



SEMICONDUCTOR RESEARCH REPORT

**FINANCE AND INVESTMENT CELL
SHRI RAM COLLEGE OF COMMERCE**

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EXECUTIVE SUMMARY

Never before has the semiconductor industry been as geopolitically significant and financially compelling as it is today. As the global economy undergoes accelerated digitisation—driven by advances in artificial intelligence, cloud infrastructure, electric vehicles, and the Internet of Things—semiconductors have moved from a supporting role in computing systems to the forefront of national security strategy, global industrial policy, and long-term investment planning.

This industry report aims to provide a strategic and global perspective on the semiconductor ecosystem and goes above and beyond just the core technology itself. It also analyses prospective long-term investment opportunities, which may be a function of the structural inefficiencies, supply chain realignments, and sustained demand across key sectors. The report explores the semiconductor value chain from chip design and foundry operations to testing, equipment, and advanced packaging while also looking at the financial metrics of industry leaders such as Nvidia, TSMC, and ARM. It highlights key growth drivers that provide tailwinds to the industry, including generative AI, the increasing semiconductor content in automotive platforms, and the proliferation of edge computing. For example, AI alone is projected to contribute over \$125 billion in revenue in 2024, or nearly 20% of total semiconductor sales, with continued expansion expected through the decade.

At the same time, the report contextualises the key risks that investors must consider.

These include the industry's heavy reliance on Taiwan for advanced manufacturing, escalating U.S.–China political tensions, and potential disruptions in global supply chains. Through scenario-based modelling—such as the ramifications of a Taiwan Strait conflict—the report provides a probability-weighted forecast of global semiconductor revenues through 2030, highlighting factors such as geopolitics that shape the industry.

Despite the impending setbacks, the overarching long-term outlook for the industry remains interesting. Semiconductor revenues are projected to surpass \$1 trillion by 2030, with investor interest growing in parallel. The combined market capitalisation of the top 10 semiconductor companies reached \$6.5 trillion by the end of 2024, nearly doubling year-over-year, with AI-focused firms driving much of this momentum. These forecasts depend on various factors, including sustained innovation by incumbents, capital expenditure by foundries, public policy support by the government, and strategic positioning by the sector as a whole.

This report aims to provide investors with the insights and analytical frameworks needed to evaluate one of the most dynamic and consequential industries at present.

INTRODUCTION

The semiconductor industry is the backbone of the digital economy. It's in every device, from smartphones and computers to cars. Semiconductors enable integrated circuits and microchips, both indispensable to

modern technology and economic productivity.

Geopolitical and economic shifts, notably the supply chain disruptions, have profoundly influenced the semiconductor industry. This report looks at the demand-side factors, key drivers, supply chain dynamics, geopolitical influences, and other aspects in the semiconductor industry. It also includes financial analysis of some of the major companies in the space.

The goal is to provide a comprehensive view of the semiconductor industry and help investors make informed decisions. This includes whether the semiconductor industry is investable now and which companies to invest in. Also, the report will identify the emerging trends and potential risks that will shape the industry’s future.

History and Evolution of the Semiconductor Industry



Fig 1 represents the historic evolution of the semiconductor industry over the last 2 decades. As time passes, the transistor sizes have been reducing at a fast pace. This is in accordance with Moore’s Law - a prediction that the number of transistors on a chip would double every two years—which drove exponential improvement in

computing power and cost.

The semiconductor industry has come a long way since its inception in the mid 20th century. The first practical semiconductor device—the transistor—was invented in 1947 at Bell Labs. This was the start of the microelectronics revolution that led to the development of integrated circuits (ICs) in the 1950s and microprocessors in the 1970s. These were the foundation of the modern digital economy. In the decades that followed Moore’s Law— The US led the industry, with around **37% of global semiconductor manufacturing capacity in 1990.**

But as globalization intensified many companies started to offshore production to reduce costs. Countries like **Taiwan, South Korea and China** invested in chip manufacturing capabilities and the global market share shifted dramatically. By the 2020s Taiwan produced over 60% of the world’s semiconductors and more than 90% of advanced chips, while the US share declined to just **12%.** This concentration created new risks. Global supply chain disruptions—especially during the COVID-19 pandemic—and rising geopolitical tensions, particularly between the US and China, exposed the threats of semiconductor over-dependence. Consequently, the US government passed the CHIPS and Science Act of 2022, allocating **\$52.7 billion for semiconductor manufacturing and R&D incentives** to regain domestic capabilities and ensure national security.

Today, the semiconductor industry is at the intersection of technology, geopolitics, and economic policy, with countries recognizing chips as key to technological leadership and

and economic resilience.

Segments of the industry

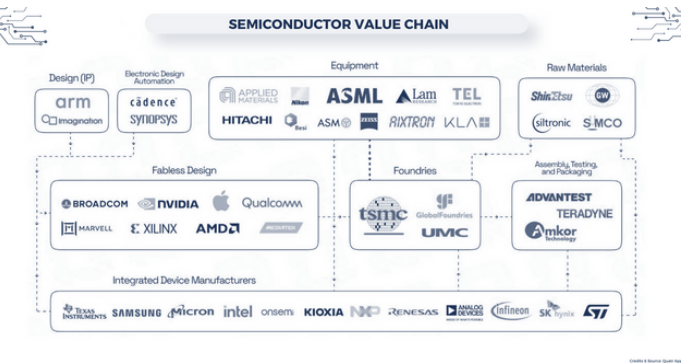


Figure 2 depicts the various stages involved in semiconductor production and the major companies operating in those segments. The semiconductor industry is divided into four segments—design, manufacturing, assembly and testing, and integrated device manufacturing (IDM)—each playing a different role in the value chain.

The **design** segment includes companies that only focus on creating the architecture and functionality of semiconductor chips. These companies, often called *fabless*, do not manufacture physical chips. Instead, they invest heavily in R&D to innovate and develop chip layouts and intellectual property, and hand it over to external foundries for manufacturing. This model allows them to stay agile and innovative without the huge cost of running fab facilities.

The **manufacturing** segment includes companies that operate semiconductor fabrication plants, or *fabs*, where the physical chips are produced. These companies, also called *pure-play foundries*, specialize in translating chip designs into

actual silicon components using advanced process nodes and highly sophisticated technology. Manufacturing is the most capital-intensive part of the industry, requiring massive investments in infrastructure, clean rooms, and cutting-edge lithography tools.

Once chips are fabricated, they move to the **assembly and testing** stage. Here, the delicate silicon wafers are diced, packaged, and tested to ensure they work as intended. This segment is critical to protect chips from damage, enable heat dissipation, and ensure performance and reliability. This is often outsourced to dedicated providers who can handle large volumes efficiently and cost-effectively. Unlike this segmented model, Integrated Device Manufacturers (IDMs) integrate chip-making under one roof—design, manufacturing, and often assembly and testing. This vertical integration gives IDMs more control over quality, customization, and supply chain resilience. However, it requires huge capital investment and operational expertise across multiple disciplines. IDMs like Intel and Samsung use this model to drive end-to-end innovation and deliver highly optimized semiconductor products.

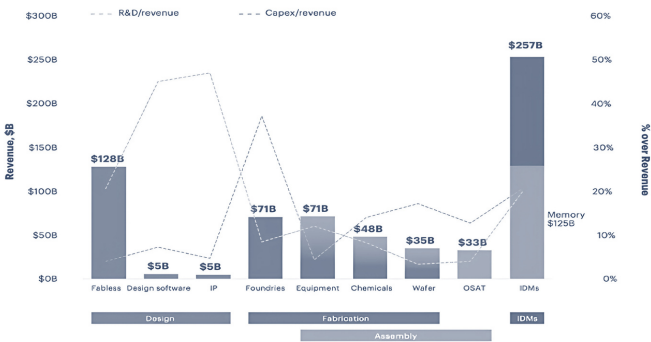


Figure 3 depicts Revenue, R&D, and Capex

trends in these segments. Together, these segments form a highly collaborative and interdependent global ecosystem contributing to the rapid advancement and scalability of modern semiconductor technology.

OVERVIEW

Semiconductors have driven technological progress for more than 70 years, sparking a fundamental transformation of many industries worldwide. Semiconductor innovations have shaped the development of critical applications globally, including smartphones/personal computers and data centers/cloud computing. Megatrends—including electrification, digitization, and increasing use of technologies like artificial intelligence (AI) and Internet of Things (IoT)—are expected to shape the future direction of the semiconductor industry. With annual worldwide revenue projected at \$642 billion in 2024 and \$1 trillion at the close of the decade, we expect sustained long-term growth.

Global semiconductor market by component type, 2020–2030 (\$bn)

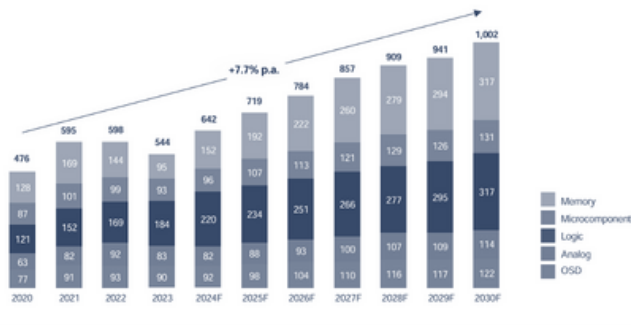


Figure 4 shows the expected rise in the semiconductor market by component type, where logic and memory chips are expected to grow faster than others.

Logic chips, which process binary data, like 0s and 1s, include microcontrollers, connectivity chips (eg, modems, Wi-Fi or Bluetooth chips), and microprocessors (like central and graphics processing units, including for artificial intelligence applications).

Memory chips that store data, like flash memory and Dynamic Random-Access Memory chips.

“Discrete, Analog and Others” (DAO) chips deal with non-binary data, typically continuous variables (e.g., diodes, transistors, voltage regulators, radio frequency chips, optical sensors).

The global chip industry has been extremely cyclical, flipping up and down over the past 34 years

Global semiconductor industry—historic billings monthly

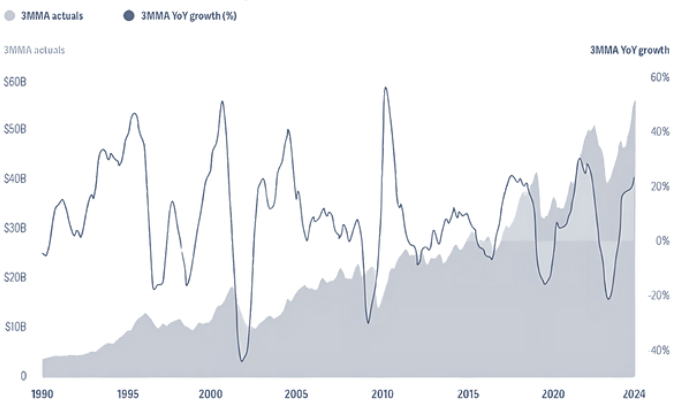


Figure 5 shows the cyclicity of the semiconductor industry. The semiconductor industry has been cyclical, experiencing many boom and bust cycles in history. Key drivers of this cyclicity include the long lead times in production, high needs for capital, fast-paced innovation, and changing demand. During upcycles, we expect demand to ramp very hard for industries such as these (smartphone, PC, automobile, similar verticals) as we have seen in the last two years in the cloud and AI infrastructure.

But, as the 2022–2023 downturn made clear, deferred capacity expansions often lead to supply gluts, inventory buildups, price cuts, and revenue pressure.

While diversification into the automotive, industrial IoT, and AI industries has decreased volatility somewhat, the industry is still subject to general business cycles, capital spending patterns, and consumer sentiment. There are also different sub-cycle patterns between chip segments; memory chips are generally more volatile, while mature-node and analog chips are stable.

Despite the generative AI boom, which underpins current growth and projections and shows strong momentum through 2025, threats such as geopolitical disruption, macroeconomic slowdown, and overcapacity remain. Ultimately, the cyclicity of the semiconductor industry remains an enduring feature, where industry players would be wise to expect losses and make calculated investments during market troughs.

DEMAND SIDE GROWTH DRIVERS

Introduction

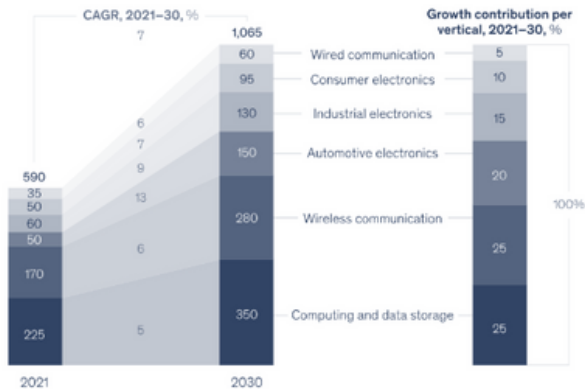
The global demand profile for semiconductors is undergoing a profound transformation. Figure 6 depicts the use cases of semiconductors and their key demand drivers. While the industry has historically been anchored in consumer electronics and communication infrastructure, a new wave of applications—anchored in artificial intelligence, cloud computing, automotive electrification, industrial IoT, and edge AI—is reshaping the market landscape. The total market opportunity is expanding due to these ongoing trends, which are also causing semiconductor applications to diversify more rapidly across different industries. As companies and governments alike scale digital capabilities, the demand for increasingly sophisticated, high-performance chips increases. This section examines how each of these verticals—AI, cloud infrastructure, personal computing, smartphones, automotive, IoT, and memory—contributes to the sector’s accelerating momentum, while outlining the emerging structural challenges and opportunities shaping prospects for growth.

2023 DEMAND BY END USE

End-Use Category						
	Communication	Computer	Automotive	Consumer	Industrial	Government
Annual Growth	-1.8	-7.1	15.0	-31.9	-13.3	-45.0
Total Value (\$B)	169.2	140.0	90.1	54.8	72.1	5.0

The overall growth in the global semiconductor market is driven by the automotive, data storage, and wireless industries.

Global semiconductor market value by vertical, indicative, \$ billion



Growth Drivers

Figure 7 shows the estimated growth rates of various segments, including Computing, Communications, Consumer electronics, Automotives, and Industrial electronics, and how they will drive the demand in the semiconductor industry. The semiconductor industry is in a growth spurt driven by AI, cloud, automotive electrification, industrial IoT, and edge computing. In 2024, the industry grew 19% to \$627B, beating expectations and setting the stage for more. The global semiconductor market is expected to be \$697B in 2025 and reach \$1T by 2030 at a 7.5% CAGR. Long-term forecasts are even more aggressive with \$1.14T by 2033 and \$2T by 2040. Investor sentiment has surged with the combined market cap of the top 10 semiconductor companies reaching \$6.5T by Dec 2024, up 93% YoY. Companies tied to gen AI have outperformed the most, showing how AI drives valuation.

Gen AI is the biggest driver of semiconductor demand. Deloitte originally projected gen AI chip sales to be \$50B in 2024, but actuals were \$125B, 20% of total semiconductor revenue. This is expected to be \$150B in 2025, and AMD's CEO estimates the AI accelerator chip market alone could be \$500B by 2028. Hyperscalers like AWS, Microsoft Azure, and Google Cloud are aggressively expanding AI supercomputing and enterprise edge deployments that will drive tens of billions of dollars of incremental semiconductor demand by 2025. But despite revenue growth, structural challenges remain: Gen AI chips are less than 0.2% of total wafer volume, and global silicon wafer shipments were down 2.4% in 2024.

Encouragingly, wafer shipments are expected to rebound 10% in 2025, driven by chiplets and advanced packaging like TSMC's CoWoS, whose production capacity will double between 2024 and 2025. Beyond cloud and AI, traditional markets like PCs and smartphones are stabilizing. PC shipments are expected to grow 4% in 2025 to 273M units, with 50% of PCs having AI NPUs. Smartphones are expected to grow 6.2% YoY to 1.24B units, with 30% having onboard AI. But the incremental silicon per smartphone is modest, under \$1, and AI-driven shorter replacement cycles could reignite growth. In automotive, semiconductors are becoming essential. Automotive chips are expected to grow at a 10% CAGR through 2030, with EVs and SDVs driving the shift. BEV penetration is expected to rise from 13.3% in 2024 to 42.5% by 2030, and semiconductor content per vehicle could triple from \$420 in 2019 to \$1,350 by 2030.

Meanwhile, IoT and edge AI are a massive long-term opportunity. McKinsey expects tens of billions of connected IoT devices by the end of the decade, but achieving mass AI penetration will require a dramatic drop in chip cost to \$0.30 per unit. Finally, the memory and storage segment is experiencing its AI-driven renaissance. HBM demand is surging, driven by AI model requirements, while DDR6 upgrades and storage class memory are about to accelerate. Traditional memory markets are cyclical, but hyperscaler-driven AI infrastructure builds are shifting memory demand to high-performance premium products, positioning memory suppliers for strong growth. The application landscape of the semiconductor industry is changing dramatically, with computing expected to

overtake communications as the largest end market from 2024 onward, growing at 9% CAGR through 2030. This is driven largely by accelerating AI adoption as industries require advanced semiconductor solutions to manage machine learning, neural networks, and intensive data analytics workloads. A key trend supporting this growth is the move towards custom integrated circuits (ICs) with companies like Apple developing proprietary chips to deliver specialized performance, energy efficiency, and security. Meanwhile, the automotive sector is expected to be the fastest growing semiconductor application with 10% CAGR through 2030. The electrification of vehicles is a major driver, with global BEV penetration expected to rise from 13.3% in 2024 to 42.5% by 2030. BEVs require more than twice the semiconductor content of traditional vehicles, and the rise of software-defined vehicles (SDVs), autonomous driving, and connected comfort features amplifies this trend. Semiconductor content per vehicle has already doubled from \$420 in 2019 to \$800 in 2023 and is expected to reach \$1,350 by 2030, further underscoring the automotive sector’s role in reshaping demand dynamics across semiconductor applications.

R&D

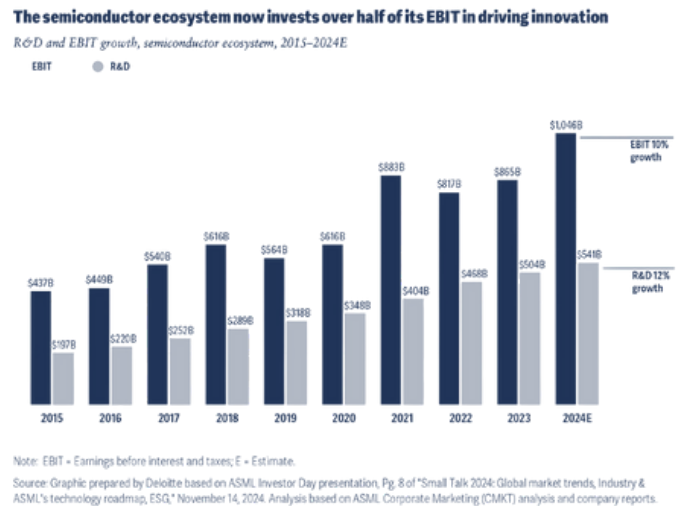


Figure 8 shows the reinvestment trend prevalent in the industry over the last decade. The industry’s innovation engine is accelerating, but not without increasing costs. Semiconductor companies have increased their focus on Research and Development. In 2015, R&D spending was about 45% of earnings before interest and taxes (EBIT). By 2024, that figure was around 52%. R&D is ramped up at 12% per annum, whereas the bottom line has demonstrated only a 10% growth. This indicates that to stay competitive, companies need to invest more and faster in new technologies, even at the risk of margin compression.

In summary, the semiconductor industry is experiencing a powerful renaissance driven by AI, where Gen AI chips are of paramount importance. While end markets like PCs and smartphones are recovering modestly, the real momentum comes from AI infrastructure. At the same time, the industry faces challenges around wafer utilization, supply chain capacity, and rising R&D costs. Companies that can innovate faster, optimize advanced manufacturing, and capture the AI-driven opportunities will lead the sector into its next multi-trillion-dollar era.

SUPPLY SIDE ANALYSIS

Introduction

Historically, the United States had dominated early design and manufacturing after the invention of the integrated circuit; however, since the 1980s, wafer fabrication has rapidly shifted to East Asia, where

South Korea emerged as a memory leader and Taiwan ruled the pure-play foundry business. The present-day semiconductor industry is a wide variety of specialized chips for processing, storing, sensing, communicating, and managing power, with various types usually manufactured by different companies using specialized processes. Global semiconductor revenues doubled to \$602 billion between 2012 and 2022, indicating the industry's role as a key enabler of pervasive digitization. Semiconductors will remain at the heart of consumer technologies and next-generation innovation in AI and defense in the future. However, the industry's highly interdependent, globally connected supply chain is under mounting pressure from geopolitical tensions, regulatory disruption, labor shortages, and rising costs. As a result, supply chain diversification, resilience investment, and regionalization efforts are becoming increasingly important, with governments actively promoting nearshored and domestic production to reduce strategic risks.

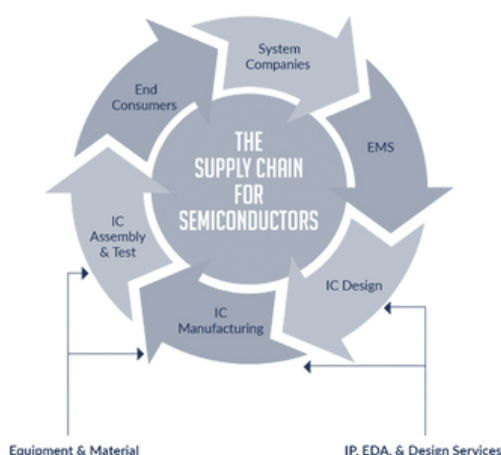


Figure 9 shows the various entities involved in semiconductor production. The semiconductor supply chain is intricate, involving system companies, EMS providers, IC design houses, IC makers, assembly and test facilities, and end consumers — all

connected through compliance principles, risk management, auditing, and continuous improvement. Supporting these supply-side arrangements will be vital to ensuring the future growth and stability of the industry.

The semiconductor industry is an integrated worldwide network of highly specialized parts with individual functions:

Semiconductor Design: They include IC design houses (e.g. Qualcomm, Nvidia, AMD) and Integrated Device Manufacturers (IDMs, e.g. Intel, Onsemi). IC design houses specialize in chip designs, and IDMs design and manufacture within their firms. Such firms, which sell Electronic Design Automation (EDA) tools like Siemens, Cadence, and Synopsys, are important in designing high-end chips.

Semiconductor Manufacturing: Foundries (e.g., TSMC, Samsung, GlobalFoundries) focus on producing chips, with TSMC the most advanced company in advanced node manufacturing. Fabs, the highly specialized plants where chips are made, are costly, particularly for advanced nodes (<5nm).

Testing and Packaging: Post-production, chips are tested for defects and functionality in test and assembly houses (e.g., Amkor Technologies). New packaging technologies like flip-chip and system-in-package technology enhance chip size and performance.

Equipment and Material Providers: Businesses such as ASML (lithography machines) and KLA (equipment used in process control) provide the necessary equipment. Raw material providers such as Resonac (photoresists) and Sumco (wafers)

provide the required materials. Service providers keep equipment in operating condition and repair environmental issues.

Consumer-Facing Companies: Some consumer tech companies like Apple, Tesla, and Google create their proprietary chips (e.g., Apple M-series, Tesla AI chips) to optimize performance, reduce dependency on third-party vendors, and enhance their product capabilities.

Logistics Support: The logistics providers (e.g., Airspace Technologies) are relied upon by the supply chain of semiconductors for the fast, secure transport of sensitive material. Effective logistics addresses the challenges of global transport, geopolitical risks, and regulatory compliance.

Strategic Insights: The U.S. dominates chip design but depends on East Asia for high-end chips. Taiwan has the lead in leading-edge manufacturing, and South Korea has the lead in memory chip production. Japan is critical in the supply chain, and Europe adds through semiconductor equipment.

Abundant such skills in certain sectors creates vulnerabilities, making diversification activities like the U.S. CHIPS Act necessary. Future growth in the sector is driven by emerging technologies like AI, self-driving cars, quantum computers, and IoT, all of which require more sophisticated semiconductors.

Manufacturing

A semiconductor foundry, commonly called a "foundry," is a fabrication plant under contract to produce integrated circuits (ICs) or microchips. In contrast to the Integrated Device Manufacturers (IDMs), who

both design and manufacture their chips, foundries do only manufacturing. Whereas foundries provide manufacturing services essential to businesses, most prominently fabless semiconductor businesses make chips but lack the resources or funds to have full-scale manufacturing facilities.

Foundries usually work on a contract basis, manufacturing chips to the precise specifications and designs of their customers. Such labor specialization has become a standard of the worldwide semiconductor supply chain, allowing for easier achievement of more innovation, efficiency, and specialization in the industry.

Foundry Manufacturing Process

The operations of foundry production are a highly developed sequence of tightly controlled procedures:

Wafer Fabrication: It starts with the fabrication of a silicon wafer, which is the base upon which integrated circuits are fabricated.

Photolithography and Etching: High-technology photolithography methods are used to image precise circuit patterns onto the surface of the wafer. Etching processes then remove material to form the precise structures that comprise the chip's electronic circuits.

Deposition and Doping: Deposition of various insulating or conducting materials and doping, in which parts of the wafer are exposed to impurities to alter their electrical properties, follow these operations.

Thermal Treatments and Metallization: Thermal treatments are used to stabilize

material properties, and metallization layers are deposited to interconnect the chip components.

Dicing and Testing: Finally, the wafer is diced into individual chips, and each one of them is tested rigorously to ensure functionality and performance requirements.

Foundries

A handful of majors control the foundry business globally, each with unique abilities:

Taiwan Semiconductor Manufacturing Company (TSMC): TSMC, headquartered in Taiwan, is the largest and most advanced pure-play foundry in the world. It is a global leader in leading-edge technologies such as 5nm and 3nm process nodes, used for high-performance computing, AI acceleration, and 5G applications. Apple, Nvidia, AMD, and Qualcomm are among its customers.

Samsung Foundry: Samsung Foundry is a South Korean subsidiary of Samsung Electronics and a market leader in the advanced node segment (specifically 3nm and below) with consumer electronics and data center manufacturing services.

GlobalFoundries: US-headquartered GlobalFoundries specializes in mature and niche technologies like RF, automotive, and industrial chips instead of competing at the bleeding edge. It is of critical importance to diversified supply chain reliability, particularly for North America and Europe.

United Microelectronics Corporation (UMC): Another Taiwanese foundry, UMC specializes in mature nodes (e.g., 28nm, 40nm) for IoT, automotive, and low-power computing applications.

SMIC (Semiconductor Manufacturing International Corporation): Being the leading foundry in China, SMIC is heavily investing to scale up its manufacturing capacity even in the case of export controls. It has a vast local and regional customer base.

Market Outlook

The semiconductor foundry industry was worth USD 127.79 billion in the previous year and is expected to reach a CAGR of 7.67% to reach around USD 184.94 billion in the next five years. Major technology trends like Artificial Intelligence (AI), Internet of Things (IoT), cloud computing, and 5G create huge demand for semiconductor manufacturing.

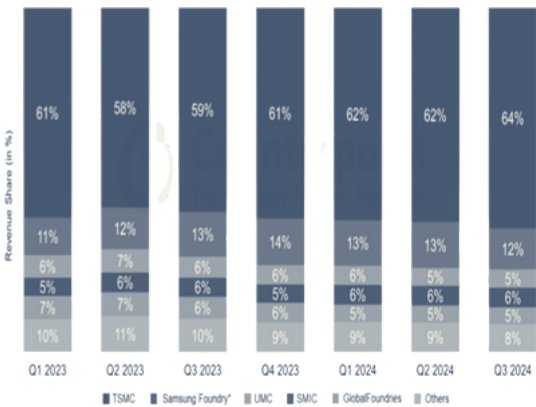


Figure 10 shows the top companies involved in the foundry business and their percentage share of production.

	TSMC	UMC	SMIC	Global Foundries
Revenue Growth	33.89%	4.39%	-13.09%	-11.32%
Net Income Growth	39.93%	-20.90%	-50.35%	-47.41%
Net Profit Margin	40.54%	20.32%	14.28%	10.95%
Return on Invested Capital	16.90%	7.31%	3.79%	3.69%

Global Nature of the Supply Chain

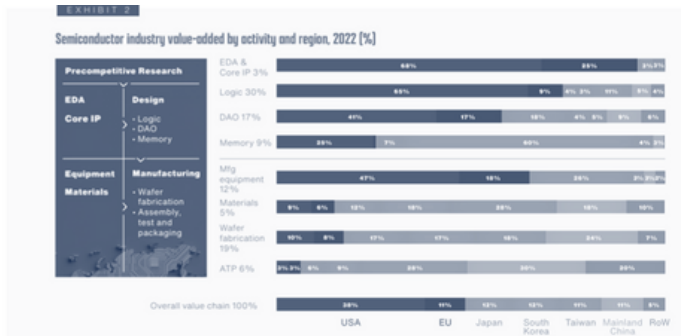


Figure 11 shows the value added by each country in different aspects related to semiconductor production.

The semiconductor supply chain is an integrated and advanced global system dispersed across numerous regions with varying strengths. Such a design has fostered technological advancement and cost savings, but simultaneously created vulnerabilities of geographic concentrations. What follows is a description of its global nature:

Regional Specialization

1. Design and R&D

- The United States has the preponderance of semiconductor design, electronic design automation (EDA), and intellectual property (IP) cores. The top players here include Nvidia, Qualcomm, and Intel²⁵.
- Europe and Japan account for significant precompetitive research and innovation in materials and equipment.

2. Manufacturing Equipment

- The U.S., EU, and Japan control the manufacturing equipment sector. For example, ASML (Netherlands) provides critical lithography equipment in advanced chip manufacturing.
- More than 50% market share in the top equipment categories for deposition

tools and process control tools is owned by American companies.

3. Materials Supply

- Mainland China, Taiwan, South Korea, and Japan lead the way in providing critical materials such as photoresist chemicals, silicon wafers, and specialty gases.
- Japan is significant in providing photoresist materials needed in high-end lithography

4. Advanced Node Fabrication

- Two main manufacturers, South Korea and Taiwan, produce sub-10-nanometer chips essential for technologies like AI and HPC, with Taiwan overwhelmingly dominating production at 92%. South Korea (8%) and Taiwan (92%) dominate the production of sub-10-nanometer chips, which are pivotal in technologies like AI and HPC⁴⁵.
- Taiwan Semiconductor Manufacturing Company (TSMC) is the leading global supplier of cutting-edge chip production.

5. Assembly, Packaging, and Testing (APT)

- More than 82% of APT activity is in East Asia, i.e., Mainland China and Taiwan.

6. Interdependence Amongst Regions

- The global integrated supply chain allows all regions to use their comparative advantage and rely on others' supply. For example:
- Taiwan's manufacturing strength depends greatly on technology from the U.S., Europe, and Japan, and inputs from East Asia.
- East Asian chips usually get exported to Mainland China to be assembled into consumer electronics.

International dependencies
Figure 4 – Global semiconductor supply chain

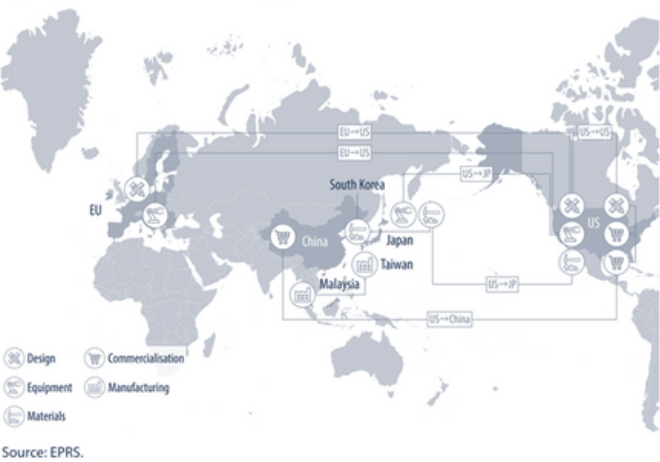


Fig. 12 shows how the semiconductor processes are scattered across the world. This makes the semiconductor industry prone to numerous challenges:

Challenges Arising from Geographic Location

- **Natural Disasters:** Nations like East Asia are vulnerable to the risk of typhoons, earthquakes, and infrastructure failure that can impact production.
- **Geopolitical tensions:** Rising tensions or conflicts or trade tensions can potentially jeopardize supply chain stability, particularly with the dependence on Taiwan for high-end chip production.
- **Supply Chain Disruptions:** The COVID-19 pandemic highlighted vulnerabilities in accessing essential materials like neon gas from Ukraine or rare earth metals from certain regions.

Efforts at Diversification

- **Industrial Policies:** Governments around the world are investing heavily to decouple dependence from concentrated locations:

- The U.S. CHIPS Act aims to expand the domestic chip production capacity from virtually zero to 28% by 2032.
- Europe and Japan are also investing in wafer fab facilities.
- **Global Investments:** During 2024–2032, \$2.3 trillion is anticipated for fresh investments in wafer fabrication globally, with diversification in the U.S., EU, Japan, South Korea, and India.

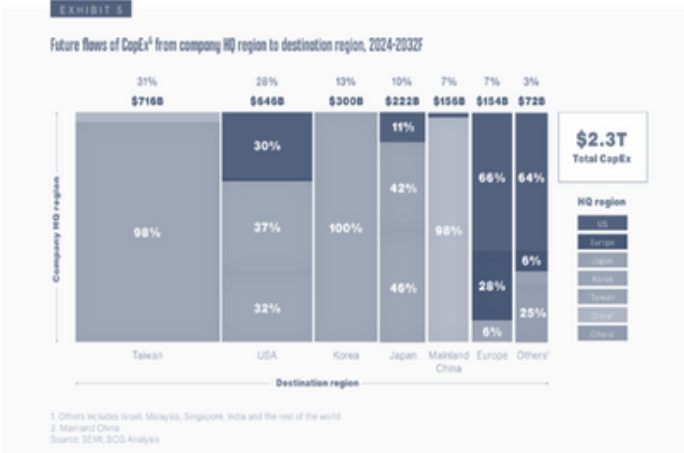


Figure 13 shows the anticipated global investments in the coming years.

GEOPOLITICS

- Significant trends have emerged in semiconductor manufacturing over the past three decades: If one considers how the making of semiconductors has unfolded over the past three decades, a clear trend emerges: a globally spread-out system of operations, largely motivated by the desire to achieve the highest possible efficiency. Rather than a spontaneous development, the trend resulted from a deliberate and strategic distribution of specific stages of the production chain across different regions of the world. This wasn't a development

that just happened; rather, it involved a deliberate and thoughtful distribution of specific steps in the production chain across different parts of the globe. While the early stages of design and conceptualisation were more concentrated in the United States, industrial hubs of Taiwan and South Korea took on the daunting task of manufacturing these technologically advanced chips. The initial stage of coming up with designs and concepts became heavily centered in the United States, while the really complex and technologically advanced work of actually building these chips found its main centers in the industrial zones of Taiwan and South Korea. Following this, the crucial tasks of putting the components together and ensuring they work correctly became mostly the responsibility of countries in Southeast Asia, with the basic materials needed to make them primarily coming from the resource-rich lands of Japan and China. While this globally distributed model of production succeeded in reducing costs, it unintentionally introduced some fundamental strategic vulnerabilities. This model of production, spread across the world, while certainly successful in reducing costs quite significantly, also unintentionally created some fundamental strategic weaknesses. These vulnerabilities have, especially when we look at the current complex and ever-changing political situation around the world, become increasingly hard to ignore and, in fact, demand our serious attention. The unforeseen arrival and subsequent impact of the COVID-19 pandemic acted as a stark and undeniable turning point, its ramifications amplified by the widespread and disruptive shortages of semiconductor components that ensued. This period unequivocally exposed the deep interconnectedness, and consequently, the inherent fragility, of these extended and intricate supply networks.

The outcome was a fundamental and ongoing re-evaluation by major global economies regarding their approaches to semiconductor policy. What initially presented itself as a concern centered on the resilience of these critical supply chains has since evolved into a more encompassing arena of strategic competition. Semiconductors are now increasingly understood as resembling bearing a resemblance to a vital natural resource – indispensable not only for sustained economic advancement but also as a foundational and non-negotiable element of national military strength.

The worldwide coordination across the deep and complicated electronics sector has accelerated innovation, resulting in new technology features at reduced costs. This globally linked digital market was made possible because of the supply chain for semiconductors. The semiconductor industry has shown rapid growth and a significant economic impact in the past three decades. The CAGR of the semiconductor market between 1990 and 2020 was recorded as 7.5%, which was higher than the 5% rise in the world GDP during the same period.

Figure 14



note: Main actors' share estimated as percentage of revenues, based on headquarter location; ¹ considers fabless companies that develop chips for use by other players
 source: Arthur D. Little, SIA

Figure 15

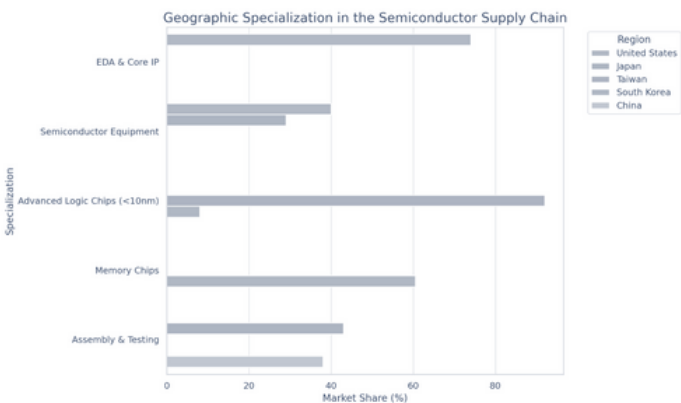


Fig 14 and Fig 15 depict the involvement of each country in the processes involved in semiconductor production. The reasons why these countries lead these sectors are given below.

Comparative Advantage of these Countries

USA

The USA leads in terms of EDA and IP because of its strong R&D infrastructure and innovation ecosystem. This is supported by the presence of leading firms such as Synopsys and Cadence, which are critical for software design. Its decades of technology leadership have also led to its high share in semiconductor equipment, with the presence of dominating companies such as Applied Materials and Lam Research.

Japan

Japan has a strong legacy when it comes to manufacturing efficiency and quality control, along with expertise in high precision machinery and materials. This makes it suitable for producing semiconductor equipment and assembly, and testing.

Taiwan

Taiwan plays a huge role in the production of advanced semiconductor chips due to TSMC, the global leader in cutting-edge chip production, based in Taiwan. It operates at the forefront of semiconductor manufacturing with high capital and technological know-how.

South Korea

South Korea plays an essential role in producing memory chips such as DRAM and NAND. This is backed by government support as well as an early mover advantage in memory technology.

RISKS

China

While lacking in semiconductor-producing technology, China has cost-effective labour and large-scale infrastructure. This is backed up by heavy state investment in chip packaging and testing facilities by the government. This makes China a suitable country for the assembly and testing of semiconductors.

RISK OF INDUSTRY FRAGMENTATION

High fragmentation and specialisation of production can contribute to vulnerabilities. The international fragmentation and specialisation of semiconductor production is a highly cost-efficient business model. Companies designing semiconductors in economies with high R&D and technological capacities can shift the manufacturing stages to the economies with the lowest production costs. This enables them to

harness the benefits of economies of scale by specialising in producing large quantities of highly differentiated semiconductors. The flipside of high-cost efficiency is that fragmentation and product variety may lead to increased vulnerability to shocks, as the supply chain is exposed to various local risks. For instance, a natural disaster at foundries in a huge production area, say the Chinese Taipei, can have enormous impacts, both on forward linkages and backward supplier linkages. Even if an industry or economy does not directly import semiconductors or export inputs to Chinese Taipei, they might have to face drastic impacts due to overall value chain linkages. Moreover, given high degrees of geographical concentration of production and horizontal differentiation, semiconductors produced in a given economy or company may not be easily substitutable with other semiconductors, creating the potential for shortages even when shocks are circumscribed to few economies or companies.

The COVID-19 pandemic, subsequent supply shortages, and now geopolitical tensions have exposed the fragility of this model. Single points of failure, such as overreliance on a few East Asian nations (Taiwan, South Korea) for advanced manufacturing, are now seen as major national security risks by governments worldwide.

In response, governments and corporations are aggressively rethinking their supply chain strategies, adopting models such as:

- Near-shoring: Relocating production closer to home markets (e.g., U.S. companies investing in Mexico or Canada).

- Friend-shoring: Sourcing critical components from allied nations with shared political interests (e.g., U.S. companies shifting sourcing to Taiwan, South Korea, Japan, and parts of Southeast Asia).
- Decoupling: Reducing direct economic and technological interdependence between the U.S. and China to insulate national industries from geopolitical risks.

These shifts are not just theoretical—they are actively reshaping investment flows, manufacturing footprints, and global technology standards.

COUNTRY-WISE DISTRIBUTION

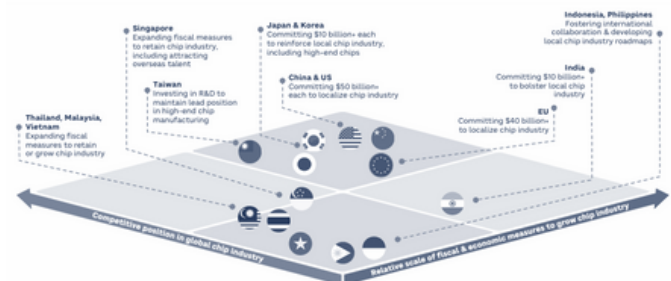


Figure 16 shows the competitive position that each country holds with respect to semiconductors. A detailed analysis of each country's position with respect to the semiconductor industry is given below.

Europe

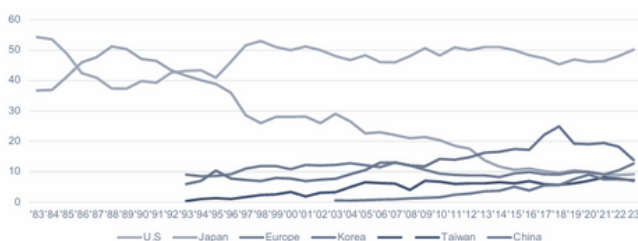
Europe has recognized the strategic importance of semiconductors in shaping the future of technology, economic resilience, and geopolitical stability. As digital transformation accelerates, ensuring access to a secure and stable supply of chips has become a top priority for the

region.

In Europe, the European Chips Act aims to assist the continent in procuring its semiconductor supplies, guaranteeing self-sufficiency, regulating more of its supply chain, minimizing foreign firms' dependency, and rivaling the US and Asia in terms of technology. The EU Chips Act is a \$47 billion package of public and private investments with a goal of creating capacity and innovation on a large scale and ensuring that Europe is not dependent on others, pre-empting potential future supply crises. The aim of the act is to increase the EU's market share in the global semiconductor market to 20% by the year 2030 from a 9% present share. The EU Chips Act also serves as a representative for the empowerment of the European ecosystem of semiconductors.

With such initiatives, Europe is charting a course toward greater technological independence and resilience. By strengthening its semiconductor capabilities, the continent aims to secure its position as a key player in the global tech landscape for the years to come.

USA



Source: World Semiconductor Trade Statistics (WSTS), Gartner, Omdia, and SIA Estimates.

Figure 17 shows the country-wise semiconductor trade statistics. It clearly depicts the dominance of the US in global semiconductor trade. The United States' dominance in semiconductor R&D is largely due to the fact that most of the world's

fabless companies are U.S.-based. Fabless companies devote on average 20% of their revenues to R&D. By focusing heavily on innovation and design, fabless companies can stay competitive and push the boundaries of semiconductor technology. According to the U.S. Bureau of Industry and Security, U.S.-based companies account for 73% of the world's fabless companies and 78% of global R&D carried out by fabless companies.³³ NVIDIA, Advanced Micro Devices (AMD), and Qualcomm, for example, are renowned IC design companies with heavier R&D costs that are over 20% of their revenues. Companies based in the United States are particularly strong in design processes, accounting for 72% of all fabless revenue, 42% of revenue among companies that do both design and manufacturing, and 53% of global semiconductor revenue in 2022.⁴³ Taiwan- and China-based companies account respectively for the second and third largest share of the fabless market. Taiwan, in particular, has developed extensive expertise and infrastructure in semiconductor manufacturing, and its strong OSAT industry offers competitive pricing and scalability, attracting more fabless companies to outsource their manufacturing needs. In 2022, Taiwan accounted for 63% of total outsourced manufacturing revenue.

China

Compared to other countries such as the USA and Taiwan, China lags significantly behind in the semiconductor industry. The Chinese semiconductor industry is heavily reliant on imports. China's share in the semiconductor supply chain is only 10%, and that too in the backend. In critical phases such as design and IP, China has a very weak presence.

China had plans to produce 40% of total semiconductors by 2020 and 70% by 2025. But these estimates had to be revised due to China only reaching a small fraction of its target. China is mainly responsible for packaging and assembly. These are straightforward processes with little technology and infrastructure involved. Every year, China thus imports US\$ 300B of semiconductors.

China majorly lacks the required technology and machinery to manufacture semiconductors. It has less than 1% of the electronic design software, semiconductor tools, and materials required to produce semiconductors. It also has less than 1% share in end-use categories.

Another important hurdle that China faces is that it wishes to transform into a green economy, which requires a necessary transition to EVs. However, it is one of the highest carbon dioxide producers in the world. Producing semiconductors also necessitates high electricity and water use, which adversely impacts the environment.

Thus, the fact that China does not have the required technology, infrastructure, and foundries required to produce semiconductors, coupled with the adverse environmental implications of producing semiconductors that China cannot afford, China is in a tough situation when it comes to semiconductor production.

Taiwan

Taiwan remains committed to high-end chip manufacturing. Besides foundry market leadership in both mature process technologies (28 nm and older) and advanced manufacturing processes

(known simply as EUV) — an innovative technology used in the semiconductor industry for manufacturing integrated circuits (ICs). Taiwan continues to invest heavily in R&D for cutting-edge 3 nm and 2 nm chips to secure technological leadership. Its 10-year chip program, starting in 2024 with a \$375 million first-year budget, aims to continue supporting advanced IC process development and attract global semiconductor collaboration. Taiwan's generous tax incentives include a 25% tax deduction for R&D expenditures and an additional 5% for advanced machinery spending. Major industry players like TSMC's \$2.9 billion chip-packaging plant and Fujifilm's \$110 million chip-polishing expansion underscore Taiwan's dedication to semiconductor excellence.

TSMC plays a critical role in ensuring national security in Taiwan. The US is highly dependent on TSMC for semiconductor fabrication, which provides Taiwan with a security umbrella. Currently, 53% of the World's semiconductors are produced by TSMC, with Samsung being the second largest producer with a 16.3% share.

India

Given the integral role of the semiconductor industry and its strategic advantages, it is essential to understand India's position in this regard.

1) Design

India plays an essential role in semiconductor design. It has many design centers, further producing a demand for more semiconductor design engineers. 3,000 chips in India are produced annually by 30,000 engineers.

2) Manufacturing

Currently, there are only 3 semiconductor fabrication plants, all led by the state. These are the SITAR facility in Bengaluru, the Gallium Arsenide Enabling Technology Centre(GAETEC) in Hyderabad, and the Semiconductor Laboratory(SCL) in Chandigarh. These limited manufacturing units also cater only to the defense and space industry, with no commercial manufacturing facility operated by either the private or government sector. Despite government schemes such as the Production Linked Incentive Scheme, there is much uncertainty about foreign investment in a fabrication unit in India.

3) ATP/ OSAT

India has an added advantage in terms of OSATs and ATPs since they require less investment and are aided by the cheap labour that India has to offer.. The major costs associated are with regard to imports, which are aided by subsidies and government incentives. The given table shows the financial incentives and schemes offered by the government to boost its domestic semiconductor industry in 2021.

Gov's Semiconductor Schemes	Gov's Semiconductor Schemes								
Design Linked Incentive (DLI) Scheme	Product Design Linked Incentive – Reimbursement of 50% of the eligible expenditure subject to a ceiling of US\$193 million incentive per application.								
Semiconductor Fab Scheme	Minimum Capital Investment – US\$2.57 billion Fiscal support from Government of India <table><tr><th>Node size</th><th>Percentage of project cost</th></tr><tr><td>28nm or lower</td><td>Up to 50%</td></tr><tr><td>29nm to 45 nm</td><td>Up to 40 %</td></tr><tr><td>46nm to 65 nm</td><td>Up to 30%</td></tr></table>	Node size	Percentage of project cost	28nm or lower	Up to 50%	29nm to 45 nm	Up to 40 %	46nm to 65 nm	Up to 30%
Node size	Percentage of project cost								
28nm or lower	Up to 50%								
29nm to 45 nm	Up to 40 %								
46nm to 65 nm	Up to 30%								
Display Fab Scheme	Minimum Capital Investment – US\$1.29 million Fiscal support from Government of India – Up to 50% of project cost or a maximum sum of US\$155 billion								
ATMP/OSAT Facility Scheme	Minimum Capital Investment – US\$6.43 million Fiscal support from Government of India – 30% of Capital Expenditure								

Figure 18 depicts the various schemes implemented by the Indian government in 2021 in order to boost semiconductor

production in India

GEOPOLITICAL SCENARIOS

1) Taiwan Strait Escalation

The worst disaster threat to the world semiconductor economy would be the Taiwan Strait escalation. Taiwan hosts about 90% of the world's leading-edge semiconductor manufacturing capacity, specifically in TSMC and associated foundries. A severe disruption would imply a very steep reduction in world semiconductor production in the first six months, with price spikes. The most impacted industries of AI, automotive, and consumer electronics would be severely affected, particularly in the United States and Europe. Supply chain resilience-building efforts would not eliminate the initial impact, and rebounding would occur slowly, depending on geopolitical events and investment in secondary manufacturing hubs.

2) US-China Decoupling

The US has the largest share of the World’s semiconductor market and is China’s biggest exporter. As such, the US has an obvious advantage over Chinese semiconductor companies. Chinese companies dependent on US companies for their everyday business operations since they need to import semiconductor chips and other tech products from the US. Around 1/3rd of US chips are exported to China each year. Therefore, the US imposing technological sanctions against China can be a extremely important

leverage for the US in the prevalent US-China trade war.

In 2018, the US imposed a 25% tariff on semiconductor imports from China. Despite such sanctions, China continued to increase its imports from the US till 2020, which depicts the level of dependency China has on the US.

At the same time, the US is dependent on China as an important end market for its products. China plays a prominent role in the packaging and assembly segment of the supply chain. In 2019, the US sold US\$ 70.5B, which was (36% of total US sales), to China. This leads to a virtuous investment cycle in the US with increased R&D intensity. Thus, the demand in the Chinese economy fuels the rapid R&D and technological advancement in the US. This means that the Semiconductor industry is based on the mutual dependence of the US and China. Over the past few years, the United States and China have moved steadily toward a de facto technological and economic decoupling, a trend that is transforming the semiconductor industry. Both countries are establishing parallel ecosystems: a U.S.-led technosphere, centered around democratic allies, and a China-led technosphere, focused on self-reliance and expansion into emerging markets such as Africa, Latin America, and Southeast Asia.

Chinese companies are leading large-scale digital infrastructure projects across the Global South, offering alternatives to Western technology frameworks and embedding Chinese standards and technologies.

Key U.S. legislative measures accelerating this decoupling include:

- **Export Control Reform Act (2018):** Strengthened U.S. authority to control the export of sensitive technologies.
- **Holding Foreign Companies Accountable Act (2021):** Increased oversight on Chinese companies listed on U.S. stock exchanges.
- **Secure Equipment Act (2021):** Banned U.S. entities from using certain Chinese telecom equipment.
- **U.S. CHIPS and Science Act (2022):** Provided \$52 billion to boost domestic semiconductor manufacturing and R&D.
- **Proposed Section 5949 of the NDAA:** Would prohibit U.S. government purchases of electronics containing Chinese semiconductors, effective December 23, 2027. Historically, government-sector bans have expanded into the broader civilian market, suggesting that these restrictions could soon impact numerous industries.

At the same time, China has responded by accelerating initiatives like **Made in China 2025**, aiming to achieve self-sufficiency in semiconductor manufacturing and other critical technologies.

3) Infrastructure Bottlenecks in India

Though India has made grand promises to emerge as a global hub of chip-making, there lie some underlying infrastructure handicaps that can dampen the dream. Volatile power supply, water shortages, absence of quality engineering talent, and red tape. Mass-production semiconductor

but essential—for investors, analysts, and policymakers to explore potential futures for the semiconductor industry under different geopolitical stress scenarios. To that end, we model four plausible outcomes for the 2025–2030 period, assigning each a probability and forecasting its compounded annual impact on industry revenue. This isn’t just forecasting; it’s strategic wargaming.

A WARGAME OF FUTURES: THE FOUR SCENARIOS

Scenario	Probability of Scenario	Annual Deviation from Baseline	Rationale
Baseline (Status Quo)	0.6	NA	Assumes stable trends and no escalation, as China likely avoids conflict amid post-COVID recovery.
Positive Scenario	0.175	2%	Assumes easing tensions and global tailwinds; moderate chance due to CCP’s high stakes in Taiwan.
Taiwan-China Blockade	0.15	-15%	Envisions a prolonged partial blockade—air and sea disruptions with limited kinetic conflict. Probability is significant due to increasing Chinese military drills and prior simulation efforts.
Taiwan-China War	0.075	-35%	Models a full-scale military conflict. Probability remains low, but not negligible, based on current risk assessments. The economic fallout would be catastrophic given Taiwan’s semiconductor centrality.

PYTHON METHODOLOGY USED FOR THE ANALYSIS

The baseline forecast is extrapolated using exponential curve fitting based on historical semiconductor revenue data from 2010 to 2024. Implemented in Python using the `scipy.optimize.curve_fit()` function, the exponential model captures the compounding growth typical of high-growth sectors like the semiconductor industry. Deviations for each scenario were then applied as compound annual growth modifiers over the baseline, allowing us to simulate diverging outcomes from 2025 through 2030. For our separate scenario-specific forecasts, as shown in the graphs below, we have assumed that the event causes deviations in the forecasted market size starting in 2025, making it easier to fit the forecasts in the exponential model. Finally, we produced a probability-weighted forecast by combining these scenario projections in proportion to their assigned likelihoods.

You can find the link to the code we used here:
<https://colab.research.google.com/drive/1c0pKHbOiSU9Sad5zuPKrIRhgfxldPUcW?usp=sharing>

INTERPRETING THE WARGAMED GRAPHS

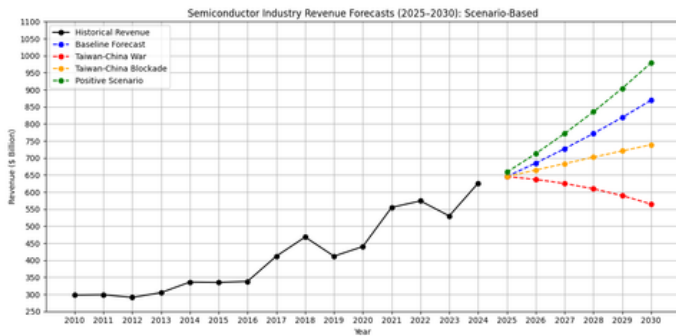


Figure 19 depicts a detailed forecast of the worldwide semiconductor revenue in various possible future scenarios.

The baseline scenario (depicted in blue) rests on the assumption that the current state of elevated tension continues, but without spiralling into a full-blown crisis. In such a landscape, the Taiwan Strait remains a zone of friction, defined more by symbolic military gestures, cyber probes, and cautious diplomatic posturing than by actual confrontation. The semiconductor industry, though aware of the persistent risk, continues to operate under the assumption that the worst can be avoided. In this environment, growth persists, driven by foundational demand for chips in AI, cloud services, and electric mobility, but not without drag. Firms would likely adopt a defensive posture, investing with restraint and managing logistical exposures more conservatively. As a result, global semiconductor revenues are estimated to reach approximately \$870 billion by 2030. It's a future where momentum survives, albeit with the constant hum of risk shaping behaviour in boardrooms and supply chains alike.

In stark contrast to the status quo, the positive scenario (green) assumes that a diplomatic thaw begins to take root, albeit gradually and perhaps informally. Strategic

incentives begin to align across borders: major powers recognise that economic interdependence in semiconductors leaves little room for destabilising conflict. Confidence-building steps, ranging from military de-escalation agreements to backchannel talks, create a more predictable operating environment. With the fog of geopolitical uncertainty lifting, capital becomes more mobile, innovation bolder, and cross-border partnerships become more feasible. Investment flows into cutting-edge R&D, manufacturing resilience improves, and firms redirect attention to technological leadership rather than geopolitical hedging. Under these conditions, revenue projections surge to approximately \$980 billion by 2030, underscoring the outsized influence of political stability on industrial acceleration.

The intermediate scenario of a blockade (orange) envisions a future where the threat materialises not as open warfare but as a persistent, non-kinetic disruption. The PLA, seeking to assert strategic control without provoking full international backlash, might implement selective maritime restrictions or restrict key air corridors. Though no shots are fired, the disruption is real, introducing delays, rerouting costs, and risk premiums across the value chain. Semiconductor firms, especially those dependent on Taiwan's logistics grid, would be forced into complex manoeuvres to keep production going. Inventory buffers would rise, insurance costs would spike, and investment decisions would tilt toward redundancy rather than efficiency. In such a setting, revenue growth would fall significantly, stalling at around \$740 billion by 2030. The sector, though operational, would be in a state of strategic limbo, navigating

uncertainty rather than innovation.

Finally, we move to the most alarming of these scenarios - an all-out China-Taiwan war (red). This scenario represents the most severe and structurally damaging pathway. A full military conflict over Taiwan—however unlikely in the short term—would upend the entire architecture of global chip supply. Key fabrication sites, including those operated by TSMC, could be rendered inoperable by precision strikes or occupation by the PLA. The consequences of such disruption would be immediate and widespread: production halts, cascading supply chain failures, and sharp cost escalations across tech-enabled sectors. Governments may attempt rapid damage control by pouring funds into domestic fabrication efforts or invoking industrial emergency powers, but such responses are rarely quick enough to fully offset near-term damage. The loss of Taiwan’s contribution to the chip ecosystem would be not just economic but systemic. Under this scenario, revenue is projected to decline sharply, stabilising around \$570 billion by 2030. More than just a temporary downturn, this reflects a structural rupture - one that forces a complete rethinking of global semiconductor resilience. The conflict will likely expand beyond the Taiwan region, inviting participation from the U.S., Japan, South Korea, and Russia.



Fig. 20 shows an integrated, probability-

weighted forecast that captures a realistic expectation of global semiconductor revenue growth from 2025 to 2030, factoring in the risks and outcomes discussed across the four primary scenarios. This composite line is not a simple average. Instead, it has been derived by assigning probability weights to each scenario: Status Quo (60%), Positive Scenario (17.5%), Blockade (15%), and War (7.5%). These probabilities have been assigned based on our understanding of current geopolitical trends, historical precedent, regional strategies, and global capacities to deter escalation, which we have discussed in detail in the previous section.

The model starts at the shared 2024 baseline of approximately \$630 billion. From there, the probability-weighted projection rises gradually to just above \$840 billion by 2030, implying a compound annual growth rate (CAGR) of 4.91%. Contrasted with pre-2022 expectations, this subdued growth rate reflects the deepening uncertainties that now shadow the semiconductor industry, particularly due to the strategic vulnerabilities of its most critical node, Taiwan.

WHY THIS GROWTH PATH EMERGES

The path plotted by the probability-weighted model represents a sophisticated and well-supported expectation. Many interdependent factors contribute to this outcome:

1) Predominant Likelihood of the Status Quo Scenario: 60% probability supports the

assumption that current tensions will continue with no immediate escalation, which is the basis of this analysis. The scenario is marked by continuing shows of military muscle, cyber attacks, air intrusions in Taiwanese airspace, and sporadic diplomatic roadblocks. Conditions of the sort, however, facilitate the functioning of semiconductor supply chains, though at increased insurance rates, requiring regional risk mitigation measures, and encouraging "friendshoring" programs, as earlier seen in the geopolitics section. Such conditions do not stop the industry from realizing its full potential growth path, but prevent it from doing so.

2) Muted Contribution from Strategic

Détente: While the most optimistic outcome, its relatively low assigned probability of 17.5%, due to the deep-seated mistrust between Beijing, Taipei, and Washington, and the CCP's political fortunes being inextricably tied to its agenda of reunifying Taiwan with China, means its contribution to the average forecast is muted. Yet, its presence provides an upward pull, especially in the latter half of the forecast period when confidence-building measures could have a payoff, if pursued. There remains a high likelihood of this occurring, if China is struck by an economic crisis, driven by its post-COVID slump in economic activity, real estate bubble bursts, and an ageing population, it might be forced to negotiate with the US and Taiwan, and make some concessions in favor of a de-escalation of the US - China trade war, enabling it to pull up its economic growth to pre-COVID levels.

3) Drag from Blockade and War Scenarios:

Combined to represent 22.5% of the

weighted input, the more aggressive scenarios have a significant influence on the projection by serving as powerful moderating factors. While the probability of war is relatively low, the blockade scenario, representing 15%, is considered significantly credible in light of recent People's Liberation Army (PLA) exercises simulating a partial encirclement of Taiwan, and the possibility of such being used as coercive, if not kinetic, options. Both scenarios impose significant revenue suppressants through compromised logistics in the Taiwan Strait, emergency production reallocations, and investor uncertainty. The magnitude of this effect can largely be explained by the central position of TSMC in the global semiconductor supply chain. This is highlighted by TSMC's possession of a 67.1% share of the global pure-play foundry market as of Q4 2024. The semiconductor manufacturing process is heavily dependent on the timely delivery of raw materials and equipment. Taiwan is dependent on the imports of key components such as silicon wafers and photolithography equipment, primarily supplied by countries including the United States, Japan, and the Netherlands. Even a simple blockade would impede these imports, thus compromising production schedules. Additionally, the export of finished semiconductor products to foreign markets would be delayed, which would have implications for industries across the world.

4) Structural Reorientation of the Industry:

The semiconductor industry is undergoing a fundamental shift, even without war. The geographical distribution of manufacturing, the establishment of "technology sovereignty" programs in the United States and European Union, and the higher capital expenditure costs of advanced node manufacturing plants all influence cost estimates and delivery schedules. These

structural changes are evident in the direction of the industry, which further reduces short-term profitability at the expense of increased long-term survivability.

INTERPRETING THE STRATEGIC IMPLICATIONS

What emerges is a scenario where **growth persists**, but at a more **cautious and constrained** pace. It is neither a trajectory of collapse nor of unbridled expansion. Rather, it is emblematic of a sector learning to adapt under pressure, where innovation proceeds, but often in parallel with political contingency planning.

From an investment perspective, this forecast implies that **risk-adjusted strategies**—particularly those that hedge supply chain exposure, support regional diversification, and align with government-backed chip programs—will be central to value creation. It also suggests that the **next inflection point in semiconductor revenue** will be determined by demand cycles and the resolution or aggravation of geopolitical standoffs alike.

In essence, the probability-weighted model stands as a call for **strategic prudence**, balancing optimism about technological demand with realism about the fragility of its delivery infrastructure.

OVERVIEW OF NVIDIA

Nvidia Corporation, founded in 1993 with its

headquarters in Santa Clara, California, is a leading American multinational tech company known for its groundbreaking work in developing graphics processing units (GPUs). Founded with the primary objective of enhancing computer graphics, Nvidia has significantly diversified its areas of operation over the years emerging as a leading player in several domains like gaming, data centers, artificial intelligence (AI), and automotive technology. Nvidia's flagship products, particularly the GeForce line of GPUs, have set performance and efficiency standards in the industry.

Currently, the main source of revenue for Nvidia is its Compute and Networking business unit, which includes artificial intelligence (AI). Currently, the company is an end-to-end computing infrastructure firm, from front-end to back-end solutions, and is converting a vast amount of complex computing operations.

Besides the GPUs Nvidia makes and sells for gaming, cryptocurrency mining, and other professional requirements, Nvidia also makes chip systems used in vehicles, robots, and other machines.

OVERVIEW OF NVIDIA

Nvidia operates primarily through two business segments:

1. Compute and Networking: This segment is the largest revenue generator for Nvidia, contributing approximately \$47.4 billion in FY 2024, depicting a major 215% increase from FY 2023. It includes:
 - Data center accelerated computing platforms
 - Networking solutions, including Quantum for InfiniBand and Spectrum for Ethernet

- NVIDIA DRIVE for automated driving
 - Jetson robotics platforms
 - AI software solutions
- 1.Graphics: This segment generated around \$13.51 billion in FY 2024, a decent growth of 14% year-over-year. It includes:
- GeForce GPUs for gaming
 - Quadro/NVIDIA RTX GPUs for professional visualization
 - Solutions for cloud-based visual computing

Overall, Nvidia reported total revenue of \$60.92 billion in FY 2024, marking a remarkable growth of 126% from the previous fiscal year.

HISTORICAL GROWTH RATES AND FINANCIALS

1) Revenue, Profits and Margins

ITEMS	FY20	FY21	FY22	FY23	FY24	TTM
Revenue	10,918.00	16,675.00	26,914.00	26,974.00	60,922.00	113,269.00
Growth Rates		53%	61%	0%	126%	86%
Gross Profit	6,768	10,557	17,475	15,356	44,301	85,926
Growth Rates		56%	66%	-12%	188%	94%
Operating Income	2,846	4,721	10,041	5,577	32,972	71,033
Growth Rates		66%	113%	-44%	491%	115%
Net Income	2,796	4,332	9,752	4,368	29,760	63,074.00
Growth Rates		55%	125%	-55%	581%	112%
Gross Margin	61.99%	63.31%	64.93%	56.93%	72.72%	75.86%
Operating Margin	26.07%	28.31%	37.31%	20.68%	54.12%	62.71%
Profit Margin	25.61%	25.98%	36.23%	16.19%	48.85%	55.69%
Net Margins	25.61%	25.98%	36.23%	16.19%	48.85%	55.69%

2) Ratio Analysis

Ratios	Current	FY2025	FY2024	FY2023	FY2022	FY2021
Market Capitalization	2,706,692	3,492,764	1,507,466	501,183	571,000	321,626
Market Cap Growth	131.70%	131.70%	200.78%	-12.23%	77.53%	109.81%
PE Ratio	37.73	47.93	50.65	114.74	58.55	74.24
PS Ratio	20.87	26.77	24.74	18.58	21.22	19.29
PB Ratio	34.23	44.03	35.08	22.68	21.46	19.04
EV/Sales Ratio	20.49	26.55	24.63	18.53	20.94	19.14
EV/EBITDA Ratio	32.09	41.58	43.51	70.21	50.25	54.85
Debt / Equity Ratio	0.13	0.13	0.26	0.54	0.45	0.45
Asset Turnover	1.47	1.47	1.14	0.63	0.74	0.72
Inventory Turnover	4.25	4.25	3.18	2.99	4.26	4.36
Quick Ratio	3.67	3.67	3.39	2.61	5.97	3.56
Current Ratio	4.44	4.44	4.17	3.52	6.65	4.09
Return on Equity (ROE)	119.18%	119.18%	91.46%	17.93%	44.83%	29.78%
Return on Assets (ROA)	57.42%	57.42%	38.55%	8.17%	17.20%	12.80%
Return on Capital (ROIC)	70.89%	70.89%	46.75%	9.61%	19.94%	15.00%
Return on Capital Employ	87.10%	87.10%	59.80%	16.10%	25.20%	19.00%

GROWTH FACTORS FOR NVIDIA

Nvidia is well-placed to capitalize on a number of key growth drivers that are defining its trajectory in the future:

- Artificial Intelligence (AI) Demand: The ongoing AI revolution is among the growth drivers. Nvidia GPUs form the backbone of AI model training and deployment, and the AI-driven semiconductor industry is expected to be \$725 billion in 2025. Nvidia's upcoming Blackwell architecture is expected to enhance performance in AI applications, further solidifying its market leadership.
- Data Center Expansion: Data center high-performance computing continues to increase. Nvidia data center revenue continues to expand exponentially, with 409% year-over-year in Q4 FY 2024 reported. This expansion trend is certain to be maintained as more companies utilize AI solutions, further supporting Nvidia's solution revenues.
- Expansion in the Automotive Segment: Nvidia's DRIVE autonomous vehicle platform is picking up pace among automobile firms. With the growing application of AI-driven technologies in this industry for safety and entertainment, it is expected that this segment will be a major driver of Nvidia's top-line growth in the near term.
- Diversification of Software and Services: In addition to its hardware products, Nvidia is diversifying its software and services offerings, spearheaded by Omniverse virtual collaboration software. This diversification process strengthens the sources of revenue and makes

RISK FACTORS OF NVIDIA

Although the prospects of growth for Nvidia are great, the firm has several risks that can affect its performance:

- **Market Demand Volatility:** Present demand for GPUs can prove to be unsustainable. When the initial training process of high-scale AI models starts slowing down, there could be a shift towards lower power consumption or usage on devices, which could translate into lower future demand for high-end GPUs.
- **Increasing Competition:** AMD and other leading technology companies, such as Google and Microsoft, are making significant investments to try and close the gap with Nvidia in the artificial intelligence space. Increasing competition can put pressure on market share and price downward, and, as such, affect Nvidia's margins.
- **Geopolitical Risks:** Nvidia's operations are significantly impacted by geopolitical tensions, specifically China trade. Control of chip sales can restrict market access and lead to supply chain disruptions, especially given Nvidia's reliance on Taiwan-based TSMC for manufacturing.
- **Supply Chain Dependency:** The supply chain of the company is extremely dependent on a few strategic partners. Geopolitical tensions or natural disasters could adversely affect production capacity and delivery timelines, thus affecting the generation of revenues.

- **Regulatory Environment:** The world semiconductor industry is increasingly coming under the scrutiny of different governments when it comes to technology transfer as well as export controls, indicating that future rules could adversely affect Nvidia's market strategy and business model.

Nvidia has a healthy credit rating at present, consistent with its healthy financial position and a good market position. In March 2024, Moody's Investors Service raised Nvidia's long-term local currency credit rating to Aa3 from A1 with a positive outlook. The upgrade is a testament to Nvidia's strong ability to fulfill its financial obligations and signifies a reduced risk of default compared to its lower-rated peers.

WACC	
Market Cap	3,313,000
% of Equity	99.70%
Cost of Equity	11.62%
Risk Free Rate	4.52%
Beta	1.46
Market Risk Premium	4.86%
Credit Rating	A
Debt	9220
% of Debt	0.28%
Risk Free Rate	4.52%
Default Spread	0.85%
Cost of Debt	5.37%
Tax Rate	14.00%
Effective Cost of Debt	4.60%
WACC	11.60%

FACTORS AFFECTING THE COST OF DEBT

A number of important factors impact Nvidia's credit rating:

- **Financial Performance:** Nvidia achieved significant revenue growth, led by the demand for its GPUs from the AI and data center markets. The revenue of the company doubled in recent years, improving significantly its financials, such as cash flow and profitability. Solid EBIT and good margins enhance its credit profile.
- **Debt Levels:** Although Nvidia has raised its capital spending to fund its growth strategy, it keeps debt levels in proportion to its earnings. The capacity to service the debt, quantified by ratios like EBIT interest coverage and operating cash flow (CFO) to debt, is robust, thus underpinning a strong robust credit rating.
- **Market Position and Competitive Advantage:** Nvidia's dominance in the GPU market, particularly in segments like AI and gaming, forms the basis of investor confidence. The firm's innovative products and positioning against the likes of AMD and Intel support its market stability and revenue predictability.
- **Economic Conditions:** General economic conditions like interest rates, inflation, and global trade relationships may have the potential to influence Nvidia's credit rating. For example, higher interest rates have the potential to increase borrowing costs, while geopolitical tensions can interfere with supply chains or limit market access.

- **Investor sentiment and market forces** are the key drivers of credit ratings. Nvidia's strong performance in the equity markets and investor sentiment toward its future growth potential improve its credit standing. Any significant adverse shift in market **sentiment, however, would affect the perceived risk of holding Nvidia's debt securities.**
- **Regulatory Environment:** Regulatory changes concerning technology export or trade policy threaten Nvidia's business. Regulatory limitations, especially related to technology transfer to nations such as China, can affect potential revenues and business operations due to adaptation.

ARM

ARM Holdings plc (ARM) designs microprocessors, physical Internet protocol (IP), and related technology, and software, and sells development tools. ARM licenses and sells its technology and products to international electronics companies, which in turn manufacture, market, and sell microprocessors, application-specific integrated circuits (ASICs), and application-specific standard processors (ASSPs) based on ARM's technology to systems companies for incorporation into a variety of end products. ARM also licenses and sells development tools directly to systems companies and provides support services to its licensees, systems companies, and other systems designers. ARM's principal geographic markets are Europe, the United States, and Asia Pacific. It operates in three segments: Processor Division (PD), Physical IP Division (PIPD), and Systems Design Division (SDD).

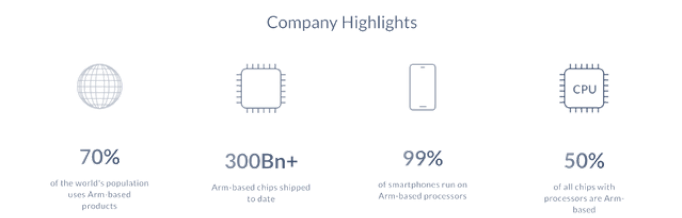


Figure 21 shows the various milestones achieved by ARM since its incorporation

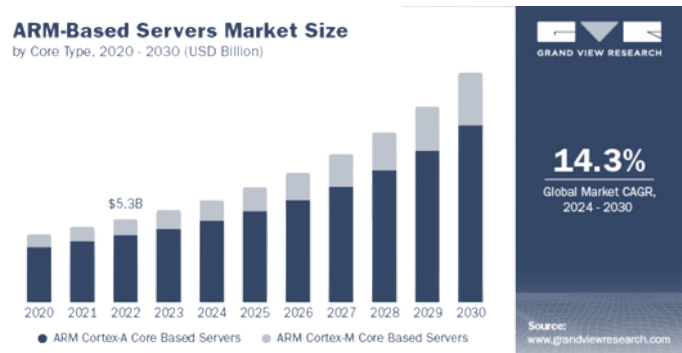


Figure 22 shows the market size of ARM-based servers estimated to grow at a 14.3% CAGR, signifying huge market opportunities for ARM

- As of September 2024, Arm Holdings reported a 5-year compound annual growth rate (CAGR) in revenue per share of 27.90%
- As of September 2024, Arm Holdings reported a 10-year compound annual growth rate (CAGR) in revenue per share of 21.10%.

We already saw that Arm's latest AI-focused Armv9 architecture drives outstanding revenue growth for the company despite much lower shipments due to a higher royalty rate. This is also probably the reason Arm's profit margin started heading higher in the past year.

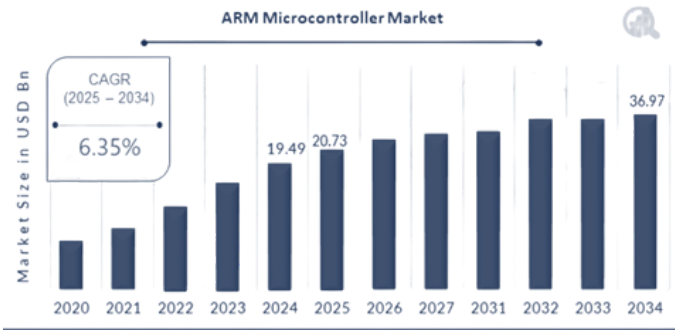


Figure 24 shows the ARM Microcontroller market size and its future estimated growth rates. The ARM Microcontroller Market Size was estimated at 19.49 (USD Billion) in 2024. The ARM Microcontroller Market Industry is expected to grow from 20.73 (USD Billion) in 2025 to 36.97 (USD Billion) by 2034, exhibiting a compound annual growth rate (CAGR) of 6.35% during the forecast period (2025 - 2034)

BUSINESS SEGMENTS

ARM's business is structured around three core segments: Licensing, Royalties, and Software & Services. In the Licensing segment, ARM generates revenue by providing companies access to its processor designs (like Cortex and Neoverse), system IP, and physical IP used in developing chips. This provides upfront payments and allows partners to customize ARM designs for a wide range of devices from smartphones and embedded systems to automotive and data center applications. The Royalties segment brings in recurring revenue as ARM earns a fee for every chip sold that uses its technology. This creates a strong annuity model tied to global chip shipments, especially in mobile and IoT markets. Finally, ARM's Software & Services segment supports its ecosystem by offering development tools, simulation environments,

technical consulting, and training to help partners integrate and optimize ARM technology. These three segments together enable ARM to maintain its leadership in energy-efficient computing across multiple high-growth industries

ARM’s long-term strategy includes multiple growth drivers. These include

- Growth will be driven by royalty revenues.
- Growth will be driven by the need for more energy-efficient computing and AI capability from the data centre to edge computers.
- Growth will be driven by Compute Subsystems.
- Growth will be driven by Arm’s unique ecosystem of software and design partners.

HISTORICAL GROWTH RATES AND FINANCIALS

Figure 24 shows the ARM Microcontroller market size and its future estimated growth rates. The ARM Microcontroller Market Size was estimated at 19.49 (USD Billion) in 2024. The ARM Microcontroller Market Industry is expected to grow from 20.73 (USD Billion) in 2025 to 36.97 (USD Billion) by 2034, exhibiting a compound annual growth rate (CAGR) of 6.35% during the forecast period (2025 - 2034)

1) Revenue, Profits and Margins

Item	TTM	FY 2024	FY 2023	FY 2022	FY 2021
Period Ending	Dec 31, 2024	Mar 31, 2024	Mar 31, 2023	Mar 31, 2022	Mar 31, 2021
Revenue	3,694	3,233	2,679	2,703	2,027
Revenue Growth (YoY)	25.73%	20.68%	-0.89%	33.35%	-
Gross Profit	3,560	3,079	2,573	2,572	1,882
Net Income	806	306	524	549	388
Net Income Growth	848.24%	-41.60%	-4.55%	41.49%	-
EPS (Basic)	0.77	0.3	0.51	0.54	0.38
EPS (Diluted)	0.76	0.29	0.51	0.54	0.38
EPS Growth	841.37%	-43.14%	-4.76%	41.72%	-
Free Cash Flow	650	998	675	424	1,129
Dividend Per Share	-	-	-	-	0.73
Gross Margin	96.37%	95.24%	96.04%	95.15%	92.85%
Operating Margin	11.98%	2.37%	26.60%	25.15%	11.94%
Profit Margin	21.82%	9.46%	19.56%	20.31%	19.14%
Free Cash Flow Margin	17.60%	30.87%	25.20%	15.69%	55.70%
EBITDA	600	224	860	830.3	422
EBITDA Margin	16.24%	6.93%	32.10%	30.72%	20.82%
EBIT	442.5	76.5	712.5	679.8	242
EBIT Margin	11.98%	2.37%	26.60%	25.15%	11.94%

Ratios	Current	FY24
Market Capitalization	109,605	128,499
Enterprise Value	107,205	126,319
PE Ratio	137.26	419.93
Forward PE	53.47	93.56
PS Ratio	29.41	39.75
PB Ratio	17.08	24.27
EV/Sales Ratio	29.02	39.07
EV/EBITDA Ratio	178.68	563.92
EV/EBIT Ratio	242.27	1651.23
Debt / Equity Ratio	0.04	0.04
Asset Turnover	0.47	0.44
Quick Ratio	4.88	2.68
Current Ratio	4.96	2.79
Return on Equity (ROE)	14.11%	6.55%
Return on Assets (ROA)	3.54%	0.65%
Return on Capital (ROIC)	4.64%	0.98%
Return on Capital Employed (ROCE)	5.80%	1.20%

CAGR (Historical & Projected), Market Size

Report Attribute	Details
Market size value in 2024	USD 6.51 billion
Revenue forecast in 2030	USD 14.51 billion
Growth rate	CAGR of 14.3% from 2024 to 2030

GLOBAL ARM SERVER MARKET DRIVERS

The market drivers for the Arm Server Market can be influenced by various factors

These may include:

- **Increasing Demand for Edge Computing:**

The rise of edge computing is a crucial factor propelling the Arm Server Market. There has been a considerable increase in demand for computing technology that is both effective and low-powered because businesses want to process data as close to its source as possible. The Arm architecture, due to its energy efficiency and its focus on performance, caters to many applications such as real-time processing. This is most relevant in the case of IoT devices and smart applications where minimal latency is imperative. More so, the data deluge created by a myriad of digitally connected devices further signals the reliance on advanced edge computing powered by Arm servers. Arm servers are becoming more widely adopted because they offer better energy efficiency and lower total cost of ownership.

- **Adoption of Cloud Services:** The acceptance rate of cloud services is on the rise, which is positively impacting the Arm Server market as a growing number of businesses are shifting their workloads to the cloud. Such approaches change the prerequisites of server architectures needed to be scalable and efficient. In the case of

- cloud-dominated environments, there is a growing adoption of Arm-based servers due to their resource-friendly approach, even when supporting multi-tenant workloads. Major industry players like Amazon and Google are using Arm architecture to diversify their offerings and improve performance metrics, which further cements Arm's counter competitiveness. The cost-effectiveness of Arm servers also makes them appealing for cloud operators aiming to reduce operational expenses while maximizing efficiency, leading to wider acceptance in the market.

- **Center Attention On Energy Efficiency:**

Energy efficiency is now one of the key concerns for the entire server market, stimulating the need for demand for Arm servers that are famous for power consumption. Companies are now more concerned than before about the operational cost associated with energy expenditure, which has shifted the focus towards more eco-friendly computing solutions. The use of ARM technology in data centers significantly reduces their carbon emissions while delivering adequate performance. This development is in tandem with policy measures aimed at curtailing energy consumption in the IT infrastructure sector. Consequently, businesses are now focusing on purchasing products that are based on Arm technology due to their effectiveness in energy savings, hence increasing their use in telecommunications, finance, and even in government.

- **Developments In Artificial Intelligence:** The Arm Server Market is one of the

- sectors under heavy influence of artificial intelligence (AI) and machine learning (ML) due to rapid evolution of technology. AI workloads place demands on computing resources that are both powerful and efficient, and can be delivered by the Arm Architecture because of its scalable and energy-efficient features. Due to their parallel processing and high throughput capabilities, Arm servers are ideal for AI applications. As more and more businesses use AI for data analysis, automation, and even advanced decision making, the greater need for Arm servers is.
- Expansion of the Internet of Things (IoT):** All of IoT's promising opportunities have kept it at the center stage for Arm server development, as IoT devices of all capabilities will need sophisticated, scalable computing options. The low power consumption characteristics of the Arm architecture are well-suited for the resource-harsh surroundings IoT applications are found. With virtually billions of new devices anticipated to join the network in the next few years, the data needs are growing exponentially. This enhances the opportunity and grounds for adopting ARM servers. The provision of real-time data analytics as well as edge computing at the IoT endpoints explains the need for strong processing resources. All these trends force Arm server technology investment to meet the evolving IoT demands from the IoT ecosystem.

RISK METRICS

Average Debt-to-Equity Ratio of the Industry	0.35
Current ratio	2.79
Debt/EBITDA	0.88
Debt/FCF	0.45

- The Risk Score is a relevant measure for the assessment of a stock's attractiveness. ARM Holdings PLC shows a Risk Score of 8.00.
- 0 corresponds to a very high risk, and 10 corresponds to a very low risk.
- The Risk Score for ARM Holdings PLC is significantly higher than its peer group's. This means that ARM Holdings PLC is significantly less risky than its peer group.

Source:
<https://www.infrontanalytics.com/fe-EN/31230EX/ARM-Holdings-plc/gprv-risk>

VOLATILITY

- The Beta of ARM's Ltd is **3.18**, which signifies the high volatility as compared to the market.
- A Beta of 1.0 means the stock is in line with the market.
 - A Beta greater than 1 means more volatility than in the market
 - A Beta less than 1 means less volatility than in the market

KEY RISKS OF ARM LTD.

- **Customer concentration:** A significant portion of Arm’s revenue is derived from a limited number of customers. This reliance exposes the company to greater risks than if its customer base were more diversified. Any reduction of business from key customers could materially affect Arm’s financial results
- **Geopolitical and technical risks in China:** China represents a substantial market for ARM. However, the ongoing tensions between Western countries and China could adversely affect the business prospects of China.
- **Intellectual Property Concentration:** As an IP-centric company, ARM is heavily reliant on its patents and proprietary technology. Infringements, challenges to adequately protect its IP could erode its competitive advantage and market share.
- **Revenue Volatility:** ARM’s revenue is derived from both licensing fees and royalties. Licensing fees can be unpredictable, as they depend on the timing of new agreements, which may not occur consistently.

CREDIT RATING

Arm Ltd does not have publicly available credit ratings from Moody’s or Fitch.

However, Morgan Stanley has rated ARM as “Top Pick,” ensuring its creditworthiness and strong demand.

Source: https://www.investopedia.com/arm-holdings-top-pick-morgan-stanley-ai-demand-8710396?utm_source=chatgpt.com

Moreover, SoftBank Group, which has the largest investment in its portfolio of ARM, was rated “BB” long-term issuer credit rating, “BB” long-term senior unsecured debt rating, and “B” subordinated debt rating after ARM was listed on the NASDAQ Stock Exchange in 2023.

Since data is not available for ARM Ltd, the improvement in Softbank Group rating can be an indicator to understand the creditworthiness of the company.

Source: https://disclosure.spglobal.com/ratings/pt/regulatory/article/-/view/type/HTML/id/3057662?utm_source=chatgpt.com

Alpha Spread reports a solvency score of 80 out of 100 for ARM, suggesting a solid ability to meet its long-term obligations.

Source: https://www.alphaspread.com/security/nasdaq/arm/summary?utm_source=chatgpt.com

WACC

A	B	C	D	E	F	G	H	I
Cost of equity								
Risk free rate		4.61%	4.61%					
Equity Risk Premium		1.24%						
Levered Beta		4.06						
Cost of equity		9.64%						
ARM WACC								
Cost of equity		9.64%						
Equity weight		100.00%						
Cost of debt		5.55%						
Debt weight		0%						
ARM WACC		9.64%						
Therefore, For ARM:								
WACC = Cost of equity								

TSMC

TSMC was founded in 1987 and is headquartered in Hsinchu Science Park, Taiwan. TSMC was the first to establish a pure-play foundry business model based solely on producing its customers' products. By deciding not to design, manufacture, or market any semiconductor products bearing its brand, the company is guaranteed not to compete with its customers. Grounded by this founding premise, the source of TSMC's success is always empowering its customers. The Company's foundry model business led to the explosion of the international fabless phenomenon, and the Company, from the outset, has ranked as one of the world's premier semiconductor foundries. The Company produced 11,895 discrete products using 288 distinct technologies for 528 diverse customers in 2023. In 2023, TSMC continued to lead the foundry portion of the world semiconductor market by holding 28% of the global semiconductor market outside of memory, down from 30% in 2022, primarily owing to the semiconductor industry inventory correction.

The Company's strong market position is primarily due to its leadership in advanced process technologies. In 2023, 58% of TSMC's wafer revenue came from advanced manufacturing processes – geometries of 7nm and below – compared with 53% in 2022. TSMC has long flown under the radar because its semiconductors are intended and marketed in goods by branded makers like Apple, AMD, or Qualcomm. But the company dominates over half the world market in manufactured-to-order chips.

TSMC is leading the way in advanced chip technology fabrication

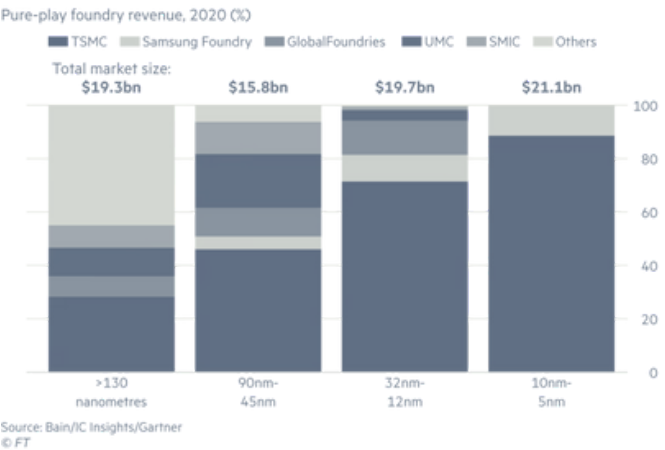


Figure 27 shows the production of semiconductor chips by some of the largest producers of semiconductors in the world. TSMC has long gone largely unnoticed because the semiconductors it manufactures are designed and sold in products by branded vendors such as Apple, AMD, or Qualcomm. Yet the company controls more than half of the world market for made-to-order chips .And it is getting more dominant with every new process technology node.

\$25bn-28bn	3nm	90%
TSMC's planned capital investment this year — up to 63% more than in 2020 and ahead of Intel and Samsung. One analyst says Intel will outsource 20% of its CPU production to TSMC in 2023	Nodes in chips to be built at Shenhua. Their transistor size is just 1/20,000th of a human hair. The most advanced chips currently in production are 5nm	TSMC's share of the market for the most advanced nodes currently in production. it has about 40-65% of revenues in the 28-65nm category used most in carmaking

Fig 28 shows that while TSMC only accounts for 40 to 65% of revenues in the 28-65nm category, the nodes used for producing most car chips, it has almost 90 per cent of the market of the most advanced nodes currently in production.

TSMC COMPANY ANALYSIS

Founded in 1987, TSMC is the world's first

dedicated semiconductor foundry. With its founder and leadership position in the Dedicated IC Foundry segment, TSMC has established its track record by providing innovative and "More-than-Moore" wafer manufacturing processes and industry-leading manufacturing efficiency. TSMC has continuously provided the leading technologies of the foundry segment and TSMC COMPATIBLE® design services since its founding.

HISTORICAL GROWTH RATES AND FINANCIALS

1) Revenue, Profits, and Margins

Items	FY 2024	FY 2023	FY 2022	FY 2021	FY 2020
Revenue	2,894,308	2,161,736	2,263,891	1,587,415	1,339,255
Revenue Growth (YoY)	33.89%	-4.51%	42.61%	18.53%	25.17%
Gross Profit	1,624,354	1,175,111	1,348,355	819,537	711,130
Net Income	1,173,268	838,498	1,016,530	596,540	510,744
Net Income to Common	1,173,268	838,498	1,016,530	596,540	510,744
Net Income Growth	39.92%	-17.51%	70.40%	16.80%	44.30%
EPS (Basic)	45.25	32.34	39.2	23.01	19.7
EPS Growth	39.93%	-17.51%	70.39%	16.80%	44.30%
Free Cash Flow	870,171	292,151	527,927	272,965	315,428
Free Cash Flow Per Share	33.56	11.27	20.36	10.53	12.16
Dividend Per Share	17	13	11	11	10
Dividend Growth	30.77%	18.18%	-	10.00%	5.26%
Gross Margin	56.12%	54.36%	59.56%	51.63%	53.10%
Operating Margin	45.72%	42.63%	49.56%	40.96%	42.31%
Profit Margin	40.54%	38.79%	44.90%	37.58%	38.14%
Free Cash Flow Margin	30.06%	13.51%	23.32%	17.20%	23.55%
EBITDA	1,976,850	1,444,889	1,551,476	1,065,770	891,979
EBITDA Margin	68.30%	66.84%	68.53%	67.14%	66.60%
EBIT	1,323,204	921,466	1,122,070	650,255	566,605
EBIT Margin	45.72%	42.63%	49.56%	40.96%	42.31%

2) Ratio Analysis

Ratios	Current	FY 2024	FY 2023	FY 2022	FY 2021	FY 2020
Market Capitalization	712,605	850,448	501,917	378,561	575,441	489,200
Market Cap Growth	69.44%	69.44%	32.58%	-34.21%	17.63%	70.51%
Enterprise Value	671,282	816,598	484,855	358,782	561,655	476,951
PE Ratio	19.91	23.76	18.34	11.44	26.73	26.91
PS Ratio	8.07	9.63	7.11	5.14	10.05	10.26
PB Ratio	5.4	6.45	4.42	3.93	7.35	7.49
EV/Sales Ratio	7.6	9.25	6.87	4.87	9.81	10.01
EV/EBITDA Ratio	11.13	13.54	10.28	7.1	14.61	15.02
Debt / Equity Ratio	0.24	0.24	0.28	0.3	0.35	0.2
Asset Turnover	0.47	0.47	0.41	0.52	0.49	0.53
Inventory Turnover	4.71	4.71	4.18	4.42	4.65	5.7
Quick Ratio	2.13	2.13	2.07	1.9	1.9	1.5
Current Ratio	2.44	2.44	2.4	2.17	2.17	1.73
Return on Equity (ROE)	30.04%	30.04%	26.00%	39.64%	29.80%	29.62%
Return on Assets (ROA)	13.53%	13.53%	10.97%	16.14%	12.53%	14.09%
Return on Capital (ROIC)	16.80%	16.80%	13.84%	20.69%	15.84%	17.65%
Return on Capital Employed	24.40%	24.40%	20.00%	27.90%	21.80%	26.60%

GROWTH RATES

Historical CAGR - 10 Years Revenue CAGR - 13.2% and 10 Years Profit CAGR - 16.1% [Source](#).

Projected CAGR - Revenue Growth at a CAGR of 20% for the next 5 Years

Current Market Size - Worldwide semiconductor market, excluding memory, reached US\$481 billion in revenue in 2023. In the foundry segment of the semiconductor industry, total revenue stood at US\$114 billion in 2023.

CREDIT RATINGS

TSMC Credit Rating			
Agency	Long-term	Short-term	Outlook
Standard & Poor's	AA-	-	Stable
Moody's	Aa3	-	Stable
Taiwan Ratings*	twAAA	twA-1+	Stable

*Taiwan Ratings (<http://www.taiwanratings.com>) is Standard & Poor's subsidiary in Taiwan.

Figure 29 shows the credit rating for TSMC by various agencies. Fitch Rating for August 2024 - 'AA'

FITCH DATA ON KEY RATING DRIVERS

Key Rating Drivers

Rating Strengths and Weaknesses: The ratings of Taiwan are supported by its highly robust external finances, conservative fiscal stance, high governance scores, and competitive business environment. Taiwan's vulnerabilities include its exposure to shocks in external demand and surprise changes in global trade policy that may impact the technology sector as well as supply chains.

This is on top of complicated and increasingly tense cross-strait relations and below the per capita income compared to our estimated median for 'AA' category peers.

Strong Economic Prospects: We predict growth to pick up to 4.0% in 2024, from 1.3% in 2023, supported by a pickup in high-tech exports during the worldwide artificial intelligence (AI) boom.

Industry leaders have increased investments in higher-end semiconductors and servers from Taiwan to create AI technology and applications. This led to Taiwan's exports to the US jumping by 62% yoy in 7M24 as the US replaced mainland China as the largest export market for the first time in more than two decades. The semiconductor revival driven by AI and the current trend of reshoring will drive further local investment.

Uncertainties Persist: We forecast growth to continue to be moderate, but remain decently healthy at 2.7% in 2025. Resilient exports of AI-related goods and investment behavior should continue to support growth, countering lackluster demand in legacy manufacturing sectors.

We also forecast private consumption to stay strong, even as real wages grow modestly. But negative risks may arise from a sharp deceleration in the growth of Taiwan's leading trading partners, weakening demand from the global AI expenditure boom, geopolitical tensions, and uncertainty over the US post-election trade policy.

Global Competitiveness: Taiwan continues to be in a good position as an indomitable powerhouse in the global semiconductor supply chain, based on its world-leading manufacturing capability and

specialized environment. These give the island leverage to capture increased economic gains from structurally stronger demand for its high-tech exports. Nevertheless, extended cross-strait tensions and market anxieties regarding energy security could worsen challenges to the business environment and medium-term growth prospects over time, in combination with demographic headwinds.

Increased Cross-Strait Tensions and Difficulty in Rapprochement: Explained in detail in the geopolitical and wargaming section

Continuity: We look for policy continuity in economic settings under the new government, primarily in deepening Taiwan's economic ties with the US, Southeast Asia, and other economies. The ruling party's loss of majority status in the legislative body will pose policy implementation challenges. The government will seek to continue to enable the current trend of Taiwanese manufacturing reshoring and nearshoring from mainland China to achieve supply-chain resilience.

Ongoing Fiscal Discipline: We are predicting the 2024 general government deficit to stay low at 0.8% of GDP, less than the 'AA' median deficit of 2.3%.

Our projection is narrower than the sanctioned budget deficit of 2.1%, owing to higher tax collection vis-à-vis budget estimates, and also because some of the fiscal actions undertaken to maintain economic resilience following the Covid-19 pandemic would reverse. We anticipate a smaller 0.4% of GDP deficit in 2025 because we think tax revenues will remain robust, even as spending on social welfare,

education, infrastructure, and defence increases.

Gradual Debt Ratio Reduction: We anticipate gross general government debt to decline to 30.5% of GDP at end-2025, comfortably below the estimated 'AA' median of 50.0%, from 33.0% at end-2023, according to our definition.

Gross general government debt/GDP must continue to trend modestly downwards in the coming years, backed by the medium-term fiscal responsibility underpinned by Taiwan's commitment to conservative fiscal management. Taiwan will endeavor to keep public debt below 50% of GDP, as mandated by the Public Debt Act. Strong External

Finances: Taiwan's external balance sheet ranks among the strongest of Fitch-rated peers worldwide, supported by many decades of consecutive current account surpluses.

We expect the current account surplus to remain strong in 2024, at 13.6% of GDP, underpinned by windfall export receipts and foreign-reserve buffers amounting to about 17.3 months of current external payments, despite financial market uncertainty; both metrics are well above 'AA' category peers. Taiwan should retain its significant net external creditor status at 226.4% of GDP in 2024, compared with 20.9% for the 'AA' median.

Default Spread: TSMC Bond Yield is approximately 4.9%, Risk Free Rate in Taiwan is approximately 1.6% , reflecting a Default spread of 3.3%.

Volatility:

The 5-year beta of TSMC is 1.23, which indicates the stock is more volatile than the

market. Among the Taiwanese market, TSMC ranks on the higher scale in terms of stock volatility.

Beta measures the risk or volatility of a company's share price in comparison to the market as a whole. For example, a company with a beta of 1.1 will theoretically see its stock price increase by 1.1% for every 1% increase in the market. Put differently, if you're expecting the overall market to return 8%, a stock with a beta of 1.5 should return 12%.

Beta is an important metric used in the Capital Asset Pricing Model (CAPM) to effectively calculate a company's cost of equity, which in turn is applied in numerous valuation models.

A company's beta can be calculated from market observations. However, since leverage (debt) can have a significant impact on a company's stock price, one needs to delever the beta to remove these effects. The unlevered beta can then be analyzed against the unlevered betas of comparable companies that operate in a similar industry. This allows an analyst to select the appropriate beta that represents the true risk of operating in that industry.

WEIGHTED AVERAGE COST OF CAPITAL

Cost of Debt - 1.04%

Average Debt for 2023 - TWD 922,216,150
Interest Expense for 2023 - TWD 11,999,400
Pre-Tax Cost of Debt = 1.30%
Corporate Tax Rate (Taiwan) - 20%
Effective Cost of Debt - 1.04%

Cost of Equity - 14.725%

Market Rate of Return - 12.1% (Including Dividend yield of 3%)

Beta - 1.23

Taiwan Risk Free Rate - 1.6%

Total Equity - 27.49 Trillion TWD (96.75% of Total Capital)

Total Debt - 922 Billion TWD (3.25% of Total Capital)

WACC = 0.0338% + 12.4904% = 12.524%

Details	Particulars
Risk Free Rate	1.62%
Market Return	12.10%
Equity Risk Premium	10.48%
Beta	1.03047
Cost of Equity	12.42%
Cost of Debt	1.09%
Tax Rate	20.00%
Cost of Debt (effective)	0.87%
Equity (Absolute in \$ Thousands)	726,630,351
Debt (Absolute in \$ Thousands)	36,701,800
Weightage of Equity	95.19%
Weightage of Debt	4.81%
WACC	11.86%

ASML COMPANY ANALYSIS

ASML is a Dutch firm headquartered in Veldhoven, the Netherlands, which designs and manufactures systems and software

utilized to manufacture semiconductor chips.

It is the world's sole 2024 manufacturer of extreme ultraviolet (EUV) lithography equipment, which allows smaller, faster, and more powerful microchips to be produced by utilizing a shorter wavelength of light.

ASML also makes deep ultraviolet (DUV) lithography equipment, metrology and inspection equipment, and computational lithography software; renovates old machines; and delivers comprehensive training and customer support services.

HISTORICAL GROWTH RATES AND FINANCIALS

1) Revenue, Profits, and Margins

Item	FY 2024	FY 2023	FY 2022	FY 2021	FY 2020
Revenue	28,263	27,559	21,173	18,611	13,979
Revenue Growth (YoY)	2.56%	30.16%	13.77%	33.14%	18.26%
Gross Profit	14,492	14,136	10,700	9,809	6,797
Net Income	7,572	7,839	5,624	5,883	3,554
Net Income Growth	-3.41%	39.38%	-4.40%	65.55%	37.09%
EPS (Basic)	19.25	19.91	14.14	14.36	8.5
EPS Growth	-3.27%	40.76%	-1.46%	69.10%	37.89%
Free Cash Flow	9,099	3,288	7,205	9,945	3,666
Free Cash Flow Per Share	23.12	8.34	18.1	24.23	8.75
Dividend Per Share	6.4	6.1	5.8	5.5	2.75
Dividend Growth	4.92%	5.17%	5.46%	100.00%	14.58%
Gross Margin	51.28%	51.30%	50.54%	52.70%	48.63%
Operating Margin	31.92%	32.81%	30.70%	35.12%	28.98%
Profit Margin	26.79%	28.44%	26.56%	31.61%	25.42%
Free Cash Flow Margin	32.19%	11.93%	34.03%	53.44%	26.22%
EBITDA	9,861	9,699	7,081	6,991	4,527
EBITDA Margin	34.89%	35.19%	33.44%	37.56%	32.38%
EBIT	9,023	9,042	6,501	6,536	4,052
EBIT Margin	31.92%	32.81%	30.70%	35.12%	28.98%

2) Ratio Analysis

Ratio	Current	FY 2024	FY 2023	FY 2022	FY 2021	FY 2020
Market Capitalization	257,126	276,165	297,327	214,796	326,687	199,710
Market Cap Growth	-7.12%	-7.12%	38.42%	-34.25%	63.58%	60.80%
Enterprise Value	248,422	275,863	297,351	214,946	326,289	199,978
PE Ratio	32.8	35.23	34.32	35.74	48.83	45.94
PS Ratio	8.79	9.44	9.76	9.49	15.44	11.68
PB Ratio	13.44	14.44	20	22.81	28.33	11.78
EV/Sales Ratio	8.49	9.43	9.76	9.5	15.42	11.7
EV/EBITDA Ratio	24.33	27.02	27.74	28.4	41.04	36.12
Debt / Equity Ratio	0.27	0.27	0.37	0.53	0.47	0.35
Asset Turnover	0.64	0.64	0.72	0.64	0.65	0.56
Inventory Turnover	1.4	1.4	1.67	1.69	1.81	1.71
Quick Ratio	0.91	0.91	0.88	0.8	0.99	1.62
Current Ratio	1.53	1.53	1.5	1.28	1.48	2.41
Return on Equity (ROE)	47.43%	47.43%	70.42%	59.35%	49.01%	26.86%
Return on Assets (ROA)	12.74%	12.74%	14.82%	12.21%	14.21%	10.15%
Return on Capital (ROIC)	26.86%	26.86%	35.39%	28.63%	24.31%	14.62%
Return on Capital Employed (ROCE)	31.60%	31.60%	38.20%	35.50%	36.40%	19.60%

Growth Rates:

- 1.CAGR: Over the past 3 years, ASML has achieved a CAGR of approximately 25.4%.
- 2.Projected Revenue Growth: ASML anticipates annual sales between €44 billion and €60 billion by 2030, implying a projected CAGR of approximately 6.5 to 8.5% from 2024 to 2030.
- 3.Financial Overview with Figures in Millions of Euros is as follows:
<https://www.asml.com/en/investors/financial-results>

CREDIT RATINGS:

Rating Agency	Credit Rating	Outlook	Date of Rating	Source
Fitch Ratings	A+	Stable	May 17, 2024	Fitch Upgrades ASML to 'A+'; Outlook Stable
Moody's Investors Service	A-	Stable	February 17, 2020	ASML - Wikirating

Figure 30 shows the credit ratings for ASML given by Fitch Ratings and Moody's Investors Service.

ASML, a key player in the semiconductor industry, holds strong credit ratings (A+ from Fitch, A- from Moody's), reflecting both qualitative and quantitative factors.

Below is an analysis linking ASML's credit rating to these factors:

QUALITATIVE FACTORS AFFECTING CREDIT RATING

1. Business Model & Market Position

- Monopoly in EUV Lithography: ASML has a monopoly in Extreme Ultraviolet (EUV) lithography equipment, which is essential for advanced semiconductor production. This provides it with high pricing power and demand visibility.
- High Barriers to Entry: Based on intellectual property, technological complexity, and large R&D spend, ASML is in an industry with very little competition.

2. Industry Competition & Business Risk

- Strong demand but cyclical industry: ASML enjoys durable demand in the semiconductor industry, yet cyclicity in chip demand is risky.
- Geopolitical Factors: ASML is subject to export controls on China (e.g., Dutch government limitations on selling advanced chip equipment), affecting revenue streams.

3. Corporate Governance & Management Strategy

- Continuous innovation & R&D

- expenditure (~15% of revenue) demonstrates a dedication to leading-edge technology.
- Shareholder-friendly policies (buybacks & dividends) are weighed against reinvestment requirements.

4. Interest Coverage Ratio

Interest Coverage Ratio = EBIT / Interest Expense

ASML has a very high interest coverage ratio, indicating strong ability to service debt.

- An A+ rating typically aligns with an interest coverage ratio above 10x.

5. Debt-to-EBITDA Ratio

Debt-to-EBITDA = Total Debt / EBITDA

ASML has low leverage, with a Debt/EBITDA ratio well below 2x, supporting its strong credit profile.

- Companies with an A+ rating generally have Debt/EBITDA below 2.5x.

6. RCF/Net Debt (Retained Cash Flow to Net Debt)

RCF/Net Debt = Operating Cash Flow – Dividends / Net Debt

ASML generates strong free cash flow, reducing its reliance on debt financing.

- A high RCF/Net Debt ratio (>50%) aligns with an A-category rating, as it indicates a company's ability to deleverage if needed.

WACC / Hurdle Rate	10.54%
Cost of Equity	13.73%
Risk Free Rate	2.45%
Market Premium	6.00%
Beta	1.88
Equity	13,452.40
Debt	4687.6
Total Capital Employed	18,140.00
Weight of equity	74.16%
Weight of debt	25.84%
Calculation of Cost of Debt:	
Loan Amount (in Mn Euros)	Interest Rate
1000	1.38%
750	1.63%
750	0.25%
750	0.63%
500	2.25%
1000	3.50%
4750	1.66%

Cost of Debt	1.66%
Tax rate	15.80%
Cost of Debt (Post of Tax)	1.40%

ARTIFICIAL INTELLIGENCE

AI implementation, especially Generative AI (Gen AI) and Predictive AI, is currently the secular growth driver for the semiconductor industry.

The need for computation is accelerating with AI penetration across sectors ranging from financial services to healthcare and manufacturing.

Predictive AI (e.g., supply chain optimization, predictive maintenance) is estimated to hit \$135 billion in revenue by 2028.

Generative AI (e.g., large language models, multimodal AI) is growing even faster, projected to reach \$58 billion in revenue by 2028, growing at a 54% CAGR.

Altogether, these could contribute \$193 billion in AI-pushed semiconductor-related software and hardware revenues.

The semiconductor industry stands at the threshold of a new S-curve of innovation and capacity growth.

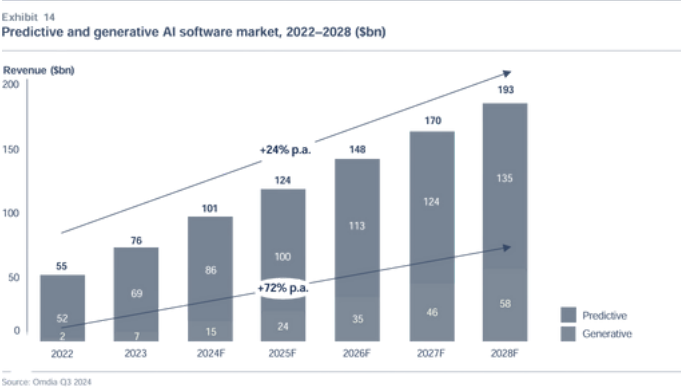


Figure 31 shows the growth rates for both predictive and generative AI, clearly showcasing how generative AI is increasing its influence in the market.

DEMAND FOR SPECIALIZED AI CHIPS AND ACCELERATORS

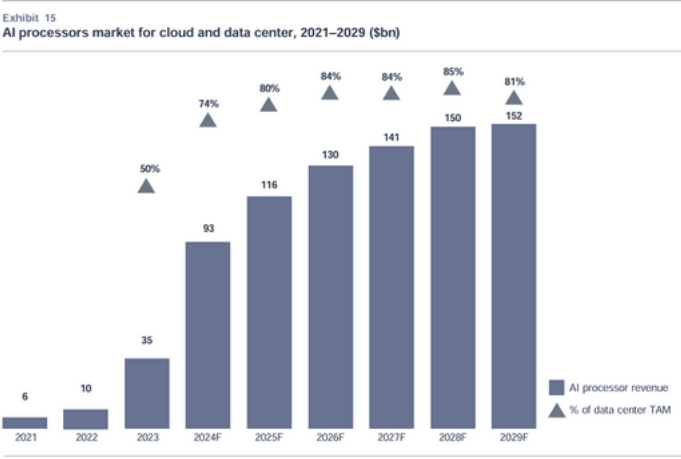


Fig 32 shows the revenue generated by the AI processor market and its future expectations. The old hegemony of general-purpose CPUs is waning. The spotlight is now on specialized semiconductors engineered to deliver top performance on AI workloads:

AI accelerators, high-end GPUs, and specialty AI ASICs are becoming essential.

By 2028–2029, more than 80% of data center processor value will derive from chips that have integrated AI acceleration.

This transition also mirrors larger strategic shifts by hyperscalers (AWS, Google, Microsoft), automakers (Tesla), and device manufacturers (Apple) toward vertical integration through custom chip creation.

AI IS REVOLUTIONIZING THE DESIGN AND MANUFACTURE OF CHIPS

AI is also changing how semiconductors themselves are constructed.

In design: AI algorithms now support chip layout optimization, transistor location, and error forecasting — compressing chip design cycles by up to 30%.

In manufacturing: AI systems forecast tool failures, tune process parameters, and enhance total production yields, especially crucial in advanced nodes like 3nm.

In supply chains: AI enhances demand forecasting, inventory management, and risk identification, making the supply chain more.

- **Strategic Implication:**

Companies incorporating AI throughout their R&D, fab operations, and supply chain management will gain significant cost savings and accelerated time-to-market.

AI is Creating a Historic Boom for Semiconductors: The runaway adoption of AI is driving an historic surge in semiconductor demand.

AI applications such as big language models

like ChatGPT and Sora need 25 times more computing than conventional enterprise software.

This is compelling the semiconductor industry to scale up production of next-generation processors and memory solutions by orders of magnitude.

Semiconductor vendors who historically updated products every several years are now competing to bring new generations out every year.

- **Strategic Implication:**

Companies with the ability to produce faster, power-efficient chips will be leading. Those unable to keep pace with AI-sourced speed and performance demands face obsolescence.

A New Generation of Application-Specific Specialized Chips Emerges

General-purpose processors (CPUs) are no longer adequate for the needs of AI.

The requirements of AI fuel AI needs are fueling a boom for specialized chips such as GPUs, AI accelerators (e.g., Google TPUs, Tesla's D1), and application-specific ASICs.

Even the big cloud players such as Amazon, Microsoft, and Meta are designing their own chips to optimize AI workloads and avoid dependencies on others, such as Nvidia.

- **Strategic Implication:**

The leadership in the semiconductor industry lies not with chipmakers, but rather with manufacturers who integrate a

software ecosystem around hardware (such as NVIDIA's CUDA)

Developing proprietary AI platforms will prove crucial to winning long-term control.

FUTURE OUTLOOK

The semiconductor industry is poised to enter a defining decade, shaped by a convergence of technological transformation, structural demand shifts, and heightened geopolitical complexity. While the industry has historically followed cycles of boom and correction, it is now undergoing a fundamental shift—driven by sustained, secular demand from artificial intelligence (AI), cloud infrastructure, automotive electrification, and the Internet of Things (IoT). For investors, the next phase of growth presents not only compelling opportunities but also a more complex risk landscape that demands strategic foresight.

At the core of this shift is the exponential growth of AI-driven compute, which has emerged as the industry's most significant growth engine. Generative AI alone contributed approximately \$125 billion to semiconductor revenues in 2024 and is expected to exceed \$150 billion by 2025, accounting for over one-fifth of total chip sales. By 2028, the market for AI accelerators could surpass \$500 billion, supported by hyperscaler investment, enterprise AI deployments, and custom silicon adoption at both cloud and edge levels. Notably, AI chips still account for less than 0.2% of total wafer volume, suggesting vast untapped potential.

Automotive semiconductors are also growing rapidly, with chip content per vehicle expected to triple by 2030 due to the rise of electric and software-defined vehicles. Similarly, the proliferation of connected IoT devices is driving demand for ultra-low power, AI-capable chips, particularly in emerging markets. Meanwhile, memory and storage segments, especially high-bandwidth memory and DDR6, are poised for significant growth. However, this growth is tempered by supply chain realignment and geopolitical risks, particularly the industry's reliance on Taiwan for advanced fabrication. Efforts to localize production, along with innovations in advanced packaging, are helping mitigate these risks. As a result, the semiconductor industry is on track to surpass \$1 trillion in annual revenue by 2030, but success will depend on navigating technological advancements, geopolitical volatility, and strategic positioning across high-growth verticals.

However, this growth outlook is accompanied by supply-side realignment and geopolitical risk. The industry's deep reliance on Taiwan for advanced fabrication has created significant strategic vulnerabilities. In response, the U.S., Europe, and allied regions are accelerating efforts to localize production capacity, supported by policy frameworks such as the CHIPS and Science Act. Advanced packaging innovations—particularly chiplet designs and CoWoS (Chip-on-Wafer-on-Substrate) technologies—are also mitigating scaling bottlenecks and enabling modular performance gains essential for AI computing.

Looking at the company profiles assessed earlier, NVIDIA is likely to continue its impressive growth. With strong profitability, high margins and a 75% ROE, it will remain a suitable opportunity for investments. ARM will continue to prioritize Research and Development in its specialized market, driving innovation, although its high costs may be a problem. TSMC is likely to display stability with strategic R&D investments. ASML, with a high ROE and stable R&D, also seems to have strong future prospects. Overall, all these companies have high growth prospects, with NVIDIA and TSMC showing scalable continuous expansion, and ASML and ARM growing in their niche areas.

As we look ahead to the coming years, the future of the semiconductor industry will be shaped by a combination of technological progress and significant geopolitical developments, particularly those concerning the Taiwan Strait. According to our probability-weighted forecast, global semiconductor revenues are projected to grow from \$630 billion in 2024 to approximately \$840 billion by 2030, reflecting a CAGR of 4.91%. This growth is likely to be driven by AI, EVs and Cloud Computing. However, even with these optimistic projections, there is a growing recognition with regards to geopolitical risks as well, one of the most prominent risks being that of the Taiwan Strait escalation.

The Status Quo scenario, as depicted in our model, shows that while tensions are likely to persist between Taiwan and China, the chances for a direct conflictor war remains low in the short term. However, scenarios such as partial blockade (25%) or a full-scale conflict (10%), while less likely, introduce a

high degree of uncertainty, significantly reducing revenue growth from its optimistic projection of US\$ 980B to well below that mark.

For investors, this means the next decade will be defined not just by technological innovation, but by supply chain resilience, policy alignment, and strategic agility. Performance will increasingly depend on positioning across high-growth verticals, alignment with national industrial policies, and the ability to manage exposure to geopolitical and macroeconomic volatility.

In sum, while the semiconductor industry is on track to surpass \$1 trillion in annual revenue by 2030, its path forward will be shaped by more than just market demand. It will require navigating a complex terrain of innovation, fragmentation, and realignment—making it one of the most dynamic, yet strategically critical, sectors in the global investment landscape.

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