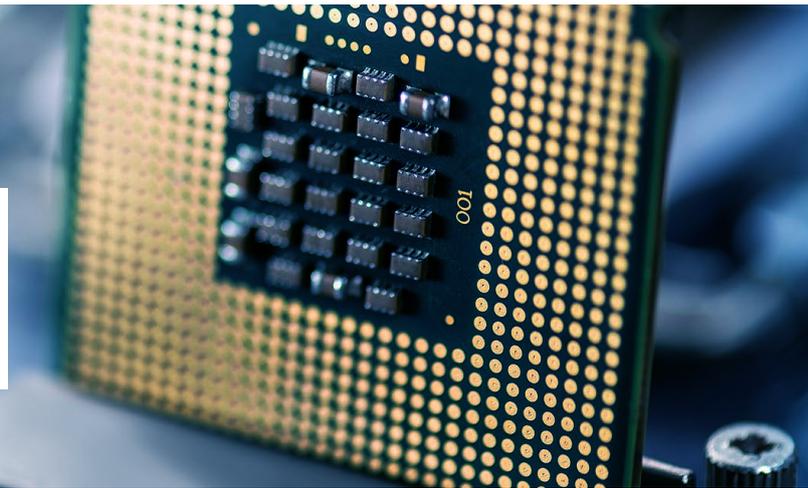


The pivotal fight between China and the US is over the microchip

The campaign for dominance in semiconductors could hurt both countries.



Japan's Kioxia Holdings, which in the early 1980s invented flash memory computer chips, was set for one of the country's biggest initial public offers for 2020. In September, however, the semiconductor maker reduced the asking price of its offer by 25%. Days later, the company postponed indefinitely a float that was initially set to value the company at US\$16 billion.[1] Kioxia's CEO blamed the IPO suspension on "market volatility and ongoing concerns about a second wave of the pandemic".[2] Given that at the time the Nikkei 225 Index was close to its highest in three decades, that explanation didn't wash.

Everyone knew why Kioxia halted its IPO. Anonymously sourced media reports had warned Kioxia would abandon its float because China-US tensions were reducing the company's profitability. Of note for Kioxia's fortunes, the US in August decreed that non-US companies would need Washington's permission to sell microchips made using US technology to Chinese telco Huawei Technologies and its affiliates.[3] The talk was that Washington's restrictions on Huawei would cost Kioxia sales and lead to a global glut and thus lower prices for flash-memory products.

The US restrictions on Huawei sting because China makes less-advanced microchips and relies on more-advanced US supplies. China is aware its inferior chipmakers make the country vulnerable amid the 'decoupling' between China and the US that is centred on technology. Beijing thus intends to become the best and self-sufficient in the pivotal microchip industry that is worth more than US\$420 billion a year in global revenue, where half the sales are to Chinese firms.[4]

Microchips form the key battleground in the rivalry between Beijing and Washington because the integrated circuit – a piece of silicon that contains nanoscopic electronic circuits – ranks with the internal combustion engine and electricity as an invention of consequence for everyday life. The integrated circuits pioneered in 1958 by Jack Kilby at Texas Instruments when the US military was seeking a lightweight computer for the Minuteman missile's guidance system underpin so many essentials to modern life it can be said that we are in the microchip age.

As Beijing and Washington see it, the country with the best 'brains of computers' will dominate biotech, business, cyberwarfare, economic, military and other fields. Both will mobilise vast financial and political resources to ensure their microelectronics industry is the world's best – and China is behind in production facilities and technical know-how in this US-private-sector-dominated industry, even if most microchips are made in US-allied countries such as Taiwan and South Korea.[5]

A microchip industry split on Sino-US lines decades after the industry established global production networks, however, will come with costs and risks for both countries and the world. For US and allied companies, lost sales to China, reduced economies of scale and lower prices mean reduced profits, less research and fewer advances in chip technology. The risk for the US is that the country will lose its commercial and military edge in chips that are heading into their third generation of semiconductor materials.[6]

China's decision to elevate microchip self-sufficiency and excellence to a national priority means that billions of dollars are destined to be spent to ensure China has the best semiconductors. The cost of this, in theory at least, is that resources are being diverted from elsewhere. Chinese businesses and consumers could face higher-priced chips than otherwise and these might still be inferior to foreign peers (just like Australia's protected car industry meant higher prices for vehicles). The overarching risk for China is that in pursuing self-sufficiency Beijing is turning towards protectionism and government direction as an economic development model.

For the world, the cost of the microchip wars could entail slowed advances in almost every field, which spells opportunities and wealth forgone. Increased tensions between the world's biggest powers over this tiny technology could change the global balance of power and might turn their rivalry into hostility, perhaps over Taiwan, the world's biggest source of made-to-order chips. China, the US and the world would be better off if the microchip wars was toned down.

The competition over microchips could, of course, lead to advancements that help the world. The battle over chips has been simmering for a while – Beijing, for instance, stymied Qualcomm's bid for NXP Semiconductors in 2018 for security reasons[7] – with little harm done seemingly. The US is granting exceptions to its microchip bans to Huawei's smartphone business, so maybe the chip wars will be a phony confrontation. [8] Chinese companies are said to be sitting on vast stockpiles of US production inventories so the sting of the US actions might

be delayed and Sino-US rivalry might settle down. If the chip war were protracted and heated, the costs of the contest could be mostly hidden for society at large. Few people would be able to quantify lost advancements, reduced capabilities, higher costs than otherwise, lower speeds than otherwise and unknown alternatives forgone. So why worry?

Because regions vying for self-sufficiency in semiconductors is a recipe for disrupting the global microchip industry at a time when ageing and depopulating western societies with debt-ridden economies need all the productivity boosts they can get. And the global political ramifications would be vast if China were to overtake the US in semiconductors, given the associated changeover in global power.

AUTARKY IN TECH BY 2035?

The Chinese Communist Party in October held the 5th plenary session, or annual convention, of the 19th Communist Party Central Committee, which, along with the National Congress that appoints the committee, is one of the party's two highest decision-making bodies. The key job of the plenary session was to devise the 14th Five Year Plan (2021-2025). At the end of the session, the party issued a communiqué that unexpectedly in the title included the words "and 2035 long-term goals".[9]

The release said the party had bought forward by 14 years to 2035 the goal for China to become a rich country radiating "scientific and technological strength". (Deng Xiaoping, the leader who launched China's reforms from 1978, had previously set 2050 as the year when China would achieve "socialist modernisation", Beijing's term for parity with the US.) The plenum release said that by 2027 the country would achieve its goal of having a modern military by "strengthening the army with science and technology" by optimising "the layout of the national defence science and technology industry". To help achieve economic and military goals, the party elevated to a "strategic support" self-reliance in technology, which implicitly prioritises excellence in microchip production as a national goal under China's new 'dual circulation' economic model. This is the term for Beijing's policy of self-sufficiency in critical industries such as technology and energy that has seen it set aside an estimated US\$1.4 trillion for tech by 2025.[10]

China has much to achieve in microchip expertise if it wants to surpass the US in semiconductors on this timetable. The US restrictions on Huawei, especially the curbs in May that stopped the Chinese company receiving supplies from Taiwan Semiconductor Manufacturing Company or TSMC, the world's largest chipmaker, exposed the hollowness of China's 2015-launched 'Made in China 2025' plan to dominate in future technology spheres such as artificial intelligence, biotech, driverless vehicles, fifth-generation telecommunications, quantum computing and more (and in some areas, especially 5G telecoms, China is already a leader). Without excellence in semiconductors, first marked as a Chinese priority in 2014 when Beijing set up a US\$150 billion investment fund focused on chips under what was known as the Guidelines to Promote the National Integrated Circuit Industry, the wider goals are hard to achieve.

Irking also for China's leaders is that much of China's supply of world-class semiconductors comes from what Beijing considers to be its rogue province of Taiwan – that's where headed the losing Nationalist side in the civil war that bought the Communists to power in 1949.[11] TSMC, the world's best at making sophisticated chips, must heed the US restrictions because it relies on manufacturing equipment that contains US technology

and the US is the largest destination of TSMC's exports. China's other major sources of memory chips are South Korea's Samsung and SK Hynix and Micron of the US. Chip products from these companies can be easily blocked by Washington too.

Thus Beijing is seeking self-sufficiency. China has already invested billions of dollars to boost chip production and can boast gains.[12] From virtually no production in the late 1990s,[13] China produces about 15% of the world's chips now and that number could treble within five years. Semiconductor Manufacturing International Corp, China's biggest contract chipmaker usually known by its initials SMIC, and Yangtze Memory Technologies, China's first 3D NAND flash memory maker, are among Chinese companies setting goals to use local and non-US equipment in production to circumvent US restrictions.[14] Alibaba and Baidu are investing in microchips while Huawei plans to build a microchip production plant in Shanghai. Government subsidies are reportedly encouraging many more Chinese companies to enter the industry.[15]

But there are questions over the sophistication of Chinese microchips (though not the quantity it is capable of making). US companies dominate the software that designs the most advanced chips such as sub-10 nanometre chips. US companies Applied Materials and Lam Research and ASML of Europe and Japan's Tokyo Electron dominate the production (fabrication) process for advanced semiconductors. Through these companies, the US government can control which allied countries have access to the cutting-edge technology used to design and lay out chip circuitry. It is a formidable task for China to overcome its shortfall in intellectual property but not an impossible one.[16] One help for China is that the petering out of the corollary to Moore's Law – that chip capabilities increase due to a doubling in the number of transistors per chip every two years – might mean the gap to the US edge is shrinking.

China's pledge to get better at making microchips could lead to advances that help society and the wider world. But the billions, even trillions, of dollars to be invested in an invention already more than 60 years old is only likely to lead to incremental improvements rather than breakthroughs. The money to be spent will come with 'opportunity cost', a term that economists use to describe the alternatives foregone. Sums to be spent on microchip development are amounts diverted from elsewhere.

Some warn that China is reversing the opening up to the world that led to its industrialisation, an about-turn that could backfire in terms of the country's advancement.[17] Even if China were to gain an edge over the US in chips, that feat would likely only provoke greater tensions with the US and its allies.

US LEADERSHIP UNDER THREAT

Perhaps the start of the microchip wars dates to 2017 when one of the last acts of the administration of US President Barack Obama was to unveil a strategy to secure US supremacy over semiconductors in regard to China.[18] Congress during the administration of Donald Trump built on that proposal with legislation such as the CHIPS for America Act of 2020[19] and the American Foundries Act of 2020[20] that offered tax breaks and grants respectively to bring the microelectronics industry back to the US. Other developments of note include Washington's ever-expanding trade blacklist that specifies restrictions on Chinese organisations for aiding certain Chinese government policies. Companies ensnared include Huawei, Chinese telco ZTE in 2018 and SMIC in October last year.[21] Other events in the chip wars extend to the US blocking the supply of sophisticated

manufacturing equipment to China such as when in 2019 the Netherlands government decided not to renew the export licence for ASML's extreme ultraviolet scanner to SMIC.[22] More still include blocked takeovers such as Washington's refusal to allow Singapore company Broadcom to buy Qualcomm in 2018 due to fears of loss of control of intellectual property.[23] Such decisions come with costs for the US side, most obviously in lost sales for US companies. An overarching danger for the US is that the strategy backfires by costing it leadership in semiconductors.

Boston Consulting Group, which estimates the US market share in chips at 45% to 50% in 2018, says US leadership is grounded in a virtuous innovation cycle. The pivotal advantage of the US is that access to global markets has allowed US chipmakers to achieve the economies of scale needed to fund huge investment in chip research and development that has consistently advanced US technology ahead of global competitors (at least until recently).[24]

Boston Consulting reckons that China's semiconductor industry (not including the manufacturing facilities built by foreign semiconductor companies in China) covers only 14% of its domestic demand. It estimates the Made-in-China-2025

plan could increase China's semiconductor self-sufficiency to about 25% to 40% by 2025, which would reduce the US's semiconductor share globally by two to five percentage points from 2018 levels.

Every time Washington broadens restrictions on Chinese access to US technology, US market share loss deepens. The consultancy warns that US companies could lose 18 percentage points of global market share and 37% of their revenues from 2018 levels if the US completely bans semiconductor companies from selling to Chinese customers. Plunging revenue would force US microchip makers to slash research and investment, thereby reversing the US industry's virtuous innovation cycle. "As a result, South Korea would likely overtake the US as the world semiconductor leader in a few years; China could attain leadership in the long term," the consultancy warned.[25]

It would be a different world if China were the global leader in advanced semiconductors. And, as the experience of Japan's Kioxia shows, it could be a lesser world as China and the US fight to dominate a world defined in nanometres.

By Michael Collins, Investment Specialist

[1] The Wall Street Journal. 'Chip maker Kioxia calls off \$16 billion IPO after Huawei fallout.' 27 September 2020. [wsj.com/articles/chip-maker-kioxia-calls-off-16-billion-ipo-after-huawei-fallout-11601254884](https://www.wsj.com/articles/chip-maker-kioxia-calls-off-16-billion-ipo-after-huawei-fallout-11601254884). See also 'Kioxia to cancel IPO plan on US-China tension: Nikkei Business.' BNN Bloomberg. 27 September 2020. [bnnbloomberg.ca/kioxia-to-cancel-ipo-plan-on-u-s-china-tension-nikkei-business-1.1499893](https://www.bnnbloomberg.ca/kioxia-to-cancel-ipo-plan-on-u-s-china-tension-nikkei-business-1.1499893)

[2] Kioxia Holdings. 'Kioxia postpones initial public offering.' 28 September 2020. [kioxia-holdings.com/en-jp/news/2020/20200928-1.html](https://www.kioxia-holdings.com/en-jp/news/2020/20200928-1.html)

[3] US Department of Commerce. 'Commerce Department further restricts Huawei access to US technology and adds another 38 affiliates to the entity list.' 17 August 2020. [commerce.gov/news/press-releases/2020/08/commerce-department-further-restricts-huawei-access-us-technology-and](https://www.commerce.gov/news/press-releases/2020/08/commerce-department-further-restricts-huawei-access-us-technology-and). In May, the US had restricted Huawei and affiliates from buying chips built with "certain" US technology and software, a decision that hindered Huawei's purchases from Taiwan Semiconductor Manufacturing, the world's largest chipmaker. Washington imposed restrictions on Huawei to stop countries using the Chinese giant to update their telecom networks for "national security" reasons – to stop Huawei fulfilling "the policy objectives of the Chinese Communist Party" in the words of US Commerce Secretary Wilbur Ross.

[4] World Semiconductor Trade Statistics. 'WSTS semiconductor market forecast Spring 2020.' 9 June 2020. [wsts.org/esraCMS/extension/media/f/WST/4622/WSTS_nr-2020_05.pdf](https://www.wsts.org/esraCMS/extension/media/f/WST/4622/WSTS_nr-2020_05.pdf)

[5] See 'Why fewer chips say "Made in the USA".' The Wall Street Journal. 3 November 2020. [wsj.com/articles/why-fewer-chips-say-made-in-the-u-s-a-11604411810?mod=business_lead_pos5](https://www.wsj.com/articles/why-fewer-chips-say-made-in-the-u-s-a-11604411810?mod=business_lead_pos5)

[6] Bloomberg describes third-generation semiconductors as mainly chipsets made of materials such as silicon carbide and gallium nitride. They can operate at high frequencies and in higher power environments and at higher temperatures. They are widely used in fifth-generation radio frequency chips, military-grade radars and electric vehicles.

[7] Reuters. 'Qualcomm ends \$44 billion NXP bid after failing to win China approval.' 25 July 2020. [reuters.com/article/us-nxp-semiconductors-m-a-qualcomm-idUSKBN1KF193](https://www.reuters.com/article/us-nxp-semiconductors-m-a-qualcomm-idUSKBN1KF193)

[8] See Financial Times. 'US allows sales of chips to Huawei's non-5G businesses.' 29 October 2020. [ft.com/content/508b0828-bcd5-46a6-84f8-d05cb2887e0a](https://www.ft.com/content/508b0828-bcd5-46a6-84f8-d05cb2887e0a)

[9] See China's government. 'Communiqué of the Fifth Plenary Session of the 19th Central Committee of the Communist Party of China.' 29 October 2020. [xinhuanet.com/2020-10/29/c_1126674147.htm](http://www.xinhuanet.com/2020-10/29/c_1126674147.htm). Note that the full plan will be issued in March after the next full session of the National People's Congress, the name of China's parliament. See also, Bloomberg News 'China pledges quality growth, tech powerhouse in 5-year plan.' 29 October 2020. [bloomberg.com/news/articles/2020-10-29/china-pledges-quality-growth-in-new-5-year-economic-plan](https://www.bloomberg.com/news/articles/2020-10-29/china-pledges-quality-growth-in-new-5-year-economic-plan). See also People's Daily online. 'How will China shape its new journey for coming five years?' 26 October 2020. en.people.cn/n3/2020/10/26/c90000-9773049.html. See also Center for Strategic & International Studies 'China's Fifth Plenum: Reading the initial tea leaves.' 30 October 2020. [csis.org/analysis/chinas-fifth-plenum-reading-initial-tea-leaves](https://www.csis.org/analysis/chinas-fifth-plenum-reading-initial-tea-leaves)

[10] Bloomberg News. 'China to plan sweeping support for chip sector to counter Trump.' 3 September 2020. [bloomberg.com/news/articles/2020-09-03/china-is-said-to-plan-broad-chip-sector-support-to-counter-trump?sref=ORbm2mFs](https://www.bloomberg.com/news/articles/2020-09-03/china-is-said-to-plan-broad-chip-sector-support-to-counter-trump?sref=ORbm2mFs)

[11] See AsiaTimes. 'Why Taiwan is at the heart of the microchip struggle.' 8 August 2020. [asiatimes.com/2020/08/why-taiwan-is-at-the-heart-of-a-microchip-struggle/](https://www.asiatimes.com/2020/08/why-taiwan-is-at-the-heart-of-a-microchip-struggle/)

[12] See Financial Times. 'China gears up to fight back in tech war over chips.' 3 November 2020. [ft.com/content/09c40e0c-df5b-4d4d-b7d5-46ccf06b2344](https://www.ft.com/content/09c40e0c-df5b-4d4d-b7d5-46ccf06b2344)

[13] China launched 'Project 908' and 'Project 909' in the 1990s to kick-start a Chinese chipmaking industry. See NikkeiAsia. 'Both sides lose in US-China chipmaking split.' 24 July 2020. [asia.nikkei.com/Opinion/Both-sides-lose-in-US-China-chipmaking-split](https://www.asia.nikkei.com/Opinion/Both-sides-lose-in-US-China-chipmaking-split)

[14] See NikkeiAsia. 'China chipmakers speed up effort to cut reliance on US supplies.' 9 September 2020. [asia.nikkei.com/Politics/International-relations/US-China-tensions/China-chipmakers-speed-up-effort-to-cut-reliance-on-US-supplies](https://www.asia.nikkei.com/Politics/International-relations/US-China-tensions/China-chipmakers-speed-up-effort-to-cut-reliance-on-US-supplies)

[15] Financial Times. 'Chinese groups go from fish to chips in new "Great Leap Forward".' 13 October 2020. [ft.com/content/46edd2b2-1734-47da-8e77-21854ca5b212](https://www.ft.com/content/46edd2b2-1734-47da-8e77-21854ca5b212)

[16] See The Diplomat. 'Can China become the world leader in semiconductors?' 25 September 2020. [thediplomat.com/2020/09/can-china-become-the-world-leader-in-semiconductors/](https://www.thediplomat.com/2020/09/can-china-become-the-world-leader-in-semiconductors/)

[17] See Ambrose Evans-Pritchard. 'Hint of menace in China's new routemap.' 1 November 2020. [telegraph.co.uk/business/2020/11/01/hint-menace-chinas-new-routemap/](https://www.telegraph.co.uk/business/2020/11/01/hint-menace-chinas-new-routemap/) 20.

[18] The White House of President Barack Obama. 'Ensuring US leadership and innovation in semiconductors.' 9 January 2017. obamawhitehouse.archives.gov/blog/2017/01/09/ensuring-us-leadership-and-innovation-semiconductors

[19] US Congress. 'S.3933 – CHIPS for America Act of 2020. [congress.gov/bills/116th-congress/senate-bill/3933/text](https://www.congress.gov/bills/116/congress/116th-congress/senate-bill/3933/text)

[20] US Congress. 'S.4130 – American Foundries Act of 2020

[21] See US Department of Commerce. 'Commerce Department adds 24 Chinese companies to the Entity List for helping build military islands in the South China Sea.' 26 August 2020. [commerce.gov/news/press-releases/2020/08/commerce-department-adds-24-chinese-companies-entity-list-helping-build](https://www.commerce.gov/news/press-releases/2020/08/commerce-department-adds-24-chinese-companies-entity-list-helping-build)

[22] Reuters. 'Trump administration pressed Dutch hard to cancel China chip-equipment sales: sources.' 6 January 2020. [reuters.com/article/us-asml-holding-usa-china-insight-idUSKBN1Z50HN](https://www.reuters.com/article/us-asml-holding-usa-china-insight-idUSKBN1Z50HN)

[23] Reuters. 'President Trump halts Broadcom takeover of Qualcomm.' 13 March 2018. [reuters.com/article/us-qualcomm-m-a-broadcom-merger-idUSKCN1G01Q4](https://www.reuters.com/article/us-qualcomm-m-a-broadcom-merger-idUSKCN1G01Q4)

[24] Boston Consulting Group. 'How restricting trade with China could end US semiconductor leadership.' 9 March 2020. [bcg.com/en-au/publications/2020/restricting-trade-with-china-could-end-united-states-semiconductor-leadership](https://www.bcg.com/en-au/publications/2020/restricting-trade-with-china-could-end-united-states-semiconductor-leadership)

[25] Boston Consulting Group. 'How restrictions to trade with China could end US leadership in semiconductors.' March 2020. Full report. Page 3. [media-publications.bcg.com/flash/2020-03-07-How-Restrictions-to-Trade-with-China-Could-End-US-Semiconductor-Leadership.pdf](https://www.media-publications.bcg.com/flash/2020-03-07-How-Restrictions-to-Trade-with-China-Could-End-US-Semiconductor-Leadership.pdf)

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