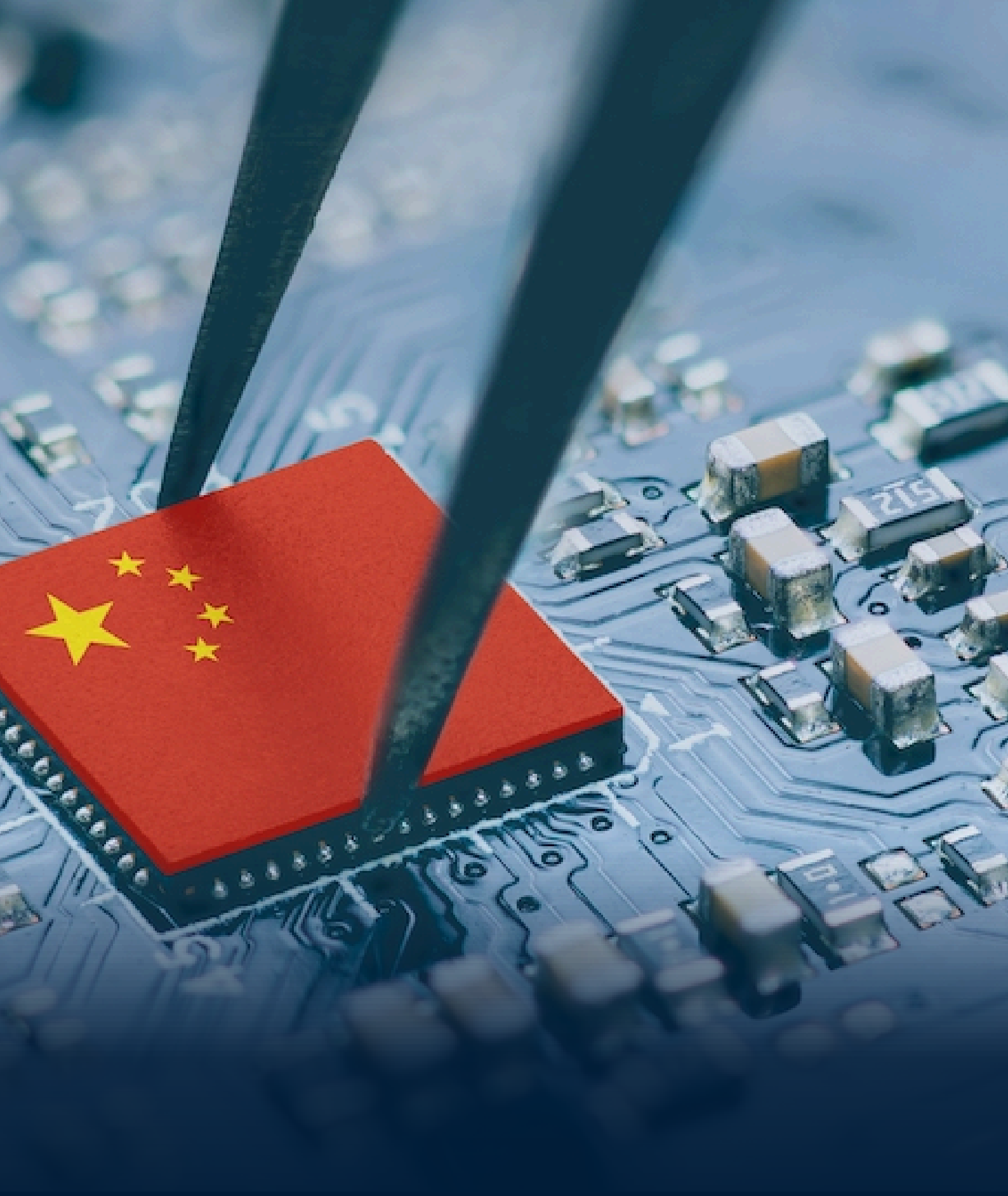

MACRO ANALYSIS ON CHINA'S SEMICONDUCTOR INDUSTRY

Global Macro Department - First Edition

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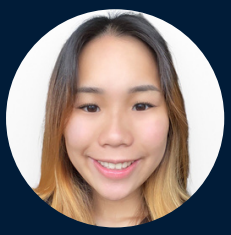

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SUMMARY

The Monarch Research Global Macro Report is a flagship opinion-based publication by Monarch Research, designed to distill complex global economic trends into clear, accessible insights for a broad audience. Our goal is to bridge the gap between institutional-grade analysis and public understanding, sharing our research, perspectives, and interpretations on macroeconomic developments that shape financial markets, industries, and nations. By examining how global forces—such as monetary policy shifts, geopolitical dynamics, and structural economic changes—interact with specific sectors and regions, we aim to empower readers with the knowledge to make more informed decisions in an interconnected world.

Monarch Research is an Independent Research Interest Group led by youths from across Singapore ranging from high schoolers to undergraduates aiming to deliver the highest quality insights to you.

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MACRO ANALYSIS ON CHINA'S SEMICONDUCTOR INDUSTRY

Global Macro Research Department

MONARCH RESEARCH

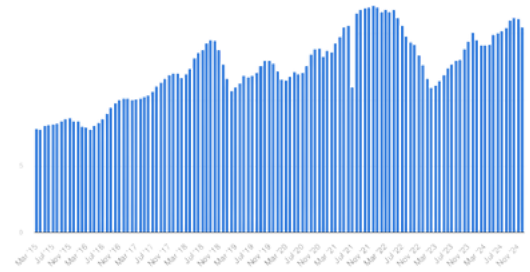


Fig 1: China's rising semiconductor sales (Statista, 2024)

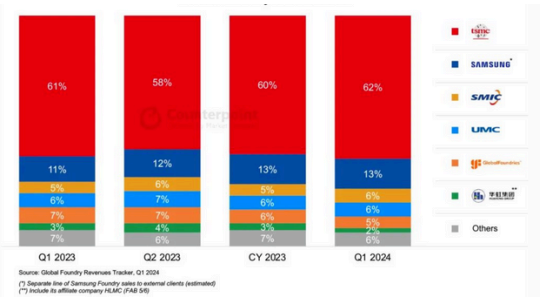


Fig 2: Chinese companies are leading in Global Foundry Market Share (Global Foundry Revenues Tracker, 2024)

Fig 3: China's Market Share of Semiconductors (20%) (SIA 2022)

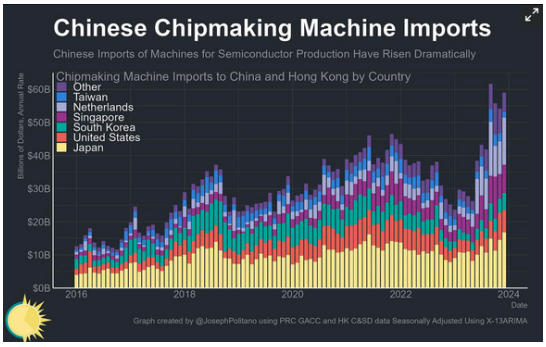


Fig 4: Chinese Chipmaking Machine Imports (Politano, 2024)

SEMICONDUCTOR INDUSTRY IN CHINA: AN OVERVIEW

The semiconductor industry in China is a rapidly growing sector, with a market size surpassing $150 billion in 2024 (Statista(A), n.d.) (See Fig 1), representing a significant portion of the $600 billion global semiconductor industry (Statista (B), n.d.). China's production primarily focuses on mature nodes (Hmaidi, 2024), while advanced node manufacturing, including 7nm and below, remains limited due to restrictions on access to EUV (extreme ultraviolet) lithography (Lovati, 2025) and advanced Electronic Design Automation (EDA) tools.

Key domestic players in China include SMIC (Semiconductor Manufacturing International Corporation), TSMC (Taiwan Semiconductor Manufacturing Company) and companies such as Hua Hong Semiconductor and YMTC (Yangtze Memory Technologies). While these companies have made strides in advanced packaging and memory chip production, their ability to produce cutting-edge semiconductor technologies is constrained by a lack of access to critical foreign tools. China's share of global semiconductor demand is approximately 40%, making it the largest consumer, but its production accounts for just over 20% (Pan & Goh, 2025; SIA, 2022; Politano, 2024), highlighting its reliance on imports, particularly in areas like DRAM, NAND flash memory, and high-end photolithography equipment. (See Fig 2)

The Chinese government has implemented several key initiatives to foster domestic growth in this space. Notably, the "Made in China 2025" plan and the "14th Five-Year Plan" emphasise semiconductor self-sufficiency, with significant investments in R&D, talent development, and infrastructure. However, despite these efforts, the industry remains heavily dependent on foreign imports, especially from countries like the US, South Korea, and Japan, for advanced semiconductor technologies. The government's strategy aims to reduce this dependency by fostering domestic development, but it may take years before China can match global leaders in advanced semiconductor production.

SUMMARY OF RELEVANT EVENTS IN THE PAST 5 MONTHS

Since January 2025, China's semiconductor industry has faced intensified pressures and developments in response to evolving global dynamics. In March, the US announced a new round of export controls, expanding restrictions to include advanced DUV lithography equipment and legacy chip technologies. In response, Beijing escalated investigations into US memory maker Micron (The Straits Times, 2024), citing cybersecurity concerns, while accelerating domestic procurement from industry leaders such as YMTC (Kaur, 2025) and SMIC. Notably, SMIC made strides in limited-volume 5nm production (Soumyakanti, 2025) using domestically adapted DUV techniques, marking a significant achievement, though still far from commercially scalable. The government also launched a major domestic AI chip procurement initiative (Kharpal, 2025) underlining China's pivot towards self-sufficient AI architecture that bypasses traditional semiconductor bottlenecks. Additionally, new domestic policies, including expanded subsidies and investments under the 14th Five-Year Plan, have been introduced to bolster domestic chip production. Foreign firms like ASML and TSMC reported sharp declines in shipments to China, reinforcing the country's shift toward self-reliance. Geopolitical tensions, particularly surrounding Taiwan and the US-China trade war, have further complicated supply chain dynamics, leading to delays and disruptions in equipment deliveries to China. (See Figs 3 and 4)

EXECUTIVE SUMMARY

China's semiconductor industry, with a market size surpassing $150 billion, is driven by a push for self-sufficiency, despite challenges in accessing advanced technologies like EUV lithography and EDA tools. While domestic players such as SMIC and YMTC make progress, China's production capacity remains below 20% of global demand, presenting both risks and opportunities for investors. The outlook for the sector is cautiously bullish, with short-term growth contingent on technological breakthroughs and favorable policy support.

SELF-SUFFICIENCY RACE AGAINST GEOPOLITICAL TENSIONS AS A LONG-TERM GROWTH DRIVER

Against this backdrop of constrained access to advanced tools and persistent reliance on imports, the Chinese government's aggressive pursuit of semiconductor self-sufficiency has emerged as the primary structural driver of the industry's evolution. This long-term, top-down industrial strategy, defined by targeted capital deployment, national security imperatives, and policy engineering, is reshaping China's domestic ecosystem and setting the foundation for long-term growth.

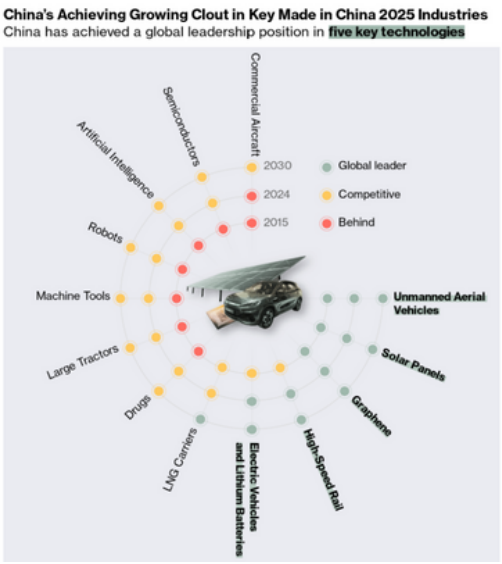


Fig 5: China's Growing Industries (Bloomberg, 2024)

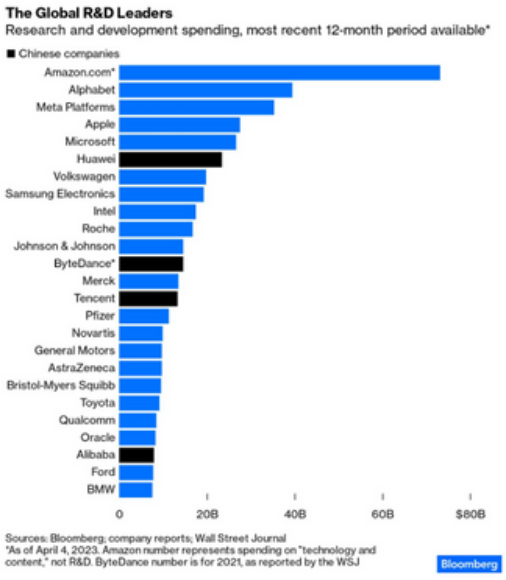


Fig 6: Global R&D Leaders (Bloomberg, 2023)

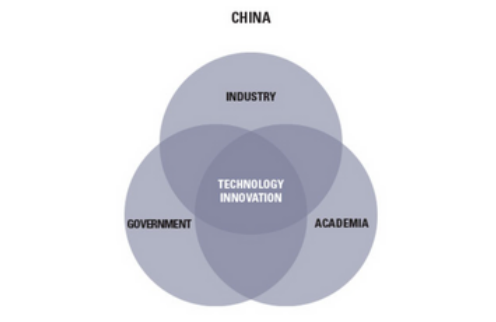


Fig 7: China's push for technology innovation (IISS, 2018)

CATALYST 1: LONG-TERM NATIONAL TECH STRATEGY AND INTERNAL POLICIES OF CAPITAL MOBILISATION

China's semiconductor self-sufficiency race is fundamentally propelled by strong government support, substantial funding, and national security imperatives. For instance, the "Made in China 2025" (MIC2025) plan serves as a strategic blueprint aiming to close the technological gap with the West and achieve 70% self-sufficiency in semiconductors by 2025 (Yang & Yin, 2024; Ezell, 2024). To date, China has already achieved global leadership in five out of thirteen critical technologies tracked by Bloomberg and is rapidly catching up in seven others. (See Fig 5)

Looking ahead, Chinese authorities are preparing a successor to MIC2025 which is expected to prioritise key strategic areas such as chip-making equipment over the next decade (Bloomberg, 2025). This long-term direction is further reinforced by the third phase of the Big Fund, launched in May 2024, which injected ¥344 billion ($47.5 billion) into scaling domestic microprocessor manufacturing on top of a suite of government grants and subsidies aimed at boosting technological self-sufficiency (The Economist, 2024; Pan, 2024). Additionally, the Xinchuang initiative mandates the use of indigenous technology in critical systems and excludes firms with over 25% foreign ownership from government vendor panels, effectively channeling state demand toward local suppliers (The Straits Times, 2021; Huld, 2021).

CATALYST 2: EXTERNAL GEOPOLITICAL PRESSURES AND TECHNOLOGY DECOUPLING:

The imposition of U.S. export controls on major Chinese telecom firms such as ZTE in 2018 and Huawei in 2019 marked a crucial turning point, cutting off access to critical components like advanced semiconductors, chipsets, and software, thereby triggering what many describe as China's "Sputnik moment" (Shields, 2020; Hai, 2025). These measures exposed deep vulnerabilities in China's reliance on foreign technology and intensified the urgency to develop domestic alternatives. (See Fig 6)

Furthermore, China's push for self-sufficiency is compounded by growing national security concerns, as advanced chips are increasingly seen as dual-use technologies which serve both civilian technologies such as AI systems as well as critical military applications (Hai, 2025). This push is further reinforced with increased academia research. (See Fig 7)

AI AND HPC DEMAND CREATES A MARKET BOOM

China's dynamic AI and high-performance computing landscape is driving unprecedented demand for advanced semiconductors, underpinned by robust microeconomic and macroeconomic trends.

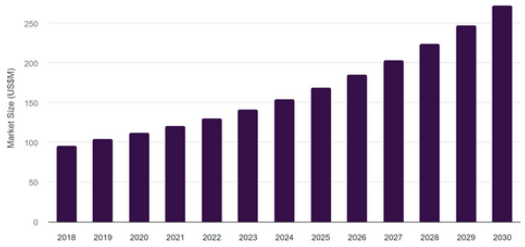


Fig 8: Global Smart Factory Market Size & Outlook (Horizon, n.d.)

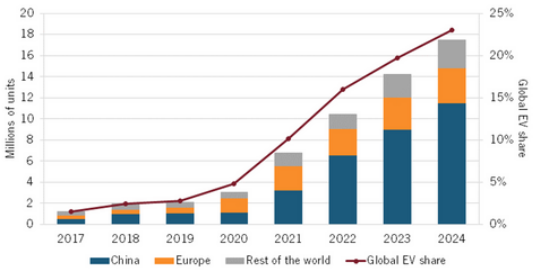


Fig 9: EV Sales by country and EVs as a share of all car sales (Ezell, 2024)

Fig 10: China's Cloud Services Market Size from 2017 to 2024 (POEMS, 2020)

Model	Input (per 1M)	Output (per 1M)
GPT-4.5	$75	$150
ERNIE 4.5	$0.55	$2.2
DeepSeek-R1	$0.55	$2.2
ERNIE X1	$0.28	$1.1

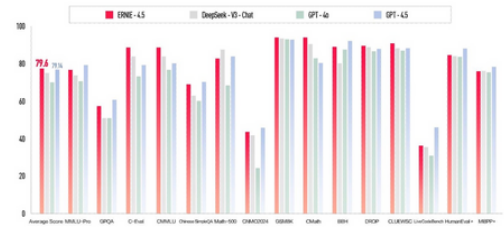


Fig 11: Comparison of Input and Output of Open-Source AI Platforms (Kahn, 2025)

CATALYST 1: MICROECONOMIC FACTORS

Firstly, China's surging domestic demand for AI, HPC and EVs creates a powerful engine for semiconductor innovation and commercialisation.

Smart Factory Adoption Fuelled by 5G and Edge AI: Furthermore, China's smart factory sector, spearheaded by leading manufacturers such as Foxconn (Global SMT, 2024) and Xiaomi (Trendforce, 2024), is rapidly adopting automation and edge AI technologies. This transformation is underpinned by the country's extensive 5G infrastructure, which boasts over 4.2 million base stations (Xinhua, 2024) and enables robust IoT connectivity and real-time data processing. With the global smart factory market projected to grow at a CAGR of 10% through 2030, demand for AI and HPC solutions is expected to rise steadily in the coming years. (See Fig 8)

EV Growth Accelerating Demand for Power and AI Chips: Moreover, The EV boom, led by BYD and CATL, raises demand for power semiconductors in China. This fuels AI and HPC needs in EVs for battery management and autonomous features, expanding the semiconductor market and boosting advanced computing investment. (See Fig 9)

Cloud Expansion Reinforcing HPC Infrastructure Investment: Finally, cloud service providers like Alibaba Cloud and Tencent Cloud are expanding data centers based on the exponentially increasing market size from 2017-2024, further stimulating semiconductor investment. As a result, local firms including Naura, AMEC, and SMIC are innovating and strengthening China's semiconductor ecosystem, ensuring robust and organic growth. (See Fig 10)

Democratisation of AI via Open-Source Platforms: The emergence of affordable, open-source AI platforms, such as DeepSeek and Baidu's Ernie 4.5, has drastically reduced the cost of advanced AI services (Tabeta, 2025), compared to GPT-4.5, making them accessible to a wide range of SMEs in China. This mass adoption is driving up the need for AI chips and specialised processors. (See Fig 11)

These microeconomic factors collectively position China as a formidable player in the global semiconductor landscape. The synergy between rising domestic demand, technological advancements in manufacturing, and strategic investments in infrastructure creates a robust ecosystem that fosters innovation and competitiveness. Furthermore, the country's commitment to sustainability and green technology aligns with global trends, enhancing its attractiveness as a hub for semiconductor development.

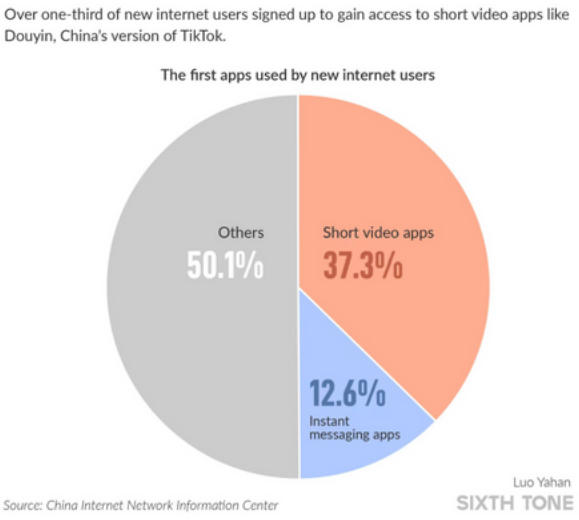


Fig 12: China's massive and growing internet user base (Sixth Tone, 2024)

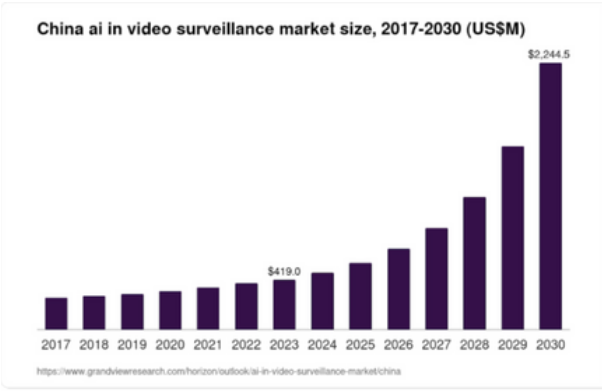


Fig 13: China AI in video surveillance market from 2017-2030 (Horizon, n.d.)

CATALYST 2: MACROECONOMIC FACTORS

China's rapid industry adoption of AI, fuelled by its vast digital economy and smart transformation across sectors, is generating surging demand for advanced HPC infrastructure. As companies increasingly turn to artificial intelligence for innovation and efficiency, the need for high-performance computing systems is more critical than ever. This demand is reshaping the technological landscape and fostering competition, as businesses leverage the latest advancements to maintain their edge.

Manufacturing: China's massive internet user base, extensive manufacturing sector (massively driven by teenagers) and rapidly digitising industries such as surveillance and healthcare are driving unprecedented adoption of AI at scale, creating enormous demand for HPC across the economy. Over 30,000 smart factories (Xinhua, 2025), including industry leaders like Xiaomi and Harbin Electric, use AI for automation and optimization, requiring robust, scalable computing solutions for real-time data processing. (See Fig 12)

Surveillance: In surveillance, China's market is expected to grow at a CAGR of 27.1% from 2024 to 2030 deploying facial recognition and smart city technologies that demand vast HPC resources. (See Fig 13)

Global Edge Solutions: The shift to cloud and edge AI solutions, supported by domestic providers like Alibaba Cloud and Huawei, makes advanced computing accessible to businesses of all sizes. As cloud adoption is forecast to triple by 2030, these trends ensure continued strong demand for AI and HPC infrastructure throughout China's economy. (See Fig 14)

Healthcare: The healthcare sector is also rapidly embracing AI for medical imaging, robotic surgery, and many other functions, with the market expected to reach US$18.88 billion by 2030 (Interesse, 2025). (See Fig 15)

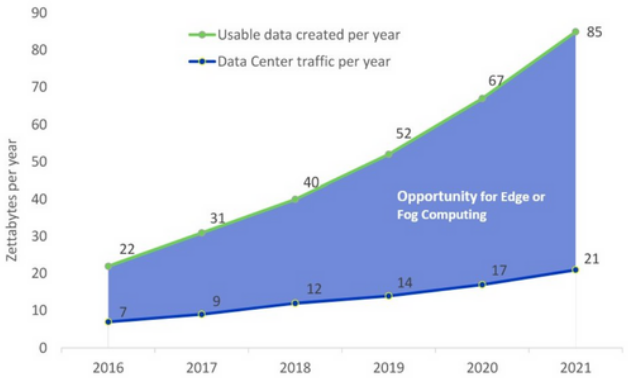


Fig 14: Global Push for Edge Solutions (Viso AI, 2024)

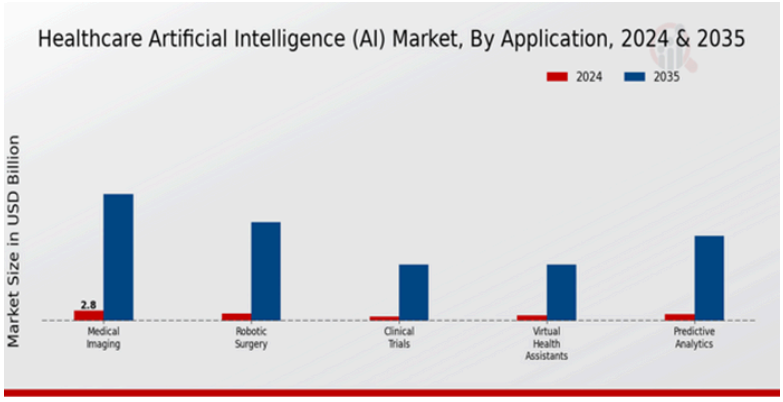


Fig 15: China's Healthcare AI Market by Application from 2024-2025 (Gotadki, 2025)

China's robust digital economy and smart transformation, fueled by burgeoning demand for advanced HPC infrastructure from sectors like manufacturing, surveillance, and healthcare, directly catalyse its semiconductor industry. This increased demand drives significant investment and innovation in semiconductor design and production, essential for supporting China's AI advancements and economic modernisation.

SUPPLY CHAIN RESILIENCE

In light of this rise in internal and external shocks as discussed earlier on China's self-sufficiency race amidst geopolitical tensions, as well as the exploding AI/HPC demand in China both on a microeconomic and macroeconomic scale, China is taking clear steps to radically realign their supply chain to ensure resilience and security.

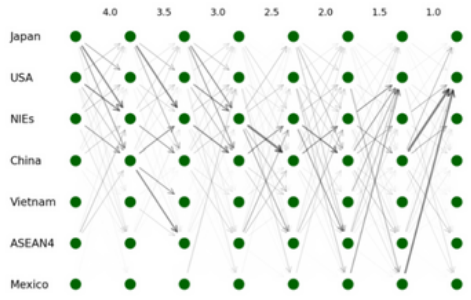


Fig 16(a): Global Semiconductor Supply Chains as of 2022 (Miki & Tamanyu 2024; OECD, 2019)

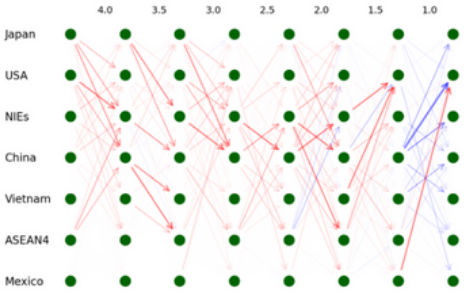


Fig 16(B): Changes in Global Supply Chains (2017-22) (Miki & Tamanyu 2024; OECD, 2019)

Fig 17: Comparisons of China's Integrated Circuit (IC) Consumption and Production (forecasted) (IC Insights, 2017)

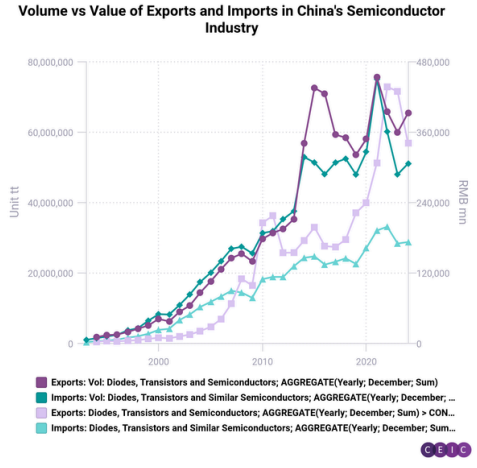


Fig 18: Contrast between High Volume Trade and Low Value Capture (CEIC, 2025)

CATALYST 1: SUPPLY CHAIN RECONFIGURATION THROUGH STATE INTERVENTION

In response to escalating geopolitical pressures and strategic imperative for technological sovereignty, China's industrial policy employs global supply chain restructuring as its core catalyst, moving beyond organic economic shifts to engineer a resilient domestic semiconductor ecosystem, as evidenced in Figs 16(a) and (b).

This state-directed reconfiguration is driven by the massive and unsustainable gap between consumption and production (Hwang, 2019); In 2018, China consumed 58.3% of the world's semiconductors while importing $312 billion worth, with domestic production meeting only 15.3% of its $155 billion market—a figure IC Insights projected would only reach 20.5% by 2023 (Grimes & Du, 2022), far short of the MIC25 target of 40% self-sufficiency by 2020 and 70% by 2025 (EETimes, 2019).

This production-consumption gap is not merely one of volume but, more critically, one of great economic value. The vast and growing deficit between the value of high-tech imports and lower-value exports that widened significantly around 2010 onwards due to China's increasing dependence on high-value foreign technology, created the strategic imperative for the radical overhaul that followed, with signs of a shift in most recent years (post-2020). (See Fig 17)

Concurrently, while a natural, wage-driven restructuring is already underway, with China shifting skill-intensive upstream production domestically while outsourcing lower-value assembly to nations like Vietnam (Miki & Tamanyu, 2024), the government's industrial policy is forcing a more radical internal overhaul.

This involves creating a "captive market" by pressuring its globally significant consumer-side companies like Huawei, Lenovo, and Xiaomi to procure chips from emerging national champions such as the foundry SMIC and memory makers YMTC and CXMT (Hwang, 2019; Hmaidi, 2024). This "domestic substitution" strategy aims to guarantee demand and scale for these nascent producers (Ernst, 2013), even though they lag technologically and are highly vulnerable to foreign sanctions, as evidenced by potential U.S. restrictions on CXMT (Freifeld, 2025).

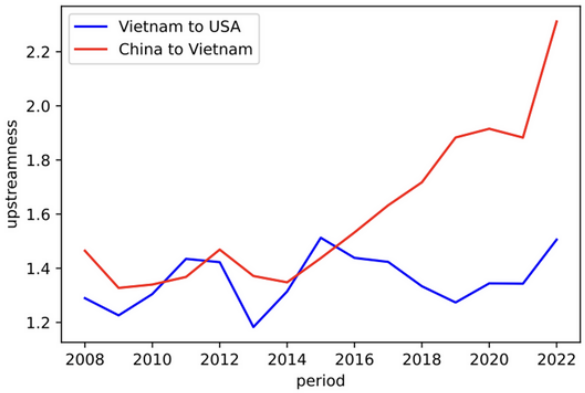


Fig 19: Rise of semiconductor-related exports (Miki & Tamanyu 2024; OECD, 2019)

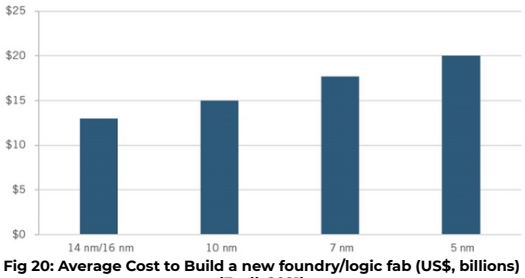


Fig 20: Average Cost to Build a new foundry/logic fab (US$, billions) (Ezell, 2021)

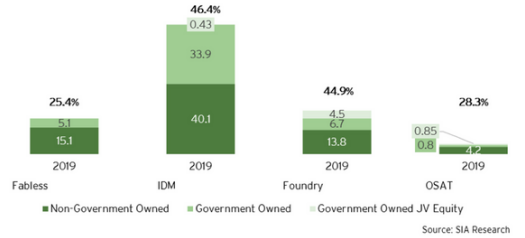


Fig 21: Equity (USD bn) and % by Ownership (SIA, 2021)

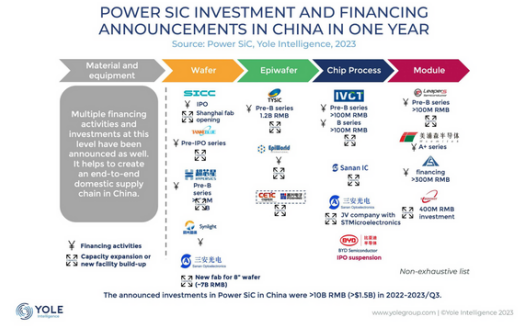


Fig 22(a): Power SIC Investment and Financing Announcements in China in One Year (Chiu, 2023)

Fig 22(b): Top greater China Mainland Packaging OSATS' Technologies (Chiu, 2023)

Company	HQ	Segment	Node(nm) K	WPM	USDbn	Production	Location	Investors
YMTC	China	3D NAND	30	200	24	2018	Wuhan	Wuhan govt, Unigroup, SMIC
Hujian Jin	China	DRAM	32	60	24	2018	Fujian	Fujian govt
Tsinghua	China	NAND/DRAM	TBD	100	30	2018	Nanjing	Nanjing govt.
Giga Devi	China	DRAM	TBD	TBD	TBD	2018	Hefei	Hefei govt.
Intel	US	3D NAND	30	30	5.5	2016	Dalian	Dalian govt.
SK Hynix	Sth Korea	DRAM	20	130	5.5 + 800 m expansion	2005	Wuxi	N/A
Samsung	Sth Korea	3D NAND	30	100	7.5 + 7.0 expansion	2014	Xian	N/A

Table 1: Major Investments (USD bn) in Memory Fabrication in China (Castellano, 2019)

CATALYST 2: RISE IN INVESTMENTS FOR EXTERNAL EXPANSION

China's strategy for external semiconductor expansion is directly catalyzed by massive state-directed capital deployment, done through the Big Fund (Tao, 2018) and other government-lined investment funds, which together with direct state ownership, control a significant portion of the industry's capital (Fuller, 2019).

The necessity for such massive capital injection is starkly illustrated by exponential rise in the cost of building new, leading-edge semiconductor foundries. (See Fig 20)

The Big Fund's mandate explicitly included promoting "mergers and acquisitions" (Allen, 2023; Ezell 2021), signaling a state-sponsored mission to acquire foreign technology and assets. Beyond the Big Fund, approximately 43% of the registered capital within the Chinese semiconductor industry is directly or indirectly owned or controlled by the Chinese state (SIA, 2021). (See Fig 21)

Initially, capital was successfully channeled into acquiring and scaling up firms in less technologically intensive segments, particularly Outsourced Assembly and Test (OSAT), which served as a key entry point into the global value chain (Fuller, 2019). This focus has enabled the top ten Chinese OSATs to grow their revenue to $12.2 billion by 2022 and begin investing in more advanced packaging platforms (Tan, 2023). Recognising the need to move up the value chain, state-led investment has pivoted to plug domestic gaps in critical upstream segments. (See Figs 22(a) and (b)).

Massive investments in materials led to the formation of the National Silicon Industry Group (NSIG), whose subsidiary ZingSemi produced China's first domestic 12-inch silicon wafers, breaking a key import dependency (Li, 2021). In equipment, capital infusion helped firms like AMEC develop advanced etching tools vital for leading-edge manufacturing (Li, 2021).

China is specifically targeting commodity sectors like 3D NAND memory (TrendForce, 2019), where it accounted for 32% of global capacity in 2018, as a strategic entry point, to leverage price competition. (ChinaFlashMarket, 2018; ELINFOR, 2019). This is considering state investment in transforming a local foundry into YMTC, which has developed globally competitive 128-layer 3D NAND flash memory (Li, 2021).

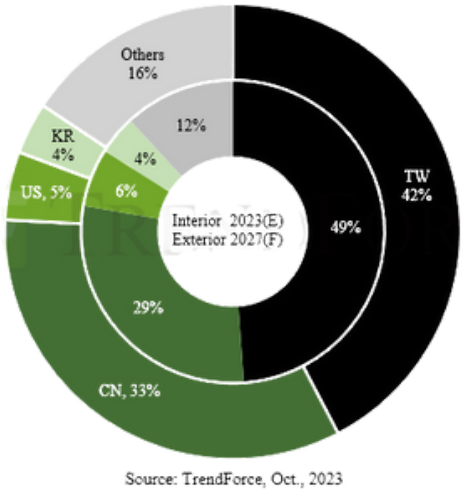
China's domestic build-out is complemented by a strategy of attracting foreign direct investment, where global leaders like Samsung and SK Hynix have built major fabs in China, further developing the country's manufacturing clusters, particularly in memory (Grimes & Du, 2022; Clarke, 2019). (See Table 1)

This concentrated effort, driven by strategic state-led capital deployment and the push for self-sufficiency in critical technologies like leading-edge foundries and advanced packaging, seeks to reduce reliance on external supply chains.

It also fosters substantial investment and technological progress within China's domestic semiconductor ecosystem.

RISK AND MITIGATIONS

China's rapid ascent in the global semiconductor industry, while driven by ambitious self-sufficiency goals, faces significant internal and external challenges. This analysis outlines key risks including potential overcapacity in mature nodes, the weaponization of supply chains and intellectual property concerns, and critical talent shortages coupled with capital misallocation. For each risk, strategic mitigation approaches are proposed, focusing on targeted investments, diversification, advanced packaging, and robust human capital development



Source: TrendForce, Oct., 2023

Fig 23: Forecast of Global Mature Process Capacity Distribution by Region, 2023 to 2027 (Trendforce, 2023)

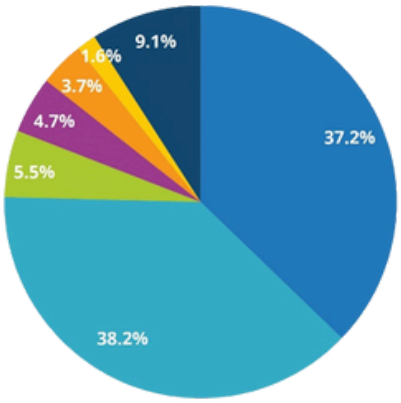


Fig 24: 2030 Foundry Matured Nodes (>22nm) Capacity Forecast by Location (IDC, 2024)

Risk: Overcapacity in Mature Nodes

China's strategic pivot toward mature-node semiconductor manufacturing (22nm and above), following restrictions on advanced technologies, has triggered a growing risk of overcapacity in legacy chip production (See Figs 23 and 24). Backed by massive government subsidies, China is aggressively scaling its domestic fabrication capabilities, with nearly 59% of new global fabs built between 2023 and 2025 located within its borders (Sourceability, 2025). Its share of global mature-node output is projected to rise from 28% in 2025 to 39% by 2027 (Pan, n.d.). The criticality of these nodes, often overlooked, was highlighted during the recent global chip shortage, where the lack of a single $0.40 MOSFET chip could halt the production of 40,000 Ford F-150s, demonstrating the profound impact of supply-demand imbalances in this segment (Xiong et al., 2024).

By injecting massive state capital into this area, China risks transforming the recent "prolonged shortages" into a period of acute "overcapacity" (Xiong et al., 2024). This creates the potential for a global price war, as Chinese firms, operating without the same market-driven profit imperatives, could flood the market and erode margins for international competitors like Wolfspeed and Onsemi (Grimm, 2025). This dynamic mirrors China's past industrial strategies in sectors like steel and solar panels (Boullenois et al, 2025), where state-backed expansion led to significant global market imbalances, forcing international firms into a "bloody knockout match" for survival in price-sensitive markets where downstream customers prioritize cost-effectiveness (Cao & Wang, 2023).

Mitigation: Strategic Allocation in an Oversupplied Semiconductor Market

Investors should prioritise foundries and chipmakers with strong competitive advantages such as proprietary technologies, specialised design capabilities, or integration with high-growth end markets. To mitigate downside risk, consider reducing exposure to players that lack cost efficiency, innovation, or diversification in their customer base and product offerings, as they are more vulnerable to price competition and margin erosion in an oversupplied market.

China's aggressive expansion into mature-node semiconductor manufacturing, driven by significant government subsidies, poses a substantial risk of global overcapacity, potentially leading to a price war akin to past industrial strategies in other sectors. Correspondingly, to mitigate this, investors should strategically allocate capital to foundries and chipmakers with strong competitive advantages such as proprietary technologies, specialised design capabilities, or integration with high-growth end markets, while reducing exposure to less diversified or cost-efficient players.

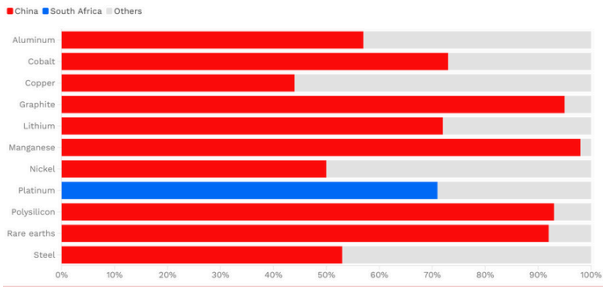


Fig 25: Global Refining Share of Metals and Minerals (Gurzu, 2025)

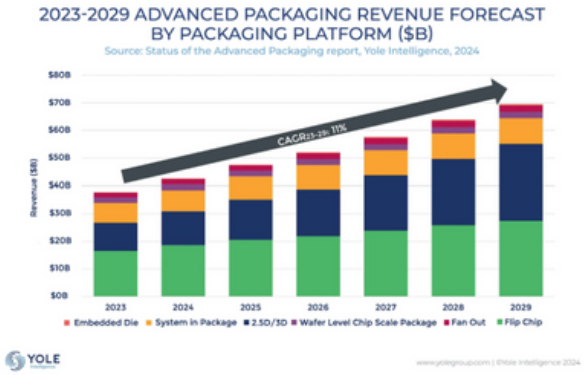


Fig 26: Global Advanced Packaging Forecast (Yole Group, 2024)

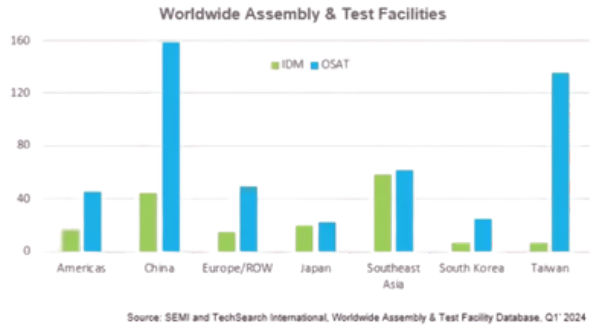


Fig 27: Worldwide Assembly & Test Facility Database (Semi, 2024)

Risk: Potential for Supply Chain Weaponization and Intellectual Property Risks

Concerns about IP theft and forced technology transfer in China are justified, given multiple cases of foreign firms pressured to share proprietary tech for market access. In response, the US has placed over 140 Chinese entities including semiconductor firms on its Entity List to block military diversion of advanced technology (Powell, Amberg & O'Brien, 2024).

China's strategy concentrates control over crucial semiconductor supply chain chokepoints, including refining nearly 90% of the world's rare earth elements (Picarsic & Bruyère, 2025) and imposing export controls on materials like gallium and germanium.

This dominance creates significant risks for global manufacturers, as China can potentially weaponize supply disruptions. These actions, alongside ongoing IP theft concerns, heighten instability for international firms dependent on these inputs.

At the same time, China's state-backed investments have pursued foreign mergers and acquisitions, especially in the OSAT sector, as a strategic way to gain technology and access to the global value chain. While OSAT is less technically demanding than advanced chipmaking, it has still sparked major IP disputes, such as the Fujian Jinhua case involving alleged theft from Micron Technology. Ultimately, China's dual strategy, tightening control over raw material inputs while expanding its presence in downstream services (Picarsic & Bruyère, 2025), creates a "pincer" effect on the global semiconductor industry (Janjeva, Baek & Sellars, 2024). This dynamic exposes international firms to both the risk of IP loss and the threat of supply chain disruption.

Mitigation: Advanced Packaging and Niche Technologies

A second strategy involves sidestepping the immensely capital-intensive race for leading-edge nodes, where building a single 5nm fab can cost $20 billion (WaferPro, 2024), and instead focusing on the "More than Moore" paradigm (Semiconductor Digest, n.d.), particularly advanced packaging. As Chinese OSATs are already a relatively mature segment and are now investing heavily to move up the value chain into advanced packaging platforms (Yole Group, 2024), this represents a key area for value capture. (Refer to Fig 26)

This strategy leverages an existing area of Chinese strength, as Assembly & Test (A&T) was a successful early entry point for less sensitive foreign acquisitions (Fuller). (Refer to Fig 27)

Therefore, given China's dominant control over critical semiconductor supply chain chokepoints and persistent intellectual property concerns that create significant risks of supply chain weaponisation and IP theft for international firms, investors should focus on advanced packaging and niche technologies, allowing companies to sidestep the capital-intensive leading-edge node race and leverage existing Chinese strengths in Assembly & Test, thereby capturing value in less sensitive segments while diversifying supply chain exposure.

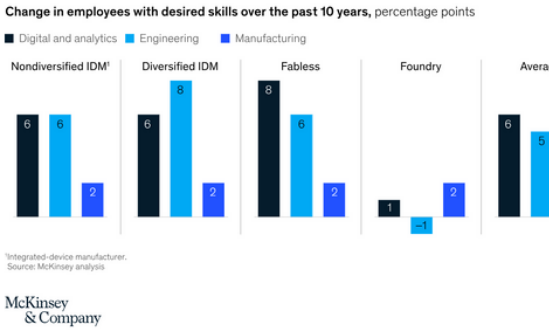


Fig 28: Although the semiconductor industry is manufacturing intensive, talent inflows into manufacturing jobs have been lower (McKinsey, 2022)

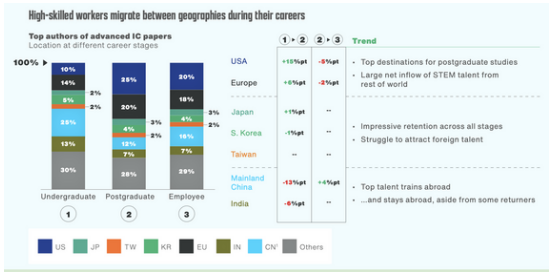


Fig 29: Migration of Highly Skilled Workers Globally (Vadarajan, et al., 2024)

Risk: Talent Shortages as well as Capital Misallocation and Inefficiencies

China's ambitious drive for semiconductor self-sufficiency is severely hampered by critical internal risks, namely a pronounced talent shortage and significant capital misallocation. The nation is projected to face a deficit of approximately 300,000 skilled semiconductor professionals by 2025, a gap widened by an academic system that often graduates students without the requisite hands-on industry experience (Hired China, 2025; The Straits Times, 2024; Cao & Wang, 2023). For instance, a 2022 survey by Chinese research firm ICWise revealed that over 60% of students studying chip engineering in China completed their degrees without any internship experience in the field (The Straits Times, 2024) (See Fig 28).

Simultaneously, massive state-led investment has led to considerable inefficiencies. Government-backed funding has caused a surge in semiconductor company registrations, leading to intense competition and overcapacity in low-end chip markets, which elevates credit risks for smaller firms (SCMP, 2024). Much of this has been linked to the "Big Fund," which, despite its strategic intent, has been plagued by corruption scandals involving top executives, thereby diluting its effectiveness and prompting a more conservative, ROI-driven approach (Caixin, 2024; The Straits Times, 2022). This approach, which favors a few "national champions," may stifle competition and the emergence of disruptive technologies from smaller enterprises (Cao & Wang, 2023).

Mitigation: Strengthening Talent Pipelines and Capital Discipline to Ensure Sustainable Growth

Investors should prioritise companies that demonstrate superior human capital development and disciplined financial management. Focus on firms that actively bridge the talent gap by forging robust partnerships with universities, technical institutes, and vocational schools that offer practical training, R&D internships, and joint research programs. Concurrently, scrutinize corporate governance by favoring companies with transparent, ROI-driven project planning to avoid the inefficiencies of opaque local subsidies and the corruption scandals that have impacted the "Big Fund" (Caixin, 2024; He, 2021). (See Fig 29)

Given that China's semiconductor ambitions are hampered by a severe talent deficit and substantial capital misallocation, exacerbated by academic-industry gaps and corruption within state-backed funds, investors should prioritize companies demonstrating superior human capital development through strong academic partnerships and disciplined financial management, favoring firms with transparent, ROI-driven project planning to avoid the pitfalls of opaque subsidies and enhance long-term sustainability.

RECOMMENDATIONS

Fig 30: World's Top 10 OSAT Companies (Chakravarty, 2019)

Long Exposure to Advanced Packaging (OSAT) Leaders:
Investors should focus on OSAT leaders given that they leverage existing strengths of China's semiconductor industry and side-step leading node race. The shift towards advanced packaging is revolutionizing the semiconductor industry by integrating multiple chips into a single package, enhancing performance, and reducing power consumption. This approach is particularly beneficial for applications requiring high computational power and efficiency.

Assets:
1. JCET Group (600584.SS)
2. Tongfu Microelectronics (002156.SZ)

Equity Opportunity: Investing in established Chinese OSAT companies with clear strategies and investment plans for advanced packaging technologies offers strong long-term potential. This is because companies like JCET Group and Tongfu Microelectronics are at the forefront of integrating cutting-edge technologies such as System-in-Package (SiP) and Fan-Out Wafer Level Packaging (FOWLP). These techniques allow for greater miniaturization and flexibility, meeting the growing demand for more compact and efficient electronic devices.

Mature Segment: China's OSAT sector is already well-developed and is now actively investing in advanced packaging. Advanced packaging is less capital-intensive and more resilient compared to leading-edge chip manufacturing.

Value Chain Strength: Advanced packaging is critical for enabling next-generation technologies such as AI, HPC, and memory. China is rapidly closing the gap in advanced packaging capabilities.

Strategic Positioning: As China aims to move up the semiconductor value chain, leadership in advanced packaging strengthens the sector's global competitiveness. By advancing in packaging technologies, Chinese OSAT companies are not only strengthening their domestic market but are also becoming formidable players on the global stage. This strategic move aligns with China's broader goals of technological self-sufficiency and leadership in the global semiconductor supply chain.

Verdict: Long
- Since OSAT leaders are a strong long-term investment, especially as China continues to expand its influence in this vital segment, the focus for investors on advanced packaging offers a unique opportunity to tap into a segment poised for significant growth. The combination of technological advancements, strategic government support, and increasing global demand positions Chinese OSAT companies as attractive long-term investments.

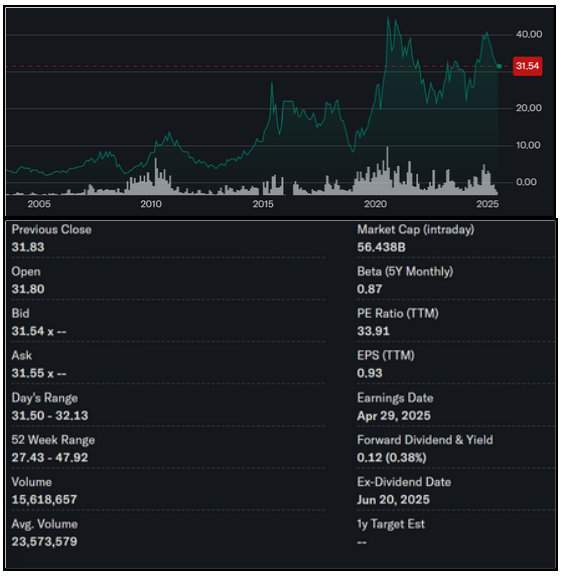


Fig 31: Key Financials of JCET Group (Yahoo Finance, 2025)

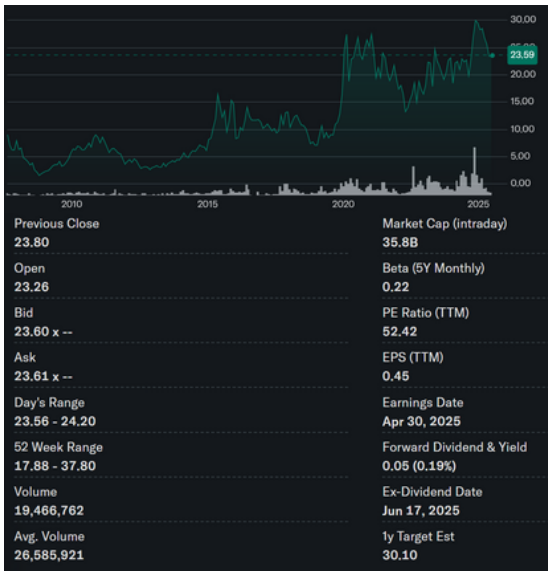


Fig 32: Key Financials of Tongfu Microelectronics (Yahoo Finance, 2025)

RECOMMENDATIONS

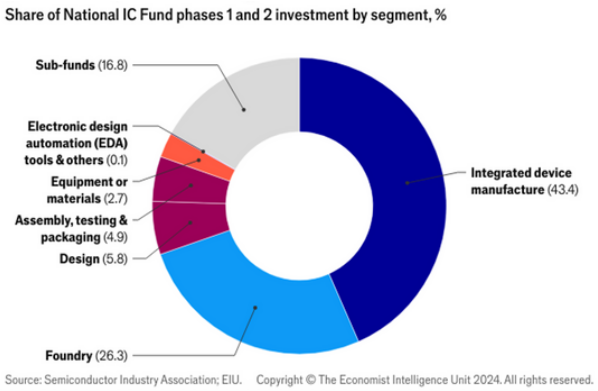


Fig 33: China's "Big Fund" (EIU, 2024)

Long Exposure to Upstream "Enablers":
State-led push for self-sufficiency creates guaranteed demand for domestic equipment and/or materials. The Chinese government's commitment to achieving technological self-reliance ensures a steady flow of investments into local semiconductor companies, offering a fertile ground for domestic firms specializing in manufacturing equipment and materials. Taking this into consideration and enacting this recommendation correspondingly confers equity in publicly-listed Chinese leaders in semiconductor manufacturing equipment and critical materials.

Assets:
1. Naura Technology Group (002371.SZ)
2. Advanced Micro-Fabrication Equipment Inc (AMEC) (688012.SS)

Guaranteed Demand: State-led expansion in semiconductor manufacturing creates sustained demand for domestic equipment and materials, regardless of which foundry succeeds (Lee, 2024). As these upstream enablers fortify their foundations, they not only cater to the increasing domestic demand but also position themselves as formidable players in the global market. This strategic alignment with national goals secures their relevance and profitability in the long term, making them an attractive option for investors who are keen on capitalizing on this wave of industrial transformation.

Strategic Focus: The Big Fund 3.0 targets critical bottlenecks in the supply chain, prioritizing equipment and materials for self-sufficiency (Lee, 2024). The focus on overcoming supply chain bottlenecks underscores the importance of innovation and technological advancement within these companies, driving them to develop cutting-edge solutions that propel the entire industry forward.

Verdict: Long
- Upstream enablers are a resilient long play, as they benefit from the entire industry's expansion. Stakeholders can expect a dynamic landscape where the confluence of policy support and technological prowess fuels sustained growth and opportunity.

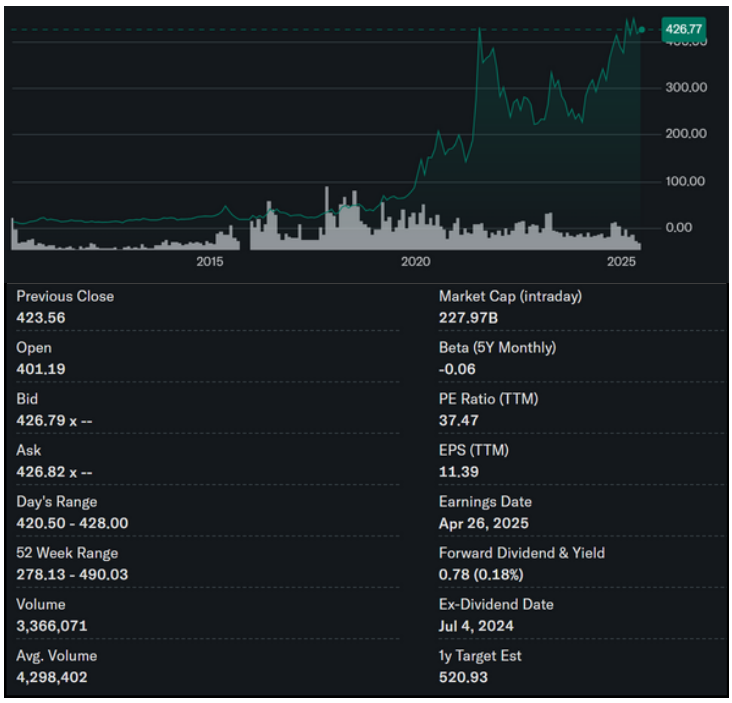


Fig 34: Naura Technology Group (Yahoo Finance, 2025)

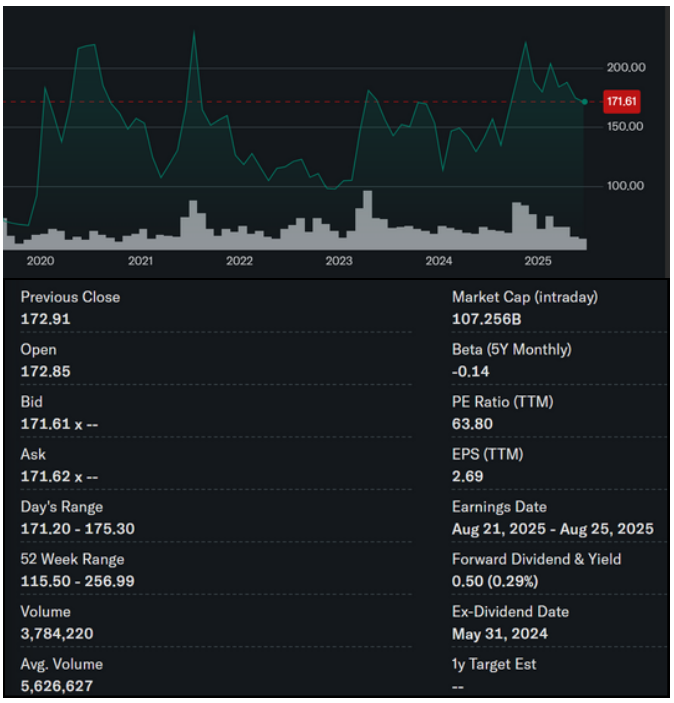


Fig 35: Advanced Micro-Fabrication Equipment Inc. (AMEC) (Yahoo Finance, 2025)

RECOMMENDATIONS

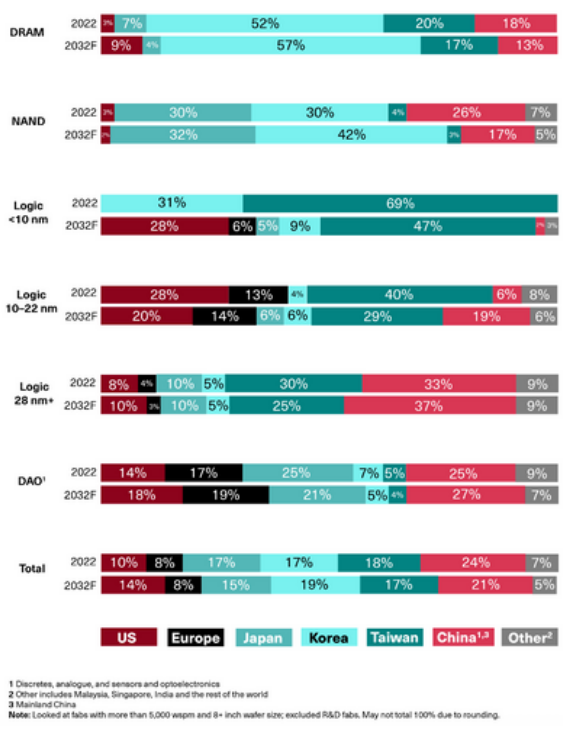


Fig 36: China's Mature Node Exposed Foundries from 2022 to 2032 (forecasted)
(Janjeva, Baek & Sellars, 2024)

Short Western Mature-Node Exposed Foundries

As China ramps up its production capabilities, leveraging state support and economies of scale, it challenges the established players who have long dominated the market. This creates a landscape where traditional strengths in innovation must be balanced with competitive pricing and strategic partnerships.

Assets:

1. GlobalFoundries (GFS)
2. United Microelectronics Corp (UMC)

China-Led Disruption: Beijing's accelerated investment into mature-node chip production (28nm and above) is flooding global supply. With China's share of legacy capacity set to reach 39% by 2027, players like SMIC and Hua Hong are aggressively undercutting prices, igniting a global price war in mature nodes.

Verdict: Short

- China is taking over the market for older-generation chips. Betting against Western chipmakers that rely on these mature technologies helps investors protect themselves from price erosion, demand displacement, and structural cost disadvantages.
- For companies like GFS and UMC, the focus may need to shift toward niche markets or advanced technology nodes to maintain their edge. Collaborations with tech giants, diversification into emerging applications such as IoT and automotive, and investments in R&D could offer pathways to sustain growth.

Fig 37: Global Foundries (GFS)
(Yahoo Finance, 2025)

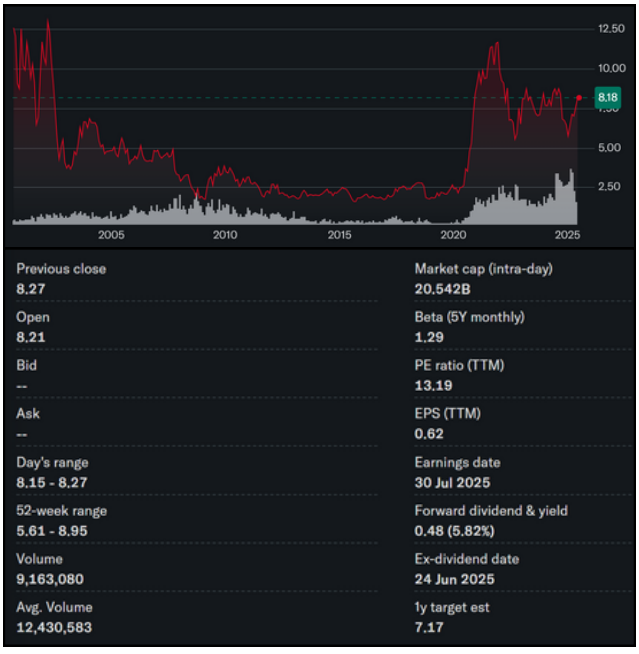


Fig 38: United Microelectronics Corp (UMC)
(Yahoo Finance, 2025)

Policymakers in Western countries might consider bolstering domestic production capabilities through incentives and support for research initiatives. Investors, on the other hand, need to stay agile, recognizing both the risks and opportunities presented by these rapid changes. A diversified portfolio, keeping an eye on the technological advancements and geopolitical developments, could help mitigate exposure to the volatility of the semiconductor sector.

RECOMMENDATIONS

Fig 39: iShares Semiconductor ETF (Yahoo Finance, 2025)

ETF Exposure (Global Fab Equipment - Raw materials are needed to make semiconductors)
By causation, there will be diversification and reduced risk by investing in global fab equipment suppliers outside China

Asset: iShares Semiconductor ETF (SOXX)

China's inability to access EUV keeps non-Chinese fabs (e.g. TSMC, Samsung) ahead in advanced nodes. SMH also includes Nvidia, which amplifies the AI angle. ETF structure reduces stock-specific risk and offers exposure to global chip companies.

Diversification: Investing in global semiconductor equipment ETFs reduces risk by spreading exposure across multiple companies and geographies. This helps mitigate the risks associated with investing in individual stocks but also allows investors to benefit from the rapid advancements and increasing global demand. The strategic inclusion of companies like TSMC and Samsung ensures that investors are well-positioned to capitalize on cutting-edge technological developments, particularly in advanced nodes where non-Chinese fabs maintain a competitive edge.

Growth Exposure: This captures growth from both Chinese and international demand for fab equipment. Additionally, the presence of AI-focused leaders like Nvidia within the ETF structure adds a compelling dimension of growth potential, as artificial intelligence continues to drive innovation and demand across multiple sectors.

Verdict: Long
ETFs are a prudent long-term strategy for investors seeking diversified exposure to semiconductor growth. As the semiconductor industry evolves, ETFs provide a versatile means to tap into this dynamic market while maintaining a balanced risk profile. The combination of diversification and targeted growth exposure makes them an attractive option for those looking to invest in the future of technology. Overall, the long-term outlook for semiconductor ETFs remains strong, offering a blend of stability and opportunity in a rapidly changing global landscape

Overall, this approach highlights a strategic approach for investors to navigate China's semiconductor industry, emphasising long-term growth in Chinese advanced packaging and upstream enablers due to state-driven demand and existing strengths. Simultaneously, it suggests shorting Western mature-node foundries facing price erosion from Chinese competition, while advocating for diversified ETF exposure to the broader global fab equipment market as a hedge. This multi-faceted strategy aims to capitalise on distinct market dynamics and mitigate risks within the evolving global semiconductor landscape.

CONCLUSION

In conclusion, China's semiconductor industry is at a critical juncture, navigating significant geopolitical pressures and striving for technological self-sufficiency. While the country remains a dominant consumer of semiconductors, its domestic production continues to focus primarily on mature nodes, with advanced manufacturing limited by external restrictions on key technologies. The Chinese government's aggressive push for semiconductor independence, through initiatives such as the "Made in China 2025" plan and the "14th Five-Year Plan," highlights the nation's long-term commitment to bridging the technological gap. Despite progress in areas like AI chip development and memory production, China still faces challenges such as reliance on foreign suppliers for critical equipment and skilled talent shortages. However, with continued investment in R&D, policy support, and domestic manufacturing, China is poised to become more self-reliant in the semiconductor sector, although it may take years before it can fully compete with global leaders. Moving forward, the sector's growth will depend on overcoming these technological bottlenecks and leveraging its vast domestic market to spur innovation.

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