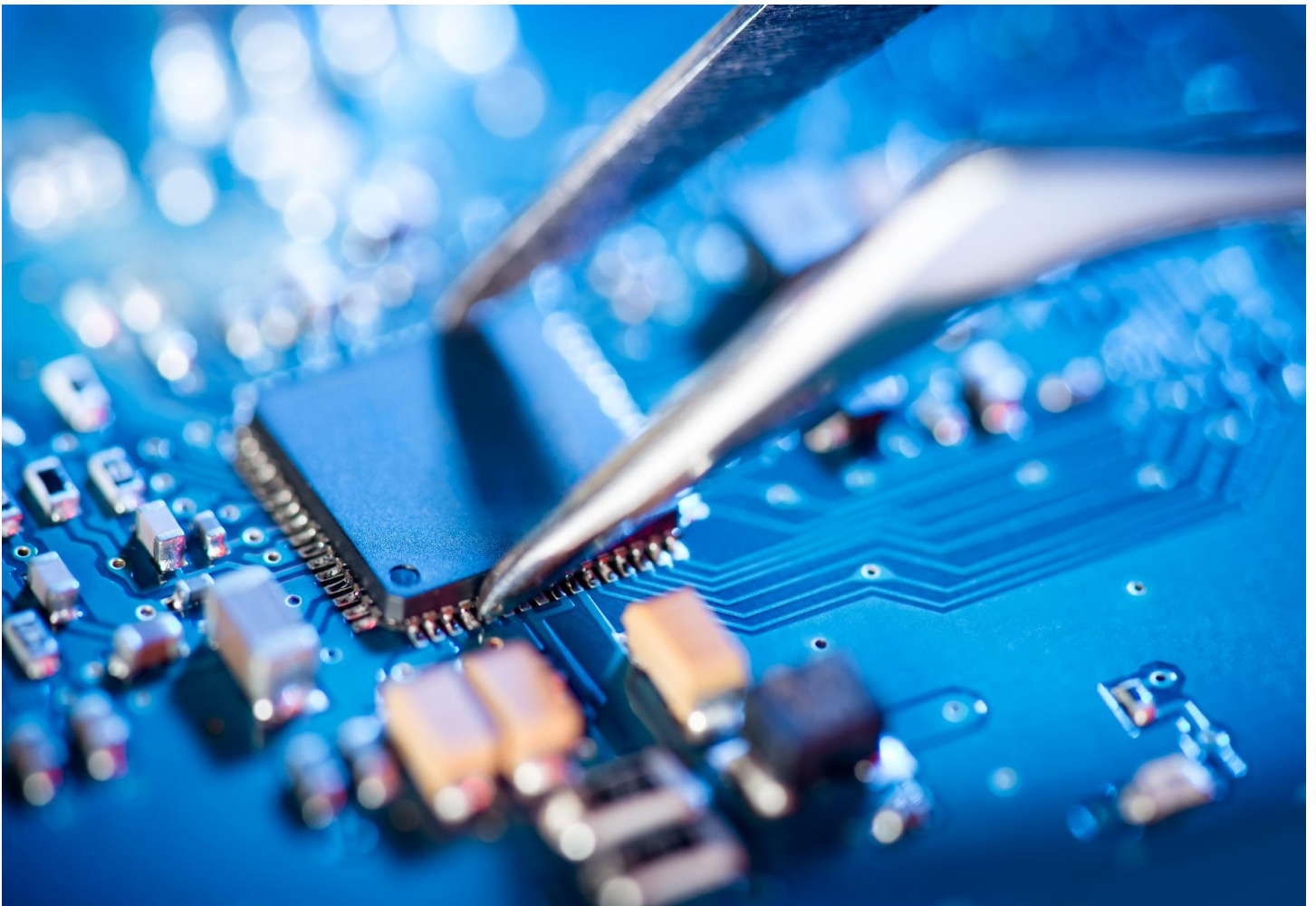


Chips of progress

The investment case for semiconductors

June 2025



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A promising investment play

Semiconductors are among a handful of industries that look ripe for long-term investment amid shifting trade patterns and growing geopolitical challenges. With governments the world over racing to build necessary infrastructure to capitalize on rapidly growing demand in an increasingly digitalized world, the industry is projected to clock a compound annual growth rate (CAGR) of ~8.1% over 2024-2030.

Several factors support growth of the industry. These include:

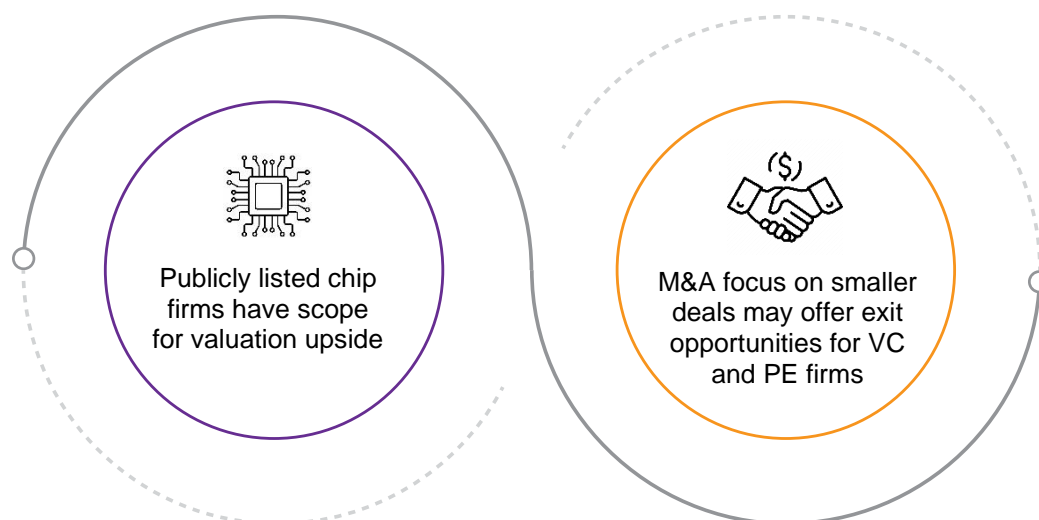
- **Strong fundamentals**

The global chip market is going through a major shift, driven by long-term demand, shifting deal trends and growing geopolitical challenges. Global demand for chip sales, which grew at 6.8% CAGR over 2001-2024 to \$627.6 billion, is projected to grow at an accelerated 8.1% CAGR through 2030, as per McKinsey & Company. Rising demand from artificial intelligence (AI), internet of things (IoT), electric vehicles (EVs) and 5G segments ensures continued momentum. The large-scale demand can be gauged from continuing strong numbers of publicly listed chip companies. Also, valuation multiples have stabilized after peaking in 2020. Hence, there is room for further upside, based on consensus estimates.

- **Smaller deals gaining traction in private markets**

With larger mergers and acquisitions (M&A) facing regulatory scrutiny, corporate interest is shifting to smaller, more manageable deals, thereby offering exit opportunities for private equity (PE) and venture capital (VC). Segments such as automotive and industrial chips, which have more predictable revenue and less speculative research and development (R&D), are attracting more attention from PE firms of late.

Semiconductor demand led by AI, IoT, EV and 5G



- **Reshaping of supply chains amid US-China trade issues**

Semiconductors are now at the centre of national security debates, especially with Taiwan's critical role in advanced manufacturing amid geopolitical challenges. Hence, the US is pushing to bring more chip production onshore while China is ramping up its domestic capabilities – the former's share of chip-related PE/VC investments rose to 52% in the January-March 2025 period from 20% in 2019.

And while the US administration on April 11, 2025, announced exemptions for semiconductors and consumer electronics, including smartphones and laptops, from the latest imposition of 145% tariffs on Chinese imports, the US Commerce Secretary, Howard Lutnick, clarified that the exemptions were temporary. The administration plans to implement new tariffs specifically targeting semiconductors within the next two months to encourage the reshoring of semiconductor manufacturing to the US, thereby reducing the reliance on foreign supply chains, mainly China.

As the US looks to reduce its dependence on China; Vietnam, India, Malaysia and Thailand could benefit from the supply chain shift. US-based companies could shift their manufacturing bases to these countries on the back of local government support, tax benefits and a young workforce.

This paper assesses the semiconductor industry and why the space remains an attractive investment theme.

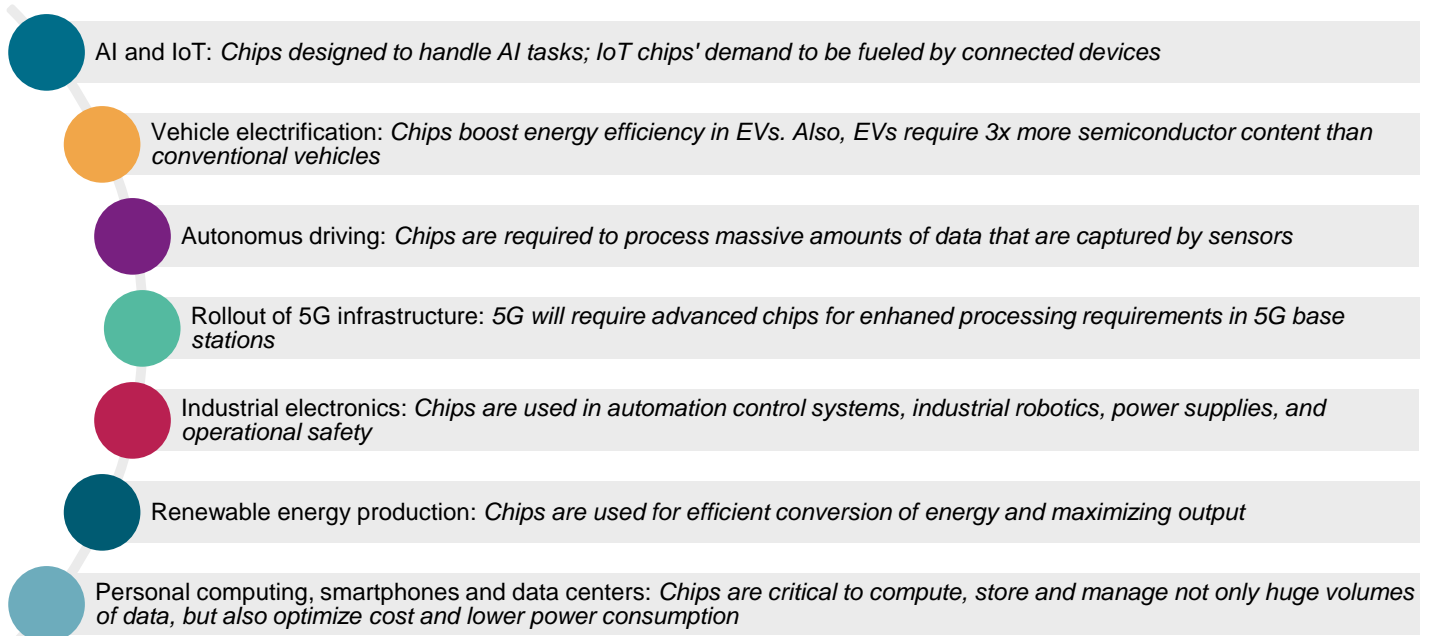
Chips are the new oil

The global semiconductor market has grown at mid-single digit pace since 2001, driven by rising demand for chips that can process vast amounts of data. Technologies such as AI, IoT, and EVs are expected to continue to be the main drivers, as they rely heavily on semiconductors to function efficiently.

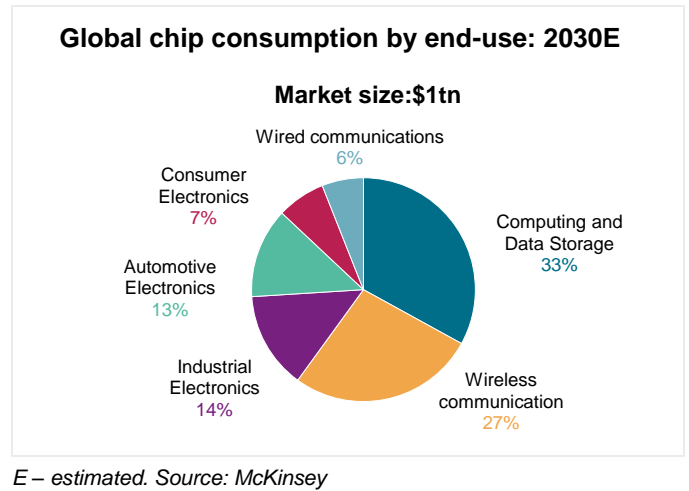
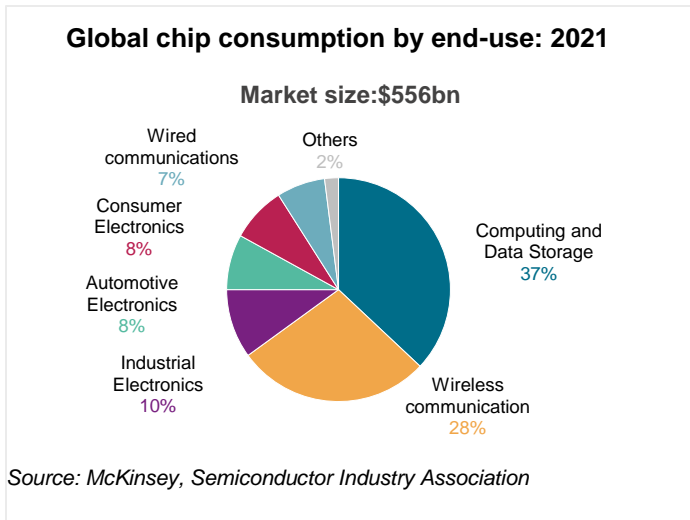
Semiconductors market is expected to grow during 2024-2030 period

Global semiconductor revenue rose at 6.8% CAGR over 2001-2024 to \$627.6 billion¹ despite an 8.2%¹ y-o-y plunge in revenue in 2023 owing to reduced demand for consumer electronics and excess inventories in the first half of 2023, which applied downward pressure on chip prices during the period. Growth, though, picked up in the second half and sustained into 2024, with expectations of the pace continuing over the longer-term on the back of increased demand from across applications, including AI, IoT, EV, autonomous driving, 5G, and industrial electronics.

Key demand drivers expected to drive ~8.1%² CAGR in global chips market during 2024-2030



Global chip demand by end-use is expected to reach \$1 trillion² by 2030. Automotive and Industrial electronics are expected to outperform other sectors, as evidenced by their rising mix.



Publicly listed companies capitalizing on growth

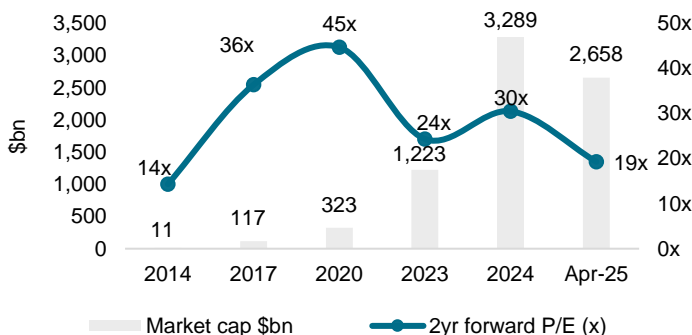
Robust demand for semiconductors is being reflected in the increase in market capitalization of leading chip stocks. Their multiples have, however, stabilized. Hence, the sector's growth potential is likely to support a further upside in valuations.

AI workloads need massive computational power, which is driving the demand for powerful and efficient chips. And as large technology companies continue to prioritize their capital expenditure for AI computing, the rally in chip stocks is projected to sustain. Pricing may further benefit from rising applications across sectors, which will improve the profitability of chip companies. Also, forward valuation multiples peaked in 2020 for most chip stocks as demand for digital technologies from consumers and businesses soared in 2020 because of the Covid-19 pandemic.

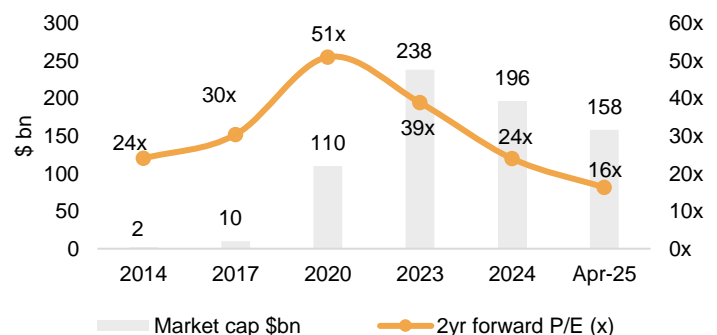
Despite rising market capitalisation, forward multiples have stabilised, and, hence, there is a room for expansion in market valuation.

Chip designers' valuation

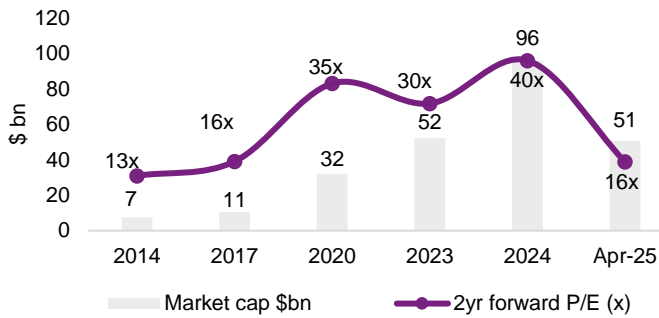
Nvidia



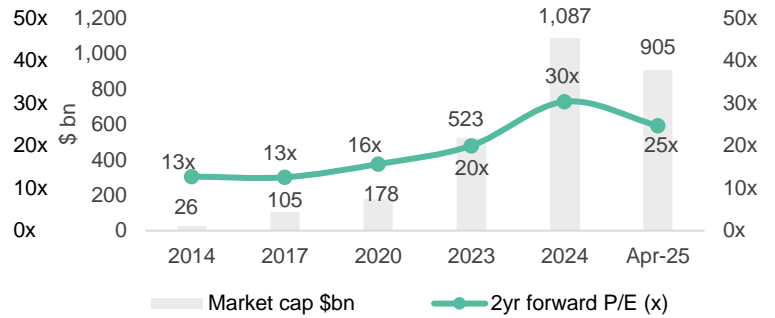
AMD



Marvel Technology

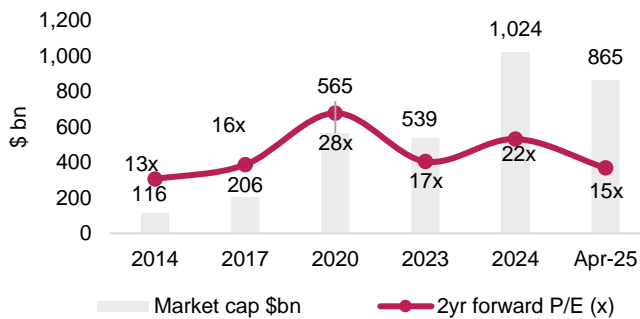


Broadcom

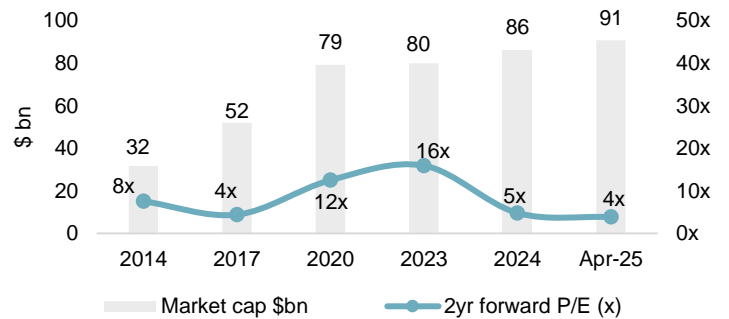


Foundries' valuation

TSMC

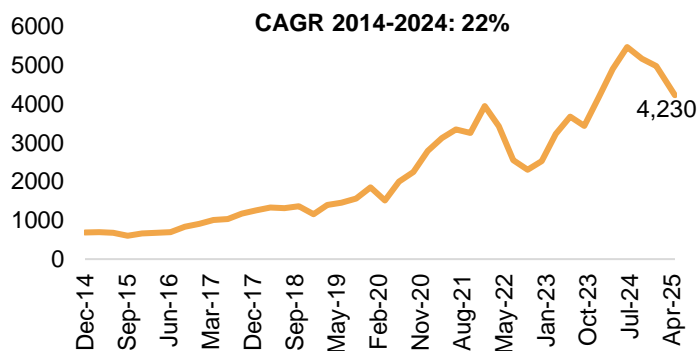


SK Hynix



Source: Bloomberg

Philadelphia Stock Exchange semiconductor index



Source: Bloomberg

Financial metrics E	CY25E	CY26E
Chip designers		
Average revenue growth %	30.6	17.2
Average EBIT margin %	44.2	46.1
Chip foundries		
Average revenue growth %	20.1	14.0
Average EBIT margin %	35.3	36.2

Revenue growth (%)	CY21	CY22	CY23	CY24	CY25E	CY26E
Leading chip designing companies						
Nvidia Corp (NVDA US)	61.4	0.2	125.9	114.2	54.6	23.8
AMD (AMD US)	68.3	43.6	(3.9)	13.7	23.5	18.0
Texas Instruments (TXN US)	26.9	9.2	(12.5)	(10.7)	10.6	9.7
Marvell Technology (MRVL US)	50.3	32.7	(7.0)	4.7	43.3	18.7
Broadcom Inc (AVGO US)	14.9	21.0	7.9	44.0	21.0	15.6
Leading chip foundries						
TSMC (TSM US)	18.5	42.6	(4.5)	33.9	27.2	16.8
SK Hynix Inc (000660 KS)	34.8	3.8	(26.6)	102.0	30.8	15.7
GlobalFoundries Inc (GFS US)	35.8	23.1	(8.8)	(8.7)	2.2	9.5

EBIT margin (%)	CY21	CY22	CY23	CY24	CY25E	CY26E
Leading chip designing companies						
Nvidia Corp (NVDA US)	37.3	15.7	54.1	62.4	63.3	65.1
AMD (AMD US)	22.2	5.4	1.8	7.4	23.6	27.7
Texas Instruments (TXN US)	48.8	50.6	41.8	34.9	34.4	35.9
Marvell Technology (MRVL US)	(7.8)	4.0	(10.3)	(12.5)	34.6	36.9
Broadcom Inc (AVGO US)	31.0	42.8	45.2	26.1	65.0	64.7
Leading chip foundries						
TSMC (TSM US)	40.9	49.5	42.6	45.7	48.0	47.6
SK Hynix Inc (000660 KS)	28.9	15.3	(23.6)	35.5	42.6	41.7
GlobalFoundries Inc (GFS US)	(0.9)	14.4	15.3	(3.2)	15.2	19.4

Source: Bloomberg

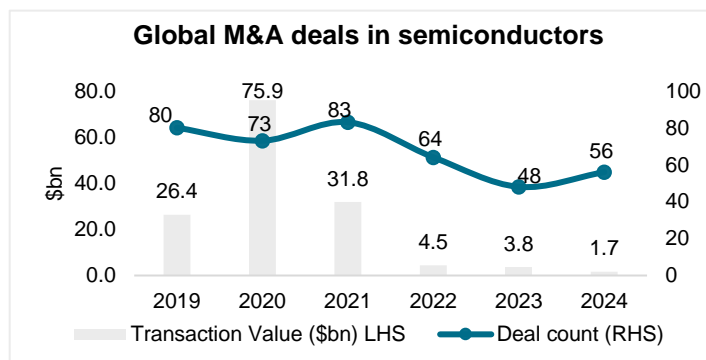
Private investors may benefit from M&A trends

VC investments in semiconductor companies have increased significantly vs 2019, mainly in fabless companies, driven by scope of better return on investments. With current regulations in favour of smaller M&As, VC and PE firms could witness an increase in deals and profitable exit opportunities.

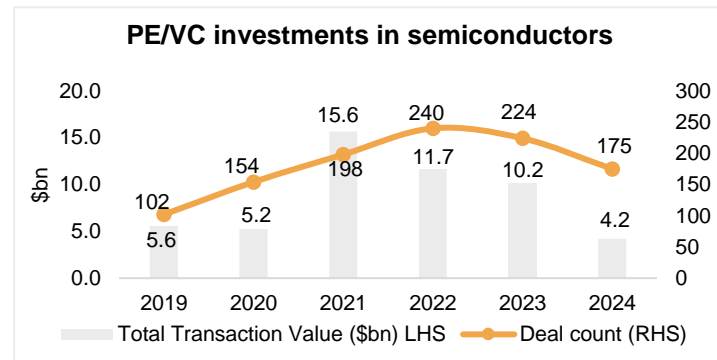
2020 was a bumper year for M&As in the semiconductor industry, as companies sought to augment their capacities to capitalize on technologies that require semiconductors. Additionally, low interest rates encouraged inorganic growth. M&As totalled \$75.9 billion in 2020 alone vs ~\$66.8 billion³ cumulatively over 2017-2019.

However, M&A activity has cooled off post 2020 **due to regulatory pressures amid issues of unfair competition and national security. Hardening interest rates 2022 onwards could have also applied the brakes on M&A deals.**

Notable examples include the cancellation of Arm's acquisition by Nvidia and the acquisition of Tower Semiconductor by Intel. Also, if companies with major business presence in China are to be acquired, it is necessary to obtain approval from the antitrust regulator in China, the State Administration for Market Regulation.



Source: Bloomberg



Source: Bloomberg

But unlike the volatile trend in overall M&As, the PE and VC deal count has grown (except 2024), as companies seek to add their technological capabilities. Aggregate deal values of PEs/VCs in semiconductors have, however, seen a downtrend in since 2022 (refer RHS chart above). This could be reflective of continuing interest in smaller companies.

With increasing regulatory scrutiny over larger deals globally and with major M&As having already been completed, this could be the time for smaller deals, which in turn offer investment as well as exit opportunities for VCs and PEs. Intel was engaged in 25 deals during 2012-22, totaling \$41 billion, and Synopsys was engaged in 22 deals over the period, totaling \$0.41 billion. ON Semiconductor featured in 9 deals, totaling \$4.9 billion⁴.

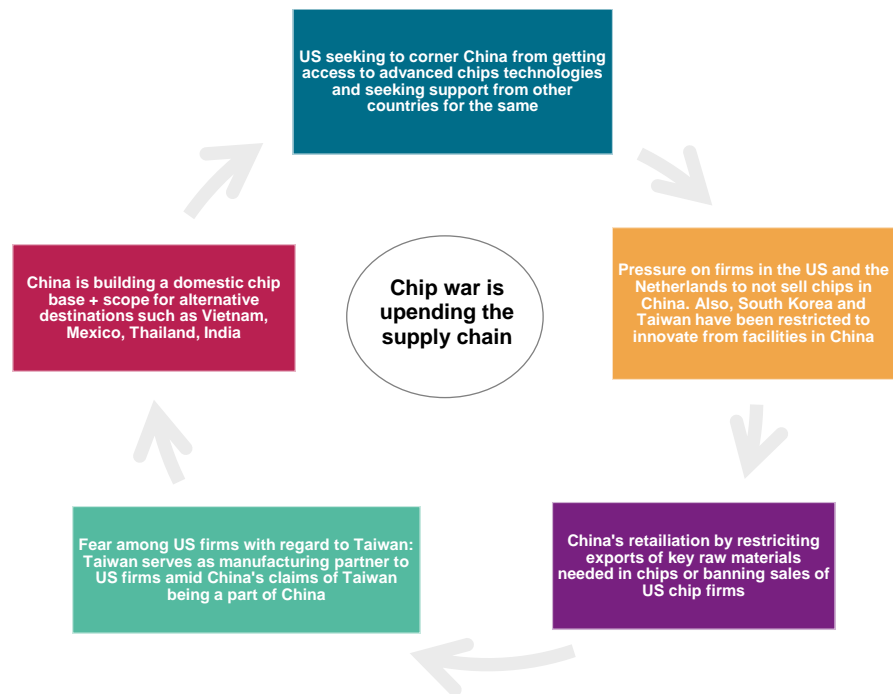
PE investors may also increasingly scout for companies in the semiconductor space

The chip sector has attracted funding from VCs. However, PE firms have been relatively slow on the uptake. But the trend is expected to gradually change, as the automotive and industrial segments are expected to corner a larger pie of the end-user demand mix (see pie chart). These industries align with the investment framework of PE firms⁵, owing to:

- Steady demand with predictable revenue and maintenance patterns
- Longer usable lives with lower capex – automotive as well as industrial segments can leverage on older technologies, i.e. legacy 200mm technologies are still key platforms for automotive and industrial chips
- R&D for chips in the automotive and industrial segments are not as intensive as R&D required for smartphones or data center chips, which have tighter time to market and address short product cycles
- More streamlined supply chains

US vying for tech dominance amid countermoves by China

Companies based in Taiwan and then South Korea are critical for the global semiconductor ecosystem. Also, the US-China trade issues may have long-lasting impact on the global supply chain.



The US has lost manufacturing share to the East; however, it continued to dominate in chip design, which typically comprised 54%⁶ of the value-added of the entire production process. Also, Intel, Nvidia and Qualcomm sell ~50% of global semiconductors⁶. Hence, the US is ahead of China in pricing and product standards.

The tech rivalry between the US and China is getting sharper, though. With the US seeking to restore its leadership in semiconductor manufacturing and R&D, and reduce dependence on foreign countries, the Biden administration had introduced the CHIPS and Science Act in August 2022, providing federal subsidies of \$52 billion to businesses that invest in US semiconductor production.

Also, a US-Japan-Netherland agreement restricts the export of equipment used to manufacture $\leq 14\text{nm}$ chips, and 18nm DRAM and NAND flash chips of over 128 layers⁷. In fact, the Netherland's restrictions disallow Dutch-based ASML to export advanced chip machinery to China⁸.

And while the US administration granted temporary exemptions for semiconductors and consumer electronics, including smartphones and laptops, in April 2025 from the newly announced 145% tariffs on Chinese imports, the US Commerce Secretary has indicated that these exemptions will be short-lived⁹.

The administration plans to introduce new tariffs targeting semiconductors within two months, aiming to incentivize the relocation of manufacturing to the US and reduce dependence on foreign supply chains, particularly China.

The looming semiconductor-specific tariffs have introduced uncertainty, complicated supply chain planning, triggering investments in domestic production, and potentially leading to increased costs for imported goods in the near future.

The US's policies on semiconductors may not, however, help the country to achieve the desired outcomes. This is attributed to a series of factors, including China's forte in manufacturing and the US's internal challenges

related to bureaucracy, workforce shortage and water supply concerns. In contrast, China has the benefit of a large manpower base, cheaper wages and government support. Manufacturing chips in Asia are also 50% cheaper than in the US⁶.

The other factors are:

China-US curbs

- In May 2023, China banned imports of memory chips manufactured by US-based Micron Technology citing “serious network security risks”. Basically, the company is banned from selling chips that support China’s information infrastructure. While Cyberspace Administration of China has not provided details, the US has urged South Korea to not supply to China¹⁰.
- China produces 80% of the world’s gallium and 60% of its germanium¹¹, which are key inputs in the semiconductor market. In December 2024, China banned exports of gallium, germanium and antimony¹²
- In 2024, China imported 549.2 billion integrated circuits worth \$385 billion, up 14.6% and 10.4% in volume and value¹³, respectively. Rise in imports is based on the expectation that the US will levy new unilateral restrictions on China’s access to high-bandwidth memory chips
- It typically takes 6-12 months for lithography equipment to be delivered after the order placement. Hence, China has aggressively ramped up its imports of chip-making equipment in fear that it may lose access to equipment if US restrictions intensify. In October 2023, China’s SMIC used ASML’s equipment to manufacture advanced processor for Huawei Technologies’ 5G smartphones. In the first seven months of 2024, China imported \$25.9 billion of chip-making equipment, which surpassed \$21.6 billion in 2022 and \$18 billion in 2023¹⁴
- Guangzhou City has invested \$29 billion in semiconductors, renewables and other hi-tech fields¹⁵
- In December 2022, China announced plans to spend \$143 billion – in the form of subsidies and tax credits – on chip production over five years¹⁶. In May 2024, China launched its third and biggest semiconductor fund, with an investment commitment of \$47.5 billion for self-reliance in the chip market¹⁷
- Chip companies in China are recruiting talented tech professionals from South Korea, Taiwan and the US by offering stock options, high salaries and research funds

Challenges in the US

- **Bureaucratic hurdles:** Producing chips in the US takes 25% longer than in Asia because of red tape. Between 1990 and 2020, the time required to build new chip plants in the US increased 38% owing to numerous permits and clearances such as Clean Air Act, National Environmental Policy Act plus, federal, state and local laws³
- **Workforce shortage:** In mid-2023, Taiwan’s TSMC rescheduled the production start date of the Arizona plant to 2025 from late-2024, due to inadequate number of skilled workers in the US. Also, TSMC may find it difficult to adapt to the US work culture since 12-hour days with weekend shifts are commonplace in Taiwan. Intel is also investing in training programs to address the skill gap. Workforce requirement in US chip manufacturing is projected to grow 33% by 2030. However, at the current degree completion rates, 58% of the jobs are expected to remain unfilled¹
- **Water supply woes in Arizona:** Chip factories require 2-4 million gallons of water per day. About 36% of Arizona’s surface water comes from Colorado River, that hit Tier 1 water shortage in late 2021. Arizona is dependent on the Colorado River as its groundwater accounts for only 40% of the supply¹⁸

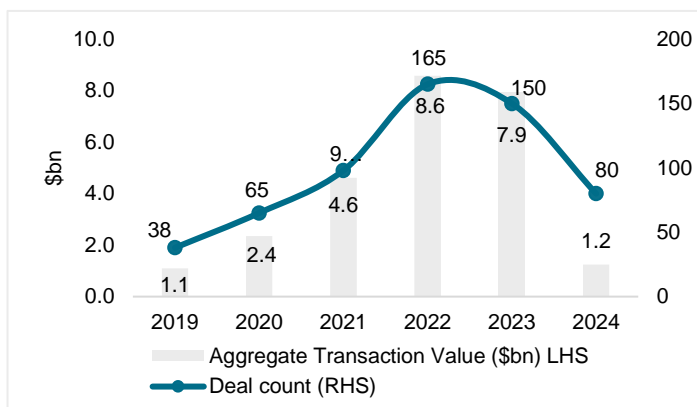
China’s interests in Taiwan

- China considers Taiwan as its “sacred territory” and is getting more vocal about its interests there. A stronger position in Taiwan means taking control over TSMC, which may go against US interests. Control over Taiwan could mean that China could control 80% of global output of chips ranging 20-45nm¹⁹

US-China trade friction may spawn investment opportunities

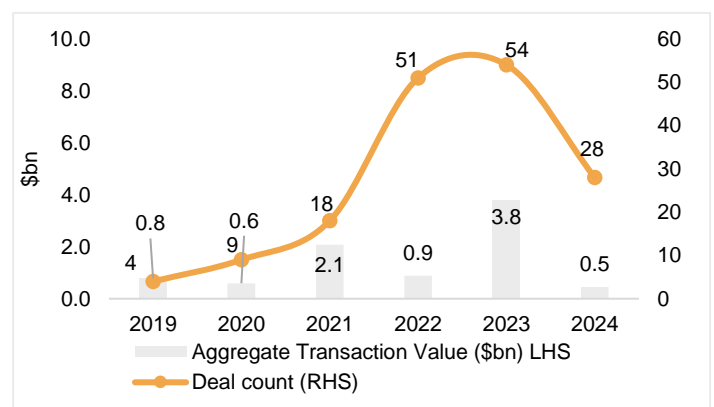
Cross-border investments between the US and China have dropped due to US government policies. Resultantly, China saw weakness in deal traction in 2024. Interest from domestic investors in China may remain elevated as the country seeks to aggressively build its chip infrastructure. The US also seeks to reduce its reliance on China for manufacturing and is exploring low-cost countries. This shift may create investment opportunities across the supply chain, including partnerships between the US and other countries.

PE/VC-backed investments in chips/materials, equipment in China surge till 2022, following weakness as US backtracks



Source: Bloomberg

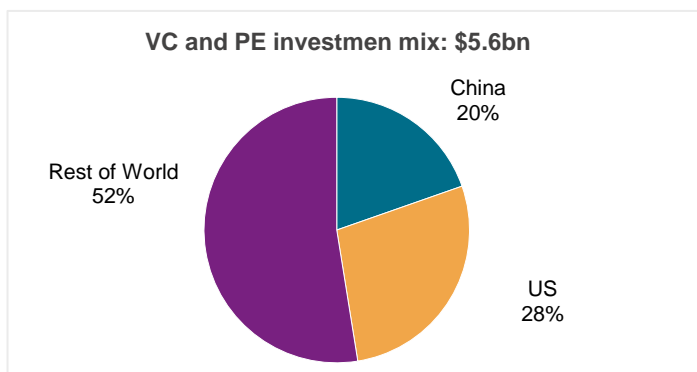
US PE/VC-backed investments in chips/materials and equipment in China drop



Source: Bloomberg

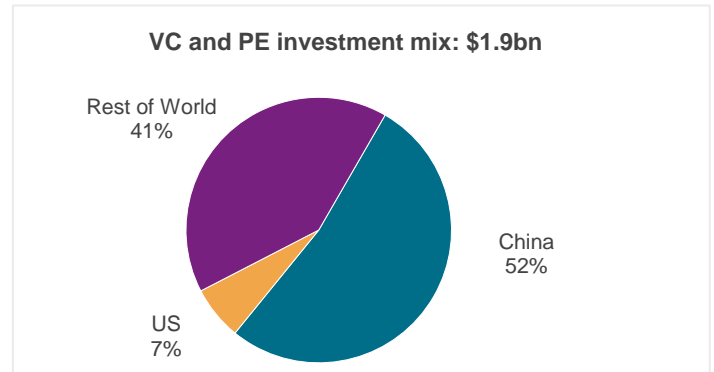
China's share in VC and PE investments in chips increased from 20% in 2019 to 52% in January-March 2025. This could be due to its aim to expand the domestic semiconductor industry amid US restrictions.

VC/PE investment mix in chips by destination: 2019



Source: Bloomberg

VC/PE investment mix in chips by destination: Jan-Mar 2025



Meanwhile, US is looking at alternative low-cost destinations.

Possible beneficiaries of US-China chip conflict	
<p>Vietnam</p> <ul style="list-style-type: none"> • Young workforce • Significant reserves of rare earth metals after China 	<p>Vietnam tops the list under the US CHIPS and Science Act, 2022</p> <ul style="list-style-type: none"> • In 2023, Dell announced plans to “meaningfully lower” the usage of China-made chips, including those made by non-Chinese chipmakers. In 2024, Dell set a goal to procure all chips from plants outside China. Vietnam could be a beneficiary of this move • German chipmaker Infineon seeks to significantly expand workforce in Vietnam adding “multiple hundreds of engineers” to boost chip production • Apple started MacBook production in Vietnam in 2023
<p>India</p> <ul style="list-style-type: none"> • Young workforce • Government incentives for chip manufacturing 	<ul style="list-style-type: none"> • In September 2024, Foxconn and the HCL Group secured approximately 30 acres of land in Noida to establish a semiconductor outsourced assembly and testing unit. Foxconn was expected to invest \$37.2 million for 40% stake • In February 2024, Israel-based Tower Semiconductor submitted a proposal to build a chip fabrication plant at an investment of \$8 billion. The company is planning to manufacture 65nm and 40nm chips in India. Successful applicants can get capex subsidy of 50%. Tower Semiconductor will also receive additional benefits from the state where the plant will be located • In February 2024, CG Power and Industrial Solutions formed a JV with Japan-based Renesas Electronics and Thailand’s Stars Microelectronics to build chip assembly and testing facilities in India at an investment of \$222 million • In September 2023, Micron selected Tata Projects to construct a semiconductor packaging plant in Gujarat. Of the total project cost of \$2.75 billion, Micron will invest \$825 million, and the remaining will be split between the Union Government (50%) and Gujarat government (20%) • Infineon is also seeking to step up hiring in India
<p>Malaysia</p> <ul style="list-style-type: none"> • New Industrial Master Plan (NIMP) 2030 • Strategic location at the center of Southeast Asia and improving logistics 	<ul style="list-style-type: none"> • NIMP 2030 seeks to raise the value-added scope of the manufacturing sector by broadening the scope of exports from Malaysia • In August 2023, Infineon announced plans to invest \$5.5 billion to expand its facility in Malaysia’s Kulim Hi-Tech Park. This involves manufacturing chips to produce EVs • In June 2023, Texas Instruments announced plans to build two assembly and test factories at an investment of over \$3.0 billion • In December 2021, Intel announced plans to invest \$7.1 billion to build an advanced 3D chip packaging facility
<p>Thailand</p> <ul style="list-style-type: none"> • Skilled workforce • Robust infrastructure • Tax benefits • Strategic location 	<ul style="list-style-type: none"> • The Thai Investment Board is working on roadshows to draft a plan for the chip industry. Thailand ranks second, behind India, in an analysis of top emerging economies for chip manufacturing²⁰. The country is targeting approximately \$15 billion (THB 500 billion) in new investments in semiconductors by 2029. • Upstream companies in the chip supply chain can enjoy tax holidays for 13 years

Conclusion

Demand for chips is expected to strengthen thanks to the rise of revolutionary technologies. This augurs well for the financial performance of listed entities, which should weigh positively on their valuations.

The sector has witnessed intense consolidation in the past. While M&As will continue, the acquisition of smaller companies is expected to be more as larger deals may be blocked by regulators in view of national interests. This may lead to rewarding exit routes for PE and VC firms as larger companies may still scout for smaller deals.

Amid US-China trade tensions, roadblocks for the former in terms of manpower, corporate interests, execution challenges and China's inherent strength in manufacturing will bear watching.

That said, the situation does open investment opportunities. While US investors may remain away from investments in Chinese semiconductors, domestic investors in China appear keen to press the growth pedal. Also, alternative low-cost destinations will likely see more inflows from US investors.

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- ¹ Semiconductor Industry Association
 - ² McKinsey & Company data published in Apr 2023
 - ³ Bloomberg
 - ⁴ S&P Global Market Intelligence data compiled in Aug 2022
 - ⁵ Alvarez and Marshal report published in Feb 2023
 - ⁶ Lawfaremedia.org article published in Jan 2024
 - ⁷ South China Morning Post article published in Feb 2023
 - ⁸ South China Morning Post article published in Apr 2025
 - ⁹ TechTarget article published in Apr 2025
 - ¹⁰ BBC article published in May 2023
 - ¹¹ BBC article published in Oct 2023
 - ¹² Reuters article published in Dec 2023
 - ¹³ South China Morning Post article published in Jan 2025
 - ¹⁴ Mobile World Live article published in Aug 2024
 - ¹⁵ South China Morning Post article published in Feb 2023
 - ¹⁶ Reuters article published in Dec 2022
 - ¹⁷ Reuters article published in May 2024
 - ¹⁸ Americanbar.org article published in Feb 2023
 - ¹⁹ Rhodium Group article published in Apr 2023
 - ²⁰ Kearney 2024 report

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Crisil Integral IQ delivers solutions and actionable intelligence to top financial institutions, driving strategic transformation, risk optimization, and operational excellence. Our offerings across research, risk, lending, analytics and operations have empowered clients to navigate complex markets, mitigate risks and unlock new opportunities. Our domain expertise, innovative solutions, future-ready technologies such as AI and data science give clients the confidence to accelerate growth and achieve sustainable competitive advantage. Our globally diverse workforce operates in the Americas, Asia-Pacific, Europe, Australia and the Middle East.

For more information, visit IntegrallQ.Crisil.com

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