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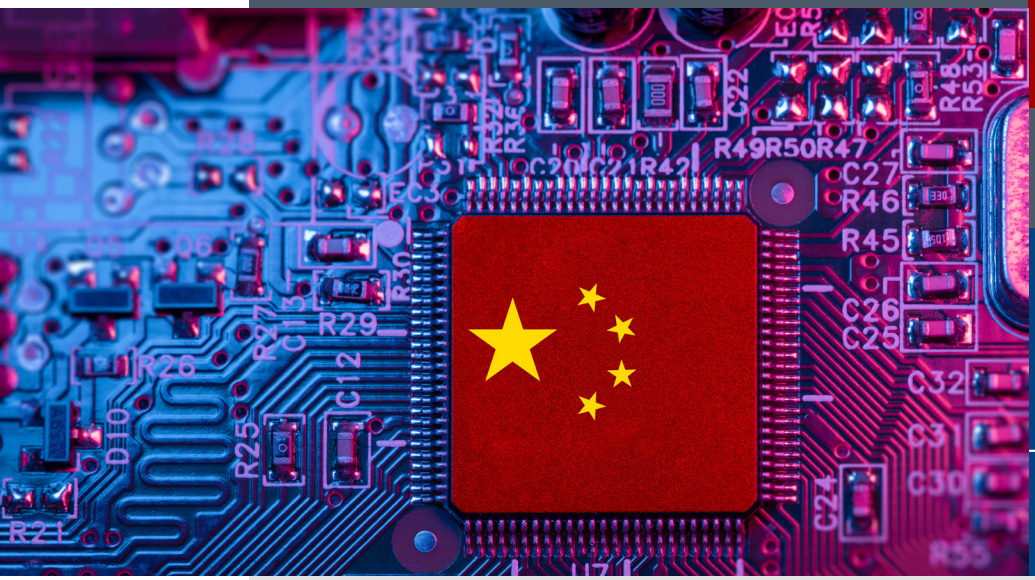


OCTOBER 7,
2024

Chinese Mature Node Overcapacity
Unfounded Fears

Arrian EBRAHIMI

Key Takeaways

- Chinese mature-node chip production is increasingly decoupled, with 80% of sales now focusing on the domestic PRC market. Meanwhile, connected devices and the Internet of Things (IoT) are the fastest-growing demand drivers in the PRC for domestically produced chips.
- Chinese chipmakers spend less on average than their global counterparts on manufacturing capacity but above the global average on research. This suggests that under a tight economy, the PRC government and chipmakers have prioritized technological catch-up over manufacturing capacity expansion.
- The growth in domestic Chinese mature-node chip demand is likely to keep a moderate pace with the growth in Chinese chip production capacity. These dual trends make unlikely a direct flood of cheap Chinese mature-node chips into Western markets, but as China increasingly fulfills its own demand, global prices may rise from gluts of Western chips crowded out of the PRC.
- Chinese chip demand will increasingly be met by domestic supply, crowding out foreign mature-node chipmakers that rely on the PRC market for revenue. Trade actions on downstream products incorporating Chinese mature-node chips may buffet market distortions, but such remedial policy measures require further study.

Introduction

China is decoupling from, not flooding, the global mature-node semiconductor market. As China increasingly pursues industrial policies encouraging domestic chip production, its own growing chip demand will prevent a direct flood of cheap Chinese chips on foreign shores. However, as Beijing achieves its goal of decreasing the reliance of domestic downstream manufacturers on foreign chips, European and American mature-node semiconductor companies will feel the ripple effects of an increasingly "involuted" (内卷) Chinese chip ecosystem[1].

"Mature-node semiconductors," as the industry generally refers to chips produced at 28-nanometer intricacies and above, are essential inputs for technologies ranging from automobiles and tanks to home appliances. As noted in the April 2024 E.U.-U.S. Trade and Technology Council joint statement[2], governments on both sides of the Atlantic increasingly worry about the global mature-node semiconductor market for both "national-security" and "economic-security" concerns. The former is a worry first proffered by the U.S.[3] and later adopted by the E.U., wherein allowing critical parts of its economy to rely on foreign inputs leaves a nation's supply chain vulnerable[4]. Meanwhile, the latter concern, shared by both the U.S. and E.U., is that unstable mature-node market conditions threaten their domestic champions.

A global shortage of mature-node chips proved crippling during the global chip shortage of 2021 and 2022. At the onset of the Covid-19 pandemic, automobile manufacturers around the world canceled orders for new chips, while demand for the most advanced chips used in cellphones and 5G infrastructure spiked. After a few months, the demand for cars rapidly recovered, but production lines for auto chips were slow to switch back into gear. Beyond demand shocks, a slew of natural disasters exacerbated already tight supply for all sorts of chips[5]. This perfect storm of crises led to factories pausing production, leaving consumers without new cars and auto workers furloughed.

1. Chinese web-slang for "intensely competitive" literally, "rolled up." Imagine a leaf dried to the point that its slides curl up into a roll.
2. "US-EU Joint Statement of the Trade and Technology Council", U.S. Department of Commerce, 2024, available at: www.commerce.gov.
3. "BIS Microelectronics Assessments", Bureau of Industry and Security, 2023, available at: www.bis.doc.gov.
4. P. Blenkinsop, "US, EU Eye Chinese Legacy Chips in Renewed Semiconductor Accord", Reuters, April 4, 2024, available at: www.reuters.com.
5. A February 2021 winter storm in Texas knocked out power for Texas Instruments' facilities supplying analog chips for automobiles, as well as Samsung's facilities in Austin manufacturing processors for 5G infrastructure and mobile devices. A March 2021 fire at a Renesas fab in Japan further strained automotive chip supplies, and, in spring 2021, TSMC cut chip production due to a drought in Taiwan. "SIA Supply Chain Submission", Semiconductor Industry Association, 2021, available at: www.semiconductors.org; "Samsung Electronics Announces New Advanced Semiconductor Fab Site in Taylor", Samsung Electronics, 2021, available at: www.samsung.com; Y. Hiroi, "Renesas Expects Bigger Damage from Fire at its Chip Factory", *Nikkei*, March 29, 2021, available at: asia.nikkei.com; E. Barbiroglio, "No Water No Microchips: What Is Happening In Taiwan?", *Forbes*, May 31, 2021, available at: www.forbes.com.

The global auto industry suffered a loss of over $210 billion [6], with Europe's manufacturing-reliant economy bearing an outsized impact.

Seeking to identify supply chain weaknesses, Western governments have begun investigating their downstream manufacturers' reliance on China for mature-node chips. Focusing its analysis on risks to national security, in January 2024 the U.S. Department of Commerce put out a survey for companies in "critical U.S. industries" to detail their reliance on mature-node semiconductors[7], as well as how much of their supply comes from China. Following conversations with American counterparts, the European Commission indicated in April 2024 that it would conduct an even broader investigation into both the national-security and economic-security implications of Chinese legacy chip production[8]. On the European side, this reported investigation follows the April release of a 712-page report by the European Commission on the support Beijing provides to a range of industries[9], including semiconductors.

Overcapacity is merely an economic term describing when supply is greater than demand, but the U.S. and E.U. have qualitatively different assessments of when Chinese chip supply is dangerously near "overcapacity." The U.S. Commerce Department's recent investigations suggest that Washington's view of Chinese "mature-node overcapacity" is an overcapacity that generates prices low enough to lure national-security critical U.S. chip customers to rely on Chinese suppliers[10]. Meanwhile, Brussels more likely considers Chinese "mature-node overcapacity" to be an overcapacity that threatens the competitiveness of domestic mature-node chipmakers like NXP[11].

Western mature-node chipmakers may find themselves increasingly squeezed out of the domestic PRC market

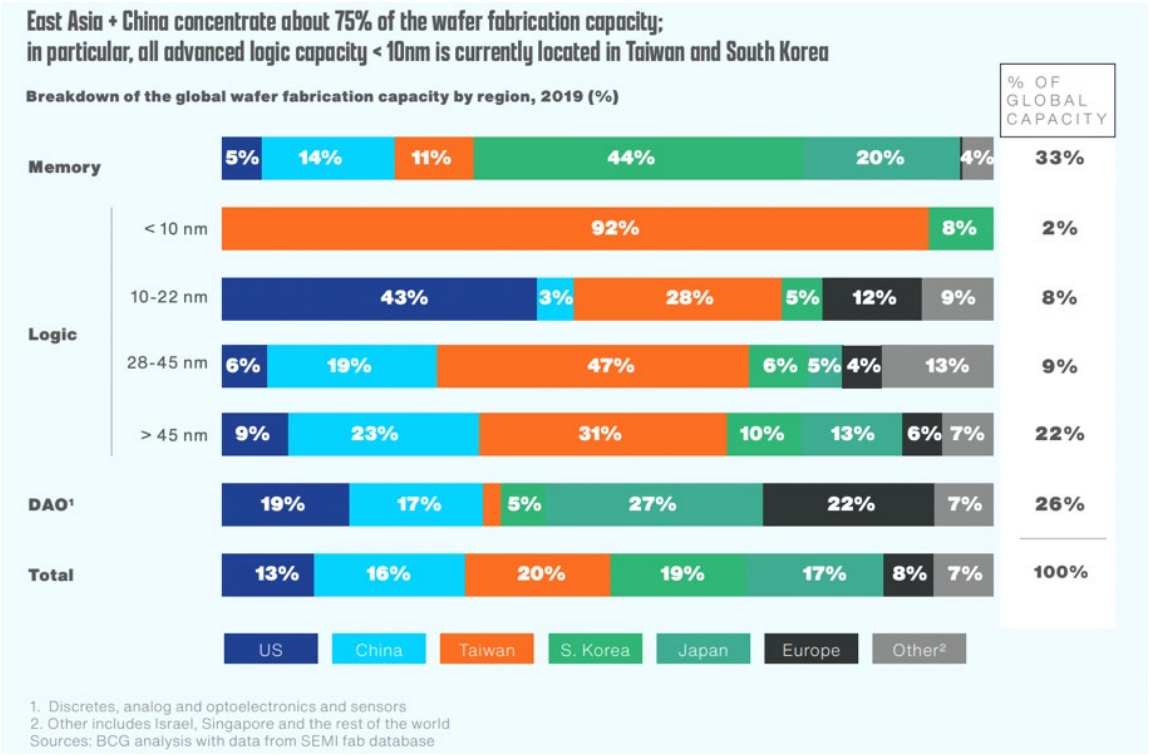
This briefing analyzes the supply chains into which Chinese mature-node chips feed, as well as the support that Beijing offers to this industry. Due to Beijing's state support, Western mature-node chipmakers may find themselves increasingly squeezed out of the domestic PRC market. These firms may need to redirect their currently China-destined sales to home markets, and as that happens, increasingly redirected supply will yield lower global mature-node chip prices. Such a trend is especially threatening for Europe, where the chip industry is nearly fully comprised of mature node manufacturing.

6. "Shortages Related to Semiconductors to Cost the Auto Industry $210 billion in Revenues this Year, Says New AlixPartners Forecast", Alix Partners, 2021, available at: www.alixpartners.com.
7. "BIS Microelectronics Assessments", Bureau of Industry and Security, 2023.
8. P. Blenkinsop, "US, EU Eye Chinese Legacy Chips in Renewed Semiconductor Accord", *op. cit.*
9. "Commission Updates Report on State-Induced Distortions in China's Economy", European Commission, 2024, available at : policy.trade.ec.europa.eu.
10. "BIS Microelectronics Assessments", Bureau of Industry and Security, 2023, available at: www.bis.doc.gov.
11. P. Blenkinsop, "US, EU Eye Chinese Legacy Chips in Renewed Semiconductor Accord", *op. cit.*

The Current Global Mature-Node Landscape

The global semiconductor industry has seen a shift in production away from the U.S., Japan, and Europe, which dominated up to the 1990s, toward Taiwan, South Korea, and China today. In a pair of reports from 2020 and 2021, the Semiconductor Industry Association[12] chronicled how the global share of chip manufacturing capacity and its segmentation by product type reached the world's current state. In 1990, the U.S. and Europe accounted for 37% and 44% of global capacity, while in 2020 they stood at only 10% and 8%, respectively[13]. In that time, South Korean, Taiwanese, and Chinese capacity grew from virtually nonexistent to 19%, 21%, and 24% of global capacity.

Figure 1: Breakdown of the global wafer fabrication capacity by region, 2019



Source: Semiconductor Industry Association

Analysts must consider these aggregate statistics alongside a more detailed breakdown of capacity by chip product segment and node generation[14]. In 2019, the two segments most relevant to the mature-node debate, logic chips and analog chips, saw value-added originating primarily from the U.S. for logic and the U.S., South Korea, and

12. The Semiconductor Industry Association (SIA) is an American trade association based in Washington, D.C. representing U.S. semiconductor companies.
13. "Government Incentives and US Competitiveness in Semiconductor Manufacturing", Semiconductor Industry Association, 2020, available at: www.semiconductors.org.
14. "Strengthening the Global Semiconductor Value Chain", Semiconductor Industry Association, 2021, available at: www.semiconductors.org.

Europe for analog[15]. The production of analog chips, all of which are mature nodes, was balanced similarly to this segment's value-added breakdown, with capacity across the U.S., China, Japan, and Europe at 19% to 27% each. Logic chip production, however, varies starkly by node generation. In 2019, Taiwan produced 92% of sub-10 nm logic chips; while Taiwan and Mainland China produced 31% and 23% of over-45 nm logic chips, respectively[16]. Another breakdown by node generation across all chip segments shows that Chinese firms account for 27% of 28-65 nm node production and 20% of 90-180 nm production[17].

The economics of mature-node chip production differ significantly from that of advanced chips:

- First, the equipment costs of mature-node fabrication facilities (fabs) have typically been fully paid off (in technical terms, "amortized"), whereas the equipment in advanced facilities is usually more recently purchased. Incentivizing mature-node fabs to expand capacity therefore requires making them change their business models into one that can accommodate higher than usual capex.
- Second, even though their capital expenditures have already been paid off, mature-node producers face thinner profit margins than those designing and producing cutting-edge chips. Low margins leave mature-node chipmakers with less liquid capital to invest in expansion, which makes government financial support more necessary to grow mature-node production.
- Downstream customers for mature-node semiconductors have relatively inflexible supply chains. Mature-node chip customers and their existing suppliers will likely grow chip demand and supply in a coordinated fashion to avoid a situation where foundries cannot find buyers for their excess capacity.

These three factors shine a light on the importance of government financing and downstream demand to the future of the Chinese mature-node chip industry. The analysis in the following sections will deal with the demand issue first, then examine Beijing's efforts to finance supply expansion.

To evaluate the risk of overcapacity, this briefing focuses on equity investments[18] from China's Big Funds[19], downstream chip demand trends[20], and rates of capital

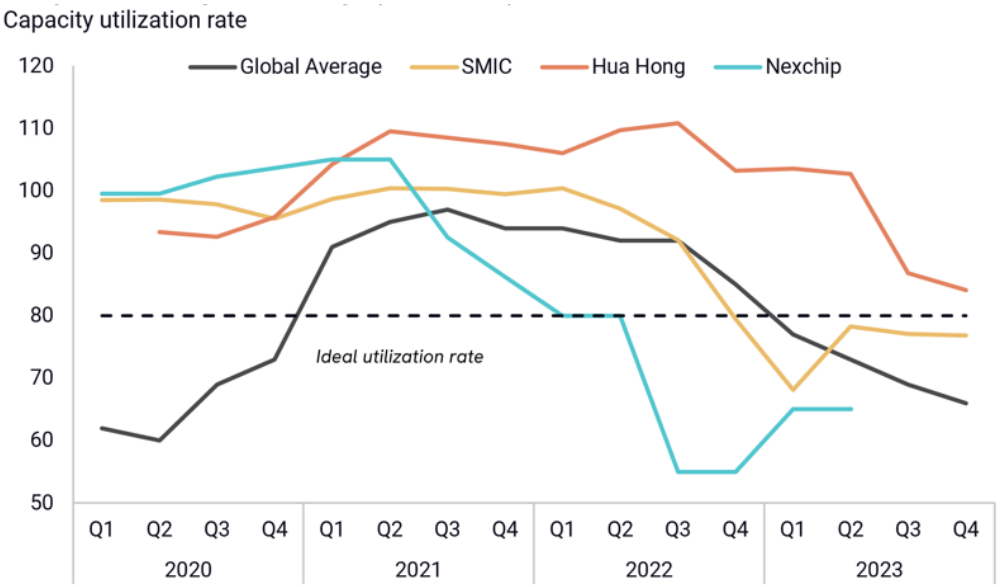
15. The other main category of semiconductor products, memory, is less relevant for this briefing because these chips are primarily produced and sold near the cutting-edge because memory end-users prioritize speed and efficiency.
16. "Strengthening the Global Semiconductor Value Chain", Semiconductor Industry Association, 2021.
17. "Legacy Chip Overcapacity in China: Myth and Reality", Center for Strategic and International Studies, 2024, available at: www.csis.org.
18. Purchases of stock in public or private chip companies.
19. As further explained below, China's "Big Funds" are large government-funded corporations tasked with investing in the semiconductor sector.
20. Sources of chip demand include smartphones, automobiles, interconnected devices, industrial appliances, etc.

expenditure [21] and research expenditures [22] by PRC chipmakers to analyze the extent to which chipmakers orient Beijing's state support toward capacity expansion. It is worth noting, however, that these are not the only indicators one could use as warning signs of Chinese overcapacity – or the lack thereof. One consultancy leveraged data on capacity utilization rates[23] — the share of time that manufacturing equipment is being used, as opposed to turned off for maintenance — to assess the risk of overcapacity. They theorized that under-utilized fabs would indicate that Chinese supply is higher than demand, leading to lower prices domestically and globally. They found that Chinese chipmakers had utilization rates above the global average, suggesting to the contrary that Chinese chip capacity currently cannot meet Chinese demand. By different measures, this briefing makes similar findings.

Chinese chipmakers have utilization rates above the global average

Figure 2: Capacity utilization rate of selected semiconductor manufacturers in China compared to the global average (2020-2023)

Source: Rhodium Group



21. Cash spent on physical infrastructure, namely semiconductor manufacturing equipment.
22. Cash spent on research for new chip manufacturing processes, material inputs, architectures, etc.
23. "Thin Ice: US Pathways to Regulating China-Sourced Legacy Chips", Rhodium Group, 2024, available at: rhg.com.

Demand for Mature Nodes in China

Although China relies heavily on semiconductor imports, accounting for 24% of global chip demand, it only contributes 9% of the global value-added in developing and producing this technology[24]. The PRC's General Administration of Customs highlights that in the first three quarters of 2023, China imported over $2 billion in chips but exported only $110 million, leaving it with a massive trade deficit in this critical technology[25]. That China only comprised a 3% share of global 10-22nm logic capacity in 2021 evinces that these limited exports are primarily mature nodes. In fact, the only stage of the semiconductor supply chain where China commands the largest global share, chip assembly and packaging at 38%, is the industry's lowest value-added step[26].

Chinese policymakers are increasingly anxious to close both their production and technology gap by subsidizing chip manufacturing and R&D[27], determining whether firms use these funds to expand production requires analyzing their capital expenditure and research expenditure rates.

Before examining China's financial support for chip supply in the next section, this section will analyze China's chip demand. In examining chip demand, this section looks only at SMIC (Semiconductor Manufacturing International Corporation), China's largest chip foundry. Limiting our study of Chinese demand to that firm allows us to compare year-to-year end uses more accurately than if we had to align the end-use categories of different chipmakers. At a 2022 revenue of $7.2 billion, SMIC is the only Chinese firm to list among the top 30 global semiconductor companies[28], and in 2020 SMIC was the only Chinese company to list among the global top 10 in terms of 200mm wafer capacity at 5%. This predominance in the Chinese market means that the trends of SMIC sales largely reflect those of the entire Chinese chip industry. While surveying smaller PRC chipmakers would make the data more complete, it would only add limited value, whereas an examination of SMIC alone provides a cleaner comparison of annual product categories.

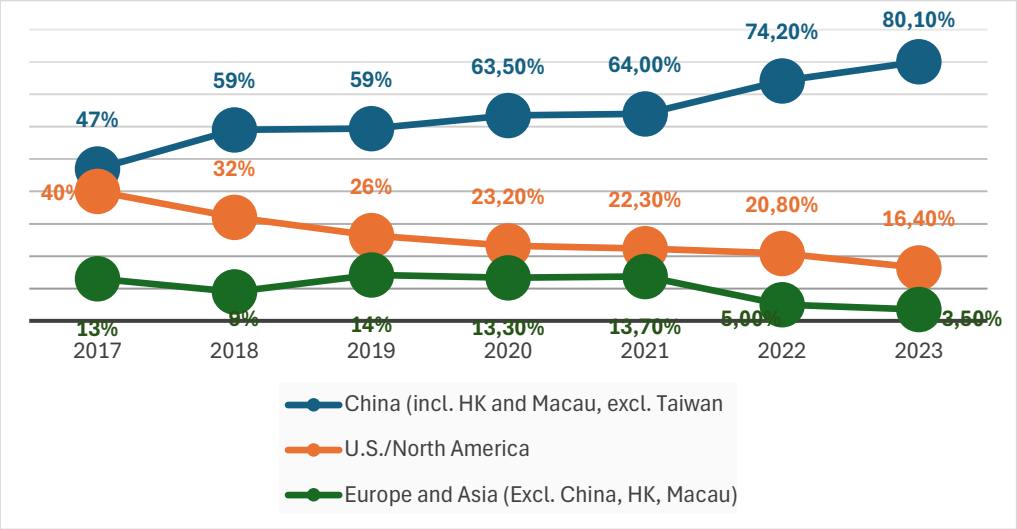
To What Regions do PRC Chipmakers Sell?

Chinese chipmakers, as represented by SMIC, are like most other mature-node manufacturers in that they have relatively steady year-to-year demand compositions. The reason for this steadiness is that mature-node chip customers, such as automobile and medical device companies, have strict qualification standards and long product life cycles.

24. "Strengthening the Global Semiconductor Value Chain", Semiconductor Industry Association, 2021.
25. *华盛通*, "四部门发"红包"，集成电路、工业母机获重磅利好(附概念股)"， September 19, 2023, available at: www.hstong.com.
26. "SIA Whitepaper: Taking Stock of China's Semiconductor Industry", Semiconductor Industry Association, 2021, available at: www.semiconductors.org.
27. *华盛通*, "四部门发"红包"，集成电路、工业母机获重磅利好(附概念股)"， September 19, 2023, *op. cit.*
28. "Assessment of the Status of the Microelectronics Industrial Base in the United States", Bureau of Industry and Security, 2023.

Maintaining their qualifications and well-established manufacturing processes does not allow them to easily switch from one company or one chip input to another.

Figure 3: SMIC's regional end markets



Source: Author's calculations based on SMIC financial filings.

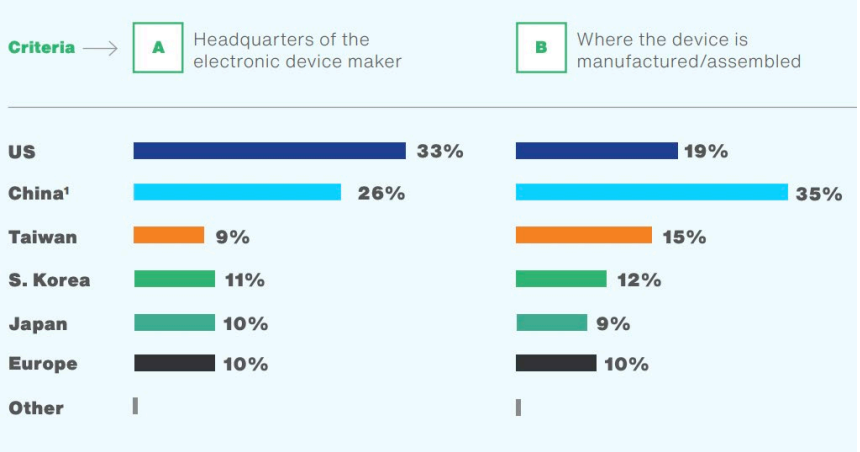
Despite this default toward consistent demand compositions, SMIC has seen its share of domestic customers increase steadily year-over-year since 2017, growing from 47% of demand going to the PRC market in 2017 to over 80% in 2023. There was an especially sharp jump in 2022 where the share of domestic demand jumped 10%, coinciding with a sharp decrease in European and non-Chinese Asian customer revenue of about the same amount.

China is home to 35% of global chip demand due to its role as an electronics assembly hub, so a growing share of Chinese chip supply in the domestic Chinese market will disproportionately grow the share of Chinese chip supply in the global supply chain[29]. However, the growth of the Chinese market as a share of SMIC revenue suggests that SMIC-produced chips will not directly flood global markets. Rather, because a smaller share of the firm's production gets sold abroad, Western chips previously sold in China will be redirected home, indirectly supressing global mature node prices.

To the extent Western governments want to limit the flow of Chinese mature-node chips, tariffs on directly imported chips themselves are unlikely to capture these semiconductors at their entry point into global supply chains. The ripple effects of Chinese firms' increasing share of domestic PRC chip demand may more likely manifest in lower downstream product prices, so trade actions on downstream products incorporating Chinese chips may better address trade distortions. These hypotheses require further study to prove.

29. "Strengthening the Global Semiconductor Value Chain", Semiconductor Industry Association, 2021.

Figure 4: Global semiconductor sales by geographic area, 2019 (%)

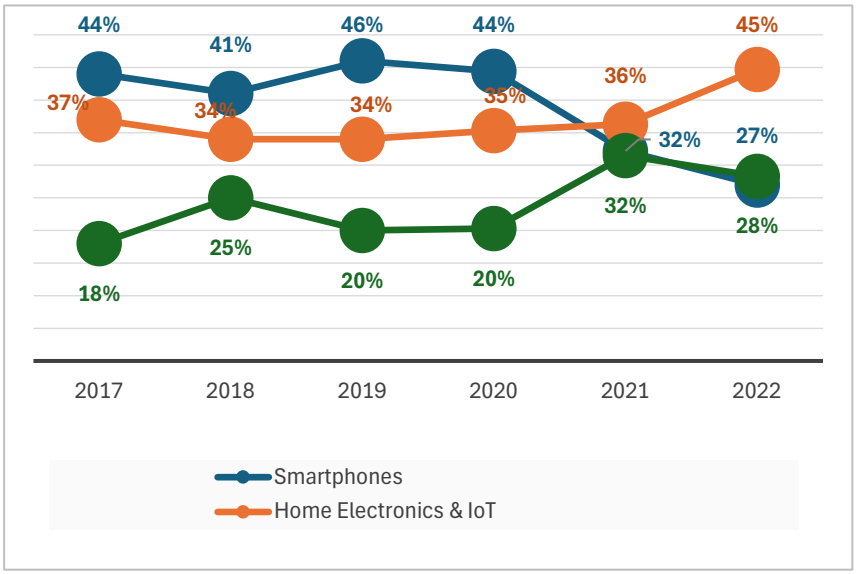


Source: Semiconductor Industry Association

For what applications do PRC chipmakers sell?

The end-uses for SMIC's chips have also changed significantly over the course of five years[30]. In 2017, SMIC's largest end-use category was smartphones, followed at a close second by connected devices, and trailed in third by another category including laptops, automotive, and industrial applications[31].

Figure 5: SMIC's end-product breakdown



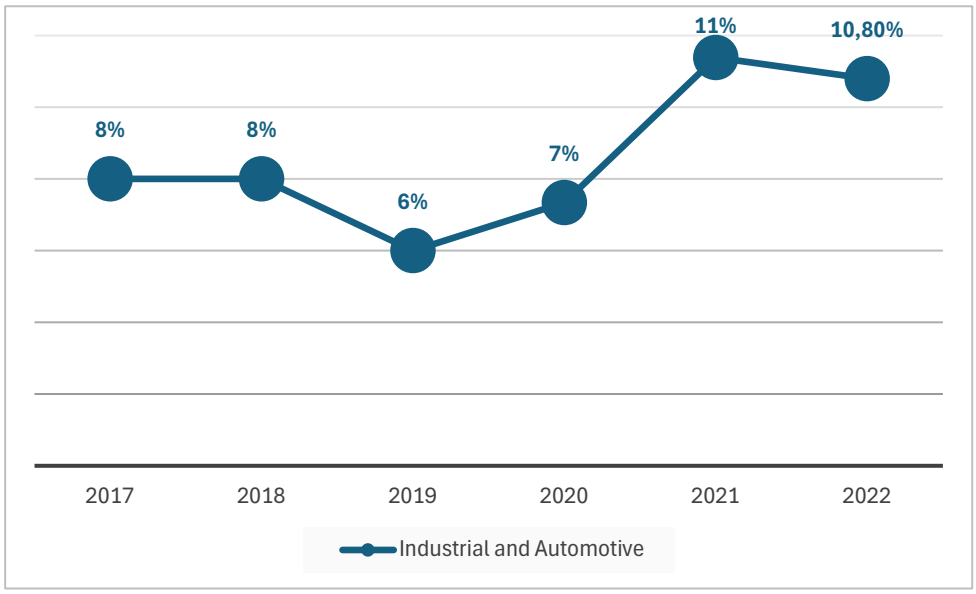
Source: Author's calculations based on SMIC financial filings

30. This includes all chips produced by SMIC, mature and relatively leading edge. Of all Chinese semiconductor companies, SMIC has the largest and most advanced non-mature node production capability, but its financial documents do not say what node generations account for what share of its sales.

31. We believe the Internet of Things application making up the orange connected devices category in Figure 5 would include IoT devices in cars. The separate automotive end-uses lumped into the "other" category likely focus solely on auto chips used for actual driving application like driving cameras, tire pressure gauges, etc.

As SMIC's demand has shifted toward the domestic Chinese market, connected devices have grown from just over a third to nearly half of the chipmaker's end-use demand. This trend may reflect the growing role of domestic chipmakers in the PRC's efforts to digitize physical infrastructure. At the same time, smartphone demand has tanked. The next subsection will look more closely at the relative growth trends of smartphones, IoT devices, and automobiles in China to further explain what these SMIC sales numbers suggest about the risk of Chinese overcapacity.

Figure 6: Industrial and automotive as share of SMIC's sales over time



Source: Author's calculations based on SMIC financial filings

Lastly, not accounting for IoT devices that go into cars, SMIC's pure industrial and automotive chip end-use demand has grown only moderately since 2017. Independently designed auto chips from PRC chip companies comprise only 4.5% of the world's total, and China relies on foreign auto chips to the tune of 90%[32]. Given the aggressive growth of Chinese car production that the next section will elaborate upon, this chart suggests that Chinese automobile companies are struggling to fight for the domestic chip supply that has increasingly flowed toward IoT manufacturers.

What is the domestic PRC growth forecast for end-use applications of mature nodes?

Whether China's domestic downstream demand for the chip end-uses described in the previous subsection continues to expand will decide whether the PRC does or does not flood the global mature-node chip market. One analyst described a non-public industry study showing that "by 2030 (assuming all of the announced fabs in China are actually built and operating by 2030) domestic capacity will be able to cover around 90% of

32. 赛博汽车, "中国汽车芯片到底差在哪里？", September 1, 2024, available at: 36kr-com.

domestic demand, including Chinese OEMs, and foreign OEMs with factories in China. This number was around 37 percent in 2020[33]."

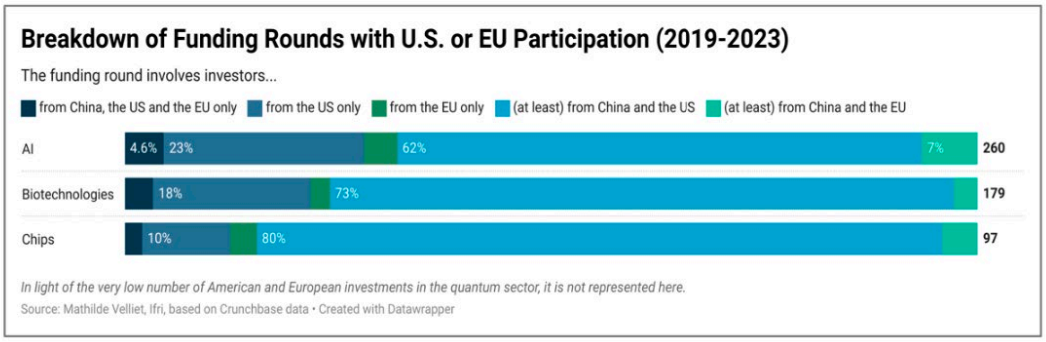
Examining the P.R.C smartphone, automobile, and Internet of Things (IoT) markets yields a similar conclusion. Smartphone demand in China is predicted to grow from $105.5 billion in 2024 to $137.4 billion in 2029[34]. Automobile production in China is expected to grow from 3 million units (a 3% global market share) to 9 million by 2030 (a 13% global market share)[35]. Lastly, the global market for IoT gateways, platforms that connect devices to the cloud, was predicted to grow 13% annually from 2020 to 2026, with most of that growth coming from China[36].

As Chinese legacy chip capacity continues to grow, an increasingly hungry domestic demand for these chips combined with a political effort to reduce reliance on imported chips will stem the tide of Chinese chips that enter the global market. Western policymakers concerned about Chinese overcapacity should therefore closely follow the growth of these downstream Chinese industries to determine which of the two grows more quickly, China's chip demand or supply.

Chinese Government Support for Mature-Node Chipmaking

From 2019 to 2023, an already high 65.79% of investment into Chinese companies came from Chinese-only investors, yet an even higher 82% of recorded investments in chip companies came solely from Chinese investors.[37] This lack of foreign participation in China's chip investment ecosystem, combined with the aforementioned low liquidity of mature-node chipmaking, mean that Beijing's public policies play a central role in China's capacity expansion.

33. "Legacy Chip Overcapacity in China: Myth and Reality", Center for Strategic and International Studies, 2024. [OEMs, "original equipment manufacturers," are producers of downstream consumer electronics and industrial products that often incorporate semiconductors as inputs.]
34. Statista, "Smartphones", available at: www.statista.com.
35. M. Wayland, "Chinese Automakers Expected to Achieve 33% Global Market Share by 2030", *CNBC*, June 27, 2024, available at: www.cnbc.com.
36. Graphical Research, *Asia Pacific IoT Gateway Market Size By Component (Multipoint Control Unit, FPGA, Sensor, Memory), By Connectivity Technology (Bluetooth, Wi-Fi, ZigBee, Ethernet, Z-Wave), By Application (Wearable Device, Healthcare, Automotive & Transportation, Building Automation, Industrial, Consumer Electronics), Research Report, Regional Landscape, Growth Prospects, Price Trends, Competitive Industry Share & Forecasts, 2020 – 2026*, 2021, available at: www.graphicalresearch.com.
37. These statistics only account for investments where the nationalities of the investors were known. Source : Crunchbase.



Pipelines for Public Funding

To provide more coordinated central support to its chip industry, Beijing has raised a series of "Big Funds" to provide equity support to chipmakers. The first phase of the "Big Bund" raised a total of 139 billion yuan ($20 billion), which it invested between September 2014 and May 2018 into 23 listed companies. The first phase of the fund had 16 shareholders, of which the Ministry of Finance (MOF) accounted for 36.47%, while the rest were state-owned enterprises (SOEs)[38]. Among the projects receiving investment, downstream chip manufacturing accounted for 67%.[39] The second phase of the big fund was established in October 2019, and as of March 2022, it has announced 79 billion yuan ($11 billion) in investments across 38 companies[40]. Based on their published figures, the two funds' combined share of support for manufacturing stood at 65% of their capital.

R&D tax credits still stand to increase the country's chipmaking capacity by offsetting capital expenditures

Tax credits are also a major boon for chip companies, but these tend to be targeted toward research and development, not manufacturing. A 2020 State Council policy excuses corporate income tax for the initial five years of a semiconductor project and levies a 12.5% rate reduced from the standard 25% PRC corporate income tax in the following years[41]. In September 2023, the Ministry of Finance further built on the 100% and 200% general R&D credits by adding a special sweetener for the semiconductor industry, allowing for

38. 每日经济新闻, "大基金启动年内首笔减持！涉及这两家公司，一期基金进入回收期二期正加码投资", March 17, 2023, available at: www.nbd.com.
39. The remainder of companies receiving investment constituted other parts of the industry like semiconductor manufacturing equipment, chip design, and advanced packaging.
40. "大基金二期投资图鉴，虎年大步快跑起来", DRAMeXchange, March 7, 2022, available at: www.dramx.com.
41. "国务院关于印发新时期促进集成电路产业和软件产业高质量发展若干政策的通知", PRC State Council, August 4, 2020, available at : www.gov.cn

deductions of up to 220% for research expenses[42].

Even though China's R&D tax credits do not directly support manufacturing, many of the biggest tax credit beneficiaries are chipmakers like SMIC. Because money is fungible in a large corporation, R&D tax credits still stand to increase the country's chipmaking capacity by offsetting capital expenditures. The next subsection will round out this briefing's analysis by examining how Chinese chipmakers use the funds they are given: to expand production or to conduct research?

How Chipmakers Use Their Funds

Based on 2023 numbers collected by this briefing's author, 17 major Chinese chipmakers, including the foundries SMIC and Huahong Semiconductor spent 12% ($2.3 billion) of their 2023 operating revenue on R&D, while spending 8% ($1.7 billion) on capital expenditures (capex). This 12% R&D spending is much higher than the global 7% average for foundries shown in the chart below, and it reflects the policy tools described above which primarily target Beijing subsidies toward semiconductor research.

Figure 7: R&D intensity, 2023

R&D Intensity		
Process	**United States**	**Rest of World**
Total	18%	10%
Chip Providers	18%	13%
Fabless	20%	18%
IDM	17%	11%
IDM ex-Intel	11%	11%
Foundry	6%	7%
OSAT	3%	4%
Source: Aggregate BIS survey data, Company annual reports		

Source: 2023 BIS Microelectronics Industrial Base Assessment

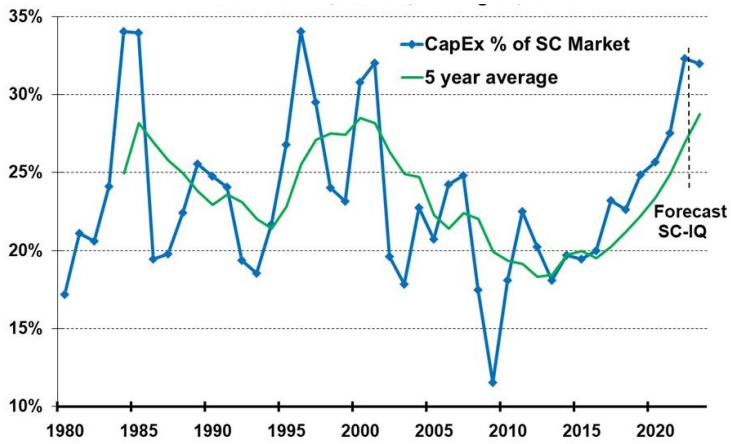
China's government support is not currently enough

Perhaps due to low profitability and the focus of Beijing's tax credits on research, Chinese chipmakers' 12% average 2023 capital expenditure statistic was significantly lower than the global industry's historical range, which as shown in the graph below only ever dipped below 17% during the 2008 financial crisis. Standing at $1.7 billion, the entire Chinese chipmaking ecosystem's combined capital expenditure is dwarfed by Intel's $20 billion in capital expenditure alone[43]. As mentioned earlier, profits tend to be thinner for the foundry industry, which produces most of China's mature-node chips.

42. China has previously, in March 2023, offered a 100% R&D tax credit with a 200% super deduction for R&D activities in any industry that result in patents. Research expenses in chip technology that *do not* result in patents qualify for an *additional* deduction of 120% of their taxable income. (This equation of the 100% general deduction plus 120% semiconductor deduction results in a 220% deduction for non-patent producing chip R&D.) Research expenses in chip technology that *do* result in patents qualify for a deduction of 220% of their taxable income.
43. B. Jewell, "Semiconductor CapEx down in 2023", SemiWiki, June 28, 2023, available at: semiwiki.com.

Although Beijing's Big Fund investments have mostly gone toward semiconductor manufacturing, those equity infusions may not have incentivized higher capex as effectively as tax credits have incentivized higher R&D. Regardless of the reason, these facts together suggest that China's government support is not currently enough to allow chipmakers to build long-term production capacity as quickly as their global competitors.

Figure 8: Semiconductor capital expenditures, in % of the semiconductor market



Source: SemiWiki, data from WSTS, Gartner, IC Insights, SC-IQ

Conclusion

As the global economy grows increasingly bifurcated, Chinese policymakers' priority in the semiconductor industry is achieving independence from Western imports, not undercutting global prices. Chinese chipmakers' demand increasingly derives from their domestic market, and the PRC's downstream smartphone, automobile, and IoT industries increasingly demand mature-node chips. These trends will grow Chinese mature-node chip demand as chipmakers invest in greater supply, and it will be the relative speed of domestic-PRC demand versus supply growth that will determine whether fears over lowered global mature-node prices come to fruition.

Due to profitability challenges and higher-than-average research expenditures, however, Chinese chipmakers may struggle to increase their production capacity as quickly as domestic demand requires. Although studies suggest that China will fulfill larger shares of its own domestic demand for mature-node semiconductors, the impact of this trend on global chip prices will likely come indirectly from a more competitive domestic Chinese market, not from aggressive dumping practices on foreign shores.

American and especially European chip companies that derive significant revenue from the Chinese market will likely face headwinds as they compete with domestic champions receiving government equity investments and tax credits. Lowering the footprint of these firms in the Chinese market is the stated goal of Beijing's policymakers, so Western governments will need to consider whether to support their firms in a battle

to keep hold of the Chinese market, or to focus on building domestic supply chain resiliency in a decoupling world.

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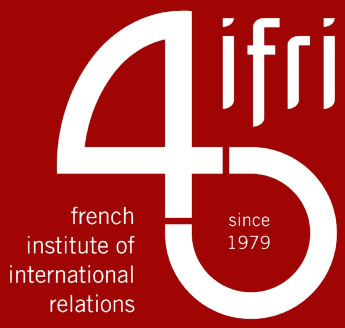

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