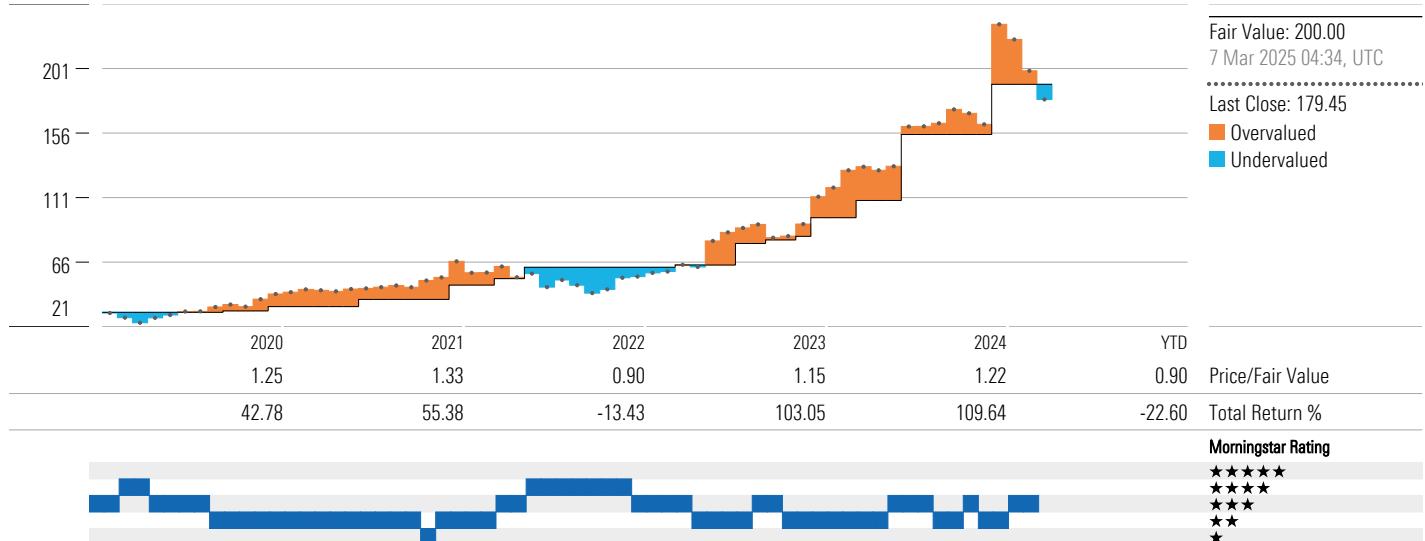


Broadcom Inc AVGO ★★★ 7 Mar 2025 04:35, UTC

Last Price 179.45 USD 6 Mar 2025	Fair Value Estimate 200.00 USD 7 Mar 2025 04:34, UTC	Price/FVE 0.90	Market Cap 843.76 USD Bil 6 Mar 2025	Economic Moat™ Wide	Equity Style Box Large Growth	Uncertainty High	Capital Allocation Exemplary	ESG Risk Rating Assessment¹  5 Mar 2025 06:00, UTC
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Price vs. Fair Value



Total Return % as of 06 Mar 2025. Last Close as of 06 Mar 2025. Fair Value as of 7 Mar 2025 04:34, UTC.

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Important Disclosure

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

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

Broadcom Earnings: Another AI Beat Brings Our Valuation Up, and Shares Look Fairly Valued

Analyst Note William Kerwin, CFA, Senior Equity Analyst, 7 Mar 2025

Broadcom's fiscal first quarter beat management guidance. Revenue rose 25% year over year and 6% sequentially to \$14.9 billion, with artificial intelligence revenue rising roughly 15% sequentially to \$4.1 billion. Guidance implies flat sequential revenue, with 7% sequential growth in AI revenue.

Why it matters: AI chip sales and VMware continue to overwhelmingly drive Broadcom's results, and AI revenue and guidance once again surpassed our expectations. AI revenue is now more than a fourth of total revenue and roughly half of chip revenue. VMware is more than a fourth of revenue.

► Broadcom announced two new AI accelerator customers, on top of its five already at different stages of development. Management reiterated a \$60 billion-\$90 billion serviceable addressable market for its three first customers in 2027, of which we expect it to capture roughly 70% share.

► Broadcom's non-AI chip markets remain cyclically soft, and we have pushed out our rebound expectations. Still, these markets are a diminishing minority driver of results, and these cyclical downturns don't materially affect our valuation.

The bottom line: We raise our fair value estimate for wide-moat Broadcom to \$200 per share, from \$190, behind a higher AI chip revenue forecast. We also raise our Morningstar Uncertainty Rating to High, stemming from the increasing concentration of AI as a driver of results.

Broadcom Inc AVGO ★★★ 7 Mar 2025 04:35, UTC

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Sector  Technology	Industry Semiconductors
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Business Description

Broadcom is the sixth-largest semiconductor company globally and has expanded into various software businesses, with over \$30 billion in annual revenue. It sells 17 core semiconductor product lines across wireless, networking, broadband, storage, and industrial markets. It is primarily a fabless designer but holds some manufacturing in-house, like for its best-of-breed FBAR filters that sell into the Apple iPhone. In software, it sells virtualization, infrastructure, and security software to large enterprises, financial institutions, and governments. Broadcom is the product of consolidation. Its businesses are an amalgamation of former companies like legacy Broadcom and Avago Technologies in chips, as well as Brocade, CA Technologies, and Symantec in software.

Shares rose about 15% after hours, due to higher AI guidance and optimistic accelerator customer commentary. We now see shares as fairly valued.

► We are conservative on the midpoint of management's SAM, given uncertainty regarding the cadence of chip customer spending. We model toward the lower end of the SAM but have raised our forecast for 2027 AI revenue, now implying roughly 55% growth over the next three years.

Business Strategy & Outlook William Kerwin, CFA, Senior Equity Analyst, 13 Dec 2024

Broadcom is an amalgamation of high-value chip and software businesses that on the whole are differentiated and moaty, in our view. Broadcom is a terrific aggregator of firms, big and small. Its ability to acquire and streamline generates strong profits and cash flow, and fuels its robust dividend. We laud the firm for its execution and operating efficiency, which build upon its large organic investment and help it to outperform its end markets organically.

In our view, Broadcom's networking chip business is its strongest and contributes heavily to the firm's wide economic moat. We expect it to retain a dominant position in merchant silicon for switching and routing applications, where we see it as best-of-breed for high speeds. We also expect it to hold a formidable position in custom artificial intelligence accelerators as it benefits from hyperscale cloud vendors building chips to reduce their reliance on Nvidia. Outside of networking, we anticipate it maintaining a technological lead in thin-film bulk acoustic resonator, or FBAR, filters, which it sells exclusively into Apple's iPhone. Broadcom's software businesses sell virtualization software, mainframe software, and cybersecurity software, and we see its offerings as highly competitive. Broadcom's focus on strategic large software customers like financial institutions, governments, and large enterprises—where it is deeply embedded—elicits steep switching costs. We also see upselling opportunities with VMware under the firm's belt.

Going forward, we see Broadcom growing rapidly as a result of its skyrocketing AI chip business. We believe artificial intelligence is already the primary driver of Broadcom's chip sales, and is becoming the firm's overall leading growth driver. Outside of AI, we see more moderate growth led by VMware and wireless chip sales to Apple. We expect acquisitions to still be on Broadcom's radar but perhaps with larger, less frequent deals. After closing on VMware in 2023, we expect the firm to focus on deleveraging for a couple of years before tapping back into the acquisition market.

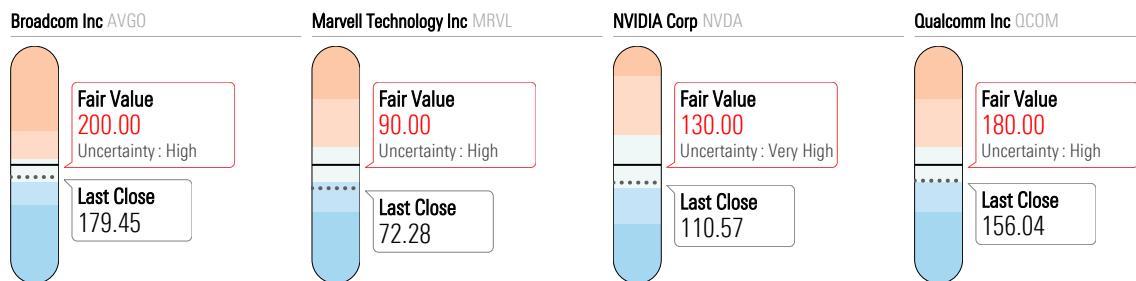
Bulls Say William Kerwin, CFA, Senior Equity Analyst, 7 Mar 2025

- Broadcom is a poster child for operating efficiency. It earns excellent operating margins and generates enormous cash flow. It is particularly strong at acquiring companies and trimming excess expenses.
- Broadcom's networking and wireless chip businesses boast best-of-breed technologies in our view, along with marquee customer relationships with Apple, Google, Cisco, Arista Networks, and others.
- We believe Broadcom will be a significant beneficiary of rising artificial intelligence spending, which we

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Competitors



Economic Moat	Wide	Narrow	Wide	Narrow
Currency	USD	USD	USD	USD
Fair Value	200.00 7 Mar 2025 04:34, UTC	90.00 4 Dec 2024 05:20, UTC	130.00 21 Nov 2024 03:43, UTC	180.00 28 May 2024 20:13, UTC
1-Star Price	310.00	139.50	227.50	279.00
5-Star Price	120.00	54.00	65.00	108.00
Assessment	Fairly Valued 6 Mar 2025	Undervalued 6 Mar 2025	Fairly Valued 6 Mar 2025	Fairly Valued 6 Mar 2025
Morningstar Rating	★★★ 7 Mar 2025 04:35, UTC	★★★★ 6 Mar 2025 22:41, UTC	★★★★ 6 Mar 2025 22:38, UTC	★★★★ 6 Mar 2025 22:39, UTC
Analyst	William Kerwin, Senior Equity Analyst	William Kerwin, Senior Equity Analyst	Brian Colello, Strategist	Brian Colello, Strategist
Capital Allocation	Exemplary	Exemplary	Exemplary	Standard
Price/Fair Value	0.90	0.80	0.85	0.87
Price/Sales	15.86	10.85	21.02	4.33
Price/Book	12.05	4.66	34.12	6.42
Price/Earning	128.48	—	39.90	17.34
Dividend Yield	1.21%	0.33%	—	2.18%
Market Cap	843.76 Bil	62.54 Bil	2,697.91 Bil	172.58 Bil
52-Week Range	119.76—251.88	53.19—127.48	75.61—153.13	149.43—230.63
Investment Style	Large Growth	Large Growth	Large Growth	Large Value

expect to spur significant growth for its networking semiconductor sales.

Bears Say William Kerwin, CFA, Senior Equity Analyst, 7 Mar 2025

- Broadcom's chip business is prone to cyclicalities and customer concentration, with a small handful of wireless and AI customers becoming a rising portion of revenue.
- Broadcom's software portfolio holds legacy and mature businesses, like virtualization and mainframes, which we think will exhibit moderating growth.
- Broadcom relies heavily on acquisitions to expand its portfolio, and may struggle to find deals large enough to move the needle that can pass antitrust scrutiny.

Economic Moat William Kerwin, CFA, Senior Equity Analyst, 22 Nov 2023

We believe Broadcom holds a wide economic moat, stemming from intangible assets in chip design and switching costs for its software products. Broadcom's strength in both chips and software allow it to

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earn terrific accounting and economic profits, and we believe its competitive positioning will allow it to do so, more likely than not, for the next 20 years. While we see most of Broadcom's businesses as moaty in isolation, we believe its ability to aggregate disparate businesses via acquisitions and run them with terrific efficiency reinforces its wide moat. We see this wide moat evidenced in starkly impressive operating and economic profit margins.

The majority of Broadcom's business is in semiconductors, with broad end market exposure across enterprise networking, wireless chips for smartphones, broadband access, and storage applications. We see the two largest exposures here, networking and wireless chips, as benefiting from wide-moat design expertise in chip design.

In wireless, Broadcom is the top supplier of thin-film bulk acoustic wave resonator, or FBAR, filters for high-end smartphones like the Apple iPhone, alongside Wi-Fi and Bluetooth chips. FBAR filters are a premium product, with better filtering, lower power consumption, and smaller size than other acoustic wave filters. FBARs are critical for new smartphones especially in the advent of 5G, allowing better reception of higher frequencies while extending battery life. In our view, FBARs require greater engineering complexity and are only successfully sold by a handful of firms, with Broadcom taking the lion's share of this slice of the market—resulting from 40 years of engineering and development. Broadcom boasts a strong relationship with Apple for placement into its iPhone models with these filters.

We don't foresee a new entrant encroaching on Broadcom's FBAR prowess and believe it would be difficult even for a rival smartphone chip supplier or for Apple itself. FBAR filters are built on non-silicon materials like aluminum nitride, which raises barriers to entry, in our view, as expertise for non-silicon materials is harder to find and develop. While mostly a fabless chipmaker, Broadcom keeps its FBAR manufacturing in-house to guard its design secrets. Though we hold concerns over customer concentration, and typically see high reliance on large smartphone makers like Apple as erosive to economic moats, we view Broadcom's focus on the premium end of the market and its large technological lead as moaty. For color, we estimate Broadcom's average dollar content sold into the iPhone close to \$20 (with roughly \$10 alone from modules including its FBAR filters), well above our estimates for peers like Skyworks (\$12) and Qorvo (\$5.).

In networking chips, Broadcom is the premier player with a commanding market share lead. To us, intangible assets in networking chip design come in the form of engineering expertise, both in terms of silicon design and integration with complementary hardware and customer networking topologies, which results from decades of development, R&D expense, and engraved customer relationships. Broadcom has the most breadth and depth of any networking chipmaker, offering a bevy of feature-rich chips tailored to specific applications in enterprises, high-speed chips that stay one step ahead of the development of the competition, and a growing custom silicon business for hyperscale cloud players like

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Google. It holds marquee customer relationships with the largest networking equipment vendors, like Cisco Systems and Arista Networks.

We see greater competition in newer corners of the networking chip landscape, including optical transceivers (where we see leadership for Marvell Technology) and offload data processors (a crowded field featuring heavyweights like Intel and Nvidia). Nevertheless, we foresee minimal eating of Broadcom's core lunch of switching and routing for enterprises and clouds. Simply put, Broadcom can outspend all its competitors on research and development to maintain its leadership. The firm estimates \$50 million-\$100 million in cumulative cost to build out a single new chip, and Broadcom has numerous networking chip lines on offer for a variety of tailored applications. We believe it can maintain the highest breadth and depth for switching and routing chips, while staying highly competitive in newer areas like optical and processing offload.

Broadcom has a significant exposure to enterprise software following its acquisition of VMware in 2023. Its primary exposures are virtualization software, mainframe software, development operations (DevOps) software, and cybersecurity primarily stemming from a string of acquisitions made following the initial Broadcom-Avago merger in 2016. We believe enterprise software is conducive to switching costs, including the tangible time, cost, and effort of finding a replacement, maintaining two systems concurrently during a transition, and managing any operational inefficiencies that result from the switch. Broadcom holds the market share leads in virtualization and mainframe software. In virtualization it dominates server virtualization for data centers and has expanded its offerings to storage virtualization, containerization, network management, and security to further embed itself in customers and make itself hard to rip out. In mainframe software, it focuses on security, monitoring, and analytics software to put primarily on IBM mainframes. IBM will often focus on the core data/payment processing software that requires specialized mainframes and leave Broadcom to specialize in complementary software. In DevOps, Broadcom is a strong player in a market with many options, including moaty businesses like Atlassian, ServiceNow, and Microsoft. In cybersecurity, Broadcom's Symantec brand is a legacy player with existing penetration, but that has struggled to transition to cloud security. We see the Carbon Black brand as more cutting-edge and better in cloud environments.

In software, we view Broadcom's strategic focus on a small group of large enterprise accounts as key to its moat. The firm is embedded in many different touchpoints in its key software customers, with more than 80% using more than five solutions (including security, DevOps, and mainframe software) per management. By focusing on selling multiple offerings into a concentrated bucket of large customers, we see Broadcom making itself difficult to rip out. We foresee Broadcom capitalizing on cross-selling opportunities between its legacy software and new VMware customer bases, further enhancing its entrenchment. Replacing Broadcom may require finding three or more new vendors that may be unable to replicate its exact capabilities and may require updated workstreams and IT support. We also see the firm's mainframe and DevOps software as competitively strong, further defending Broadcom against

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aspiring disruptors. Finally, Broadcom's core software is almost entirely made up of recurring revenue and subscriptions, which increases stickiness, in our view.

In sum, we see Broadcom deriving the vast majority of its sales from moaty businesses in software, networking chips, and wireless chips. We expect it to fend off serious competitive threats and maintain its impressive profitability over the next 20 years, more likely than not.

Fair Value and Profit Drivers William Kerwin, CFA, Senior Equity Analyst, 7 Mar 2025

Our fair value estimate for Broadcom is \$200 per share. Our valuation implies a fiscal 2025 adjusted price/ earnings multiple of 31 times and a fiscal 2025 enterprise value/sales multiple of 16 times.

In our view, Broadcom's primary valuation drivers are the growth of its AI chip business and its ability to extract growth and operating leverage from VMware. We also anticipate continued inorganic growth over the long term.

We model 19% revenue growth for Broadcom through fiscal 2029. We see high artificial intelligence sales driving supernormal growth in the next five years, but for longer-term durable growth to settle around 10% on an organic basis.

In semiconductors, we see the wireless and networking businesses driving growth, but for the AI portion to dominate Broadcom's chip revenue by fiscal 2029. Wireless should benefit from Apple iPhone sales and modestly rising 5G content, though we also model the firm losing some chip content as Apple develops its own Wi-Fi and Bluetooth chips. Networking should grow the fastest and benefit primarily from artificial intelligence-led data center buildouts. We model Broadcom's AI chip sales rising at more than a 40% compound annual growth rate through fiscal 2029. We believe in management's \$60 billion to \$90 billion serviceable addressable market estimate in fiscal 2027, and forecast the firm to earn more than half of that opportunity. We believe growth will be durable, with rising spending at existing customers and multiple new customers generating revenue toward the end of the decade.

In software, we believe growth will come primarily through upselling across Broadcom's base of around 3,000 large customers, between its virtualization (from VMware,) mainframe, DevOps, and security businesses. We see VMware as the firm's primary software growth driver, going forward.

We believe Broadcom will continue to exert operating leverage and grow operating expenses below sales growth. Broadcom did a terrific job cutting expenses after acquiring VMware. We expect the combined entity to spend more on sales and marketing than pre-VMware Broadcom, but significantly less than stand-alone VMware, as Broadcom focuses its sales and marketing on core customers. Along with higher gross margins incorporating VMware, we project non-GAAP operating margins rising to the mid-60% range in fiscal 2029, from 60% in fiscal 2024.

Broadcom Inc AVGO ★★★ 7 Mar 2025 04:35, UTC

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Risk and Uncertainty William Kerwin, CFA, Senior Equity Analyst, 7 Mar 2025

We assign a High Morningstar Uncertainty Rating to Broadcom. As a chipmaker, Broadcom is vulnerable to market supply and demand cycles. Though it has been able to offset cyclicalities in recent years with its software exposure and networking strength as a buoy, future cycles may not look similar. It also operates with a high reliance on TSMC for its chip supply, and supply constraints could hamper its ability to ship to customers in the future. Nonetheless, we believe Broadcom is a preferred customer of TSMC and would earn high priority in such a scenario—both for its scale and lengthy relationship.

We also see risk arising from customer concentration and AI: Broadcom is increasingly reliant on its AI accelerator business, which is made up of a handful of high-spending customers, like Google. Changes in spending patterns from these customers and overall AI demand can create fluctuations in Broadcom's results and affect market sentiment on its stock. We also see medium-term displacement risk in Broadcom's wireless chip sales into Apple, and expect Broadcom to lose its Wi-Fi and Bluetooth chip sales into iPhones and other products as early as 2025. Nevertheless, sales to Apple are a minority of sales compared with the larger networking chip segment, going forward.

We believe there is key man risk with CEO Hock Tan, who is in his seventies. Tan has been integral to Broadcom's acquisition and operating strategy, and new management may fail to realize the impressive efficiencies of the current team. Even with Tan at the helm, Broadcom's reliance on acquisitions is risky. The firm is encountering greater regulatory pushback and seeing the size of targets inflate as the business grows. If Broadcom can't find sufficient targets, or overpays for a deal, it could destroy value.

Finally, on the environmental, social, and governance, or ESG, front, we see little risk for Broadcom, primarily resulting from hard-to-find engineering talent for wireless and networking chips.

Capital Allocation William Kerwin, CFA, Senior Equity Analyst, 13 Dec 2024

We rate Broadcom's capital allocation as Exemplary, based on our assessment of a sound balance sheet, appropriate shareholder distributions, and exceptional investments. In our view, Broadcom's investments are the biggest contributor to shareholder returns.

Broadcom's balance sheet is sound to us, with long-dated debt maturities and robust annual cash flow. Despite taking on a larger debt load following the VMware acquisition, we expect it to steadily deleverage. We also see its shareholder distributions as appropriate. The firm targets 50% of prior-year free cash flow toward dividend payouts and often repurchases shares on top of that. Its shareholder payouts do not hamper its organic or inorganic investment, in our view.

We believe Broadcom's investments, both organic and inorganic, have created shareholder value and reinforced its competitive advantages. Broadcom uses inorganic growth as a key tenet of its strategy. CEO Hock Tan has been steering the ship since the days of stand-alone Avago Technologies and is a serial deal-maker. Recently, deals have been software-focused (Brocade, CA, Symantec, and VMware).

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We believe that up to this point, Broadcom has bought niche, but moaty software businesses that have augmented the company's profit profile and overall moatiness. VMware is a departure from that trend as the dominant virtualization software provider but should still augment profits and maintain the moat, in our view. Tan and team's ability to trim expenses and augment target profitability—quickly—is key to our rating. Furthermore, we don't see any lack of organic investment resulting from the firm's M&A record. In fact, Broadcom's \$9 billion annual research and development budget helps it fortify its competitively advantaged existing businesses, in our view.

Analyst Notes Archive

DeepSeek R1 Model Doesn't Alter Our Valuations or Forecasts for Technology Hardware Stocks

William Kerwin, CFA, Senior Equity Analyst, 27 Jan 2025

Many technology hardware stocks under our coverage plunged in Monday trading after reports of DeepSeek's R1 generative artificial intelligence model out of China offering performance parity to top US models at a much lower training cost. The iShares Semiconductor ETF was down 8% in midday trading. Why it matters: In our view, the market selloff implies fears of weaker future generative AI infrastructure investment resulting from cheaper models. We are less pessimistic and expect strong generative AI investment to continue. We've expected generative AI models to become slimmer and more efficient. We expect US model builders to develop more efficient models, but overall hardware spending will continue to rise, particularly with a serious competitive alternative out of China. In the longer term, we foresee a commoditization of AI models that shouldn't diminish investment in hardware infrastructure. Lower-cost models should accelerate the path to financial returns for model builders, but that they will continue to invest heavily in hardware to support them. The bottom line: We maintain our fair value estimates and moat ratings for our technology hardware coverage, including Apple, Broadcom, Marvell Technology, Arista Networks, and Micron Technology. The DeepSeek news and market selloff don't alter our long-term forecasts today. We don't expect a cut to infrastructure investment in the short term and believe US and European model builders will continue to invest heavily in developing larger and higher-performing models. Demand still exceeds chip supply, and we don't expect that to change due to the DeepSeek news. We believe the selloff largely reflects more uncertainty being priced into AI-exposed stocks, which we believe to be reasonable. We believe AI investment will continue to rise rapidly, but that more bullish forecasts might have underestimated efficiency gains in new models.

Broadcom Earnings: We Raise Our Valuation to \$190 on a Higher Medium-Term AI Revenue Forecast

William Kerwin, CFA, Senior Equity Analyst, 13 Dec 2024

Broadcom reported October-quarter revenue of \$14.1 billion, rising 8% sequentially. Longer-term, management also estimated its serviceable addressable market, or SAM, for artificial intelligence chips

Broadcom Inc AVGO ★★★ 7 Mar 2025 04:35, UTC

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at its three largest customers to be between \$60 billion and \$90 billion in fiscal 2027. The bottom line: We raise our fair value estimate for wide-moat Broadcom to \$190 per share, from \$155, as we raise our AI revenue growth forecast for the firm. We now see shares as roughly fairly valued after a 15% jump after hours in response to strong results and guidance. We now forecast nearly 40% annual revenue growth for Broadcom's AI chips through fiscal 2029, inclusive of more than 50% annual growth through fiscal 2027. This puts us on the conservative end of management's SAM. We model \$44.2 billion in AI chip revenue in fiscal 2027. To buy Broadcom shares today, we believe investors have to believe in the midpoint or upper end of management's SAM and expect Broadcom to retain a 70% share of this opportunity. Why it matters: Broadcom's SAM estimate for fiscal 2027 implies significantly higher AI revenue growth over the next three years than we expected, at a roughly 62% annual rate from fiscal 2024. We believe Broadcom has a path to a majority share of this future SAM. Management estimates its fiscal 2024 SAM to be between \$15 billion and \$20 billion, which implies Broadcom holding a roughly 70% share with \$12.2 billion in fiscal 2024 AI chip revenue. We see potential upside to management's SAM, given Broadcom has just begun working with two more custom AI accelerator customers (who we believe to be Apple and OpenAI) and sells its merchant networking chips for AI to a wider customer base. Big picture: Broadcom's impressive outlook for AI revenue adheres to our long-term thesis that the firm possesses differentiated chip design capabilities for high-performance networking and computing that allow it to capitalize on significant cloud investment and take market share.

Broadcom: We Don't Foresee Immediate Risk From Apple's Modem Plans William Kerwin, CFA, Senior Equity Analyst, 6 Dec 2024

We maintain our fair value estimates for Apple and Broadcom after Bloomberg reported that Apple would be rolling out its own cellular modem as early as 2025. We aren't surprised by Apple's modem ambitions, and they fit with our longer-term expectations for the firm to wrap more chip content under its design umbrella. Apple's vertical integration strategy is a key tenet of our gross margin expansion thesis on the firm, and helps it to reduce price inflation. We like the strategy, as reported, for a staged rollout beginning with the lower-value iPhone SE before eventually moving up to the premium iPhone models. We don't see immediate risk to chip supplier Broadcom from this report. We see Broadcom's FBAR chips as among the most differentiated pieces in Apple's products, and one of the hardest for Apple to displace. Moreover, we continue to see both Apple and Broadcom as overvalued today. Bloomberg reported on Dec. 6 that Apple would begin rolling out self-designed internal baseband chips, or modems, in 2025. These would begin to displace Qualcomm content in iPhones and other Apple products, starting with the lower-end iPhone SE. Bloomberg also reported that other radio-frequency, or RF, parts from the likes of Qorvo might also be displaced alongside a core modem chip. According to the report, Apple would seek to build confidence in its technology in the lower end SE models before establishing technology leadership and displacing Qualcomm in premium iPhone models around 2027. For Apple, we see this as a continuation of ongoing vertical integration of chip content,

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with the most notable recent example being the M-series chips for Macs and iPads to displace Intel chips in 2020. Vertical integration has been a key driver of 500 basis points of product gross margin expansion since 2019 for Apple, and we expect nearly 200 basis points of expansion over the next five years, driven in part by integrating Apple-designed modems.

Broadcom Earnings: AI Growth and VMware Integration Align With Our Thesis and \$155 Valuation

William Kerwin, CFA, Senior Equity Analyst, 6 Sep 2024

We maintain our \$155 fair value estimate for shares of wide-moat Broadcom, and our long-term growth thesis is intact. Artificial intelligence continues to drive the firm's organic growth in fiscal 2024, supplemented by the continuing inorganic addition of VMware. Non-AI semiconductor revenue remains weak, but we have increasing confidence that these non-AI chip markets will rebound over the coming quarters. Broadcom's fiscal third-quarter results and fiscal fourth-quarter guidance were in line with our expectations. We continue to expect strong growth over the next five years, driven by AI chip demand, VMware, and rebounding non-AI chip markets. Shares dipped about 6% after-hours on guidance, lightly missing Factset consensus expectations, leaving them fairly valued. July quarter revenue rose 5% sequentially to \$13.1 billion. As reported, that implies 47% growth year over year, including VMware's inorganic contribution. Organically, revenue rose 4% year over year. AI chip revenue again drove the organic growth, and we continue to see strong adoption of Broadcom's custom accelerators and merchant networking chips. Weaker demand and inventory reductions in the storage, broadband, and industrial chip end markets have partially offset strong organic AI chip growth, but management positively guided for sequential growth in the October quarter, and we project multiyear rebounds to start meaningfully in fiscal 2025. October quarter guidance was in line with our expectations. Broadcom is guiding for \$14 billion in sales, implying a sequential growth acceleration to 7%. We expect another step up for AI revenue, along with recoveries in cyclically depressed chip markets, to drive growth. We are pleased Broadcom is on track with its integration of VMware and cost reductions, with guidance calling for a 64% non-GAAP EBITDA margin in the October quarter, in line with levels prior to the acquisition.

Broadcom Earnings: Another Excellent Period for AI Brings Our Forecast and Valuation Up

William Kerwin, CFA, Senior Equity Analyst, 13 Jun 2024

We raise our fair value estimate for wide-moat Broadcom to \$1,550 per share from \$1,350 as we raise our medium-term growth forecast for artificial intelligence revenue. AI chip sales exceeded our expectations, and management raised its full-year guide for AI and total firm revenue. Even so, we see the new fiscal 2024 AI guidance as conservative and model further upside. Broadcom's impressive AI results lend credence to our long-term thesis for networking to benefit from robust generative AI investment and for Ethernet to take share within generative AI networks. Positively, Broadcom also raised its guidance for VMware cost-cutting in fiscal 2024, which we believe will help short-term

Broadcom Inc AVGO ★★★ 7 Mar 2025 04:35, UTC

Last Price	Fair Value Estimate	Price/FVE	Market Cap	Economic Moat™	Equity Style Box	Uncertainty	Capital Allocation	ESG Risk Rating Assessment¹
179.45 USD 6 Mar 2025	200.00 USD 7 Mar 2025 04:34, UTC	0.90	843.76 USD Bil 6 Mar 2025	Wide	Large Growth	High	Exemplary	 5 Mar 2025 06:00, UTC

margins. Shares rose more than 10% after-hours, aligning with our valuation raise. We continue to see Broadcom's valuation as challenging, reflecting even more robust AI sales growth than our bullish expectations. April-quarter sales rose 43% year over year and 4% sequentially to \$12.5 billion, with inorganic contributions from VMware and organic AI sales driving most of the growth. Organically, Broadcom sales rose 12% year over year, almost entirely from AI. AI chip sales of \$3.1 billion rose about 35% sequentially, well above our expectations. Broadcom is seeing tremendous growth from its custom AI accelerators and merchant networking chips selling into generative AI infrastructure. Non-AI chip sales declined about 30% year over year, reflecting continued cyclical downturns for non-AI networking chips. Broadcom raised its fiscal 2024 sales outlook to \$51 billion, up from \$50 billion, due almost entirely to AI revenue, in our view. Management now expects over \$11 billion in AI chip sales in fiscal 2024, up from \$10 billion. We see this as conservative, implying flat sequential growth in the next two quarters. We expect Broadcom to beat this figure and model \$13 billion in AI revenue this year.

Broadcom: Shares Now Look Fairly Valued With Our Higher Valuation Based on Generative AI Forecast

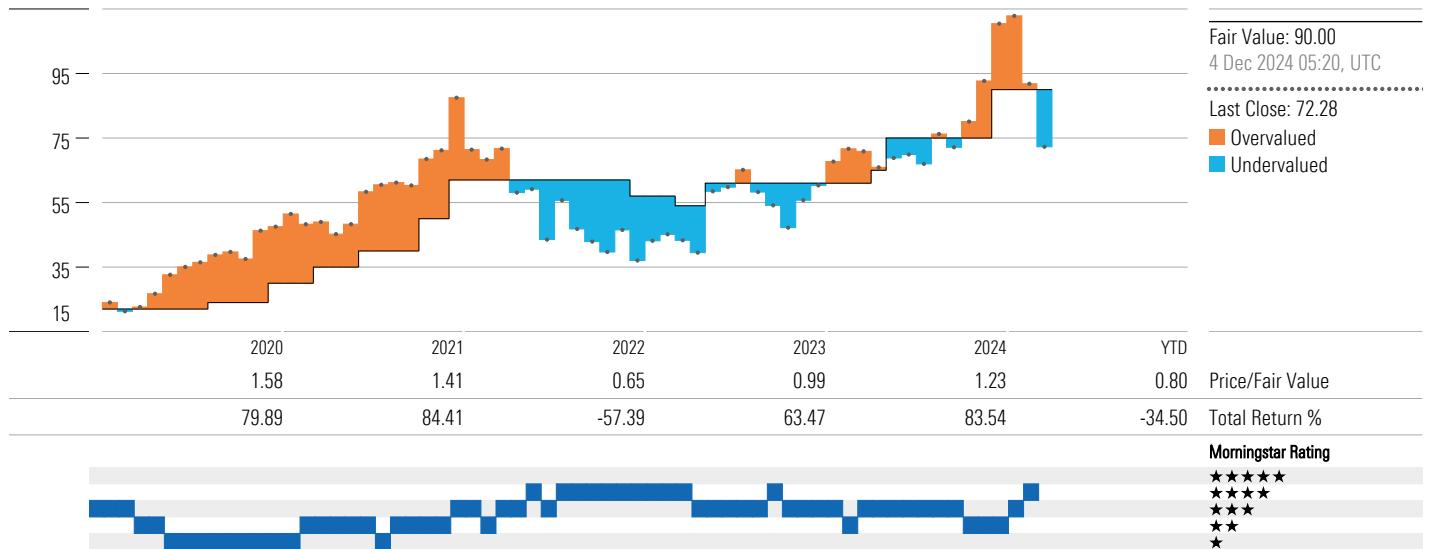
William Kerwin, CFA, Senior Equity Analyst, 31 May 2024

We raised our fair value estimate for wide-moat Broadcom to \$1,350 per share, from \$1,090, as we raise our long-term growth assumptions to factor in a greater generative AI opportunity for the firm. We continue to view Broadcom as a diversified investment with both semiconductor and software exposure. Within semiconductors, we increasingly view AI as a driver of growth, and forecast it to approach half of overall chip sales over the next five years. We retain our positive views of the firm's other chip businesses, and its software portfolio, inclusive of VMware. We believe Broadcom's ability to manage various differentiated businesses and generate tremendous profitability from each underpins a wide economic moat. We like its diversified growth opportunity, but view AI as the fastest grower over our medium-term forecast. While we've previously been bearish on Broadcom's valuation, we now see the shares as fairly valued. Investors eager to play into AI may see an opportunity here, though we continue to see AI as a minority of total firm sales against other chip and software businesses. Broadcom's AI opportunity is broad and spans networking and computing. We believe its strongest opportunity is in its custom accelerator business, with wins at hyperscale cloud vendors like Google and Meta. We believe its merchant switch and routing chip opportunity in AI is also strong, and believe Broadcom dominates these markets at the highest speeds required for building generative AI models. We believe the firm's generative AI opportunity is roughly 70% in custom accelerators and 30% in merchant networking chips, and we expect this split to continue into the medium term. Furthermore, we believe networking is a critical necessity to connect GPUs and accelerators for generative AI models, and see Broadcom as very well positioned to reap a meaningful share of AI investment over the next five years. 

Broadcom Inc AVGO ★★★ 7 Mar 2025 04:35, UTC

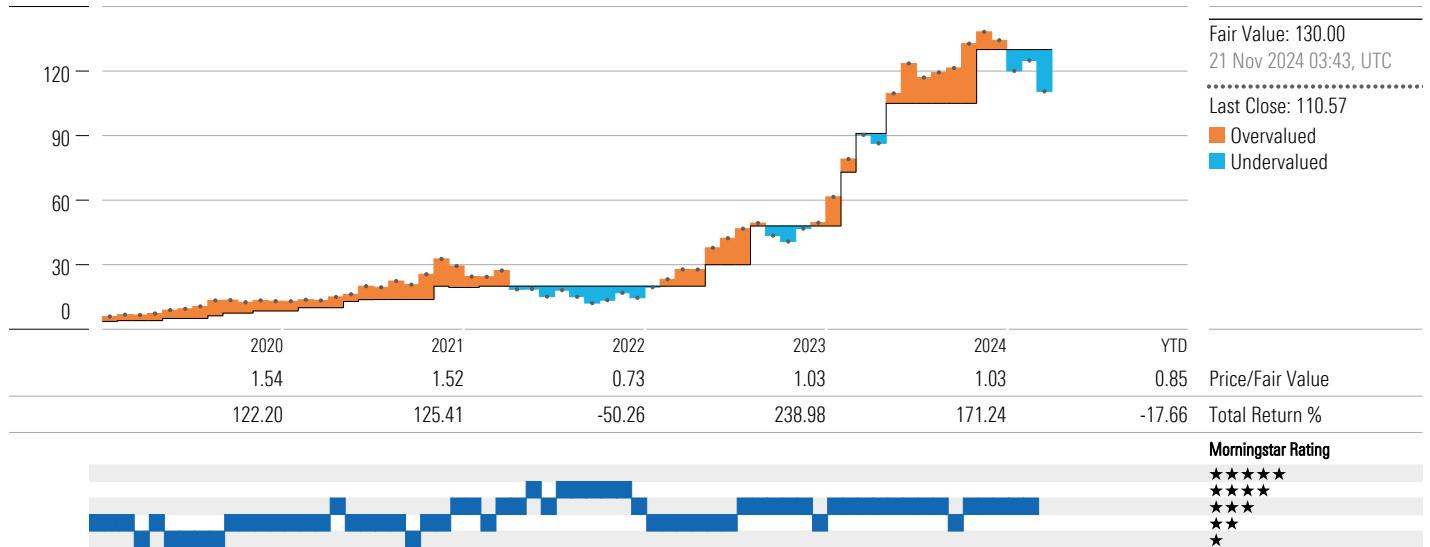
Competitors Price vs. Fair Value

Marvell Technology Inc MRVL



Total Return % as of 06 Mar 2025. Last Close as of 06 Mar 2025. Fair Value as of 4 Dec 2024 05:20, UTC.

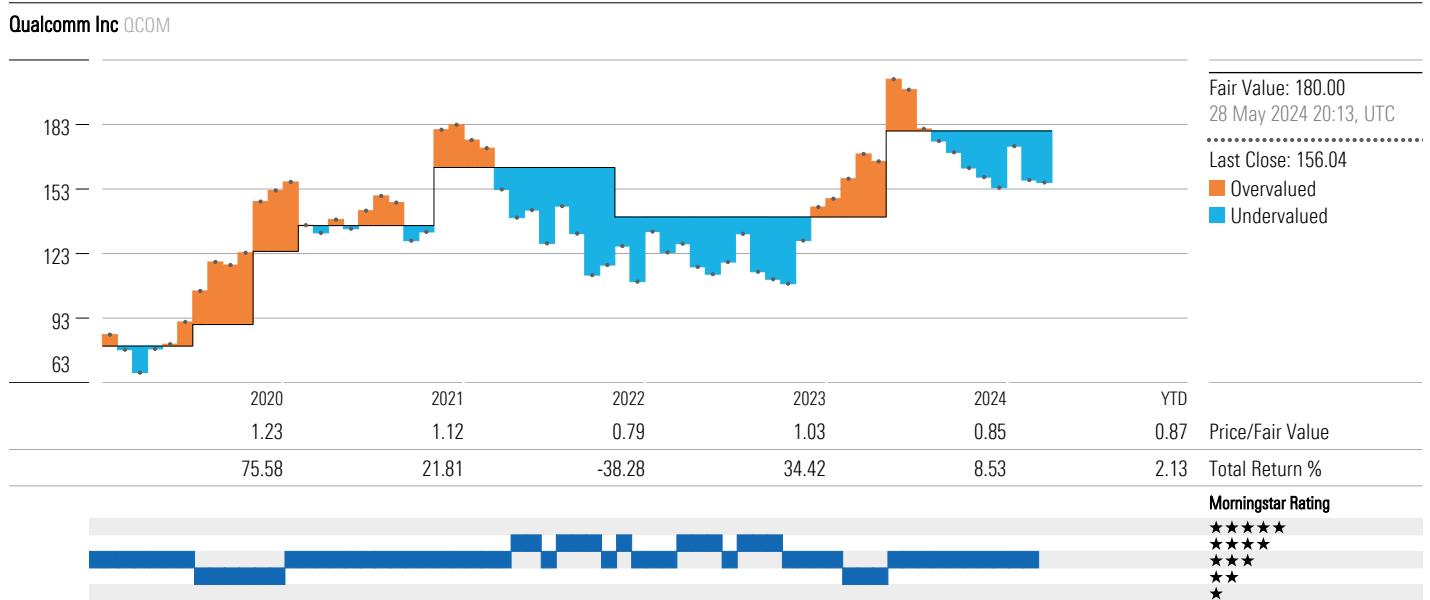
NVIDIA Corp NVDA



Total Return % as of 06 Mar 2025. Last Close as of 06 Mar 2025. Fair Value as of 21 Nov 2024 03:43, UTC.

Broadcom Inc AVGO ★★★ 7 Mar 2025 04:35, UTC

Competitors Price vs. Fair Value



Total Return % as of 06 Mar 2025. Last Close as of 06 Mar 2025. Fair Value as of 28 May 2024 20:13, UTC.

Broadcom Inc AVGO ★★★ 7 Mar 2025 04:35, UTC

Last Price 179.45 USD 6 Mar 2025	Fair Value Estimate 200.00 USD 7 Mar 2025 04:34, UTC	Price/FVE 0.90	Market Cap 843.76 USD Bil 6 Mar 2025	Economic Moat™  Wide	Equity Style Box  Large Growth	Uncertainty High	Capital Allocation Exemplary	ESG Risk Rating Assessment¹  5 Mar 2025 06:00, UTC
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Morningstar Historical Summary

Financials as of 31 Oct 2024

Fiscal Year, ends 31 Oct	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	YTD	TTM
Revenue (USD Bil)	6.82	13.24	17.64	20.85	22.60	23.89	27.45	33.20	35.82	51.57	51.57	51.57
Revenue Growth %	59.9	94.0	33.2	18.2	8.4	5.7	14.9	21.0	7.9	44.0	44.0	44.0
EBITDA (USD Bil)	2.62	2.52	7.02	9.25	9.48	11.13	14.69	19.16	20.55	23.88	23.88	23.88
EBITDA Margin %	38.4	19.0	39.8	44.4	41.9	46.6	53.5	57.7	57.4	46.3	46.3	46.3
Operating Income (USD Bil)	1.77	0.59	2.65	5.37	4.18	4.21	8.67	14.28	16.45	15.00	15.00	15.00
Operating Margin %	25.9	4.4	15.0	25.8	18.5	17.6	31.6	43.0	45.9	29.1	29.1	29.1
Net Income (USD Bil)	1.36	-1.74	1.78	12.26	2.72	2.96	6.74	11.50	14.08	5.90	5.90	5.90
Net Margin %	20.0	-13.1	9.6	58.8	11.9	11.2	23.5	33.8	39.3	11.4	11.4	11.4
Diluted Shares Outstanding (Mil)	2,810	3,830	4,210	4,321	4,201	4,221	4,290	4,232	4,272	4,778	4,778	4,778
Diluted Earnings Per Share (USD)	0.49	-0.49	0.40	2.84	0.64	0.63	1.50	2.65	3.30	1.23	1.23	1.23
Dividends Per Share (USD)	0.16	0.19	0.41	0.70	1.06	1.30	1.44	1.64	1.84	2.11	2.11	2.11

Valuation as of 28 Feb 2025

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Recent Qtr	TTM
Price/Sales	6.0	5.1	6.1	5.3	5.9	7.7	10.4	7.1	13.3	21.5	21.5	18.5
Price/Earnings	29.3	-38.6	63.7	8.9	49.0	69.4	44.4	21.1	33.9	178.6	178.6	153.8
Price/Cash Flow	17.6	19.8	16.5	12.3	13.7	15.3	20.8	14.2	26.4	55.6	55.6	47.8
Dividend Yield %	1.13	1.43	1.87	3.11	3.54	3.05	2.24	3.02	1.71	0.94	0.94	1.09
Price/Book	8.5	3.7	5.2	3.9	5.0	7.5	11.0	10.3	21.8	16.1	16.1	13.9
EV/EBITDA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Operating Performance / Profitability as of 31 Oct 2024

Fiscal Year, ends 31 Oct	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	YTD	TTM
ROA %	13.0	-5.8	3.2	23.5	4.6	3.7	8.5	15.1	19.3	4.9	4.9	4.9
ROE %	34.3	-14.7	8.6	52.2	10.5	10.9	26.4	47.1	60.3	12.9	12.9	12.9
ROIC %	17.7	-6.8	5.9	30.9	7.0	6.6	12.8	20.1	24.1	8.1	8.1	8.1
Asset Turnover	0.6	0.4	0.3	0.4	0.4	0.3	0.4	0.4	0.5	0.4	0.4	0.4

Financial Leverage

Fiscal Year, ends 31 Oct	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Recent Qtr	TTM
Debt/Capital %	44.8	41.1	46.2	39.6	54.6	62.7	61.2	63.2	61.1	49.5	49.5	—
Equity/Assets %	44.8	37.8	37.3	53.2	37.0	31.4	33.0	31.0	32.9	40.9	40.9	—
Total Debt/EBITDA	1.5	5.4	2.5	1.9	3.5	3.7	2.7	2.1	1.9	2.8	2.8	—
EBITDA/Interest Expense	13.7	4.3	15.5	14.7	6.6	6.3	7.8	11.0	12.7	6.0	6.0	6.0

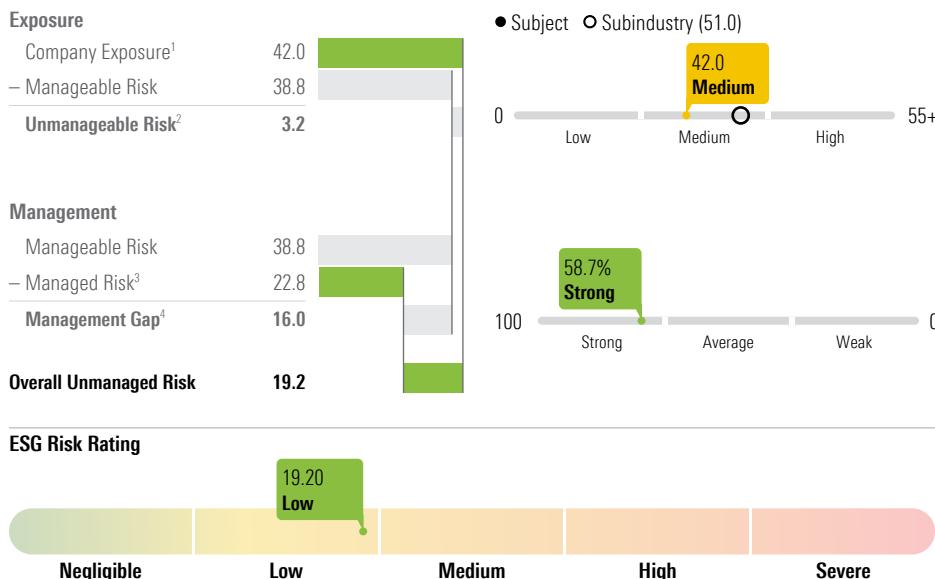
Morningstar Analyst Historical/Forecast Summary as of 06 Mar 2025

Financials	Estimates					Forward Valuation	Estimates			
	2023	2024	2025	2026	2027		2024	2025	2026	2027
Fiscal Year, ends 31 Oct 2024										
Revenue (USD Mil)	35,819	51,574	62,567	76,531	96,538	9.7	15.4	13.5	11.0	8.7
Revenue Growth %	7.9	44.0	21.3	22.3	26.1	19.9	34.9	28.1	22.3	16.7
EBITDA (USD Mil)	23,213	31,897	41,108	50,277	64,502	—	—	—	—	—
EBITDA Margin %	64.8	61.9	65.7	65.7	66.8	2.2	1.2	1.3	1.6	2.3
Operating Income (USD Mil)	16,451	14,996	26,744	35,630	48,690	15.0	12.0	12.2	11.8	11.0
Operating Margin %	45.9	29.1	42.7	46.6	50.4	16.2	26.7	21.9	17.9	14.0
Net Income (USD Mil)	18,040	23,251	30,758	38,403	50,715					
Net Margin %	50.4	45.1	49.2	50.2	52.5					
Diluted Shares Outstanding (Mil)	4,270	4,778	4,813	4,770	4,709					
Diluted Earnings Per Share(USD)	4.22	4.87	6.39	8.05	10.77					
Dividends Per Share(USD)	1.84	2.10	2.36	2.86	4.06					

Broadcom Inc AVGO ★★★ 7 Mar 2025 04:35, UTC

Last Price	Fair Value Estimate	Price/FVE	Market Cap	Economic Moat™	Equity Style Box	Uncertainty	Capital Allocation	ESG Risk Rating Assessment¹
179.45 USD 6 Mar 2025	200.00 USD 7 Mar 2025 04:34, UTC	0.90	843.76 USD Bil 6 Mar 2025	Wide	Large Growth	High	Exemplary	 5 Mar 2025 06:00, UTC

ESG Risk Rating Breakdown



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 58.7%
4. Management Gap assesses risks that are not managed, but are considered manageable
5. ESG Risk Rating Assessment = Overall Unmanaged Risk + Unmanageable Risk

- 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 Assessment⁵



ESG Risk Rating is of Mar 05, 2025. Highest Controversy Level is as of Feb 08, 2025. 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 05 Mar 2025

Company Name	Exposure	Management	ESG Risk Rating
Broadcom Inc	42.0 Medium	58.7 Strong	19.2 Low
Marvell Technology Inc	32.5 Low	54.5 Strong	16.0 Low
Qualcomm Inc	38.1 Medium	69.3 Strong	13.6 Low
Skyworks Solutions Inc	49.9 Medium	56.2 Strong	24.1 Medium
Dsilicon Co Ltd	51.0 Medium	22.2 Weak	40.6 Severe

Appendix

Historical Morningstar Rating

Broadcom Inc AVGO 6 Mar 2025 22:50, UTC

Dec 2025	Nov 2025	Oct 2025	Sep 2025	Aug 2025	Jul 2025	Jun 2025	May 2025	Apr 2025	Mar 2025	Feb 2025	Jan 2025
—	—	—	—	—	—	—	—	—	★★★	★★★	★★
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
★★	★★	★★	★★	★★★	★★★	★★★	★★★	★★★★	★★★★	★★★★	★★★★

Marvell Technology Inc MRVL 6 Mar 2025 22:41, UTC

Dec 2025	Nov 2025	Oct 2025	Sep 2025	Aug 2025	Jul 2025	Jun 2025	May 2025	Apr 2025	Mar 2025	Feb 2025	Jan 2025
—	—	—	—	—	—	—	—	—	★★★★	★★★	★★
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
★	★	★	★	★	★	★	★★	★★	★★	★★	★★

NVIDIA Corp NVDA 6 Mar 2025 22:38, UTC

Dec 2025	Nov 2025	Oct 2025	Sep 2025	Aug 2025	Jul 2025	Jun 2025	May 2025	Apr 2025	Mar 2025	Feb 2025	Jan 2025
—	—	—	—	—	—	—	—	—	★★★	★★★	★★★
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
★★	★★	★★	★	★	★	★	★★	★★	★★	★★	★★

Qualcomm Inc QCOM 6 Mar 2025 22:39, UTC

Dec 2025	Nov 2025	Oct 2025	Sep 2025	Aug 2025	Jul 2025	Jun 2025	May 2025	Apr 2025	Mar 2025	Feb 2025	Jan 2025
—	—	—	—	—	—	—	—	—	★★★	★★★	★★★
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
★★	★★	★★	★★	★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★

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, depth 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 re-

turns 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 de-

rive 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.

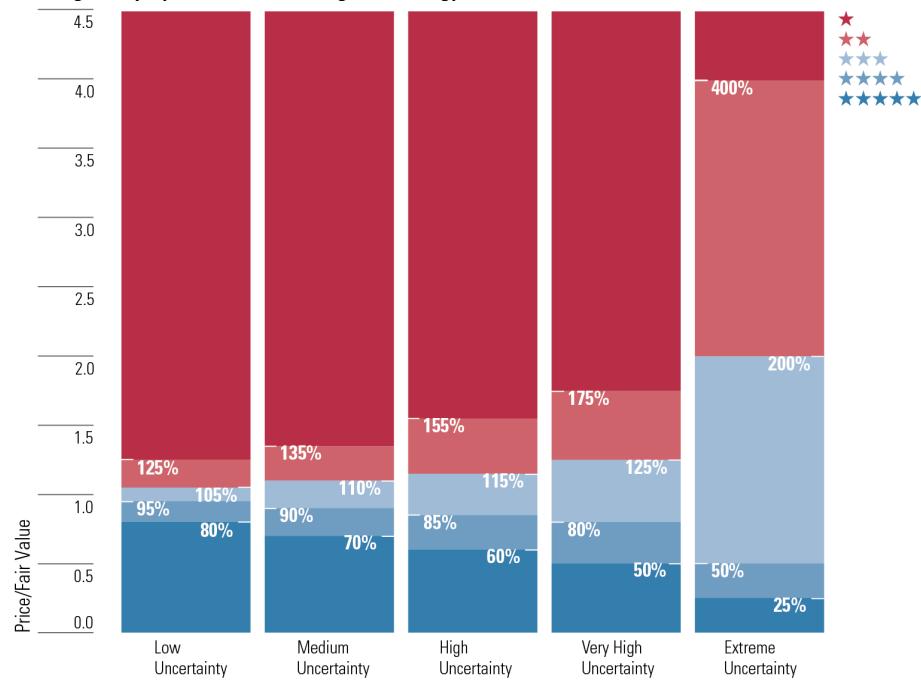
4. Market Price

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 ad-

justed 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 compa-

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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/

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