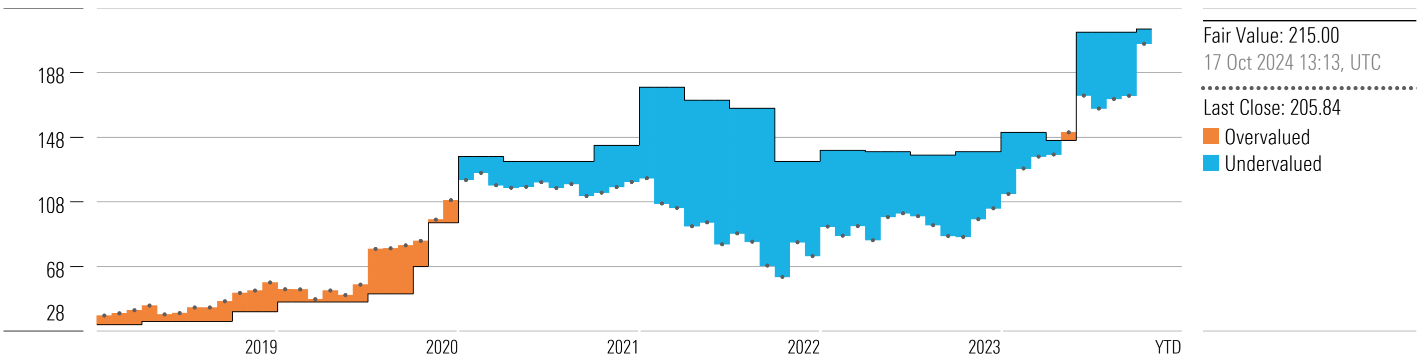
Taiwan Semiconductor Manufacturing Co Ltd ADR TSM ★★★ 17 Oct 2024 21:31, UTC

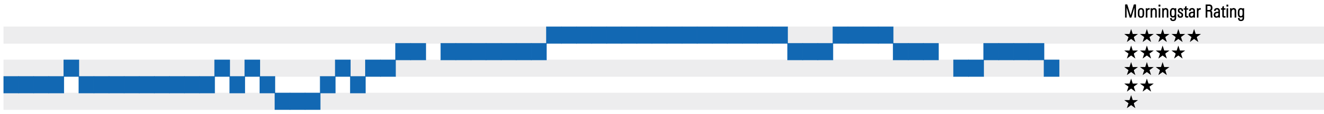
Last Price	Fair Value Estimate	Price/FVE	Market Cap	Economic Moat™	Equity Style Box	Uncertainty	Capital Allocation	ESG Risk Rating Assessment[1]
205.84 USD 17 Oct 2024	215.00 USD 17 Oct 2024 13:13, UTC	0.96	1.07 USD Tril 17 Oct 2024	Wide	Large Growth	Medium	Exemplary	2 Oct 2024 05:00, UTC

Price vs. Fair Value



	2019	2020	2021	2022	2023	YTD
Price/Fair Value	1.45	1.15	0.84	0.56	0.75	0.96
Total Return %	62.86	90.64	12.06	-36.57	42.08	99.57

Morningstar Rating



Total Return % as of 17 Oct 2024. Last Close as of 17 Oct 2024. Fair Value as of 17 Oct 2024 13:13, UTC.

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The primary analyst covering this company does not own its stock.

[1]The ESG Risk Rating Assessment is a representation of Sustainalytics' ESG Risk Rating.

TSMC Earnings: Outstanding Guidance Fueled by AI Conviction; Shares Undervalued

Analyst Note Phelix Lee, Equity Analyst, 17 Oct 2024

Despite impressive guidance and results, we maintain our fair value estimate for wide-moat Taiwan Semiconductor Manufacturing Co. at TWD 1,380 per share (USD 215 per ADR under updated exchange rates) as long-term fundamentals are largely unchanged. TSMC's shares remain attractive as the company remains the go-to foundry for artificial intelligence chips and is the only foundry with sufficient scale to meet the content growth demand for cutting-edge chips in both AI and other applications.

TSMC anticipates fourth-quarter revenue to grow 11.6% sequentially to TWD 848 billion at the midpoint (12.8% in US dollar terms to USD 26.5 billion), bringing 2024 revenue to TWD 2.87 trillion, above our prior full-year estimate of TWD 2.7 trillion, due to the better-than-expected ramp-up of 3 nanometer mobile and AI products. Gross and operating margin guidance is marginally higher sequentially to 58% and 47.5% at their respective midpoints, well above our 55% gross margin forecast. As a result, we have increased our 2024 revenue and earnings per share projections by 6% and 10%, respectively.

Third-quarter results were much better than we anticipated. Revenue came in at TWD 760 billion, 13% higher sequentially. Gross and operating margins improved almost 5 percentage points from the prior quarter to 57.8% and 47.5%, respectively. The stellar numbers come from higher utilization, which we believe is concentrated at 5 nm and 7 nm processes, as AI features are driving additional chip content on PCs and smartphones. Debottlenecking efforts also helped in the quarter by enabling more AI chip

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Taiwan Semiconductor Manufacturing Co Ltd ADR TSM ★★★ 17 Oct 2024 21:31, UTC

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Sector	Industry
Technology	Semiconductors

Business Description

Taiwan Semiconductor Manufacturing Co. is the world's largest dedicated chip foundry, with over 60% market share. TSMC was founded in 1987 as a joint venture of Philips, the government of Taiwan, and private investors. It went public as an ADR in the U.S. in 1997. TSMC's scale and high-quality technology allow the firm to generate solid operating margins, even in the highly competitive foundry business. Furthermore, the shift to the fabless business model has created tailwinds for TSMC. The foundry leader has an illustrious customer base, including Apple, AMD, and Nvidia, that looks to apply cutting-edge process technologies to its semiconductor designs. TSMC employs more than 73,000 people.

shipments than projected.

Management said 2025 capital expenditure is likely to be higher than 2024 without providing numbers, in line with our view of a 20% year-on-year increase. Back-end packaging capacity remains tight, echoing Nvidia's CEO's view of "insane" demand.

Business Strategy & Outlook Phelix Lee, Equity Analyst, 17 Oct 2024

Taiwan Semiconductor Manufacturing Co. is the world's largest dedicated contract chip manufacturer, or foundry, with over 60% market share. It makes integrated circuits for customers based on their proprietary IC designs. TSMC has long benefited from semiconductor firms around the globe transitioning from integrated device manufacturers to fabless designers. Like all foundries, it assumes the costs and capital expenditures of running factories amid a highly cyclical market for its customers. Foundries tend to add excessive capacity during times of burgeoning demand, which can result in underutilization during downturns that hampers profitability.

The rise of fabless semiconductor firms has been maintaining the growth of foundries, which has in turn encouraged increased competition. However, most of these newer competitors are confined to low-end manufacturing due to prohibitive costs and engineering know-how associated with leading-edge technology. To prolong the excess returns enabled by leading-edge process technology, or nodes, TSMC initially focuses on logic products, mostly used on central processing units and mobile chips, then focuses on more cost-conscious applications. This strategy has been successful, illustrated by the fact that the firm is one of the two foundries still possessing leading-edge nodes when dozens of peers lagged.

We note two long-term growth factors for TSMC. First, the consolidation of semiconductor firms is expected to create demand for integrated systems made with the most advanced nodes. Second, organic growth of artificial intelligence, Internet of Things, and high-performance computing applications may last for decades. AI and HPC play a central role in quickly processing human and machine inputs to solve complex problems like autonomous driving and language processing, which accentuated the need for more energy-efficient chips. Cheaper semiconductors have made integrating sensors, controllers, and motors to improve home, office, and factory efficiency possible.

Bulls Say Phelix Lee, Equity Analyst, 17 Oct 2024

- TSMC should consistently earn higher gross margins than competitors thanks to its economies of scale and premium pricing justified by cutting-edge process technologies.
- TSMC wins when customers compete to offer the most advanced processing systems using the latest process technologies.
- TSMC will benefit from more semiconductor firms embracing the fabless business model and internet

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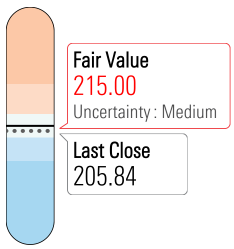
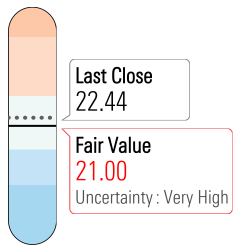
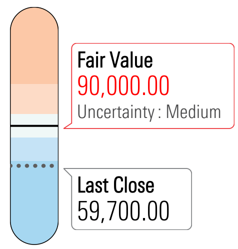
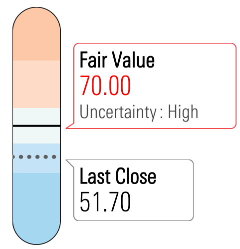
Competitors

	Taiwan Semicon...ing Co Ltd ADR TSM	Intel Corp INTC	Samsung Electronics Co Ltd 005930	United Microelectronics Corp 2303
				
Economic Moat	Wide	None	Narrow	None
Currency	USD	USD	KRW	TWD
Fair Value	215.00 17 Oct 2024 13:13, UTC	21.00 2 Aug 2024 03:48, UTC	90,000.00 8 May 2024 06:21, UTC	70.00 2 Feb 2024 04:58, UTC
1-Star Price	290.25	36.75	121,500.00	108.50
5-Star Price	150.50	10.50	63,000.00	42.00
Assessment	Fairly Valued 17 Oct 2024	Fairly Valued 17 Oct 2024	Significantly Undervalued 17 Oct 2024	Undervalued 17 Oct 2024
Morningstar Rating	★★★17 Oct 2024 21:31, UTC	★★★17 Oct 2024 21:29, UTC	★★★★★17 Oct 2024 12:28, UTC	★★★★17 Oct 2024 13:32, UTC
Analyst	Phelix Lee, Equity Analyst	Brian Colello, Strategist	Kazunori Ito, Director	Phelix Lee, Equity Analyst
Capital Allocation	Exemplary	Standard	Standard	Standard
Price/Fair Value	0.96	1.07	0.66	0.74
Price/Sales	12.68	1.72	1.26	2.86
Price/Book	8.34	0.83	1.08	1.83
Price/Earning	33.47	52.76	14.54	12.44
Dividend Yield	1.17%	2.24%	2.43%	5.80%
Market Cap	1,067.50 Bil	95.95 Bil	405,522.35 Bil	647.72 Bil
52-Week Range	84.95—212.60	18.51—51.28	58,900.00—88,800.00	46.10—58.00
Investment Style	Large Growth	Large Value	Large Blend	Large Value

giants designing their own data center chips.

Bears Say Phelix Lee, Equity Analyst, 17 Oct 2024

- Although TSMC is the foundry leader, each generation of process technology matures and commoditizes quickly, forcing the company to deal with pricing pressure.
- TSMC's new approach to diversify production geographically may add cost pressures with little added resilience to stability.
- Samsung and Intel are committed to heavy capital spending under the support of the US government. SMIC and other state-supported Chinese foundries also lurk as potential threats.

Economic Moat Phelix Lee, Equity Analyst, 17 Oct 2024

We believe TSMC's wide moat stems from its cost advantage and intangible assets, which are realized from its leading position in process technology, or nodes. TSMC's long-standing leadership in node advancement comes from its ability to correctly and consistently prioritize the right areas in which to innovate for nodes, while maintain fiscal discipline. Process technology leadership enables TSMC to improve power, performance, and area, or PPA, cost per chip, and time to market, which are critical for the competitiveness of computing devices. It also justifies higher prices than peers. As such, we believe that TSMC's leading position in the advanced processes will contribute to attracting and retaining more customers, more stable utilization of ever-expanding production capacities, and lower production costs, generating a higher return than peers because of the cost advantage, and as a result, ensuring sufficient profits to fund research and development and capital expenditures on subsequent nodes. This virtuous cycle of intangible assets brought by heavy R&D and cost advantages brought by better PPA prevents smaller peers from catching up, in our view. In fact, TSMC has been leading node advancement and maintaining over 50% market share since the early 2000s, and its gross and operating margins have been about twice as high as those of its closest peers for years.

We believe TSMC's wide moat is justified by a wider gap between it and smaller peers. Because of technical hurdles, node advancement has been growing more costly, prompting some smaller players to give up on catching up with the industry leaders and other firms to divest. While there were six companies with cutting-edge nodes when the industry introduced 16/14 nanometer fabs around 2015, there are currently only two, TSMC and Samsung Electronics, selling 5 nm chips, as smaller peers such as GlobalFoundries and UMC decided not to introduce sub-14 nm processes. TSMC's historical and projected return on invested capital, stable market share, and superior margins all support our wide moat rating.

Multiple technical barriers and high capital requirements form TSMC's wide moat. Semiconductor manufacturing is inherently capital-intensive. While for every foundry each successive node requires exponentially more R&D and capital expenditures, customers are only willing to pay a premium to first movers. Though node advancements are viewed as evolutionary, manufacturing methods may change drastically in every few generations of process technology. In CPUs and mobile systems on chips, where adoption of new nodes first occurs, planar processes are only used up to the 22/20 nm process. Fin field-effect transistor, or FinFET, is used from 16/14 nm onward. After FinFET comes gate all around, or GAA, which will be adopted on TSMC's 2 nm and Samsung's 3 nm nodes. Successive technologies improve electrical performance and miniaturization to fit as many transistors as possible onto chips, thus improving performance relative to costs. Breakthroughs in semiconductor manufacturing aim to improve PPA.

FinFET is the first major barrier that eliminated most foundries from advancing further. Only the largest foundries—TSMC, Samsung, GlobalFoundries, UMC, SMIC, and more recently Intel as a new entrant to the space—possess FinFET-related intangible assets. Only TSMC, Intel, Samsung, and GlobalFoundries can meet customers' stringent constraints in mass production. UMC has suspended expansion of 14 nm capacity while SMIC is still ramping up. Manufacturers that decide to halt FinFET R&D have little choice other than divesting, as did Panasonic in 2019, Fujitsu's 12-inch operations in 2019, and IBM in 2014.

GAA is the new technology hurdle and major potential intangible asset that foundries must overcome to master 3 nm and later nodes. TSMC plans to implement GAA from 2 nm, with mass production projected in 2025. We do not expect foundries apart from Samsung and Intel Foundry to commercialize GAA-derived products owing to prohibitive costs, with R&D alone estimated to exceed USD 1 billion. The adoption of GAA should lead to better and more stable electrical performance even as circuitries become more intricate. Currently, only TSMC, Intel, and Samsung have unveiled timetables to introduce GAA-derived products. We think TSMC's dominant market share and strategy to focus on high-end products put it in the best position to outspend competitors in terms of R&D to advance through GAA and beyond.

Close relationships with industry giants help justify investments in process advancement. One of TSMC's intangible assets is its strong relationships with leaders in multiple subsectors, like Apple in mobile chips, Nvidia in graphic processors, and Xilinx in reprogrammable chips. Combined with its leadership in process technology, TSMC can readily justify hefty investments in new process nodes by convincing customers to share detailed road maps, while smaller foundries have to build facilities first and wait for orders that TSMC cannot fill. Over the decades, TSMC has helped AMD to maintain competitiveness in PCs, Apple and Qualcomm to advance smartphone technology, and now Nvidia, Marvell, and Xilinx, among others, to develop AI, HPC, and automotive electronics for the next decade and beyond. TSMC's technological independence ensures its R&D efforts are customer-agnostic and readily expanded to legacy applications as cost and reliability improve. Without advance process technology, it is difficult for smaller foundries like SMIC and UMC to convince customers to risk their own road map.

The Open Innovation Platform nudges customers closer to TSMC. TSMC's OIP bridges intellectual property owners with potential licensees. These licensees are typically TSMC's 500-plus customers outside the top 10, constituting about 30% of sales. OIP becomes more valuable for all users when intellectual property owners join in search of potential licensees and potential licensees look for solutions to optimize their products. While other foundries have similar platforms, TSMC's dominant market share and technical leadership would naturally gravitate users to its OIP. Even though TSMC offers OIP for free, it indirectly benefits from licensees eventually placing foundry orders. In order to keep licensees inside the ecosystem, the company releases some of its technical data—including FinFET and GAA data—to intellectual property owners to entice them to base their future designs on it. It also cooperates with top electronic design automation tool vendors like Cadence and Synopsys to manage intellectual property libraries and generic product modules. This way, licensees would not use other foundries as the latter have different production parameters.

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Fair Value and Profit Drivers Phelix Lee, Equity Analyst, 17 Oct 2024

Our base-case fair value estimate is USD 215 per ADR, at which TSMC would trade at a forward price/earnings ratio of 24 times and price/book ratio of 7 times per 2025 estimates. We use a weighted average cost of capital of 8.2% to discount our forecast cash flow for TSMC.

We project the company's top-line CAGR at 15.8% over the next five years. Even with its dominant market share, we believe TSMC can deliver above-industry growth through a higher proportion of more valuable 10 nm to 2 nm logic and 28 nm to 12 nm specialty products, which are currently only produced by it and Samsung at scale. We expect Internet of Things and automotive applications are sources of incremental demand in newer specialty products. In terms of node advancement, mass production of 3 nm began in December 2022 and 2 nm manufacturing is expected to begin in 2025.

We project 2024 gross and operating margins to be higher year on year at 56% and 45%, respectively, as product mix improvements are offset by ramping of 3 nm production and conversion of existing capacity in the second half of 2024. While quarterly margins may fluctuate while the company ramps up production of a new node, long-run margins should be stable, as we expect TSMC's moat to support its pricing power for years to come. Management also aligns its interests to the 53% gross margin target by listing it as one of the criteria for performance-linked bonuses.

High-performance computing is TSMC's largest growth driver. We believe increasing in-house design of cloud computing and AI chips by US and Chinese internet giants to benefit TSMC for the next few years.

One recurring threat to TSMC's long-term growth is the loss of key personnel to competitors. In the past, TSMC has managed the issue by offering above-average salaries to employees. But to counter Chinese semiconductor companies that are poaching talent, TSMC rolled out a performance share scheme in 2021, which links financial performance and environmental, social, and governance initiatives to staff remuneration. We think this better aligns employees' interest with more stakeholders. TSMC's scheme is one of Taiwan's first to include ESG goals.

Risk and Uncertainty Phelix Lee, Equity Analyst, 17 Oct 2024

TSMC operates in the semiconductor industry, which is one of the most cyclical ones. TSMC derives about a third of its revenue from the smartphone market. The industry alternates between shortages and oversupply. Foundries cannot always raise prices during shortages yet have to deal with high fixed costs in all downturns. Compared with its peers, TSMC's earnings volatility has been lower, with no earnings per share decline larger than 20% in the past 10 years. We expect this to continue as a result of TSMC's dominant share in high-end products and customers' preference for TSMC as their primary (sometimes sole) foundry.

TSMC has client concentration risk, with the largest customer contributing 25% of revenue in 2023 and

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the top four clients about 50%. We believe Apple has been TSMC's largest customer for the last five years, owing to consistent wins of A series processors on multiple devices. Due to short product lifecycles, the possibility of Apple choosing Samsung as the foundry for an upcoming chip will also linger.

Currency risk is limited as most transactions are made in US dollars. Intellectual property theft is a major risk. The most high-profile incident was TSMC's settlement with SMIC, in which the firm received shares and cash from SMIC after a series of legal disputes from 2003 to 2009, as reported by Reuters.

TSMC's expansion requires a lot of land, electricity, and water. TSMC's land acquisition may be slowed by objections from locals. The company works with government agencies to ensure supply of electricity and water and with suppliers to enhance its waste and water treatment systems.

The current CEO doubles as chair following the previous chair's retirement in June. While near-term implications should be minimal, we hope the CEO can balance managing day-to-day operations with government relations.

Capital Allocation Phelix Lee, Equity Analyst, 17 Oct 2024

We assign TSMC an Exemplary Capital Allocation Rating, given its consistent excess ROIC and return on equity, both averaging over 20% for the past decade. In January 2022, the company hiked its ROE target to 25% from 20%, in view of higher certainty in secular drivers like high-performance computing and autonomous driving. TSMC's ROIC and ROE are far higher than those of UMC and SMIC, with the latter averaging less than 10% over the last 10 years. TSMC's earnings are also more stable than peers', with a 2012-23 EPS compound annual growth rate at 16.2% without major decreases (more than 20%) year on year. UMC had four major decreases and SMIC had three in the same period. We believe such impressive financial performance is evidence of management's ability to expand capacity without being distracted by short-term supply demand imbalances and focus on cementing long-term technological leadership instead of pursuing short-term opportunistic pricing during shortages. Moreover, TSMC is more disciplined in expansion than peers. It tends to direct 30%-50% of revenue to capital expenditures each year. UMC and SMIC's capital expenditures appear to be more arbitrary, with historical capital expenditures/sales ratios fluctuating between 9% and 62% and between 31% and 150%, respectively. TSMC also appears to match capital expenditures with future demand better than its peers, with a more stable depreciation/sales ratio in the mid-20s.

TSMC's more stable earnings lead to more consistent dividends. The company has never stopped paying dividends since its first distribution in 2004 (for 2003 earnings) and has never reduced the dividend. In fact, TSMC's annual dividend per share has increased for six consecutive years with a payout ratio at around 50%, which is a feat given the industry's cyclicality and heavy investments needed. The company has two main shareholder return policies. The first is to at least maintain, if not increase, the dividend per share every year. The second is to prioritize dividends over share repurchases. Dividends have been paid quarterly since 2019. We forecast dividends to increase to TWD 15 per share by full-year 2024. In contrast, SMIC has never declared a dividend since its IPO in 2004, and UMC's dividend history is marked with ups and downs in line with its earnings.

TSMC has not made material acquisitions in recent years. This is reasonable, considering that other foundries look unattractive in the face of TSMC's unparalleled manufacturing capabilities and the company has no plans to compete with customers in IC design or replace downstream packaging, assembly, and testing firms.

Analyst Notes Archive

TSMC Earnings: Negative News and Upbeat Guidance Create Entry Opportunity Phelix Lee, Equity Analyst, 18 Jul 2024

We are maintaining our TWD 1,380/USD 213 fair value estimate for wide-moat Taiwan Semiconductor Manufacturing Co. after the company reported second-quarter results and third-quarter guidance that was on track with our full-year estimates and more bullish than PitchBook consensus. Negative news like US presidential candidate Donald Trump's remarks on Taiwan and a Bloomberg article on possible new export restrictions should have limited direct impact on TSMC's operations, as most of the chipmaker's direct customers are from the US or Taiwan. We see this week's pullback as an entry point for investors seeking an inexpensive way to gain exposure to artificial intelligence and overall semiconductor growth.

TSMC: Raising Valuation by 45% on Potential Price Hike, and Incremental AI PC and Datacenter Demand Phelix Lee, Equity Analyst, 24 Jun 2024

We raise our fair value estimate on Taiwan Semiconductor Manufacturing, or TSMC, to TWD 1,380 per share from TWD 950 (USD 213 per ADR from USD 146) owing to higher pricing expectations, stronger artificial intelligence demand, and plausible upward revision in its full-year revenue guidance. As a result, we increase our revenue and EPS expectations for 2024 to 2028 by up to 9% and 17%, respectively. In addition, we lowered our WACC to 8.2% from 9.3% as TSMC is closer to opening overseas plants to mitigate geopolitical risks in East Asia. Even after a 60% year-to-date share price rally, we view TSMC is undervalued as potential price hikes without much additional capital expenditure would disproportionately improve free cash flow.

Revenue upside from edge or on-device AI has become more visible, in our view. Apple said on its recent Worldwide Developers Conference that it will take a hybrid approach in handling user queries. Simpler queries will be handled on-device instead of being sent to remote cloud servers. We take this as validation to chip designer MediaTek's earlier declarations that edge AI will gain prominence as more AI models are trained. We expect both Android and iOS smartphones to enable on-device AI processing over the next 3-5 years, which directly leads to 10%-20% more silicon content on smartphones.

Datacenter AI also contains pleasant surprises. First, Apple says it will run complex queries on "dedicated Apple silicon servers," which we interpret as incremental semiconductor demand for TSMC structurally, given Apple has to maintain and expand a vast fleet of datacenters to handle user queries. Second, top-10 customer Broadcom raised its full-year guidance from AI-linked chips by 10%. Third, Nvidia accelerated its datacenter GPU refresh cycle to annually from biennially, which may speed up expansions if total cost of ownership reduction is proven.

TSMC Earnings: Shares Cheap as Cautious Capital Spending and Industry Outlook Dent Sentiment
Phelix Lee, Equity Analyst, 19 Apr 2024
We keep our TWD 950 per share fair value estimate for wide-moat Taiwan Semiconductor Manufacturing (lowered to USD 146 per ADR from USD 151 with an updated exchange rate) as there is no change in the company’s long-term thesis. TSMC’s disciplined approach to capital spending in 2024—and possibly in the next few years—reduces risks of oversupply, and allows more flexibility in cutting-edge research to maintain its leadership. TSMC’s shares remain attractive, as artificial intelligence-related demand continues to pleasantly surprise us, and there is limited downside to sentiment for the automotive and industrial markets.

TSMC anticipates second-quarter revenue to grow 9% sequentially to TWD 646 billion at the midpoint (6% in US dollar terms to USD 20 billion). This gives us more confidence that TSMC can achieve our full-year 2024 revenue estimate of TWD 2.64 trillion. Gross margin guidance is 107 basis points lower sequentially at 52% at the midpoint, 50 basis points of which is due to scrapping raw materials that were damaged by an earthquake on April 3. The remainder stems from 25% higher electricity costs in Taiwan. However, we have not changed our forecasts as we believe higher utilization and 3nm contribution in the second half will mostly mitigate these headwinds.

While we did not anticipate management to change its full-year revenue guidance given in January, we are mildly disappointed about the unchanged capital expenditure budget and sector commentary. Management lowered its 2024 foundry market forecast to growth in the mid to high teens from 20% previously, citing weaker-than-anticipated recovery, especially in automotives, where it expects sales to fall year on year.

TSMC: USD 6.6 Billion in Chips Act Grant Is a Slight Positive Phelix Lee, Equity Analyst, 9 Apr 2024
We retain our fair value estimate of TWD 950 per share (USD 151 per ADR) for Taiwan Semiconductor Manufacturing after the firm received preliminary approval for up to USD 6.6 billion in grants and USD 5 billion in loans under the Chips Act. We intend to finalize our forecasts after TSMC’s earnings call on April 18, during which management will likely provide more information on the grant. Regardless of the

Chips Act funds, TSMC is undervalued as the firm's dominant position in cutting-edge chips is sometimes overshadowed by geopolitical risks, which is partially addressed in this grant.

We think the USD 6.6 billion grant aligns with market expectations as it is a "large-enough" sum while being smaller than Intel's, an American company. In return for the grant and loans, TSMC will increase its total commitment in Arizona from USD 40 billion to USD 65 billion and from two plants to three. The third plant will feature TSMC's 2nm technology and production will begin in 2028. The third plant is unlikely to affect the supply-demand dynamics of the current artificial intelligence arms race and the eventual turnaround of automotive and industrial markets. TSMC will probably keep its most advanced manufacturing processes in Taiwan after 2028, as 2nm technology will be three years old by then. We believe the largest portion of the incremental USD 18.4 billion net capital expenditure will be incurred in 2026 and possibly lead to USD 1 billion to USD 2 billion upside to management's 2024 capex budget of USD 28 billion to USD 32 billion.

Taiwan Earthquake Poses Limited Short-Term Downside to Our Taiwan Tech Coverage Phelix Lee, Equity Analyst, 3 Apr 2024

We retain our fair value estimates on Taiwanese technology companies in our coverage following a powerful earthquake and multiple strong aftershocks near the eastern city of Hualien on April 3, namely: Advantech at TWD 337; Delta Electronics at TWD 331; GlobalWafers at TWD 710; Largan at TWD 3,000; MediaTek at TWD 1,400; Sino-American Silicon at TWD 281; Taiwan Semiconductor Manufacturing Co at TWD 950 (USD 151 per ADR); United Microelectronics Corp at TWD 70; and Win Semiconductors at TWD 245 per share.

Based on feedback from some of those companies, production is temporarily interrupted due to staff evacuation and equipment inspection. We think long-term damage is unlikely as production facilities in Taiwan are designed to mitigate harm from earthquakes. Another mitigating factor is that a mountain range separates Hualien from the most densely populated areas and factories.

We have not changed our annual forecasts for all companies in our coverage, but earnings for the June quarter may be affected. We expect it will take up to a week to inspect all equipment, and that sales impact is likely limited to 3%-4% of June-quarter revenue and up to 10% of earnings per share. Given that the capacities of most companies in our coverage are not fully utilized, we assume shortfalls in the June quarter will be made up in the latter half of the year.

TSMC Earnings: Raising Valuation by 6% After Upbeat Guidance and Lower 2024 Capital Expenditure Phelix Lee, Equity Analyst, 19 Jan 2024

We lifted our fair value estimate for Taiwan Semiconductor Manufacturing to TWD 950 per share (USD 151 per ADR at current exchange rates) after management provided a better full-year 2024 outlook than we foresaw thanks to strong artificial intelligence-related growth and lowered 2024 capital expenditure

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Taiwan Semiconductor Manufacturing Co Ltd ADR TSM ★★★ 17 Oct 2024 21:31, UTC

Last Price	Fair Value Estimate	Price/FVE	Market Cap	Economic Moat™	Equity Style Box	Uncertainty	Capital Allocation	ESG Risk Rating Assessment[1]
205.84 USD 17 Oct 2024	215.00 USD 17 Oct 2024 13:13, UTC	0.96	1.07 USD Tril 17 Oct 2024	Wide	Large Growth	Medium	Exemplary	2 Oct 2024 05:00, UTC

budget. The release of AI-capable consumer devices strengthens our belief that AI is here to stay, and the high growth phase will not be over soon. TSMC's disciplined approach to capital spending in 2024 should reassure investors concerned with an underwhelming recovery and potential gluts two to three years ahead. With the stock undervalued to our fair value, we don't think it is too late for investors to jump on the stock.

Our long-term bullishness on TSMC is unchanged following the results. Management upped its medium-term AI expectations to high-teens revenue from mid-teens, citing more customers are already working on chips made on 2nm processes. We believe TSMC is in the early stages of reaping the benefits that AI bring, as servers are only the initial step of AI adoption, and smartphones, factory equipment, and low-power outdoor devices will also need different mixes of AI capabilities to complete the hardware ecosystem. These developments lead us to raise our 2024 to 2027 revenue by 6.5% on average. We are also unfazed by potential oversupply in mature processes like 28nm since TSMC's definition of "mature" extends to 10nm and most of its offerings are unique in the industry, such as power-efficient chips made on 12nm that can be applied on outdoor sensors.

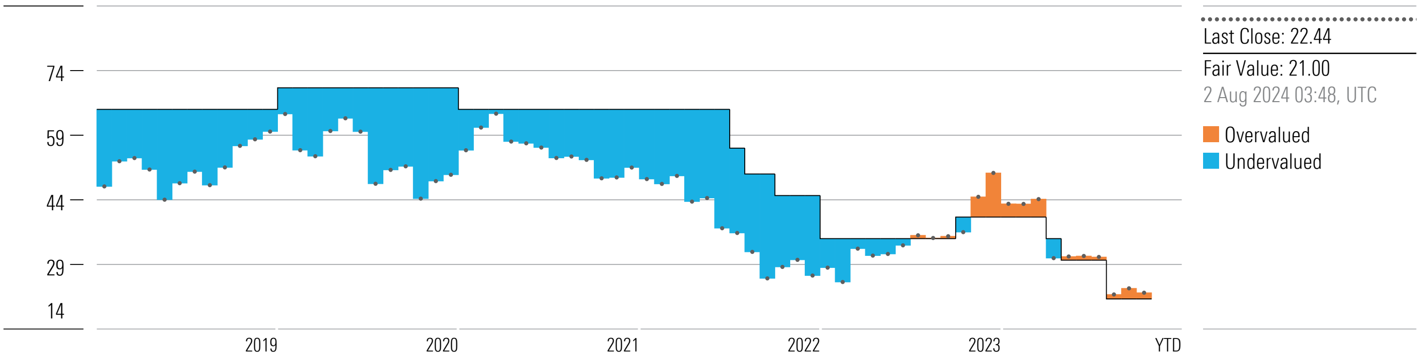
TSMC anticipates that first-quarter revenue will fall 8.5% sequentially to TWD 572 billion (6.2% in USD terms to USD 18.4 billion). We view management's first-quarter and full-year revenue guidance of low to mid-20s year-on-year growth to TWD 2.6 trillion as achievable as many 5nm products are migrating to the 3nm process, which we estimate improves the prices of relevant wafers by about 30%.

Morningstar Equity Analyst Report | Report as of 17 Oct 2024 23:49, UTC | Reporting Currency: TWD | Trading Currency: USD | Exchange: NEW YORK STOCK EXCHANGE, INC. Page 12 of 22

Taiwan Semiconductor Manufacturing Co Ltd ADR TSM ★★★ 17 Oct 2024 21:31, UTC

Competitors Price vs. Fair Value

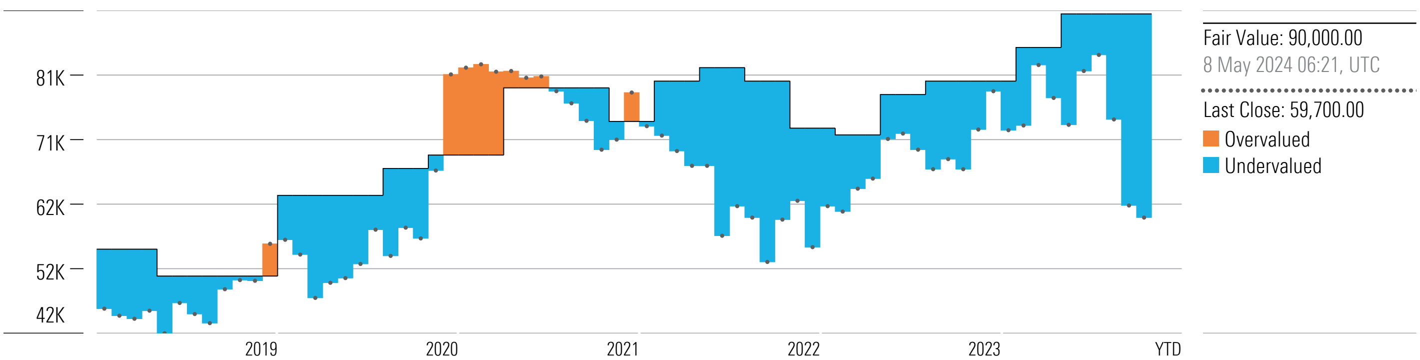
Intel Corp INTC



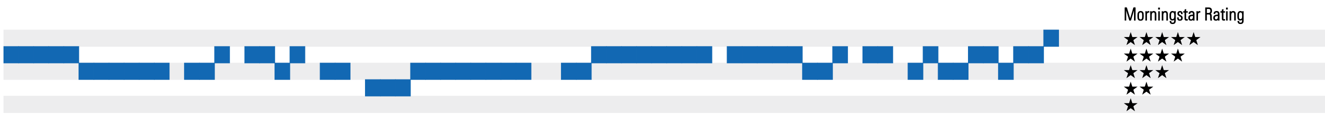
2019	2020	2021	2022	2023	YTD	
0.92	0.71	0.79	0.59	1.26	1.07	Price/Fair Value
30.22	-14.55	6.16	-45.84	92.92	-54.60	Total Return %

Total Return % as of 17 Oct 2024. Last Close as of 17 Oct 2024. Fair Value as of 2 Aug 2024 03:48, UTC.

Samsung Electronics Co Ltd 005930



2019	2020	2021	2022	2023	YTD	
1.09	1.17	1.06	0.76	0.98	0.66	Price/Fair Value
47.84	50.04	-1.75	-27.60	44.56	-23.03	Total Return %



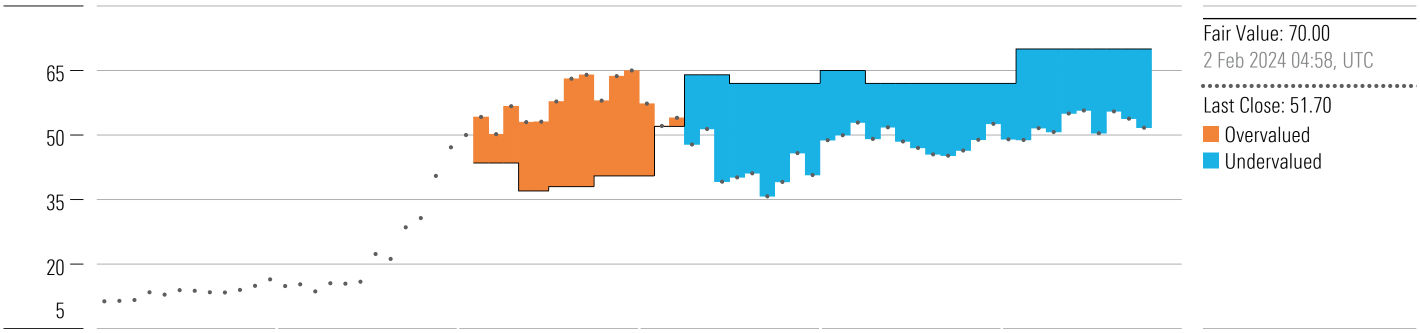
Total Return % as of 17 Oct 2024. Last Close as of 17 Oct 2024. Fair Value as of 8 May 2024 06:21, UTC.

Morningstar Equity Analyst Report | Report as of 17 Oct 2024 23:49, UTC | Reporting Currency: TWD | Trading Currency: USD | Exchange: NEW YORK STOCK EXCHANGE, INC.

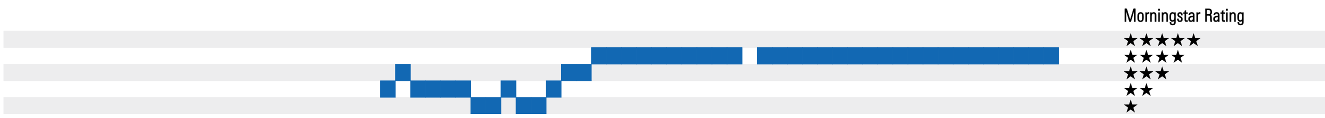
Taiwan Semiconductor Manufacturing Co Ltd ADR TSM ★★★ 17 Oct 2024 21:31, UTC

Competitors Price vs. Fair Value

United Microelectronics Corp 2303



	2019	2020	2021	2022	2023	YTD
Price/Fair Value	—	—	1.60	0.66	0.85	0.74
Total Return %	51.47	191.51	41.25	-32.77	38.08	3.99



Total Return % as of 17 Oct 2024. Last Close as of 17 Oct 2024. Fair Value as of 2 Feb 2024 04:58, UTC.

Morningstar Equity Analyst Report | Report as of 17 Oct 2024 23:49, UTC | Reporting Currency: TWD | Trading Currency: USD | Exchange: NEW YORK STOCK EXCHANGE, INC. Page 14 of 22

Taiwan Semiconductor Manufacturing Co Ltd ADR TSM ★★★ 17 Oct 2024 21:31, UTC

Last Price	Fair Value Estimate	Price/FVE	Market Cap	Economic Moat™	Equity Style Box	Uncertainty	Capital Allocation	ESG Risk Rating Assessment[1]
205.84 USD 17 Oct 2024	215.00 USD 17 Oct 2024 13:13, UTC	0.96	1.07 USD Tril 17 Oct 2024	Wide	Large Growth	Medium	Exemplary	2 Oct 2024 05:00, UTC

Morningstar Historical Summary

Financials as of 30 Jun 2024

Fiscal Year, ends 31 Dec	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	YTD	TTM
Revenue (TWD Bil)	763	844	948	977	1,031	1,070	1,339	1,587	2,264	2,162	760	2,438
Revenue Growth %	27.8	10.6	12.4	3.1	5.5	3.7	25.2	18.5	42.6	-4.5	39.0	9.4
EBITDA (TWD Bil)	506	576	613	660	693	680	919	1,091	1,593	1,524	361	1,727
EBITDA Margin %	66.3	68.3	64.7	67.5	67.2	63.6	68.6	68.7	70.4	70.5	47.5	70.8
Operating Income (TWD Bil)	297	322	378	387	384	373	567	650	1,121	921	361	1,024
Operating Margin %	38.9	38.1	39.9	39.6	37.2	34.8	42.3	40.9	49.5	42.6	47.5	42.0
Net Income (TWD Bil)	254	303	332	345	363	354	511	592	993	852	325	936
Net Margin %	33.3	35.9	35.0	35.3	35.2	33.1	38.1	37.3	43.9	39.4	42.8	38.4
Diluted Shares Outstanding (Mil)	5,186	5,186	5,186	5,186	5,186	5,186	5,186	5,186	5,186	5,186	5,186	5,186
Diluted Earnings Per Share (TWD)	49.05	58.40	63.95	66.50	70.00	68.25	98.50	114.20	191.45	164.25	62.70	180.55
Dividends Per Share (TWD)	14.98	0.00	30.38	35.23	41.17	61.87	50.02	52.55	54.77	57.08	19.78	64.83

Valuation as of 30 Sep 2024

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Recent Qtr	TTM
Price/Sales	5.4	4.6	5.4	6.4	5.7	8.7	12.2	11.4	5.7	7.7	11.7	11.7
Price/Earnings	16.4	13.1	15.9	18.0	16.6	26.5	31.5	30.5	13.4	19.0	30.4	30.4
Price/Cash Flow	9.9	7.4	9.6	10.8	9.9	15.0	20.6	17.4	7.9	12.4	18.9	18.9
Dividend Yield %	2.23	—	3.27	2.92	3.64	3.46	1.58	1.56	2.44	1.77	1.26	1.26
Price/Book	3.8	3.5	3.8	4.3	3.7	5.7	8.8	8.3	4.3	5.0	7.5	7.5
EV/EBITDA	225.1	174.8	220.9	283.8	252.9	398.0	522.5	515.1	225.1	315.5	0.0	0.0

Operating Performance / Profitability as of 30 Jun 2024

Fiscal Year, ends 31 Dec	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	YTD	TTM
ROA %	18.4	19.2	18.7	17.8	17.8	16.3	20.3	18.3	22.9	16.2	5.4	16.8
ROE %	27.4	27.3	26.0	24.2	23.0	21.6	29.6	29.7	39.3	26.9	8.4	26.8
ROIC %	21.8	22.2	21.5	20.5	19.9	18.8	25.2	23.2	29.4	19.8	6.7	19.7
Asset Turnover	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.1	0.4

Financial Leverage

Fiscal Year, ends 31 Dec	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Recent Qtr	TTM
Debt/Capital %	17.3	13.9	10.1	5.8	3.3	2.4	13.1	22.8	23.0	21.6	19.0	—
Equity/Assets %	68.4	72.0	72.0	75.0	79.4	71.3	66.5	57.7	58.5	62.0	64.8	—
Total Debt/EBITDA	0.5	0.4	0.4	0.3	0.3	0.3	0.4	0.7	0.6	0.6	—	—
EBITDA/Interest Expense	156.2	180.6	185.4	198.1	227.2	209.2	441.3	201.5	135.6	127.0	—	151.9

Morningstar Analyst Historical/Forecast Summary as of 17 Oct 2024

Financials

Fiscal Year, ends 31 Dec 2023	2022	2023	Estimates 2024	2025	2026
Revenue (TWD Bil)	2,264	2,162	2,864	3,492	3,895
Revenue Growth %	42.6	-4.5	32.5	21.9	11.6
EBITDA (TWD Bil)	1,571	1,444	1,957	2,417	2,680
EBITDA Margin %	69.4	66.8	68.3	69.2	68.8
Operating Income (TWD Bil)	1,121	921	1,292	1,670	1,837
Operating Margin %	49.5	42.6	45.1	47.8	47.2
Net Income (TWD Bil)	1,017	809	1,147	1,503	1,646
Net Margin %	44.9	37.4	40.0	43.1	42.3
Diluted Shares Outstanding (Bil)	26	26	26	26	26
Diluted Earnings Per Share(TWD)	39.20	31.20	44.22	57.97	63.48
Dividends Per Share(TWD)	11.00	11.25	15.00	16.00	17.50

Forward Valuation

	2022	2023	Estimates 2024	2025	2026
Price/Sales	5.1	7.1	9.4	7.7	6.9
Price/Earnings	11.7	20.5	30.0	22.9	20.9
Price/Cash Flow	—	—	—	—	—
Dividend Yield %	2.4	1.8	1.1	1.2	1.3
Price/Book	4.0	4.8	8.1	6.5	5.3
EV/EBITDA	7.0	10.2	13.1	10.6	9.5

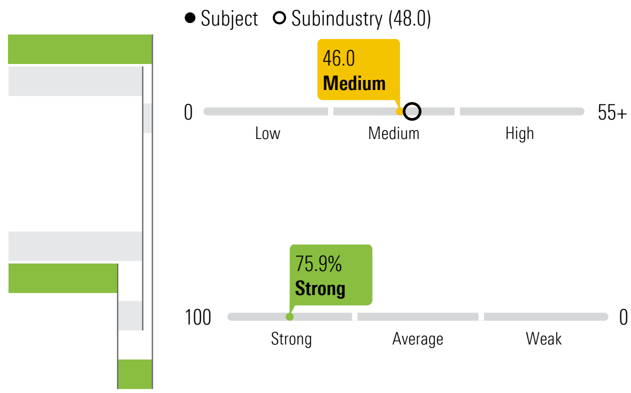
Morningstar Equity Analyst Report | Report as of 17 Oct 2024 23:49, UTC | Reporting Currency: TWD | Trading Currency: USD | Exchange: NEW YORK STOCK EXCHANGE, INC.

Taiwan Semiconductor Manufacturing Co Ltd ADR TSM ★★★ 17 Oct 2024 21:31, UTC

Last Price	Fair Value Estimate	Price/FVE	Market Cap	Economic Moat™	Equity Style Box	Uncertainty	Capital Allocation	ESG Risk Rating Assessment[1]
205.84 USD 17 Oct 2024	215.00 USD 17 Oct 2024 13:13, UTC	0.96	1.07 USD Tril 17 Oct 2024	Wide	Large Growth	Medium	Exemplary	2 Oct 2024 05:00, UTC

ESG Risk Rating Breakdown

Exposure	
Company Exposure[1]	46.0
– Manageable Risk	42.9
Unmanageable Risk[2]	**3.1**
Management	
Manageable Risk	42.9
– Managed Risk[3]	32.5
Management Gap[4]	**10.3**
Overall Unmanaged Risk	**13.5**



- Exposure represents a company's vulnerability to ESG risks driven by their business model
- Exposure is assessed at the Subindustry level and then specified at the company level
- Scoring ranges from 0-55+ with categories of low, medium, and high-risk exposure

- Management measures a company's ability to manage ESG risks through its commitments and actions
- Management assesses a company's efficiency on ESG programs, practices, and policies
- Management score ranges from 0-100% showing how much manageable risk a company is managing

ESG Risk Rating

ESG Risk Ratings measure the degree to which a company's value is impacted by environmental, social, and governance risks, by evaluating the company's ability to manage the ESG risks it faces.

1. A company's Exposure to material ESG issues 2. Unmanageable Risk refers to risks that are inherent to a particular business model that cannot be managed by programs or initiatives 3. Managed Risk = Manageable Risk multiplied by a Management score of 75.9% 4. Management Gap assesses risks that are not managed, but are considered manageable 5. ESG Risk Rating Assessment = Overall Unmanaged Risk = Management Gap plus Unmanageable Risk

ESG Risk Rating Assessment[5]

ESG Risk Rating is of Oct 02, 2024. Highest Controversy Level is as of Oct 08, 2024. Sustainalytics Subindustry: Semiconductor Design and Manufacturing. Sustainalytics provides Morningstar with company ESG ratings and metrics on a monthly basis and as such, the ratings in Morningstar may not necessarily reflect current Sustainalytics' scores for the company. For the most up to date rating and more information, please visit: sustainalytics.com/esg-ratings/.

Peer Analysis 02 Oct 2024

Peers are selected from the company's Sustainalytics-defined Subindustry and are displayed based on the closest market cap values

Company Name	Exposure		Management		ESG Risk Rating	
Taiwan Semiconduct...nufacturing Co Ltd	46.0 | Medium	0 – 55+	75.9 | Strong	100 – 0	13.5 | Low	0 – 40+
Intel Corp	48.4 | Medium	0 – 55+	74.2 | Strong	100 – 0	15.1 | Low	0 – 40+
Samsung Electronics Co Ltd	32.1 | Low	0 – 55+	62.1 | Strong	100 – 0	13.3 | Low	0 – 40+
United Microelectronics Corp	47.0 | Medium	0 – 55+	76.7 | Strong	100 – 0	13.5 | Low	0 – 40+
GLOBALFOUNDRIES Inc	55.0 | Medium	0 – 55+	75.1 | Strong	100 – 0	16.7 | Low	0 – 40+

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Appendix
Historical Morningstar Rating

Taiwan Semiconductor Manufacturing Co Ltd ADR TSM 17 Oct 2024 21:31, UTC

Dec 2024	Nov 2024	Oct 2024	Sep 2024	Aug 2024	Jul 2024	Jun 2024	May 2024	Apr 2024	Mar 2024	Feb 2024	Jan 2024
—	—	★★★	★★★★	★★★★	★★★★	★★★★	★★★	★★★	—	★★★★	★★★★
Dec 2023	Nov 2023	Oct 2023	Sep 2023	Aug 2023	Jul 2023	Jun 2023	May 2023	Apr 2023	Mar 2023	Feb 2023	Jan 2023
★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★	★★★★	★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Dec 2022	Nov 2022	Oct 2022	Sep 2022	Aug 2022	Jul 2022	Jun 2022	May 2022	Apr 2022	Mar 2022	Feb 2022	Jan 2022
★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Dec 2021	Nov 2021	Oct 2021	Sep 2021	Aug 2021	Jul 2021	Jun 2021	May 2021	Apr 2021	Mar 2021	Feb 2021	Jan 2021
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	—	★★★★	★★★★	★★★	★★★
Dec 2020	Nov 2020	Oct 2020	Sep 2020	Aug 2020	Jul 2020	Jun 2020	May 2020	Apr 2020	Mar 2020	Feb 2020	Jan 2020
★★	★★★	★★	★	★	★	★★	★★★	★★	★★★	★★	★★
Dec 2019	Nov 2019	Oct 2019	Sep 2019	Aug 2019	Jul 2019	Jun 2019	May 2019	Apr 2019	Mar 2019	Feb 2019	Jan 2019
★★	★★	★★	★★	★★	★★	★★	★★★	★★	★★	★★	★★

Intel Corp INTC 17 Oct 2024 21:29, UTC

Dec 2024	Nov 2024	Oct 2024	Sep 2024	Aug 2024	Jul 2024	Jun 2024	May 2024	Apr 2024	Mar 2024	Feb 2024	Jan 2024
—	—	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★
Dec 2023	Nov 2023	Oct 2023	Sep 2023	Aug 2023	Jul 2023	Jun 2023	May 2023	Apr 2023	Mar 2023	Feb 2023	Jan 2023
★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★★	★★★★
Dec 2022	Nov 2022	Oct 2022	Sep 2022	Aug 2022	Jul 2022	Jun 2022	May 2022	Apr 2022	Mar 2022	Feb 2022	Jan 2022
★★★★★	★★★★	★★★★	★★★★★	★★★★	★★★★	★★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
Dec 2021	Nov 2021	Oct 2021	Sep 2021	Aug 2021	Jul 2021	Jun 2021	May 2021	Apr 2021	Mar 2021	Feb 2021	Jan 2021
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★	★★★	★★★	★★★	★★★	★★★
Dec 2020	Nov 2020	Oct 2020	Sep 2020	Aug 2020	Jul 2020	Jun 2020	May 2020	Apr 2020	Mar 2020	Feb 2020	Jan 2020
★★★★★	★★★★★	★★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★
Dec 2019	Nov 2019	Oct 2019	Sep 2019	Aug 2019	Jul 2019	Jun 2019	May 2019	Apr 2019	Mar 2019	Feb 2019	Jan 2019
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★

Samsung Electronics Co Ltd 005930 17 Oct 2024 12:28, UTC

Dec 2024	Nov 2024	Oct 2024	Sep 2024	Aug 2024	Jul 2024	Jun 2024	May 2024	Apr 2024	Mar 2024	Feb 2024	Jan 2024
—	—	★★★★★	★★★★	★★★★	★★★	★★★★	★★★★	★★★	★★★	★★★★	★★★
Dec 2023	Nov 2023	Oct 2023	Sep 2023	Aug 2023	Jul 2023	Jun 2023	May 2023	Apr 2023	Mar 2023	Feb 2023	Jan 2023
—	★★★★	★★★★	—	★★★★	★★★	★★★	★★★★	★★★★	★★★★	★★★★	★★★★
Dec 2022	Nov 2022	Oct 2022	Sep 2022	Aug 2022	Jul 2022	Jun 2022	May 2022	Apr 2022	Mar 2022	Feb 2022	Jan 2022
—	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★	★★★	—
Dec 2021	Nov 2021	Oct 2021	Sep 2021	Aug 2021	Jul 2021	Jun 2021	May 2021	Apr 2021	Mar 2021	Feb 2021	Jan 2021
—	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★	★★	★★
Dec 2020	Nov 2020	Oct 2020	Sep 2020	Aug 2020	Jul 2020	Jun 2020	May 2020	Apr 2020	Mar 2020	Feb 2020	Jan 2020
—	★★★	★★★	—	★★★★	★★★	★★★★	★★★★	—	★★★★	★★★	★★★
Dec 2019	Nov 2019	Oct 2019	Sep 2019	Aug 2019	Jul 2019	Jun 2019	May 2019	Apr 2019	Mar 2019	Feb 2019	Jan 2019
—	★★★	★★★	★★★	★★★	★★★	★★★	★★★★	★★★★	★★★★	★★★★	★★★★

Morningstar Equity Analyst Report | Report as of 17 Oct 2024 23:49, UTC | Reporting Currency: TWD | Trading Currency: USD | Exchange: NEW YORK STOCK EXCHANGE, INC.

United Microelectronics Corp 2303 17 Oct 2024 13:32, UTC

Dec 2024	Nov 2024	Oct 2024	Sep 2024	Aug 2024	Jul 2024	Jun 2024	May 2024	Apr 2024	Mar 2024	Feb 2024	Jan 2024
—	—	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
Dec 2023	Nov 2023	Oct 2023	Sep 2023	Aug 2023	Jul 2023	Jun 2023	May 2023	Apr 2023	Mar 2023	Feb 2023	Jan 2023
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	—	★★★★
Dec 2022	Nov 2022	Oct 2022	Sep 2022	Aug 2022	Jul 2022	Jun 2022	May 2022	Apr 2022	Mar 2022	Feb 2022	Jan 2022
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★	★★★	★★
Dec 2021	Nov 2021	Oct 2021	Sep 2021	Aug 2021	Jul 2021	Jun 2021	May 2021	Apr 2021	Mar 2021	Feb 2021	Jan 2021
★	★	★★	★	★	★★	★★	★★	★★	★★★	★★	—
Dec 2020	Nov 2020	Oct 2020	Sep 2020	Aug 2020	Jul 2020	Jun 2020	May 2020	Apr 2020	Mar 2020	Feb 2020	Jan 2020
—	—	—	—	—	—	—	—	—	—	—	—
Dec 2019	Nov 2019	Oct 2019	Sep 2019	Aug 2019	Jul 2019	Jun 2019	May 2019	Apr 2019	Mar 2019	Feb 2019	Jan 2019
—	—	—	—	—	—	—	—	—	—	—	—

Research Methodology for Valuing Companies

Overview

At the heart of our valuation system is a detailed projection of a company's future cash flows, resulting from our analysts' research. Analysts create custom industry and company assumptions to feed income statement, balance sheet, and capital investment assumptions into our globally standardized, proprietary discounted cash flow, or DCF, modeling templates. We use scenario analysis, indepth competitive advantage analysis, and a variety of other analytical tools to augment this process. Moreover, we think analyzing valuation through discounted cash flows presents a better lens for viewing cyclical companies, high-growth firms, businesses with finite lives (e.g., mines), or companies expected to generate negative earnings over the next few years. That said, we don't dismiss multiples altogether but rather use them as supporting cross-checks for our DCF-based fair value estimates. We also acknowledge that DCF models offer their own challenges (including a potential proliferation of estimated inputs and the possibility that the method may miss shortterm market-price movements), but we believe these negatives are mitigated by deep analysis and our longterm approach.

Morningstar's equity research group ("we," "our") believes that a company's intrinsic worth results from the future cash flows it can generate. The Morningstar Rating for stocks identifies stocks trading at a discount or premium to their intrinsic worth—or fair value estimate, in Morningstar terminology. Five-star stocks sell for the biggest risk adjusted discount to their fair values, whereas 1-star stocks trade at premiums to their intrinsic worth.

Four key components drive the Morningstar rating: (1) our assessment of the firm's economic moat, (2) our estimate of the stock's fair value, (3) our uncertainty around that fair value estimate and (4) the current market price. This process ultimately culminates in our singlepoint star rating.

1. Economic Moat

The concept of an economic moat plays a vital role not only in our qualitative assessment of a firm's long-term investment potential, but also in the actual calculation of our fair value estimates. An economic moat is a structural feature that allows a firm to sustain excess profits over a long period of time. We define economic profits as returns on invested capital (or ROIC) over and above our estimate of a firm's cost of capital, or weighted average cost of capital (or WACC). Without a moat, profits are more susceptible to competition. We have identified five sources of economic moats: intangible assets, switching costs, network effect, cost advantage, and efficient scale.

Companies with a narrow moat are those we believe are more likely than not to achieve normalized excess returns for at least the next 10 years. Wide-moat companies are those in which we have very high confidence that excess returns will remain for 10 years, with excess returns more likely than not to remain for at least 20 years. The longer a firm generates economic profits, the higher its intrinsic value. We believe low-quality, no-moat companies will see their normalized returns gravitate toward the firm's cost of capital more quickly than companies with moats.

When considering a company's moat, we also assess whether there is a substantial threat of value destruction, stemming from risks related to ESG, industry disruption, financial health, or other idiosyncratic issues. In this context, a risk is considered potentially value destructive if its occurrence would eliminate a firm's economic profit on a cumulative or midcycle basis. If we deem the probability of occurrence sufficiently high, we would not characterize the company as possessing an economic moat.

2. Estimated Fair Value

Combining our analysts' financial forecasts with the firm's economic moat helps us assess how long returns on invested capital are likely to exceed the firm's cost of capital. Returns of firms with a wide economic moat rating are assumed to fade to the perpetuity period over a longer period of time than the returns of narrow-moat firms, and both will fade slower than no-moat firms, increasing our estimate of their intrinsic value.

Our model is divided into three distinct stages:

Stage I: Explicit Forecast

In this stage, which can last five to 10 years, analysts make full financial statement forecasts, including items such as revenue, profit margins, tax rates, changes in workingcapital accounts, and capital spending. Based on these projections, we calculate earnings before interest, after taxes (EBI) and the net new investment (NNI) to derive our annual free cash flow forecast.

Stage II: Fade

The second stage of our model is the period it will take the company's return on new invested capital—the return on capital of the next dollar invested ("RONIC")—to decline (or rise) to its cost of capital. During the Stage II period, we use a formula to approximate cash flows in lieu of explicitly modeling the income statement, balance sheet, and cash flow statement as we do in Stage I. The length of the second stage depends on the strength of the company's economic moat. We forecast this period to last anywhere from one year (for companies with no economic moat) to 10–15 years or more (for wide-moat companies). During this period, cash flows are forecast using four assumptions: an average growth rate for EBI over the period, a normalized investment rate, average return on new invested capital (RONIC), and the number of years until perpetuity, when excess returns cease. The investment rate and return on new invested capital decline until a perpetuity value is calculated. In the case of firms that do not earn their cost of capital, we assume marginal ROICs rise to the firm's cost of capital (usually attributable to less reinvestment), and we may truncate the second stage.

Stage III: Perpetuity

Once a company's marginal ROIC hits its cost of capital, we calculate a continuing value, using a standard perpetuity formula. At perpetuity, we assume that any growth or decline or investment in the business neither creates nor destroys value and that any new investment provides a return in line with estimated WACC.

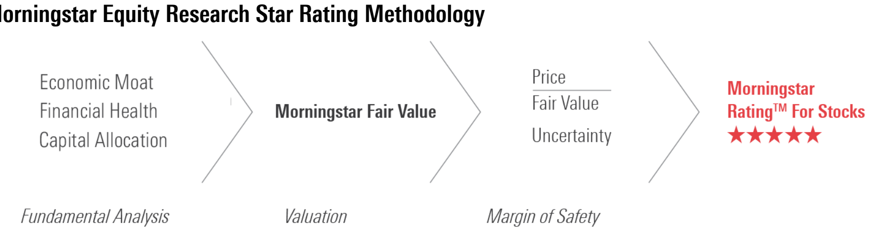
Because a dollar earned today is worth more than a dollar earned tomorrow, we discount our projections of cash flows in stages I, II, and III to arrive at a total present value of expected future cash flows. Because we are modeling free cash flow to the firm—representing cash available to provide a return to all capital providers—we discount future cash flows using the WACC, which is a weighted average of the costs of equity, debt, and preferred stock (and any other funding sources), using expected future proportionate long-term, market-value weights.

3. Uncertainty Around That Fair Value Estimate

Morningstar's Uncertainty Rating is designed to capture the range of potential outcomes for a company's intrinsic value. This rating is used to assign the margin of safety required before investing, which in turn explicitly drives our stock star rating system. The Uncertainty Rating is aimed at identifying the confidence we should have in assigning a fair value estimate for a given stock.

Our Uncertainty Rating is meant to take into account anything that can increase the potential dispersion of future outcomes for the intrinsic value of a company, and any-

Morningstar Equity Research Star Rating Methodology



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thing that can affect our ability to accurately predict these outcomes. The rating begins with a suggested rating produced by a quantitative process based on the trailing 12-month standard deviation of daily stock returns. An analyst overlay is then applied, with analysts using the suggested rating, historical rating data, and their own knowledge of the company to inform them as they make the final Uncertainty Rating decision. Ultimately, the rating decision rests with the analyst. Analysts take into account many characteristics when making their final decision, including cyclical factors, operational and financial factors such as leverage, company-specific events, ESG risks, and anything else that might increase the potential dispersion of future outcomes and our ability to estimate those outcomes.

Our recommended margin of safety—the discount to fair value demanded before we'd recommend buying or selling the stock—widens as our uncertainty of the estimated value of the equity increases. The more uncertain we are about the potential dispersion of outcomes, the greater the discount we require relative to our estimate of the value of the firm before we would recommend the purchase of the shares. In addition, the Uncertainty Rating provides guidance in portfolio construction based on risk tolerance.

Our Uncertainty Ratings are: Low, Medium, High, Very High, and Extreme.

	Margin of Safety	
Qualitative Analysis Uncertainty Ratings	★★★★★Rating	★Rating
Low	20% Discount	25% Premium
Medium	30% Discount	35% Premium
High	40% Discount	55% Premium
Very High	50% Discount	75% Premium
Extreme	75% Discount	300% Premium

Our uncertainty rating is based on the interquartile range, or the middle 50% of potential outcomes, covering the 25th percentile–75th percentile. This means that when a stock hits 5 stars, we expect there is a 75% chance that the intrinsic value of that stock lies above the current market price. Similarly, when a stock hits 1 star, we expect there is a 75% chance that the intrinsic value of that stock lies below the current market price.

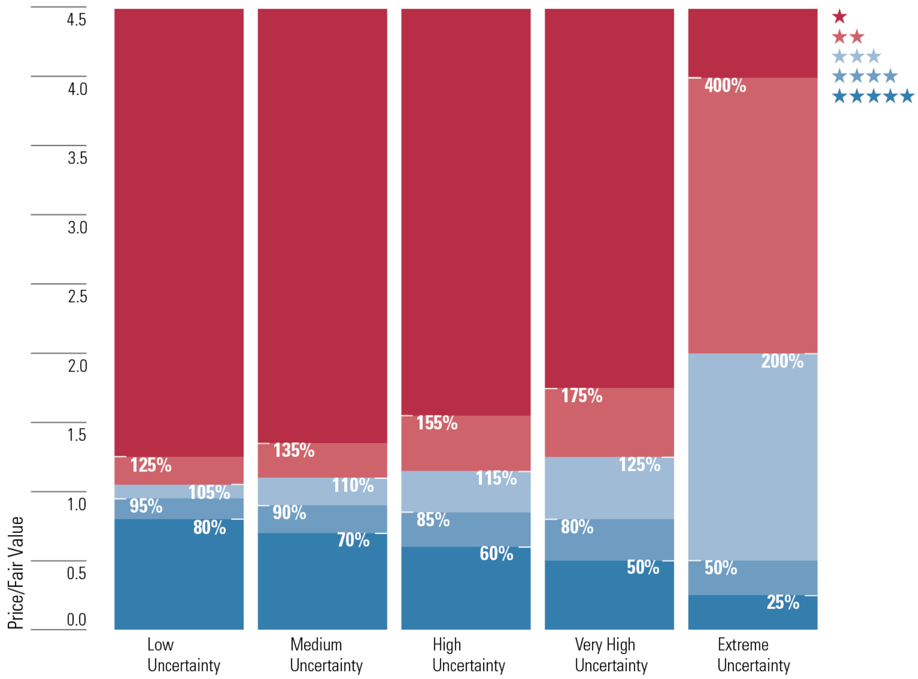
4. Market Price

The market prices used in this analysis and noted in the report come from exchange on which the stock is listed which we believe is a reliable source.

For more details about our methodology, please go to https://shareholders.morningstar.com

Morningstar Star Rating for Stocks

Morningstar Equity Research Star Rating Methodology



Once we determine the fair value estimate of a stock, we compare it with the stock's current market price on a daily basis, and the star rating is automatically re-calculated at the market close on every day the market on which the stock is listed is open. Our analysts keep close tabs on the companies they follow, and, based on thorough and ongoing analysis, raise or lower their fair value estimates as warranted.

Please note, there is no predefined distribution of stars. That is, the percentage of stocks that earn 5 stars can fluctuate daily, so the star ratings, in the aggregate, can serve as a gauge of the broader market's valuation. When there are many 5-star stocks, the stock market as a whole is more undervalued, in our opinion, than when very few companies garner our highest rating.

We expect that if our base-case assumptions are true the market price will converge on our fair value estimate over time generally within three years (although it is impossible to predict the exact time frame in which market prices may adjust).

Our star ratings are guideposts to a broad audience and individuals must consider their own specific investment goals, risk tolerance, tax situation, time horizon, income needs, and complete investment portfolio, among other factors.

The Morningstar Star Ratings for stocks are defined below:

★★★★★ We believe appreciation beyond a fair risk adjusted return is highly likely over a multiyear time frame. Scenario analysis developed by our analysts indicates that the current market price represents an excessively pessimistic outlook, limiting downside risk and maximizing upside potential.

★★★★ We believe appreciation beyond a fair risk-adjusted return is likely.

★★★ Indicates our belief that investors are likely to receive a fair risk-adjusted return (approximately cost of equity).

★★ We believe investors are likely to receive a less than fair risk-adjusted return.

★ Indicates a high probability of undesirable risk-adjusted returns from the current market price over a multiyear time frame, based on our analysis. Scenario analysis by our analysts indicates that the market is pricing in an excessively optimistic outlook, limiting upside potential and leaving the investor exposed to Capital loss.

Other Definitions

Last Price: Price of the stock as of the close of the market of the last trading day before date of the report.

Capital Allocation Rating: Our Capital Allocation (or Stewardship) Rating represents our assessment of the quality of management's capital allocation, with particular emphasis on the firm's balance sheet, investments, and shareholder distributions. Analysts consider compan-

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ies' investment strategy and valuation, balance sheet management, and dividend and share buyback policies. Corporate governance factors are only considered if they are likely to materially impact shareholder value, though either the balance sheet, investment, or shareholder distributions. Analysts assign one of three ratings: "Exemplary", "Standard", or "Poor". Analysts judge Capital Allocation from an equity holder's perspective. Ratings are determined on a forward looking and absolute basis. The Standard rating is most common as most managers will exhibit neither exceptionally strong nor poor capital allocation.

Capital Allocation (or Stewardship) analysis published prior to Dec. 9, 2020, was determined using a different process. Beyond investment strategy, financial leverage, and dividend and share buyback policies, analysts also considered execution, compensation, related party transactions, and accounting practices in the rating.

Capital Allocation Rating: Our Capital Allocation (or Stewardship) Rating represents our assessment of the quality of management's capital allocation, with particular emphasis on the firm's balance sheet, investments, and shareholder distributions. Analysts consider companies' investment strategy and valuation, balance sheet management, and dividend and share buyback policies. Corporate governance factors are only considered if they are likely to materially impact shareholder value, though either the balance sheet, investment, or shareholder distributions. Analysts assign one of three ratings: "Exemplary", "Standard", or "Poor". Analysts judge Capital Allocation from an equity holder's perspective. Ratings are determined on a forward looking and absolute basis. The Standard rating is most common as most managers will exhibit neither exceptionally strong nor poor capital allocation.

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Sustainalytics ESG Risk Rating Assessment: The ESG Risk Rating Assessment is provided by Sustainalytics; a Morningstar company.

Sustainalytics' ESG Risk Ratings measure the degree to which company's economic value at risk is driven by environment, social and governance (ESG) factors.

Sustainalytics analyzes over 1,300 data points to assess a company's exposure to and management of ESG risks. In other words, ESG Risk Ratings measures a company's unmanaged ESG Risks represented as a quantitative score. Unmanaged Risk is measured on an open-ended scale starting at zero (no risk) with lower scores representing less unmanaged risk and, for 95% of cases, the unmanaged ESG Risk score is below 50.

Based on their quantitative scores, companies are grouped into one of five Risk Categories (negligible, low, medium, high, severe). These risk categories are absolute, meaning that a 'high risk' assessment reflects a comparable degree of unmanaged ESG risk across all subindustries covered.

The ESG Risk Rating Assessment is a visual representation of Sustainalytics ESG Risk Categories on a 1 to 5 scale. Companies with Negligible Risk = 5 Globes, Low Risk = 4, Medium Risk = 3 Globes, High Risk = 2 Globes, Severe Risk = 1 Globe. For more information, please visit sustainalytics.com/esg-ratings/

Ratings should not be used as the sole basis in evaluating a company or security. Ratings involve unknown risks and uncertainties which may cause our expectations not to occur or to differ significantly from what was expected and should not be considered an offer or solicitation to buy or sell a security.

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