Trends shaping the semiconductor industry in 2025

March 2025



What to expect in this report:

Jan Frederik Slijkerman
Senior Sector Strategist, TMT
jan.frederik.slijkerman@ing.com

Expect robust semiconductor demand in 2025, but not in all segments

In 2025, we expect 9.5% growth in the global semiconductor market, driven by robust demand for data centre services, including AI. However, growth in other, more mature segments is expected to be stagnant. Our forecast is lower than the projections of WSTS and others, but slightly exceeds ASML's long-term growth expectations for the sector

We expect 9.5% growth for the global semiconductor market

The Covid-19 crisis marked an interesting period in the recent history of the semiconductor industry. There was a high demand for electronics products and therefore semiconductors. This demand was initially difficult to meet, leading to a build-up in semiconductor inventory. These challenges were especially prevalent in the automotive sector, where a shortage of semiconductors led to production delays. What followed was a ramp-up in inventory and a subsequent run-off. Indicators, such as the South Korean semiconductor and parts inventory, suggest that inventory levels have normalised. However, leading industry executives have expressed early concerns about a potential slowdown in the mature market semiconductor segment.

We think the market is becoming increasingly bifurcated, with strong growth in AI and data centre-related segments and stalling growth in more traditional segments, like PCs, smartphones and the automotive sector, driven by semiconductor price pressures. Recent Nvidia results were poorly received, and Samsung has also lowered its outlook for AI-driven demand for its products. Despite this, advancements in AI are progressing rapidly, and growth appears strong at present.

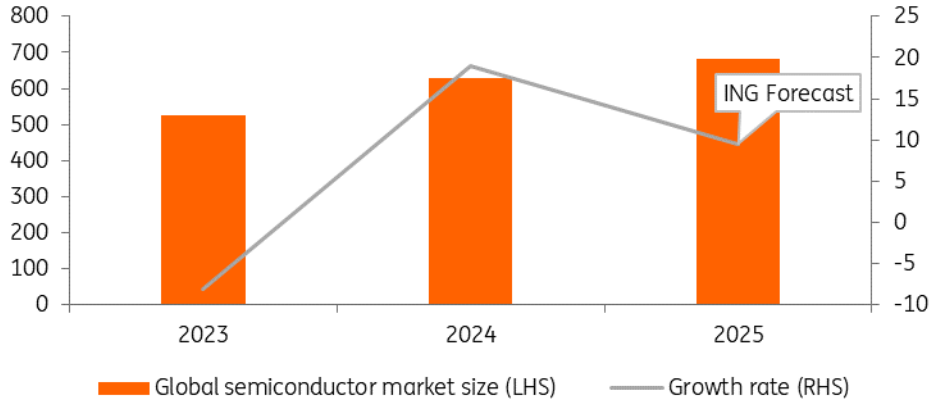
The WSTS (World Semiconductor Trade Statistics), a leading institute, expects global semiconductor market growth of 11.2%. This is below previous forecasts of IDC (15%) and Gartner (12.7%). The WSTS forecasts are driven by 16.8% growth in logic microchips, 13.4% growth in memory microchips and low single-digit growth in mature technology semiconductors.

Considering the weaker-than-expected earnings season and disappointing 1Q25 guidance, along with signs of inventory build-up and price pressure from China, we hold

a more negative outlook on mature technology compared to the WSTS. Additionally, Deepseek demonstrated that advanced AI models can operate with fewer advanced memory chips. Coupled with capacity expansions in the memory segment, this could result in some price pressure. Therefore, we are slightly less optimistic about the growth of the memory market than the WSTS.

Our overall expectation for FY25 semiconductor market growth is therefore 9.5%. This remains slightly above the 9% longer-term industry trend growth rate assumed by ASML. Despite the observation that the sentiment in the sector is turning somewhat negative at the moment, the outlook is still rather good for the global semiconductor sector. Nevertheless, since European manufacturers do not focus on leading-edge technology, the continent may not benefit from sector growth.

ING expects solid semiconductor market growth (US$bn, %)



Source: WSTS, ING

Smartphone sales will not drive the semiconductor industry in 2025

Smartphones no longer seem to be the driver of revenue growth in the semiconductor sector. Recent iPhone upgrades were relatively minor compared to previous generations, with the iPhone 16 showing small improvements on the iPhone 15 and disappointing AI capabilities. Also, as global technology market analyst Canalys recently stated, “vendors are facing a tricky 2025 with mounting complexities”. Therefore, the global smartphone market will not be a driver of semiconductor market growth in 2025. Nevertheless, as the market is increasingly driven by high-end products, Samsung and Apple will likely grow their revenues.

Semiconductor sales for the automotive industry will likely disappoint

There is a strong secular trend towards a higher share of semiconductors in cars, which is accelerating with the increasing adoption of electric vehicles (BEV/PHEV). However, the overall global automotive market outlook for 2025 is modest, with our automotive analyst projecting a 1.6% growth.

The share of electric vehicles in Europe and North America is only slowly rising. Nevertheless, in 2025, the share of electric vehicles will likely approach 50% in China. Therefore, we expect 19% sales growth for electric vehicle sales.

Since the second half of 2024, we have observed an inventory correction across automotive supply chains, which typically takes about a year to stabilise. However, the increasing significance of the Chinese market complicates predictions. While Chinese demand exceeded expectations in the latter half of 2024, there are growing indications of oversupply in China, resulting in lower prices.

Given the low growth in the Western world and indications from recent earnings releases, we hope for stable automotive semiconductor markets in 2025. Nevertheless, the automotive semiconductor market is notoriously difficult to predict.

Semiconductor sales for AI and server applications continues to rise

The trend of hyperscale data centres spending more on semiconductors is continuing. According to Gartner, hyperscale data centres spent US$112bn on semiconductors in 2024, almost double the amount the year before. Strong growth is expected to continue.

AMD reported FY24 AI chip revenue of more than US$5.0bn and expects AI-driven sales to be in the "strong double digits" in 2025. AMD expects "tens of billions" of dollars in sales from AI chips in the next couple of years. Nvidia is also confident it can grow sales, especially because of the ramp of its next-generation AI chip (Blackwell).

TSMC expects "the revenue growth from AI accelerators to approach a mid-40% CAGR for the five-year period". This is above its overall long-term revenue growth expectation which should approach a 20% CAGR in US dollar terms for the five years starting from 2024.

We also expect a drive by data centre operators to develop their own microchips and therefore expect the rise of Application Specific Integrated Circuits (ASICs). Large hyperscale operators look for the most cost-efficient computing power because of the need for cheap AI model inference and some training applications. This can be achieved through tailored ASICs. Companies such as Broadcom and Marvel will help to design the semiconductors, while TSMC will produce them. Over time, these products are expected to take market share from AMD and Intel.

In 2025, we continue to see the technological advancement of leading-edge memory chips and solid demand for high-bandwidth memory. As Deepseek showed, there is some downside risk to this expectation as data centres may invest a bit less in high-bandwidth memory chips and a bit more on advanced compute chips. However, as data centre investments grow, the future demand for advanced node logic semiconductors looks promising.

TSMC pledges $100bn in US investment as governments push for semiconductor influence

The Trump administration's announcement that TSMC will invest US$100bn in US semiconductor manufacturing without subsidies is a policy win. We expect governments across the globe to work to attract semiconductor manufacturing capabilities to reduce geopolitical risks. The implementation of trade tariffs would weaken our outlook for the industry

TSMC's announcement of US investment is a policy win

We're expecting solid growth for the semiconductor industry in 2025 as governments across the world work to shift semiconductor manufacturing capacity closer to home. Taiwan Semiconductor Manufacturing Company's announcement to expand its US-based manufacturing capacity could be seen as a successful attempt by the Trump administration to achieve this. Nevertheless, the inefficiencies created by potential barriers to trade, such as tariffs, will likely increase the cost for local manufacturers in the US who buy semiconductors as a semi-finished good, since the US has no specialised manufacturing capacity for all products. Moreover, ASML estimates that geopolitically-driven inefficiencies will add 5-8% extra demand on top of its normal equipment demand.

A trade war could disrupt our outlook and reduce the scope for revenue growth across the industry. Both NXP and Infineon discussed this risk with their recent earnings releases. These companies are particularly exposed to global trade given their sales to the automotive industry. Also, China already announced curbs on the export of materials used for semiconductor manufacturing, although the restrictions have been mild, so far. Nevertheless, the threat of an American import tariff for semiconductors could provide a strong incentive for local US production, while restrictions on the sales of semiconductor manufacturing equipment to China will restrain its ability to produce advanced semiconductors.

Policymakers help shape the industry in 2025

We still deem the outlook for the semiconductor sector to be relatively solid. However, trade tariffs could weaken this outlook.

Trump administration works to remove Chips Act subsidies

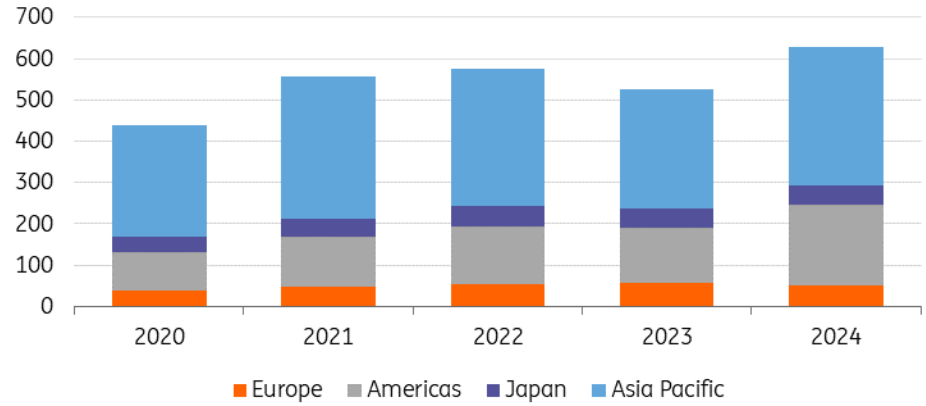
On Tuesday, US President Donald Trump announced his disapproval of the Chips Act and his intent to remove it. We agree that the global semiconductor manufacturing sector probably works optimally without subsidies – but also without tariffs. Nevertheless, we think the risk of import tariffs has contributed to TSMC's recent decision to invest US$100bn in chip fabrication plants in Arizona. This announcement, which follows a $65bn commitment by TSMC under the Biden administration, is a success for Trump and comes at a time when the Americas are already growing their share of semiconductor manufacturing, as can be seen in the graph below.

Our view is that semiconductor manufacturing in the Asia-Pacific region benefits from comparative advantages, such as scale, more favourable labour costs and an ecosystem that includes most stages of the supply chain. Subsidies are a way to help close a technological gap and contribute to the local production of important semi-finished goods, such as semiconductors. Geopolitical risks could therefore validate subsidies that aim to bring semiconductor manufacturing capabilities closer to customers.

The challenge with tariffs is that higher import costs for semiconductors will likely increase the cost of products and ultimately have an upward effect on consumer prices. This risk is reduced when there is sufficient local production capacity. The threat of tariffs could therefore be used as an instrument to incentivise foundries to start local production.

One-off subsidies could also have been an effective way to improve the US ecosystem and competitiveness. Many announced investments in American foundry capacity were dependent on Chips Act subsidies, and it's now uncertain whether all plans will be executed as the government looks to modify the terms of the subsidies. Moreover, we think the way policy measures are implemented in the US contributes to economic uncertainty, while tariffs aren't likely to be in the best interest of consumers.

More semiconductors being manufactured in the Americas (US$bn)



Source: WSTS

Competition regulators will have their say

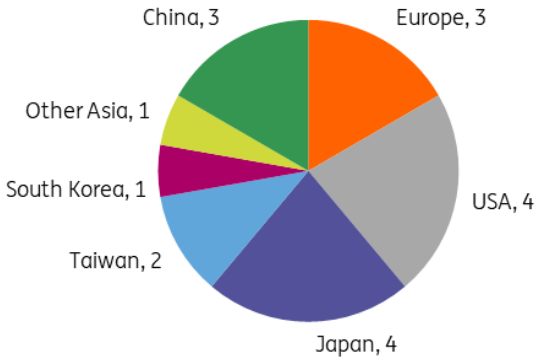
Given the political landscape and a tough regulatory environment, the scope for consolidation is challenging. This was illustrated by previous efforts from Intel to acquire Tower Company, which China did not want to happen. The acquisition of ARM by Nvidia was also blocked on competition grounds – a relevant topic in light of discussions about Intel. Now that its foundry business has been set apart, we're seeing media reports

frequently speculating about a potential carve-out. Nevertheless, for Intel, the key driver remains the successful implementation of advanced production technologies.

Subsidies remain an important driver outside the US

Meanwhile, TSMC makes substantial investments in 2nm technology and expects that this better technology will drive demand for new products. Because China cannot produce this technology due to sanctions and capabilities, it wants to grow in the mature technology market segments, driven by the objective of strategic autonomy. Across the globe, many expansion plans have made use of available subsidies. With subsidies in place under the Biden administration, expansion plans have been announced in the US, but also in Europe. Another example is Malaysia, where efforts are being undertaken to promote the local production of semiconductors through cooperation with ARM. According to SEMI, new capacity was added in most regions, with 18 new fabrication plants under construction in 2025.

Construction of many new semiconductor fabs has been announced for 2025



Source: SEMI World Fab Forecast 4Q24 update

Why the importance of China as a semiconductor manufacturer is growing

In 2024, ASML sold a lot of semiconductor manufacturing equipment to China in an effort to ramp up its domestic semiconductor manufacturing capabilities. This was part of a longer-term plan to be less dependent on semiconductor imports, for which the government also took the initiative to set up a fund to foster semiconductor innovation and production. As the Chinese market is an important global market for smartphones but also for electric vehicles, Western companies ideally maintain solid market shares there as well. This is why some Western semiconductor companies are looking to increase their Chinese production facilities. Nvidia also wants to continue operating in China to remain relevant in that market, according to the WSJ.

Current production in China is centred around mature technologies used in local production. However, many analysts were surprised by the quality of the Huawei Mate 60s series smartphone, launched in 2024, because it incorporated advanced semiconductor manufacturing technology as it was based on 7nm technology. In 2025, it will likely launch its new Mate 70s series smartphone, and we'll see what further progress Chinese companies have made on the production front.

Recently, the Financial Times reported that Huawei has reached a 40% production yield for its advanced Ascend 910C server processor based on 7nm technology. This implies that SMIC is improving its production yields. Nevertheless, companies like TSMC reach 80% or even 90% yields although the yield is lower for relatively large dies, such as an estimated 60% for the Nvidia H100, according to the newspaper. A low yield implies that costs are high because there is a lot of waste. Besides the remaining yield challenge, it

will also be nearly impossible to build more advanced semiconductors without EUV lithography machines. There are export control regulations in place for these machines.

Europe faces tough competition

Given the dominance of the nations leading in semiconductor manufacturing, Europe's ambition to secure 20% of global production capacity faces significant challenges. We think it'll be a challenge for Europe to increase its share beyond the current 8% by 2030. However, without the EU Chips Act, this share could decrease significantly. Therefore, to maintain Europe's competitiveness by securing steady access to advanced microchips for industries like automotive and telecommunications, Europe needs to continue its work to become a more attractive production location for semiconductors. While full independence from other regions is unattainable due to the semiconductor market's reliance on efficient global supply chains, we still argue that Europe must strive to attract cutting-edge manufacturing capabilities. Yet, without support from TSMC or the now-delayed assistance from Intel, achieving this goal will be nearly impossible.

Three semiconductor innovations to watch in 2025

As the semiconductor industry moves to smaller scales, it must overcome several technical challenges. In 2025, we expect three key developments to make headlines: Gate-All-Around transistor designs, Backside Power Delivery, and an increased focus on semiconductor assembly and packaging

What will make headlines in 2025

To achieve smaller semiconductor structures, improved transistor designs are essential. Leading-edge fabs have been working on new transistor designs, known as Gate-All-Around (GAA), for some time. We expect these designs to enter production in 2025 at TSMC and possibly Intel. TSMC's GAA pilot lines are already operational, while Samsung has been producing GAA transistors since the previous generation.

Another interesting development is backside power delivery, which revolutionises semiconductor design through a new power delivery network. By decoupling the power delivery network from the signal network, semiconductors can benefit from improvements, such as reduced heat. Intel is incorporating this technology into its latest manufacturing process, though it's uncertain if it will enter production this year.

We also expect to see a growing importance of the semiconductor supply chain back-end (assembly and testing). TSMC is advancing its assembly and packaging solutions, transitioning from CoWoS-S to CoWoS-L technology. This technology allows semiconductor manufacturers to create larger semiconductors by connecting multiple discrete elements within a chip.

What about Intel?

Intel is currently working on its 18A node semiconductor manufacturing process, which incorporates backside power delivery and the new GAA transistor design. The company needs to develop this technology to remain in the race with TSMC as the leading semiconductor manufacturer.

Intel recently announced that its 18A process is ready for customer projects and expects to start production in 2H25. Nevertheless, the big uncertainty remains the ability to achieve good production yields. Intel's showcase product, the Clearwater Forest data centre CPU, which is based on the 18A process, is now expected in 1H26, pointing at a delayed introduction of the 18A manufacturing process.

What is happening at TSMC?

TSMC offers leading manufacturing capabilities to its customers. Customers such as Nvidia and Apple are willing to pay a premium for these leading semiconductors as they need these to sell superior, high-margin products to their consumers. TSMC benefits from its scale to optimise its production process but can also gain process technology before the competition does, thereby increasing its yields.

If TSMC solidifies its position as a technological leader, it can invest its profits into new technologies, advancing its leadership position further, while others may struggle in segments that are less profitable. If Intel does not close the gap now, it risks remaining behind for a considerable time.

Key 2025 semiconductor developments to watch out for

- Gate All Around transistor design
- Backside power delivery
- Growing importance of Assembly and Packaging solutions

The importance of the Windows/Intel combination may slowly fade

For decades, the combination of Microsoft Windows and the x86 processor architecture dominated computing in the PC era. However, the rise of smartphones has shifted this landscape. Modern smartphones typically use CPUs based on ARM designs and run on Android or iOS operating systems. Microsoft's efforts to support ARM-based hardware could be a game-changer for traditional x86 microprocessor developers, especially as Apple has found success with its ARM-based laptops.

NVIDIA is also developing a home server based on ARM-based processor architectures. Intel and AMD aim to fend off this threat with a new x86 alliance and new, more efficient processor designs. However, as ARM is developing its capabilities to design data centre servers, the traditional x86 server stronghold also comes under pressure.

Besides the dominance of the ARM and x86 architectures, the arrival of Nvidia compute engines also comes with a new software standard, the Cuda programming language for computing applications. Developed by Nvidia, this toolkit facilitates the programming of AI models. We anticipate that Cuda will continue to be widely used in 2025, while the prominence of the x86 architecture will further decline.

Key developments taking place in the Benelux in 2025

We also expect some exciting developments in the Benelux. First, we anticipate more news about the volume production of ASML's High NA EUV machines. Recently, Intel announced that it has already produced 30k wafers using High NA EUV, which is a positive step towards potential volume production in 2026. This will also be done with the help of research Institute IMEC in Belgium, which contributes to the development of key building blocks for this technology, such as mask technology, UV resist and metrology. We also expect to hear more about IMEC's investments into start-ups and scale-ups using funds from imec.istart and imec.xpand.

From Nearfield Instruments, we think we'll hear more about its expansion plans following a strong 2025 order book. The company may report additional orders for its advanced metrology system.

We are also keen to hear what progress Besi makes with orders for its advanced hybrid bonding technology, given the AI-driven investments in advanced semiconductors.

ASM should benefit from a higher demand for its atomic layer deposition techniques as the industry moves to 3D memory and smaller node sizes. With a recently obtained €1bn loan from the EIB, NXP will fund research into next-generation semiconductors for the automotive sector and other applications. In Belgium, Melexis is working on innovative sensors for robotics applications. Finally, we expect that SMART Photonics and EFFECT Photonics will announce further steps in 2025 towards volume manufacturing.

Disclaimer