



# Semiconductor Manufacturing: 2025 Q1

Capital expenditure in AI stays strong, but other areas are less upbeat.



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# Executive Summary

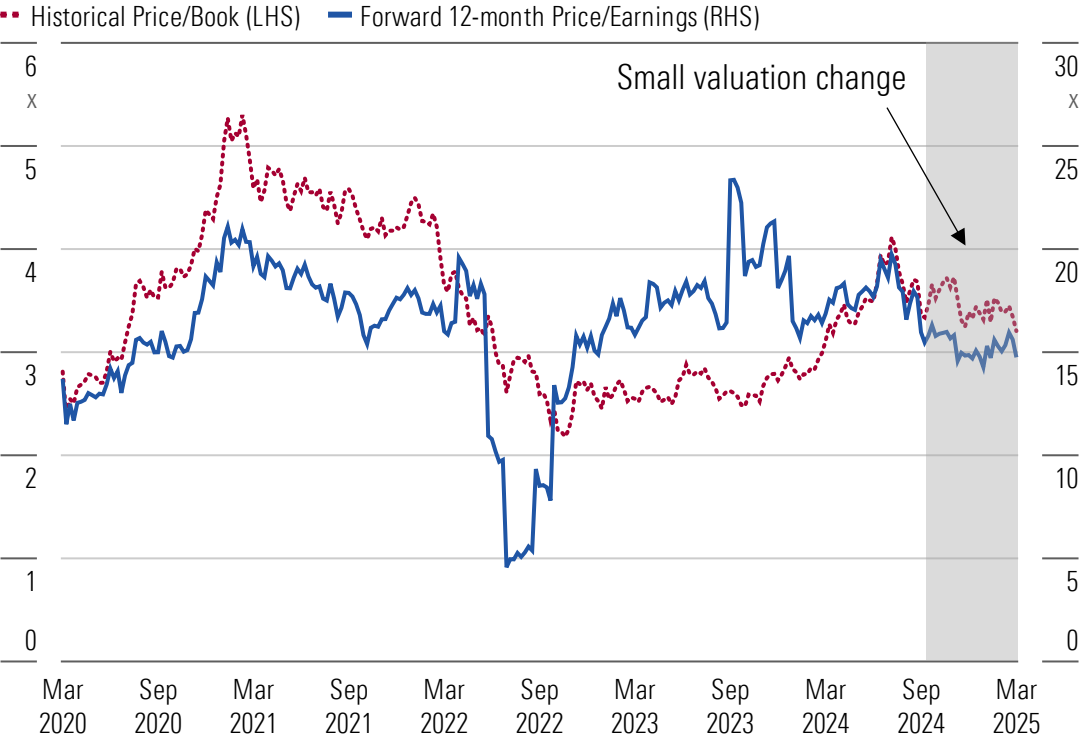
AI investments stay strong, but US tariffs pose risks to other areas.

# Valuation May Head to a Downturn if US Tariffs Dampen Demand

Valuation has changed little for almost half a year as bullishness in artificial intelligence has been offset by uncertainty in the automotive and industrial sectors. All Chinese stocks are expensive as localization initiatives and sporadic news reports on tech breakthroughs have lifted sentiment. We are worried that US tariffs and potential tit-for-tat will push up prices of chips and weaken demand, leading to a downturn in the semiconductor industry and its valuation. Best-in-class companies like Taiwan Semiconductor Manufacturing Company and GlobalWafers tend to shine in downcycles.

## Valuation Ratios Show We Are Just Past the Middle of Share Price Upcycle

Market cap-weighted average including foundries, memory makers, wafer producers.

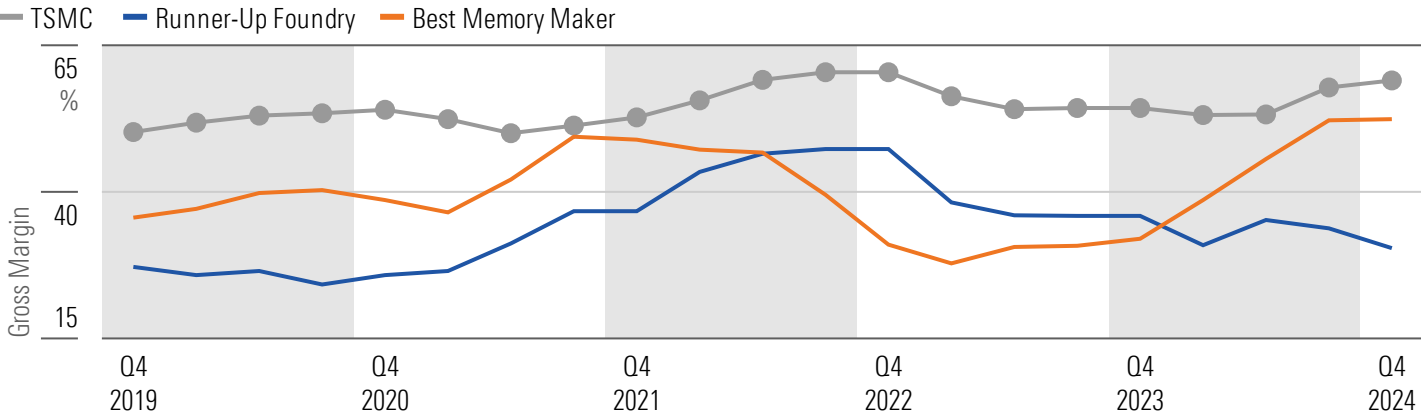


## Key Acronyms and Abbreviations Used in This Report

ACEA	Association des Constructeurs Européens d'Autos
BEV	Battery Electric Vehicles, has no fuel tank
CAAM	China Association of Automobile Manufacturers
EV	Electric Vehicles
GF	Globalfoundries, Inc
HBM	High Bandwidth Memory
HEV	Hybrid Electric Vehicles
ICE	Internal Combustion Engine
IDC	International Data Corporation
MOEA	Taiwan's Ministry of Economic Affairs
MOEF	Korea's Ministry of Economy and Finance
NEV	New Energy Vehicles; includes EVs and other types of non-ICE vehicles
NIST	National Institute of Standards and Technology
NSIG	National Silicon Industry Group
PHEV	Plug-in Hybrid Electric Vehicles
SMIC	Semiconductor Manufacturing International Corporation
TSMC	Taiwan Semiconductor Manufacturing Company
UMC	United Microelectronics Corporation
VIS	Vanguard International Semiconductor

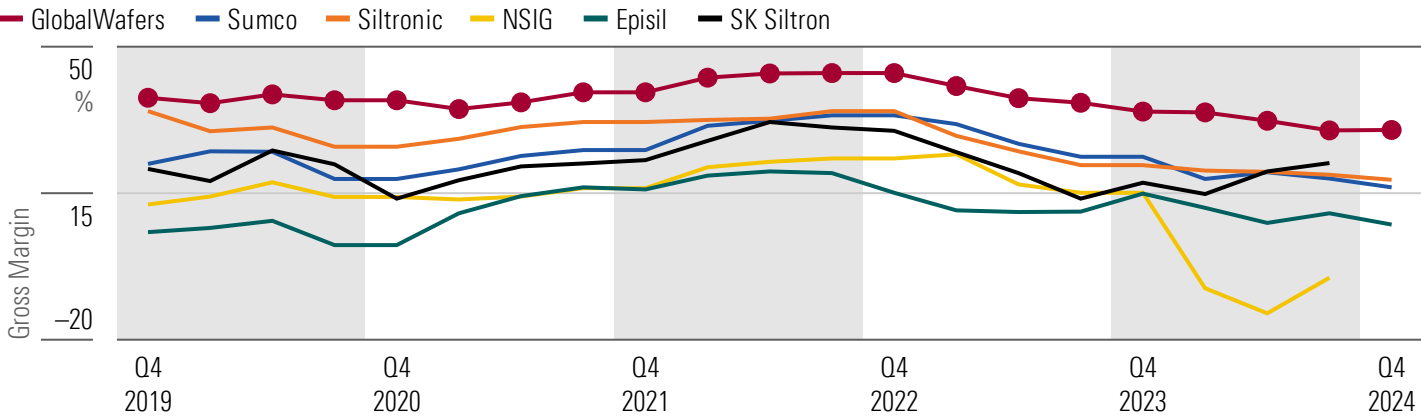
# Best-in-Class Stocks Are Our Top Picks

## TSMC Gross Margin Advantage Stems From a Cycle of Technology Lead, Research, and Premium Pricing



Foundries and memory makers are exposed to the intense cyclicality of the semiconductor sector. Companies with economic moats have more resilient gross margins than their no-moat peers as they can maintain higher capacity utilization through production quality and reliability in delivery. TSMC fits best among foundries. We think Samsung Electronics’ share price may catch up with other memory firms as automotive and other non-AI demand recovers later this year.

## GlobalWafers’ Efficient Operations Are Key to Its Superior Gross Margin



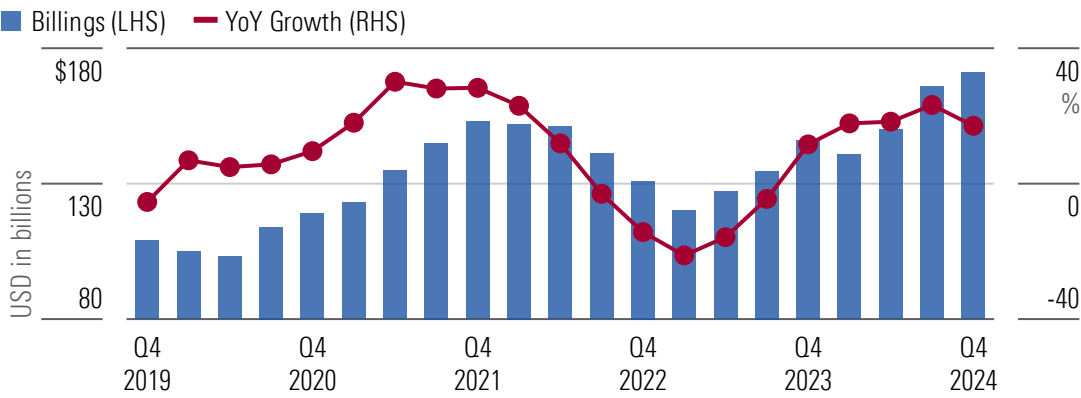
The industry’s cyclicality extends to silicon wafer producers. Companies with economic moats have higher gross margins because they maintain higher capacity utilization and more exposure to cutting-edge processes. Proximity to customers is important for wafer suppliers as customers prefer to quickly replenish wafers to keep their production lines fully stocked. TSMC’s commitment to invest another USD 100 billion in the US benefits GlobalWafers the most as the latter is opening its Texas production site later in 2025.

Source: Company filings, Morningstar. Data as of Dec. 31, 2024.  
Note: NSIG and SK Siltron have announced gross margins up to Sept. 30, 2024.

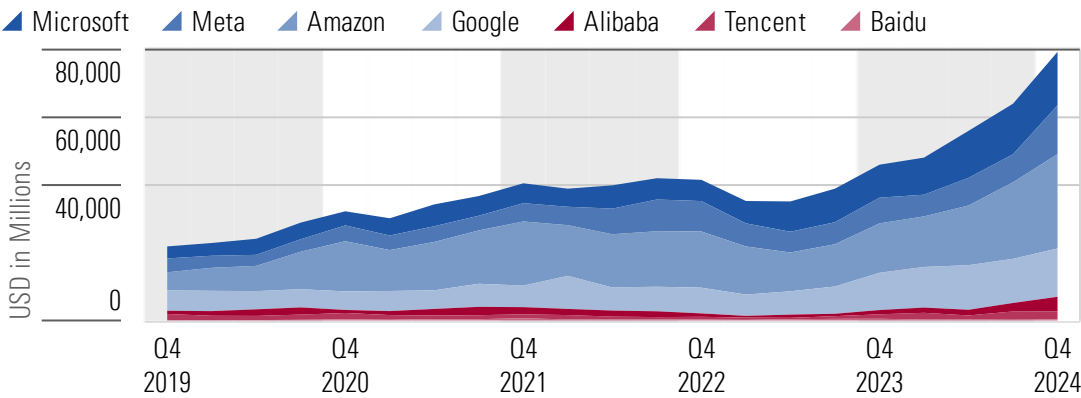
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# AI Spending Continues, but Macroeconomic Risks Intensify

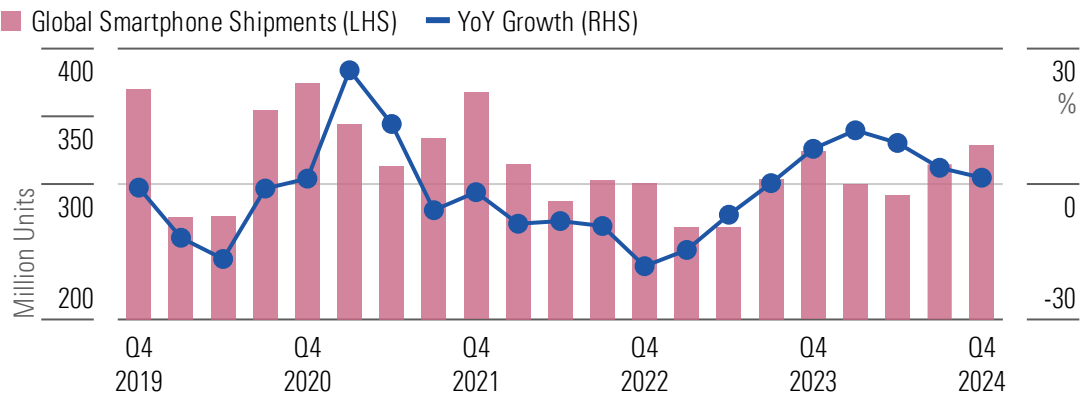
## Global Semiconductor Billings Are Growing, but not as Fast...



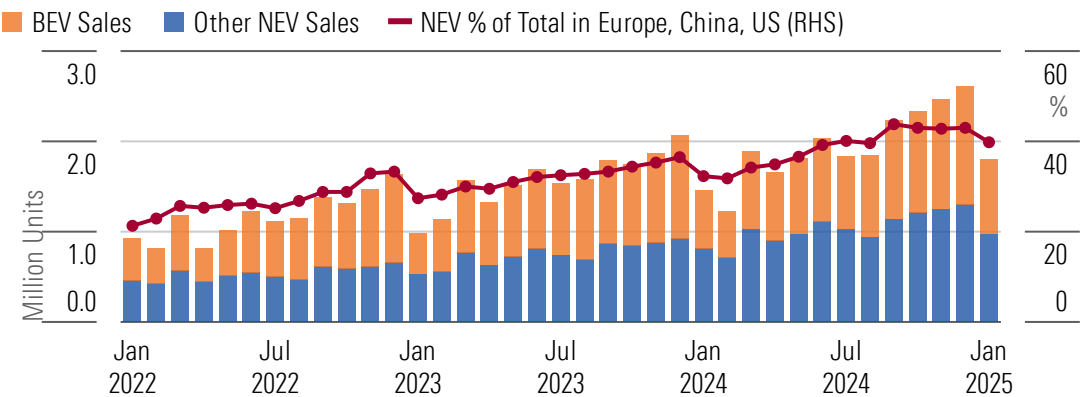
## ... Supported by Continued AI Spending Growth by Internet Giants...



## ... but Moderated by 2% Smartphone Recovery in 2025...

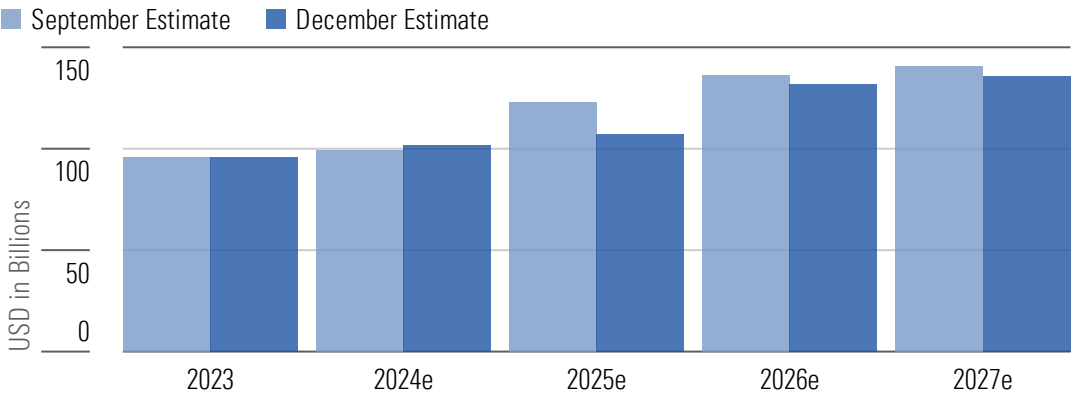


## ... and NEV Growth Slows to Midteens in 2025 From 25% in 2024

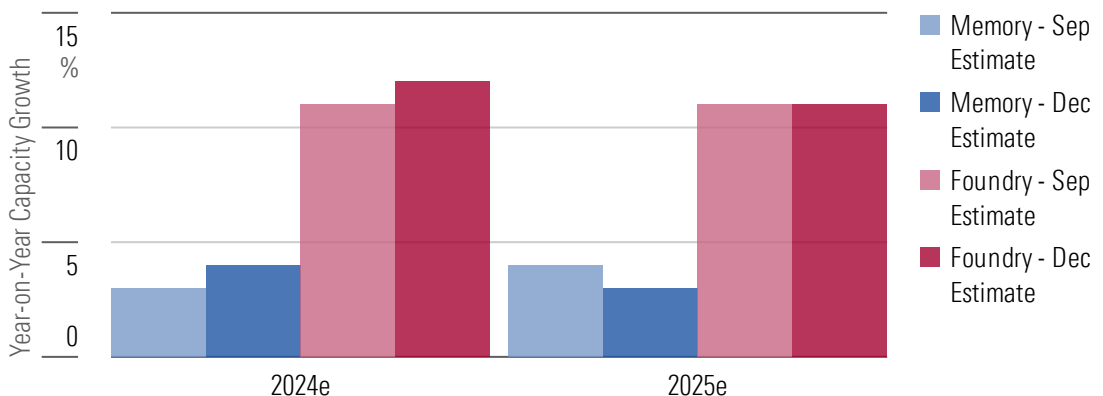


# Foundry Investments Less Confident, but AI Memory Capital Spending Remain Robust

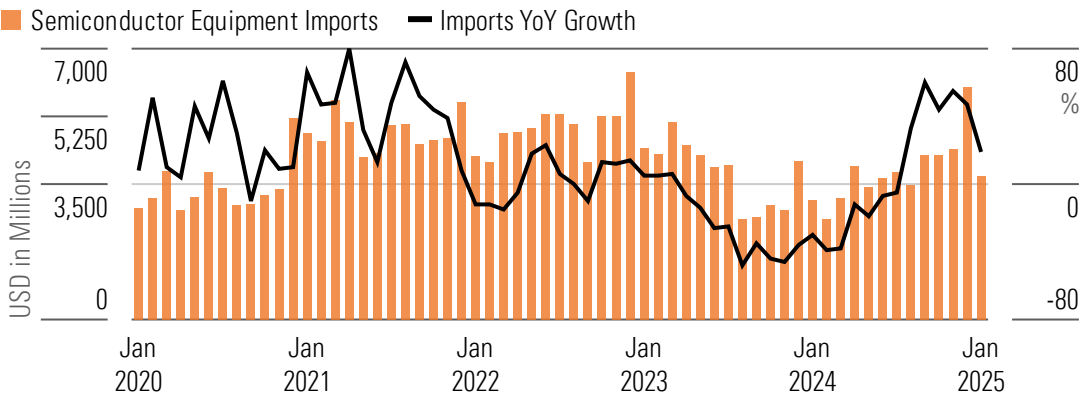
## Capital Spending Estimates After 2025 Dropped...



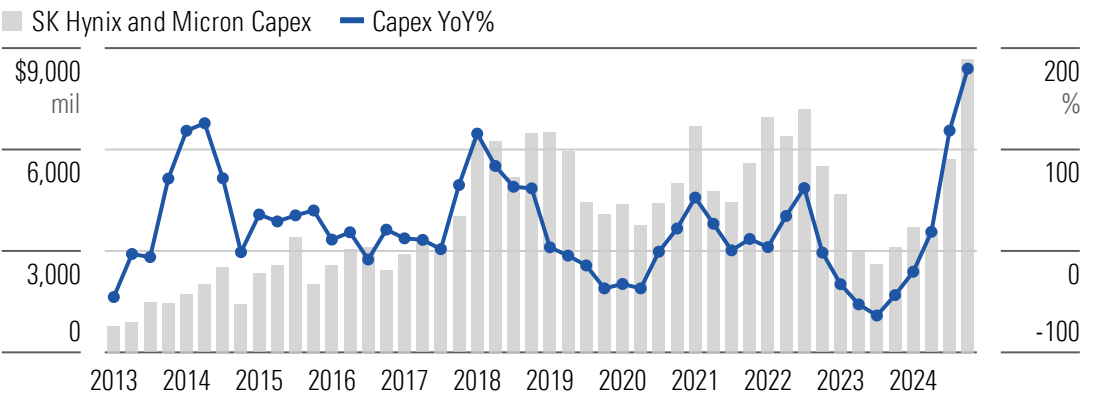
## ...Due to Slow Recovery in Non-AI Memory, and...



## ...Equipment Imports Data Suggest Foundry Investments Have Peaked...



## ...Though Aggressive Capital Expenditure Continues in HBM



Source: SEMI. Data as of Dec. 19, 2024 (top left and top right). MOEF, MOEA. Data as of January 31, 2025 (bottom left). SK Hynix, Micron. Data as of Jan. 31, 2025 (bottom right).

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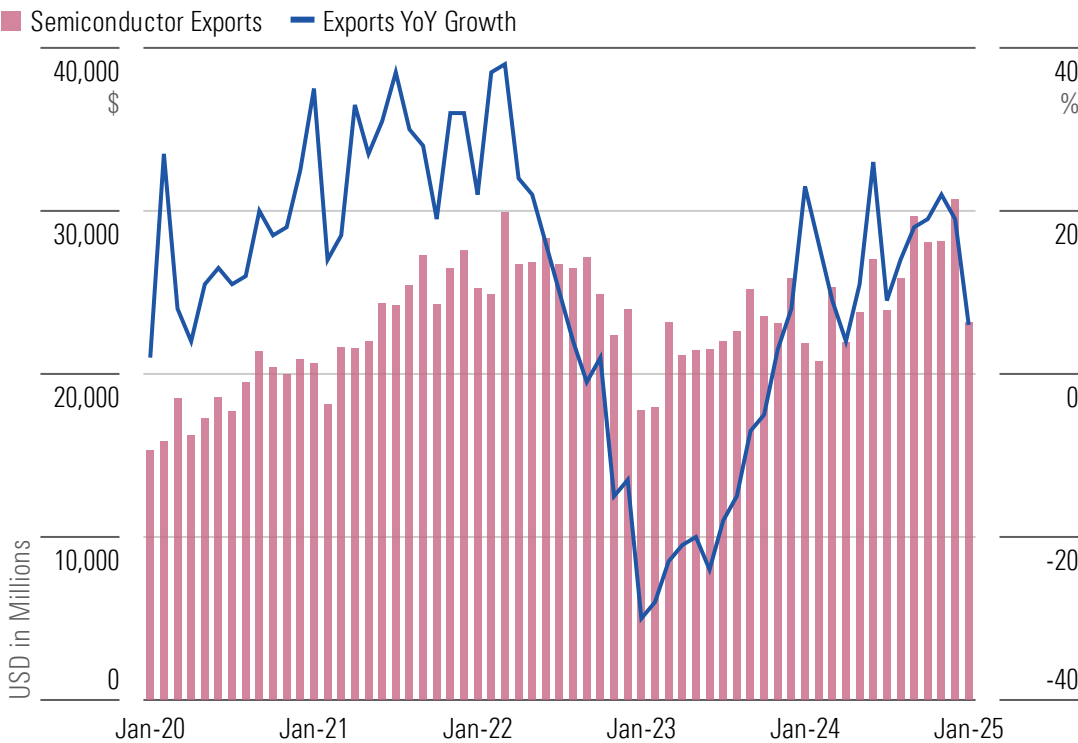
# Demand Outlook

US tariffs pose uncertainty to demand, but long-run drivers intact.

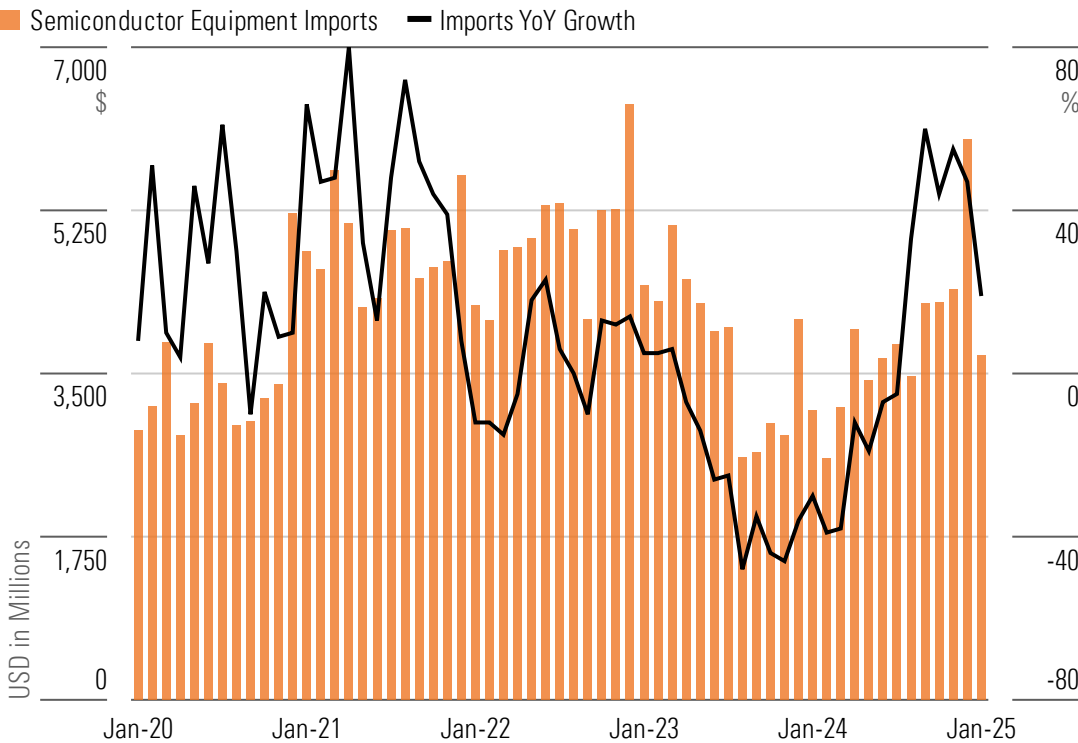
# Demand Is Improving, but Macroeconomic Uncertainty Prevents Strong Upcycle

The semiconductor cycle lasts about four years on average. The cycle usually peaks when revenue and capital expenditure record strong double-digit year-on-year growth, as was the case in 2024. Although we see signs of demand in automotive and industrial markets improving, risks of tariffs deter aggressive restocking. Tariffs will hurt semiconductor demand across the board as consumer goods and autos become more expensive and industrialists reassess where to set up factories to house new equipment.

## Export Data Growth Tapers Due to High Base in 2024 AI Demand...



## ...And Macro Uncertainties Hurt Investment Appetite



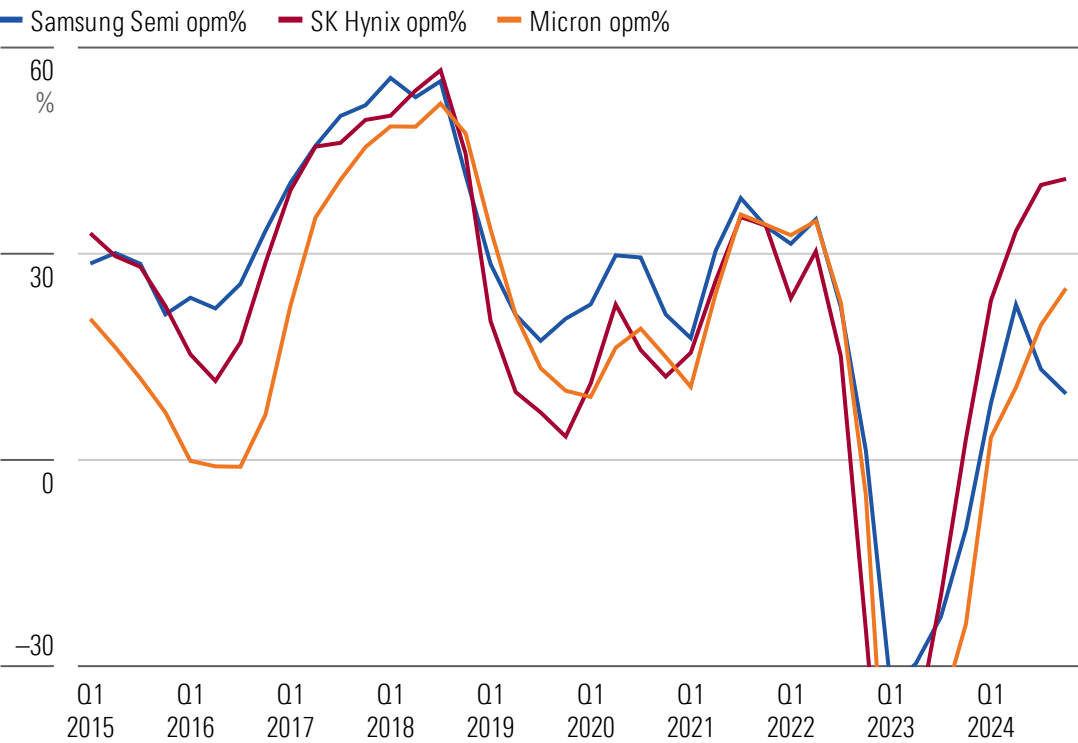
Source: Taiwan's Ministry of Foreign Affairs, Korea's Ministry of Economy and Finance. Data as of Jan. 31, 2025.

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# Conventional Memory Prices to Bottom Out in First Half; AI Demand Will Be the Focus in Second Half

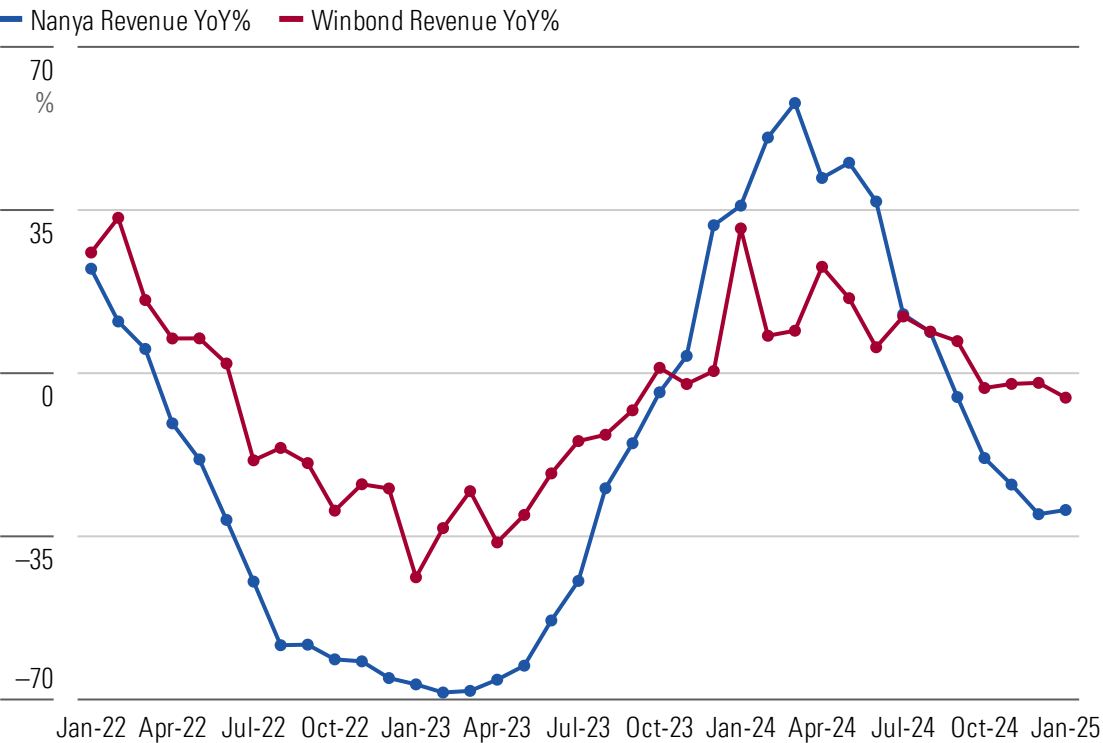
Conventional memory prices declined in the second half of 2024 due to sluggish smartphone shipments and aggressive memory production by Chinese suppliers. However, SK Hynix and Micron Technology's operating margin continued to expand due to the significant increase in HBM shipments. Samsung Electronics' operating margin declined for two consecutive quarters due to lower contribution from HBM and greater exposure to the Chinese market. We expect memory prices to bottom out in the first half of 2025 as an inventory correction is completed. Demand for AI-enabled devices, which require more memory content, will be the focus in the second half of this year.

## Operating Margin Gap Between SK Hynix and Samsung Has Widened...



## ...As Legacy Memory Slowdown Hits Samsung More

We use Taiwanese competitors as a proxy for legacy memory demand.

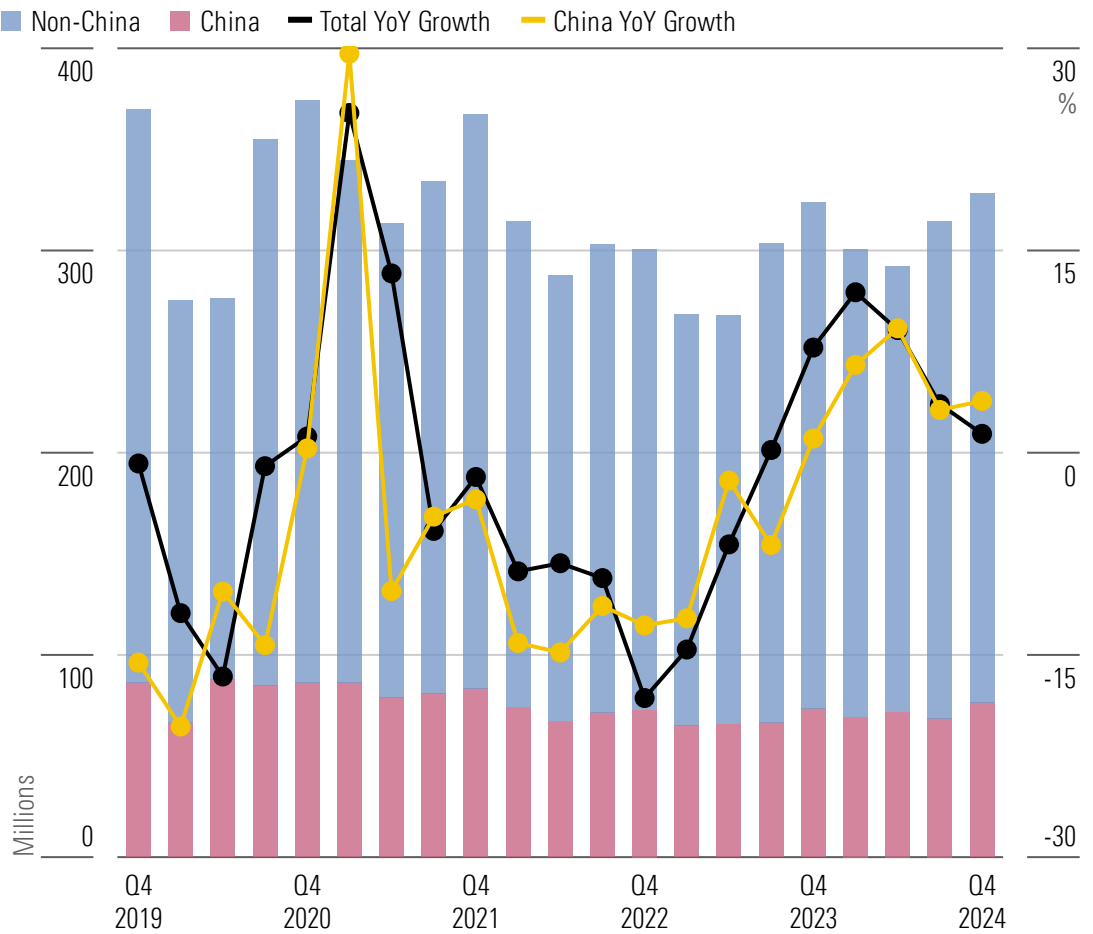


Source: Micron, Samsung, SK Hynix (left). Gartner (right). Data as of Jan. 31, 2025.

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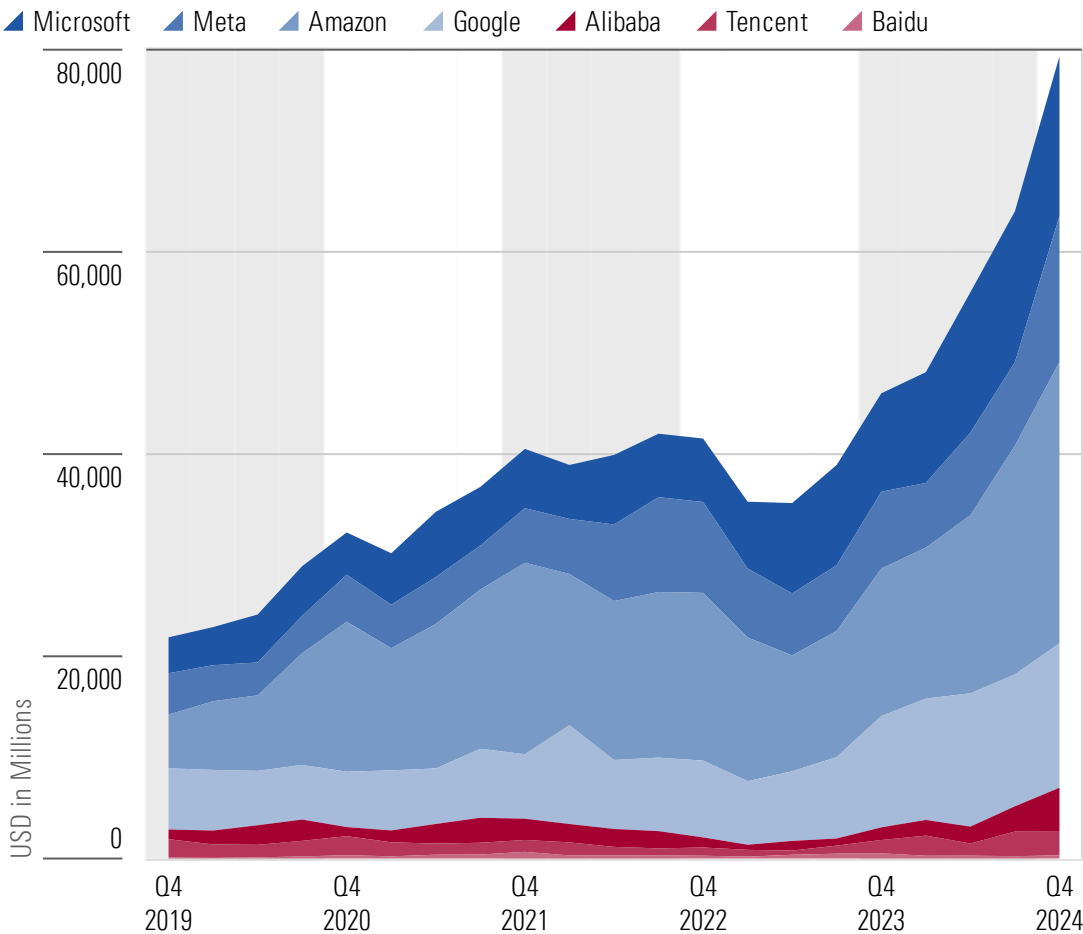
# AI Functions Pique Consumer Interest and Spur Corporate Investments

## Restocking Paused, but Advances in AI and Cameras Support Smartphone Demand



## Internet Giants Keep on Ramping Up AI Hardware Investments in 2025

US technology firms guide for 41% increase for 2025 to USD 320 billion in aggregate.

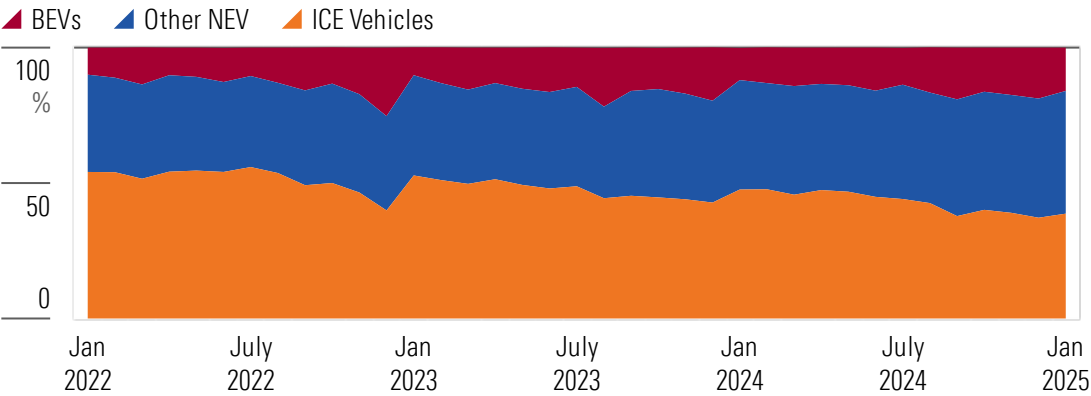


Source: IDC (left), Company filings. Data as of December 31, 2024.

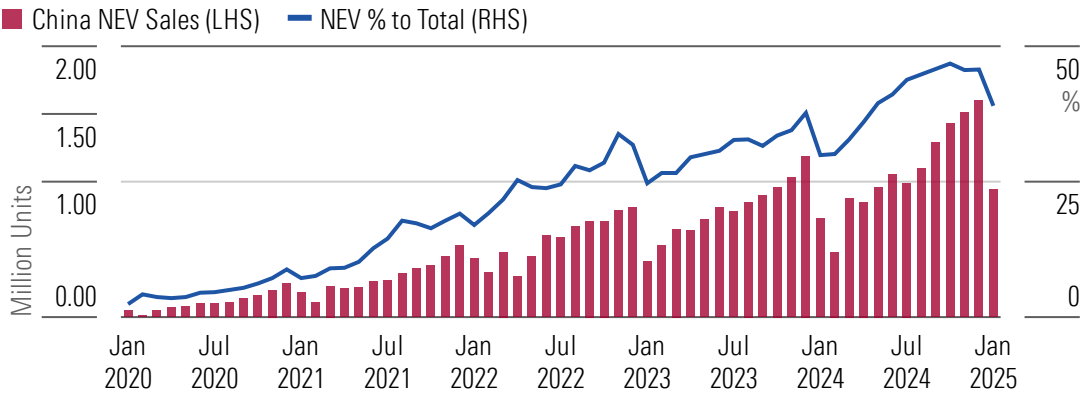
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# Recent Slowdown Worries Does Not Change Our Long-Term View on Electrification

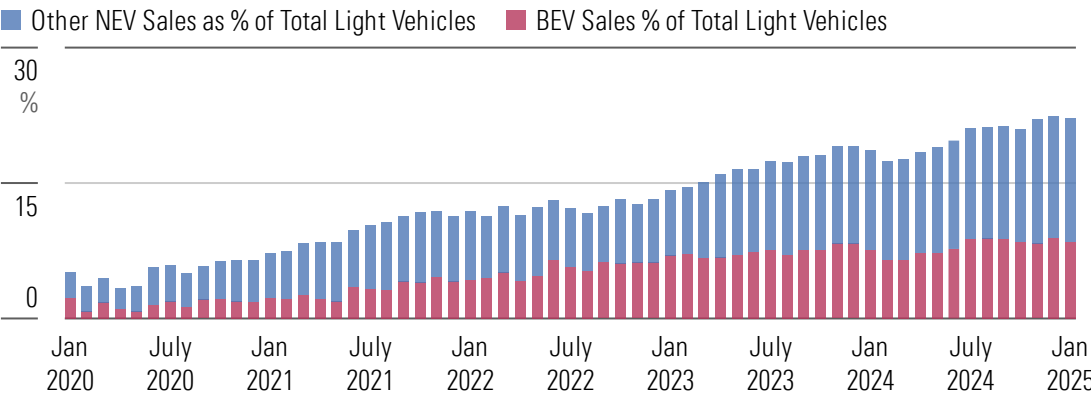
## Europe Car Sales Moving From ICE Vehicles to HEVs, Will Then Move to BEVs



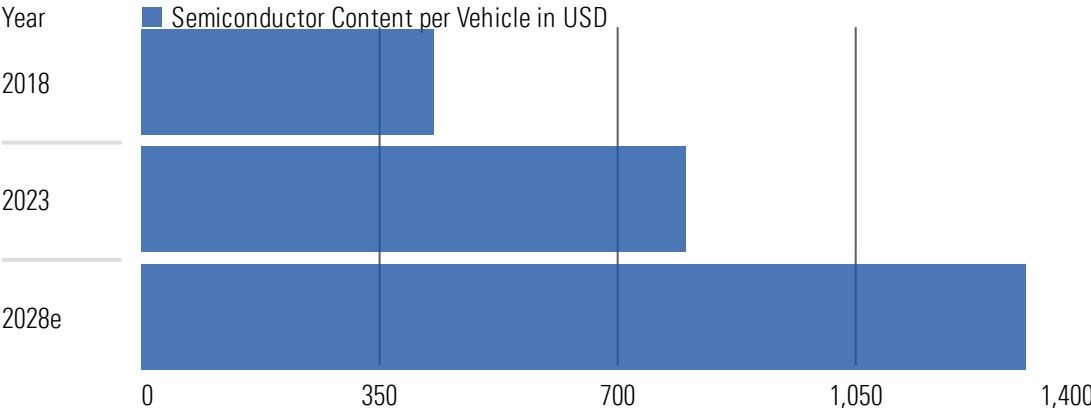
## China Is Nowhere Close to Full Electrification



## US Is in Very Early Stage of Electrification



## Room for Growth as BEVs Have Three Times the Chip Content Versus ICEs



Source: European Automobile Manufacturers Association (top left), CAAM (top right), Argonne National Laboratory (bottom left), Soitec (bottom right). Data as of Jan. 31, 2025.  
Note: Europe includes European Union and European Free Trade Association member states, plus the UK.

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# Supply Outlook

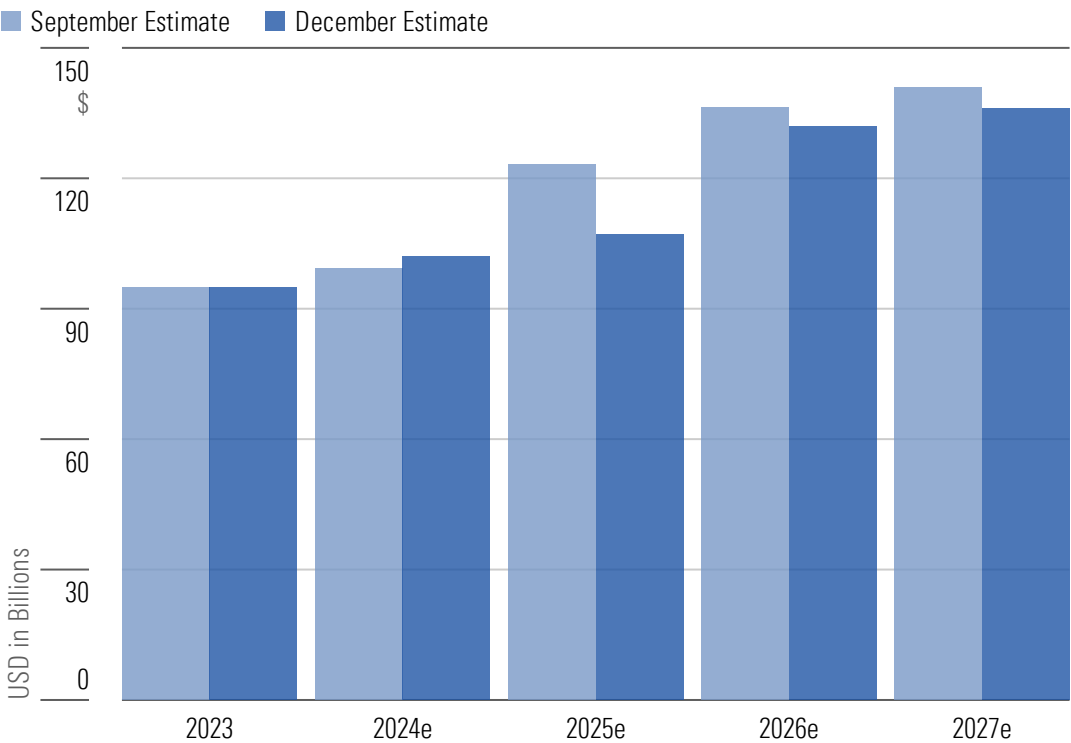
Fears of slowing demand dampen urge to invest.

# Capital Spending on Non-AI Memory Cut, but Foundry Investments Continue

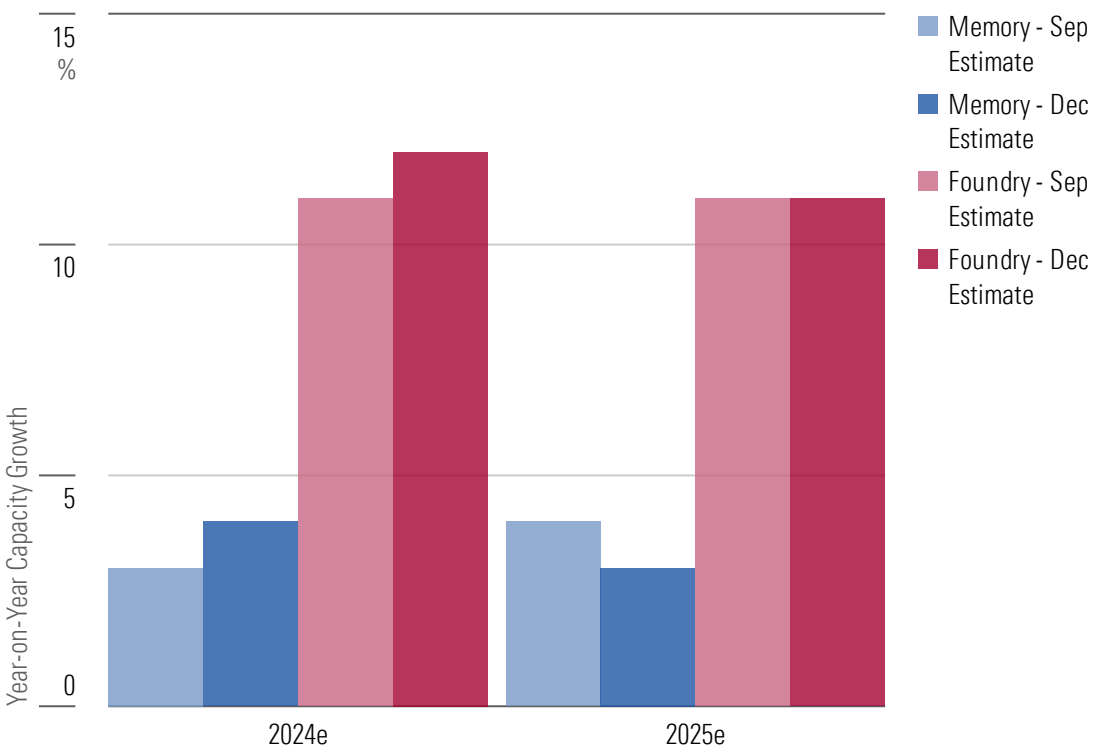
Capital expenditure forecasts are more cautious than the previous quarter due to manufacturers bracing for hits from tariffs. Memory capacity growth forecasts for 2025 are flat sequentially after a slow 2024. Non-cutting-edge foundry is at risk given 25% cumulative capacity growth to 2025 compared with 2023, due to aggressive spending by SMIC and Hua Hong Semiconductor. Higher prices after tariffs combined with aggressive spending cuts by the US government are likely to hit macro demand, warranting caution in new investments.

## Mature Semiconductor Capital Spending Eases Versus the Prior Quarter...

Includes 300 mm wafer investments only.



## ...Which Leads to Less Pipeline Capacity in 2025



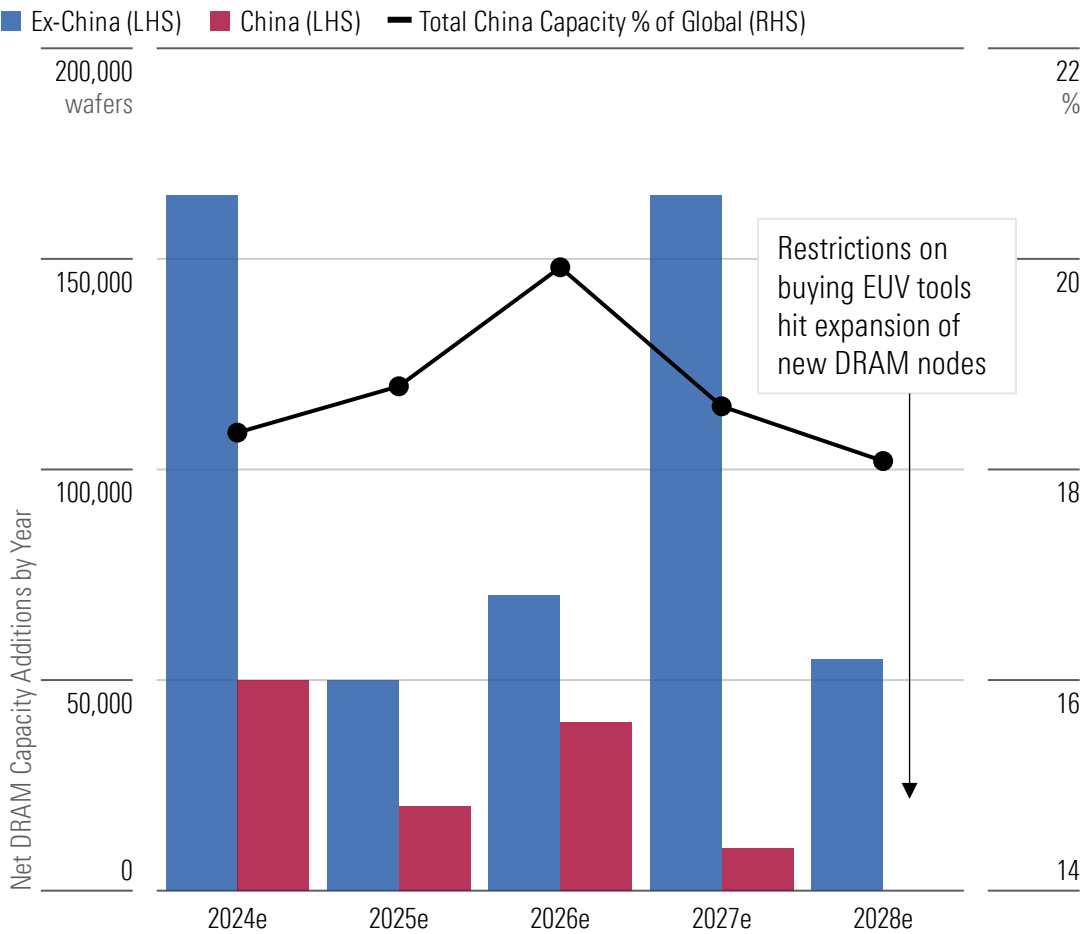
Source: SEMI. Data as of Dec. 19, 2024.

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# China’s Rapid Expansion Has Little Effect on Cutting-Edge Foundry and DRAM Supply

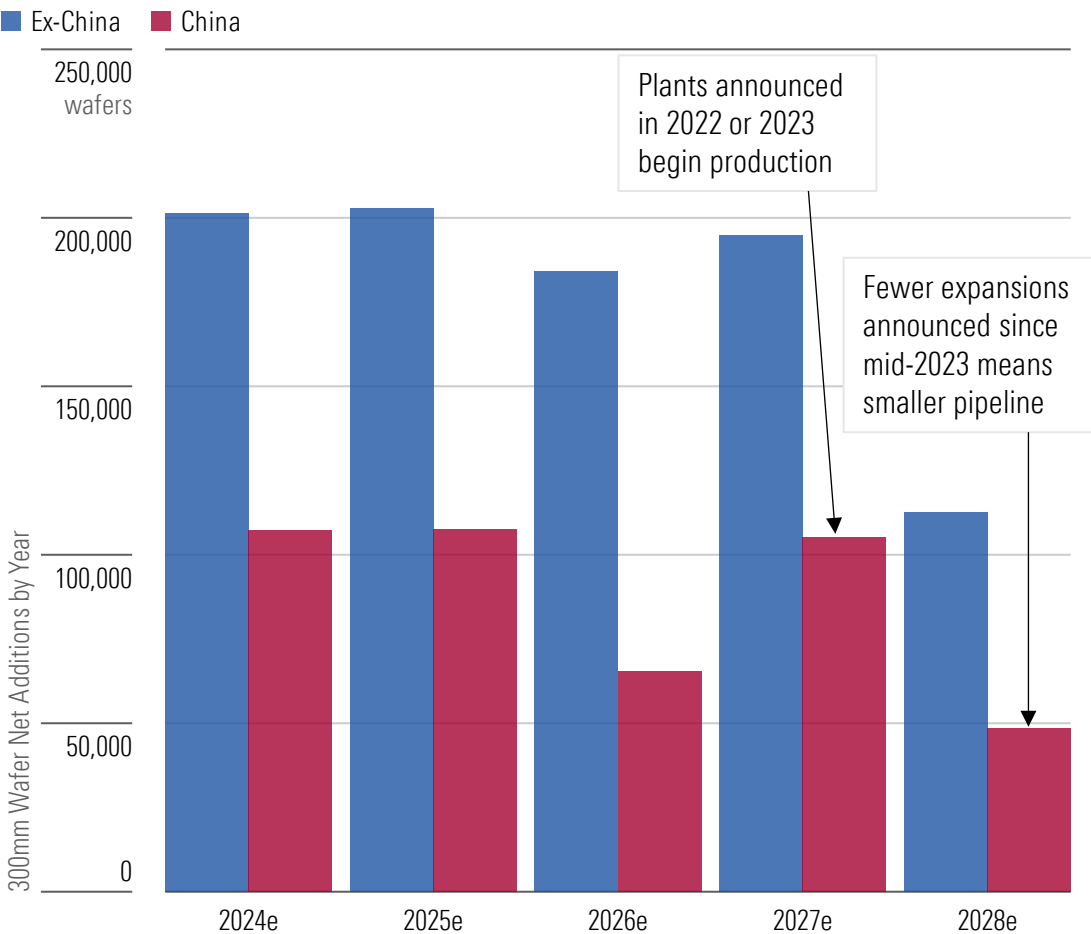
## China Share of Global DRAM Capacity Peaks in 2026...

Samsung, SK Hynix, and Micron continue to dominate cutting-edge DRAM supply.



## ...And Foundry Expansions to Taper in 2028 Due to Fewer New Projects

Chinese foundry announcements peaked in 2022.



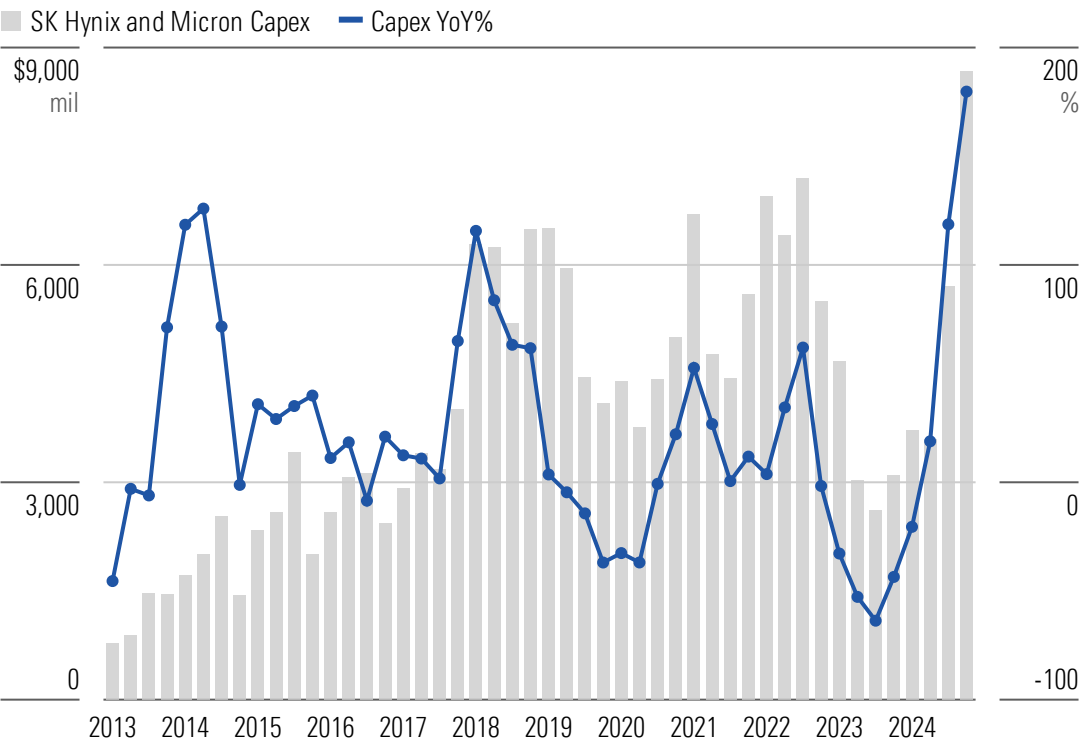
Source: Gartner, Morningstar.  
Note: Capacity is quoted in 300 mm (12-inch) equivalent wafers per month.

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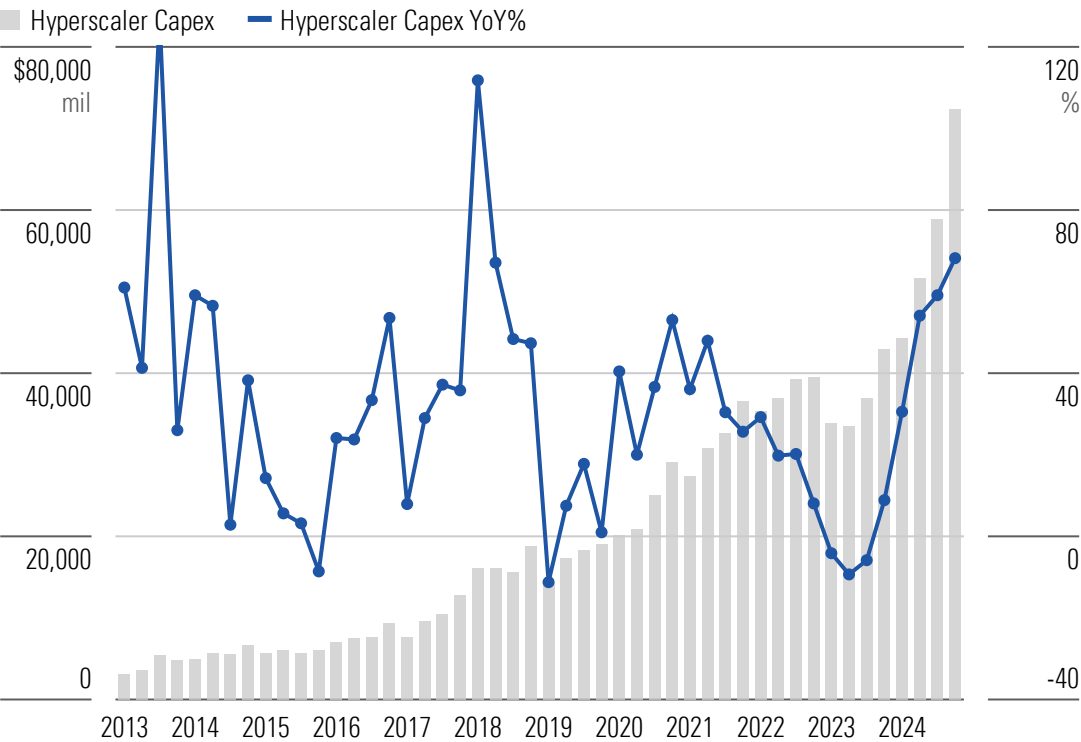
# Memory Companies Continue Aggressive Capital Expenditures in 2025, but Focus on DDR5 and HBM

As we expected, US hyperscalers intend to continue to invest aggressively in 2025, with plans to increase capital expenditures by 35%-40% year over year. We believe this will support active capital spending by memory suppliers. However, due to intensifying competition for conventional products, memory suppliers will focus investments on high-end products such as DDR5 and HBM, which are used in AI servers. We expect memory supply to tighten in the second half of 2025.

## Memory Supplier Capital Expenditures Start to Pick Up...



## ...Driven by Historically High Capital Spending by Hyperscalers

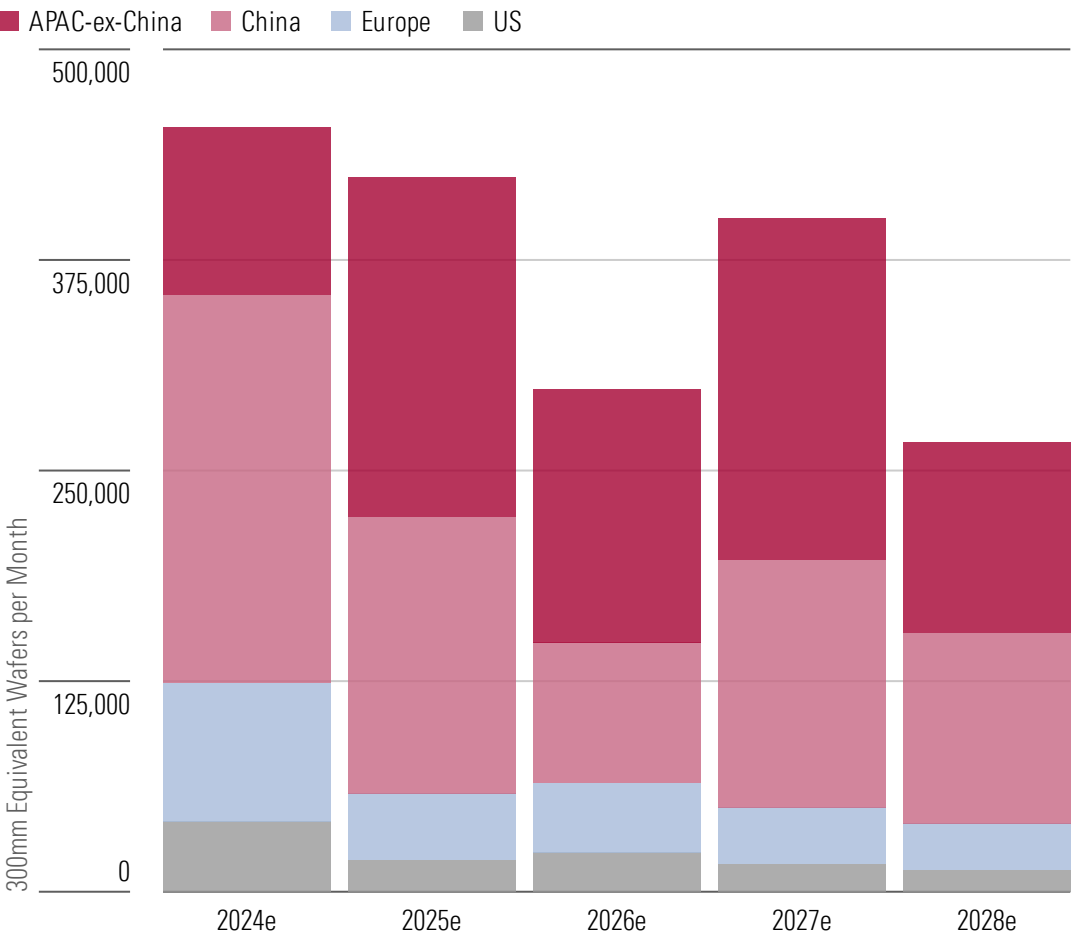


Source: SK Hynix and Micron Technology (left), Alphabet, Amazon, Microsoft, and Meta (right). Data as of February 2025. DDR5=Double data rate 5 synchronous dynamic RAM.

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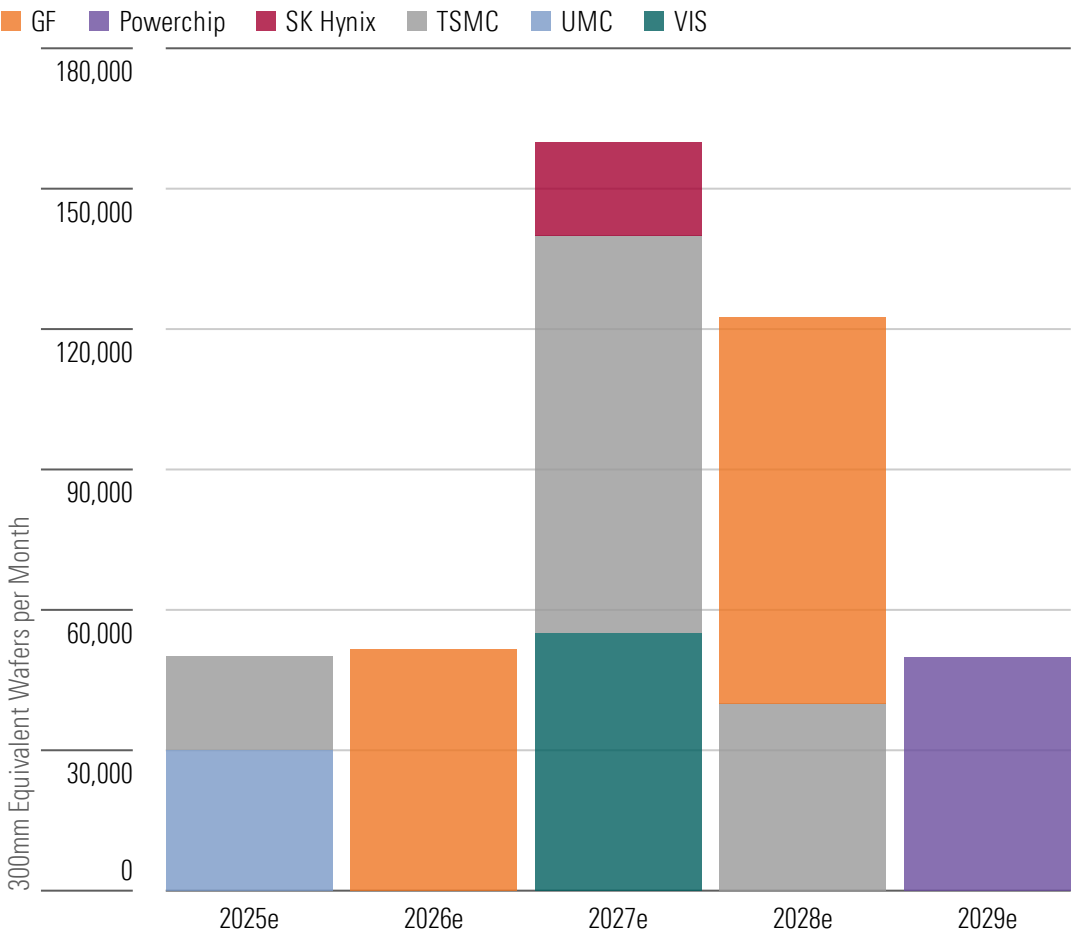
# Building Factories Outside Home Countries Is a Persistent Trend

## Asia Remains the Preferred Location Despite Western Subsidies



## ... But Most Manufacturers are Hedging Geopolitical Risks With Overseas Sites

Overseas capacity pipeline by company; TSMC and GF are the most proactive.



Source: Company filings, Gartner, Morningstar estimates.  
Note: Overseas is defined as regions outside a company's headquarters. Powerchip and Vanguard International Semiconductor Corporation are not covered by Morningstar.

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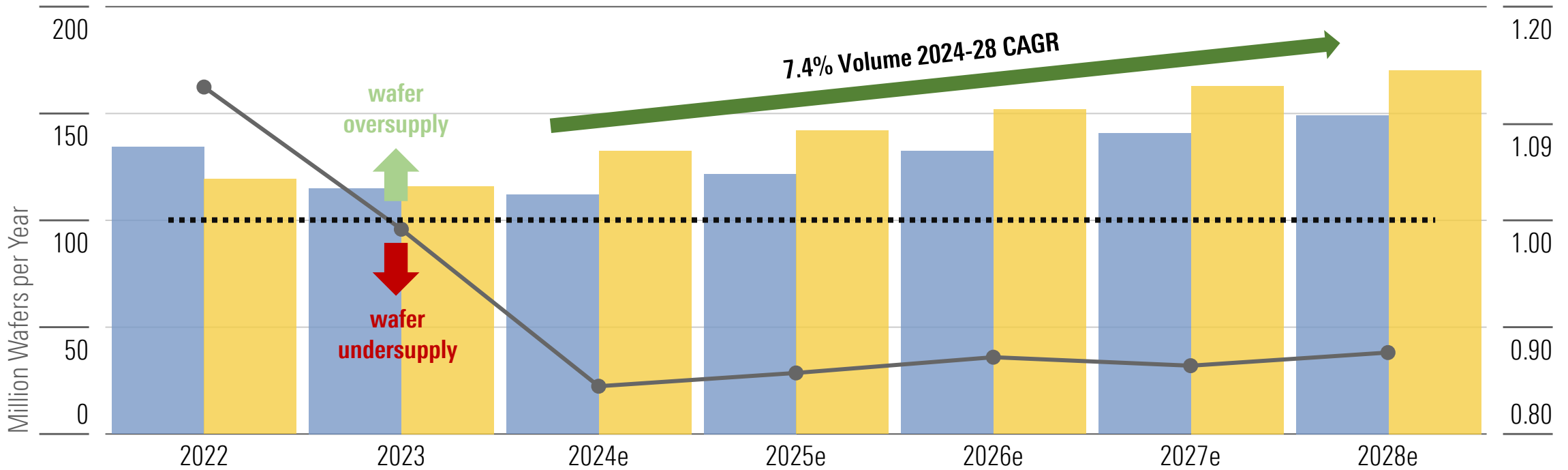
# Silicon Wafer Supply at Low Risk of Structural Glut

We see a low risk of structural oversupply of silicon wafers over the long term. Wafer shipments for 2024 dropped 2.7% year on year, but a mild recovery in automotive and industrial markets has led to 6.5% growth in the second half. On the bright side, we expect wafer shipments to be structurally lower than fabrication facilities in the next five years since wafer producers are disciplined about expansion. Thus, we believe the risks of price erosion will also be modest.

## Semiconductor Fabrication Capacity Outpaces Wafer Shipments for the Next Five Years

Low risk of structural oversupply and price wars.

■ Wafer Shipments ■ Annual Fab Capacity — Shipments/Capacity



Source: SEMI, Gartner. Data as of December 2024.  
Note: Capacity and shipments are quoted in 300 mm (12-inch) equivalent wafers per year.

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# Top Picks and Coverage

Non-Chinese stocks are undervalued.

# We Prefer TSMC and GlobalWafers Among Semiconductor Manufacturers

## Semiconductor Manufacturers Coverage List

Non-Chinese wafer producers and foundries, and Samsung are undervalued.

Company	Ticker	Industry	Market Cap (US\$'b)	Moat Rating	Uncertainty Rating	Trading Currency	Last Close	Fair Value Estimate	Star Rating	P/FVE	2024 P/E	P/B	3M Return	1Y Return
Taiwan Semiconductor Manufacturing Company	NYS:TSM	Semiconductors	792.46	Wide	Medium	USD	177.10	273.00	★★★★★	0.65	25.63	7.04	-7.4%	22.6%
Taiwan Semiconductor Manufacturing Company	TAI:2330	Semiconductors	792.46	Wide	Medium	TWD	1,005.00	1,800.00	★★★★★	0.56	22.24	6.07	-5.3%	30.1%
GlobalFoundries	NAS:GFS	Semiconductors	22.11	None	High	USD	40.00	42.00	★★★★	0.95	25.81	1.92	-9.5%	-23.7%
United Microelectronics Corporation	TAI:2303	Semiconductors	16.86	None	High	TWD	44.15	60.00	★★★★	0.74	11.01	1.51	1.0%	-9.2%
Semiconductor Manufacturing International	HKG:00981	Semiconductors	68.66	None	High	HKD	54.60	14.00	★	3.90	100.38	2.72	102.2%	228.5%
Hua Hong Semiconductor	HKG:01347	Semiconductors	9.46	None	High	HKD	38.00	25.00	★★	1.52	81.51	1.34	81.8%	124.8%
Win Semiconductors	ROC:3105	Semiconductors	1.35	Narrow	High	TWD	105.00	130.00	★★★★	0.81	40.78	1.20	-7.1%	-31.4%
Foundry Market Cap-Weighted Average										0.83	28.66	5.58	3.8%	43.9%
Renesas Electronics	TKS:6723	Semiconductors	29.00	Narrow	High	JPY	2,394.00	3,000.00	★★★★	0.80	12.90	1.74	18.4%	-8.3%
Integrated Device Manufacturer Market Cap-Weighted Average										0.80	12.90	1.74	18.4%	-8.3%
Samsung Electronics	KRX:005930	Consumer Electronics	245.09	Narrow	Medium	KRW	53,700.00	75,000.00	★★★★	0.72	11.13	0.93	0.1%	-24.8%
SK Hynix	KRX:000660	Semiconductors	91.70	None	High	KRW	192,400.00	270,000.00	★★★★	0.71	1.00	1.80	13.7%	13.2%
Micron Technology	NAS:MU	Semiconductors	103.57	None	High	USD	92.96	100.00	★★★	0.93	9.89	2.21	-5.1%	-4.3%
Memory Market Cap-Weighted Average										0.77	8.73	1.41	1.7%	-12.0%
Sumco	TKS:3436	Semiconductor Equipment & Materials	2.66	None	High	JPY	1,127.50	1,760.00	★★★★	0.64	19.51	0.66	-8.1%	-53.6%
Global Wafers	ROC:6488	Semiconductors	5.88	Narrow	High	TWD	404.50	620.00	★★★★	0.65	19.21	2.12	-0.8%	-30.6%
Sino-American Silicon Products	ROC:5483	Semiconductor Equipment & Materials	2.42	Narrow	High	TWD	129.50	255.00	★★★★★	0.51	13.20	1.64	-13.7%	-34.1%
National Silicon Industry Group	SHG:688126	Semiconductor Equipment & Materials	7.79	None	High	CNY	20.56	3.70	★	5.56	(108.21)	4.36	-7.3%	36.5%
Silicon Suppliers Market Cap-Weighted Average										2.67	(34.46)	2.78	-6.2%	-6.4%
Overall Market Cap-Weighted Average										0.84	21.21	4.15	3%	25%

Source: PitchBook. Data as of March 7, 2025.

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# TSMC Is a Primary AI Beneficiary, While GlobalWafers Has a Head Start in the US

## TSMC Is the Dominant Foundry With All-Round AI Exposure

### Taiwan Semiconductor Manufacturing Company (TAI:2330)

	Market Cap	Moat Rating	Last Close	Fair Value Est.	Rating
P/FV	763.31B USD	Wide	TWD 970	TWD 1,800	★★★★★
1.75	<p>TSMC is a primary beneficiary of artificial intelligence as it has dominant share in cutting-edge contract manufacturing. It is immune from shifts between cloud AI and edge AI, and between in-house designs and buying Nvidia's off-the-shelf chips, as all these groups rely on TSMC's supply. We believe TSMC's average selling prices will benefit from higher demand at its latest processes, and volume will benefit from bigger chips to ensure AI features on both servers and devices run smoothly.</p> <p>We think geopolitical concerns are overblown, since TSMC is building new factories in Japan, Germany, and the US. Capital expenditures in overseas plants are higher than in Taiwan, but most of the increment is covered by government subsidies. TSMC received USD 1.5 billion under Chips and Science Act grant in 2024. And TSMC committed another USD 100 billion to build three more plants and a research center in Arizona.</p> <p>Shares are trading at 18 times 2025 P/E, which we view as undervalued given TSMC's dominant position and strong EPS growth in the coming two years.</p>				
1.50					
1.25					
1.00					
0.75					
0.50					
0.25					

## GlobalWafers Is Our Pick for Its Cost Controls and US Monopoly

### GlobalWafers (ROCO:6488)

	Market Cap	Moat Rating	Last Close	Fair Value Est.	Rating
P/FV	5.59B USD	Narrow	TWD 385.50	TWD 620	★★★★
1.75	<p>We view the market has underappreciated GlobalWafers' earnings growth potential as it is a beneficiary from growing silicon wafer demand thanks to expansions globally. The performance of wafer producers' performance lags their customers' performance by about two quarters, as customers stock up only when the market is booming. We expect sentiment to improve as electric vehicles, industrials, and other non-AI applications recover from the second half of 2025.</p> <p>GlobalWafers will open a new 300mm wafer plant in Texas, next to customers like Intel and Texas Instruments. It is the first new 300mm wafer plant in the US and likely the only one that can supply wafers used in cutting-edge processes. This means GlobalWafers will enjoy a four to five-year monopoly even if competitors change their minds and set up plants in the US. The cherry on top is GlobalWafers' upcoming receipt of Chips and Science Act subsidies and Advanced Manufacturing Investment Credit in the US, and EUR 103 million of aid from Italy.</p> <p>Shares are trading at 14 times 2025 P/E, which we think is undervalued as sentiment is near rock bottom, and the company is more successful at managing rising labor and energy costs.</p>				
1.50					
1.25					
1.00					
0.75					
0.50					
0.25					

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