International Journal of Finance and Digitalization
www.ijfd.uz
ISSN: 2181-3957
Vol. 4 Issue 01, 2025

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VALUING LEADING TECH STOCKS THROUGH AI AND ESG LENSES: A POST-PANDEMIC ANALYSIS OF APPLE, MICROSOFT, AMD, NVIDIA AND TESLA

ABSTACT. The COVID-19 pandemic transformed world capital markets, increasing volatility and accelerating digitalization. Under these circumstances, investors are increasingly looking to data-driven approaches and sustainability metrics to inform equity valuation and portfolio strategies. This study provides a comparative valuation of the top five technology firms - Apple, Microsoft, AMD, NVIDIA, and Tesla - by integrating traditional financial models with technical analysis, AI-based forecasting, and ESG considerations. Utilizing a multi-model approach using DCF, CAPM, ROIC, and RSI/MACD analysis, the study analyzes intrinsic value and short-term market momentum. The study explains that firms with more favorable ESG scores and consistent free cash generation are stronger against post-pandemic market disruptions, and analysis from AI enhances the quality of short-term signals. The hybrid assessment approach delivers insights for investors seeking profitability as well as sustainability in a high-volatility world.

Keywords: capital markets volatility; post-pandemic finance; technology equities; comparative valuation; discounted cash flow (DCF); capital asset pricing model (CAPM); return on invested capital (ROIC); technical analysis indicators; RSI and MACD signals; AI-based forecasting; ESG performance metrics; intrinsic value assessment; free cash flow resilience; sustainable investment strategies; hybrid valuation model

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INTRODUCTION.

Big tech companies have, in the recent years, not only been growth drivers for the stock market but also structural pillars for portfolios around the world. Apple, Microsoft, AMD, NVIDIA, and Tesla are among the companies that now shape not only how capital is invested by investors but also how societies react to digitalization and technological changes [1]. Their effects extend to shareholder profits, intersecting with industry sectors such as artificial intelligence, semiconductors, electric transportation, and cloud infrastructure. Concurrently, equity valuation has evolved from being strict profit-oriented to including qualitative factors such as environmental, social, and governance (ESG) performance, as well as the use of artificial intelligence (AI) in forecasting models [2][3]. Integration of ESG has earned recognition for its link with long-term corporate resilience and reduced risk exposure [4].

The pandemic induced by COVID-19 accelerated the shift. When volatility rose and market fundamentals soured, valuation models based on conventional approaches such as discounted cash flow models could not cope with the uncertainty and behavioral elements of investors [5]. This had the implication that hybrid analytical models are needed which integrate financial information with ESG scoring and artificial intelligence-based risk assessment to indicate more holistic and forward-looking investment perspectives [2][5]. This study examines five big tech firms with a dual view of traditional valuation methods - DCF, CAPM, ROIC - and technical indicators such as RSI and MACD, including also ESG scores and AI-based forecast signals. In this way, the study strives to provide deeper insight into how stocks behave in post-pandemic markets and why both the incorporation of sustainability and technological foresight are becoming increasingly important in modern investment strategies.

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LITERATURE REVIEW

Equity valuation of the technology sector has moved away from conventional financial modeling toward a multidisciplinary process that incorporates market dynamics, sustainability, and data analysis. Throughout the body of scholarly literature, researchers have sought to depict the complex character of tech stock performance, but diversity exists throughout regions in terms of research priorities and methodology.

In Western finance theory, Discounted Cash Flow (DCF) and Capital Asset Pricing Model (CAPM) are the undisputed rulers of valuation. These theories, rooted in efficient market theory, concentrate on intrinsic value based on expected cash flows and systematic risk [1]. But Damodaran identifies their limitations in high-speed industries such as technology, where high-tech innovation, brand

reputation, and intangibles shatter traditional risk-return assumptions [2]. His results suggest that narrative-driven variables - such as ecosystem benefit or user base increase -are to be complemented with numeric models in order to more accurately evaluate equity.

European research has increasingly paid attention to Environmental, Social, and Governance (ESG) factors as important valuation drivers. Researchers like Müller [6] and De Marco [7] have found that highly rated ESG firms have a lower cost of capital and reduced idiosyncratic risk. They provide empirical evidence of a converging trend between shareholder value and sustainability. Moreover, the emergence of the EU's Sustainable Finance Disclosure Regulation (SFDR) has formalized ESG metrics into investment mandates, with their incorporation into active and passive portfolio construction.

In Asia, specifically in Japan, South Korea, and China, attention has turned to artificial intelligence (AI) and its application in equity forecasting. Zhang and Liu [8], in their study of China’s A-share market, demonstrate that machine learning models outperform conventional methods in price momentum forecasting when combined with technical indicators such as RSI, MACD, and moving averages. Similarly, Suzuki’s research [9] on the Nikkei 225 applies deep learning models to improve the timing of market entries and exits, particularly for volatile tech portfolios.

In the Central Asian region, and particularly in Uzbekistan, the academic discussion around equity valuation is transitioning from classical financial theory to more applied, market-specific models. Ruzmetov and Norbotayev [10] propose a localized version of the CAPM that adjusts for the unique capital structure and sovereign risk profile of Uzbek issuers. Meanwhile, Abduganiev [11] explores how global volatility in tech stocks affects investor sentiment and liquidity in the

International Journal of Finance and Digitalization
www.ijfd.uz
ISSN: 2181-3957
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Uzbekistan stock exchange, suggesting that ESG and AI-based models may improve predictive precision in emerging markets.

Despite these advancements, current scholarship remains largely siloed. Most studies explore either financial valuation, ESG, or AI-based analytics in isolation. A comprehensive model that synthesizes all three remains underdeveloped. This paper contributes to bridging that gap by applying an integrated framework to assess five global tech leaders - Apple, Microsoft, AMD, NVIDIA, and Tesla - through the combined lens of traditional finance, sustainability, and artificial intelligence.

METHODOLOGY

To determine the investment appeal of five leading technology firms - Apple, Microsoft, AMD, NVIDIA, and Tesla - this study employs an integrated analytical framework that integrates classical financial valuation models, technical analysis indicators, and non-financial ESG variables. This framework reflects the multifaceted character of stock performance in the modern financial environment, where quantitative performance and qualitative sustainability both influence capital flows.

Simple valuation is based on the reliability of the discounted cash flow (DCF) model, which estimates the intrinsic value of a company by discounting future forecasted free cash flows at a rate equal to the firm's weighted average cost of capital (WACC) [1]. The WACC itself adds up the cost of equity - derived from the Capital Asset Pricing Model (CAPM) - and the cost of debt net of tax efficiency [1][2]. CAPM also incorporates systematic risk of the market through beta coefficients, allowing expectations of investors to vary based on the volatility of the company [2].

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Measuring capital effectiveness is done using return on invested capital (ROIC), showing how effectively every company can translate invested capital to net operating profit after taxes [3]. ROIC is particularly useful in ranking value creation amongst technology companies based on different profiles of capital intensiveness.

As part of intrinsic value determination complement, technical analysis is used for study of short-run price trend. Moving averages (200-day and 50-day) signal trend direction and act on crossovers - well-known instances include widely popular "Golden Cross" and "Death Cross" phenomena [4]. The Relative Strength Index (RSI) is utilized in detection of momentum extremes, wherein greater than 70 may suggest overbuy and less than 30 may suggest oversold conditions [5]. The. Moving Average Convergence Divergence indicator provides further confirmation by way of the identification of trend reversals or accelerations via exponential moving averages differences [5]. With the advent of artificial intelligence in asset pricing, machine learning models have become indispensable in detecting nonlinear relationships in financial data. Gu, Kelly, and Xiu [13] demonstrate that these models significantly outperform traditional linear estimators, especially in volatile industries like the technology sector, and thus become a vital part of modern equity research.

In addition to financial and technical metrics, the study includes ESG scores as a measure of non-financial risk exposures. The ratings, compiled by providers such as MSCI and Sustainalytics, are used to measure long-term sustainability and regulatory compliance [3][6]. Chava and Hsu [12] further attest to the usability of ESG indicators through evidence of their predictive power on stock returns and resilience. By marrying these layers - financial fundamentals, technical trends, AI-driven projections, and ESG sensitivity - this method attempts to create a more

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integrated and responsive model of valuation. This is particularly attuned to the post-pandemic landscape, where investor anxiety is as concerned with growth and innovation as with stability and accountability.

ANALYSIS

In the financial markets of today, the valuation of high-growth technology equities entails more than traditional valuation techniques. The intersection of pandemic-induced volatility, artificial intelligence disruption, and investor behavioral changes requires an integrated approach. This chapter provides a combined five-year performance review of Apple, Microsoft, AMD, NVIDIA, and Tesla using a synthesis of financial fundamentals, technical momentum indicators, and macro-thematic narratives. The historical stock prices are charted in Figures 1 to 5.

Apple's share price exhibited steady long-term appreciation, buffered by stable free cash flow (FCF), dividend strength, and high ROIC (>30%). As can be seen in Figure 1, a short-term setback in early 2020 due to the COVID-19 pandemic was followed by quicker recovery, driven by digital service growth and hardware demand [14]. AI integration through M-series chips with embedded neural engines has enabled on-device inference, reducing dependence on the cloud and improving user security - a factor positively priced into long-term valuation [15]. Technically, Apple’s 50-day moving average (MA) has remained above its 200-day MA since mid-2021, confirming a structural uptrend. RSI averages around 65, indicating active momentum without signaling overheating. The stock's relatively low beta (~1.18) suggests moderate volatility within the sector.

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ISSN: 2181-3957
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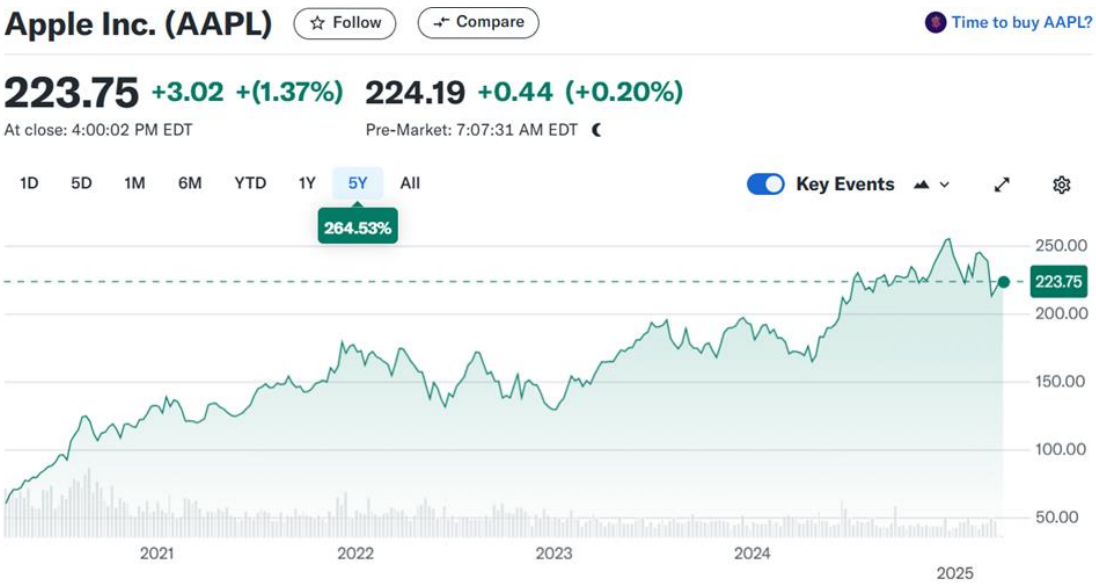

Figure1. Apple Inc. – Five-year stock price performance (2019–2024)

Microsoft's price action shown in Figure 2 reveals resilience and strong upward momentum, attributed primarily to cloud expansion (Azure), SaaS scaling (Teams, Office365), and AI-led productivity tools [16]. Post-COVID acceleration in remote work adoption reinforced Microsoft's strategic positioning, resulting in a five-year appreciation of over 160%.

Figure 2. Microsoft Corporation – 5-Year Performance and AI Productivity Impact https://www.yahoo.com/

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www.ijfd.uz
ISSN: 2181-3957
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Fundamentally, Microsoft's P/E (~35) and beta (~0.90) reflect moderate valuation pressure but low systemic risk. Its ESG score consistently ranks in the upper decile, enhancing institutional investor appeal. Technically, MACD signals have remained positive for long durations, while RSI fluctuations between 60–70 indicate sustained but controlled bullishness.

AMD's chart in Figure 3 shows pronounced price fluctuations reflective of high beta (~1.35), competitive pressures from Intel and NVIDIA, and sensitivity to macro conditions. The COVID-19 shock initially boosted chip demand, but subsequent supply constraints caused price swings [14][17].

AI-focused product lines such as the MI300X series are projected to enhance AMD's enterprise market share. Financially, its ROIC (~15%) and FCF ($3.2B) demonstrate improving capital efficiency despite relatively high EV/EBITDA multiples. Technical indicators confirm volatility, with frequent RSI cycles between 40–75 and short-term MA crossovers being prevalent.

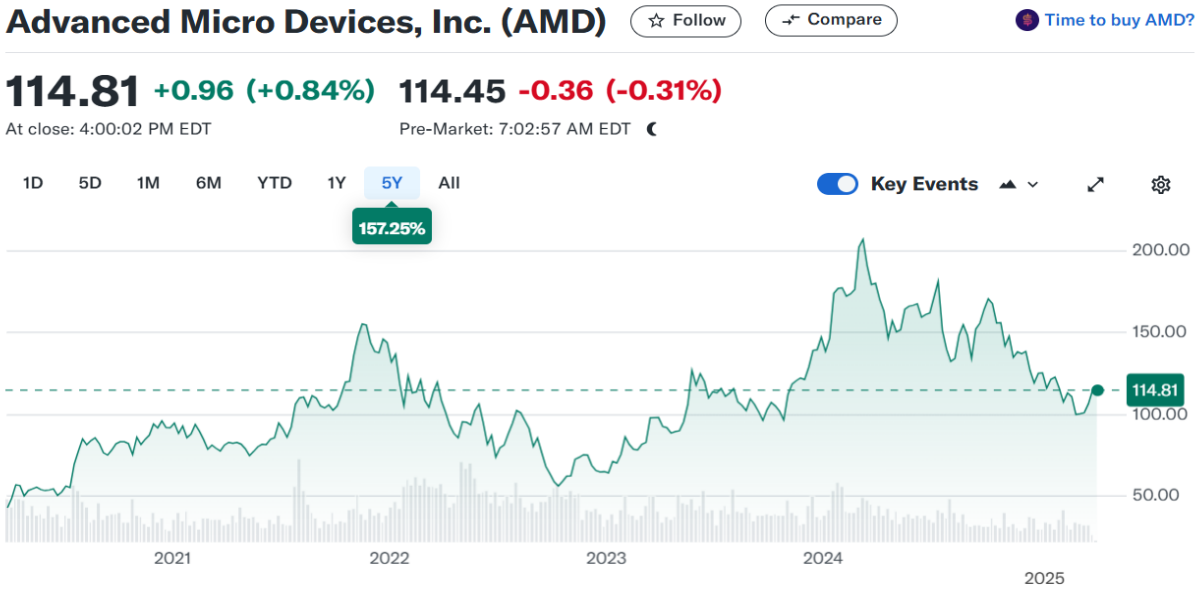

Figure 3. AMD – Five-Year Price Volatility and Chip Cycle Effects

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NVIDIA represents the epitome of AI-driven valuation. As seen in Figure 4, the firm's five-year chart reflects explosive growth tied to GPU dominance in LLMs, generative AI, and hyperscale computing [18]. Its fundamentals include a P/E above 50, ROIC of ~45%, and FCF exceeding $60B — exceptional even by tech standards.

The firm's technicals exhibit bullish extremes: RSI often breaches 70, MACD momentum remains elevated, and golden cross formations were observed during all major AI narrative peaks (e.g., ChatGPT-4Q rollout). Yet, such sharp uptrends introduce valuation fragility, evidenced by occasional corrections of 15–25%.

Figure 4. NVIDIA – Five-Year AI-Driven Stock Surge https://www.yahoo.com/

Tesla's five-year trajectory is shown in Figure 5, characterized by exceptional volatility ($\beta \approx 2.00$) and speculative momentum. The company's narrative-driven valuation—anchored in electric vehicles, full self-driving (FSD),

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www.ijfd.uz
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and energy products—allowed it to defy classical DCF norms [19]. Post-pandemic recovery saw unprecedented investor inflow. Tesla's Dojo AI chips and autonomy stack differentiated it in the ESG and AI arenas. Technically, Tesla has undergone multiple MACD reversals and RSI extremes (above 80, below 30), revealing a sentiment-sensitive pattern that's less anchored to fundamentals.

Figure 5. Tesla – 5-Year Sentiment-Driven Price Dynamics

https://www.yahoo.com/

The comparative analysis of Apple, Microsoft, AMD, NVIDIA, and Tesla over a five-year horizon reveals a structural divergence in both volatility patterns and valuation dynamics. While each company operates within the broader technology ecosystem, the heterogeneity in their financial architecture, innovation lifecycle, and market risk exposure delineates distinct equity profiles that require separate risk modeling frameworks.

Apple and Microsoft demonstrate defensive characteristics, marked by low beta coefficients, high and stable free cash flows, and consistent dividend growth. Their capital structures and earnings stability have positioned them as low-

volatility, high-quality equities within the technology segment. Technical indicators reinforce this interpretation, with sustained positive momentum in MACD readings and RSI levels that rarely breached overbought zones. These traits are consistent with the ‘quality factor’ pricing anomaly described in contemporary asset pricing literature [20].

In contrast, AMD and NVIDIA represent high-beta, innovation-driven equities whose valuations are deeply sensitive to thematic capital flows and product cycle dynamics. NVIDIA's trajectory, in particular, is emblematic of speculative repricing under conditions of perceived technological dominance, especially in the AI hardware supply chain. The firm’s multi-year RSI surges and exponential moving average crossovers align with periods of increased capital concentration-a pattern extensively documented in machine learning-based predictive finance models [21].

Tesla exhibits characteristics of a narrative-driven asset, where valuation appears to be untethered from near-term fundamentals and instead anchored in the anticipation of long-term strategic disruption. Its beta coefficient (~2.0), inconsistent RSI reversals, and macro-sensitive MACD signals indicate elevated exposure to behavioral volatility. This aligns with recent studies linking founder-driven vision and ESG narratives to disproportionate equity inflows in the electric vehicle sector [22].

From a methodological standpoint, this analysis confirms that a singular valuation model-such as discounted cash flow (DCF) or CAPM-fails to capture the multidimensional forces influencing modern equity pricing. The interplay of AI innovation, pandemic-induced structural shifts, and ESG-aligned investor behavior necessitates hybrid analytical architectures that incorporate both statistical inference and contextual financial theory [23].

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The findings affirm a new technology-sector valuation paradigm: one that transcends linear modeling and recognizes equity pricing as an emergent product of tangible performance, intangible perception, and temporal synchrony with macro narratives. Such findings are thus warranted in the direction of more interpretive, multi-factor, and machine-based valuation logic-an issue discussed in the following Conclusion.

CONCLUSION

With the evolving capital markets landscape, valuing technology companies is now a more complex science - one that goes far beyond the mechanics of traditional financial modeling. This study has demonstrated how the convergence of innovation, macroeconomic transformation, and investor sentiment now drives long-term value, especially in high-growth sectors. The firms researched in this research - Apple, Microsoft, AMD, NVIDIA, and Tesla - are five diverse but converging tales of how technology, strategy, and perception can come together into diversified equity trajectories.

What emerges in this examination is that investors are no longer simply responding to margins and earnings. They are reacting to this capacity of businesses to embed artificial intelligence in their operating model, to pivot on a dollar invested in response to calamity, and to be part of broader socio-technical transformations.

Those businesses with both fiscal resiliency and narrative integration - businesses that can articulate an attractive vision of the future as well as demonstrating short-term proficiency - earn premiums of valuation that conventional discounted cash flow models struggle to explain. This imbalance between financial production and market price is not the rule, but a reflection of the changing texture of modern investment reasoning [25].

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www.ijfd.uz
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The pandemic functioned not merely as an exogenous shock, but also as a diagnostic tool. It was an indicator of organizational vulnerability, but also expanded the advantage of platform-based scalability and data-fostered business models. Microsoft and Apple, with their end-to-end digital platforms, recovered faster and emerged more robust. Their equity performance was not just a function of reliable cash flow, but also of leadership vision in defining the post-pandemic digital economy [26].

In the meanwhile, NVIDIA's ascension shows the strength of thematic investing. Its role as a supplier of underlying infrastructure to train AI models led it from being a GPU supplier to a building block of global computing. Investors perceived it as not merely technological supremacy, but as sitting at the table of architecture for an entirely new economy. AMD's renaissance and Tesla's strategic positioning based on AI-powered automation and clean energy follow parallel trends. They accumulate capital not only by balance sheet strength, but by relevance to where the world is headed [27].Across all five companies, the role of ESG narratives proved equally consequential. It is no longer sufficient to produce returns; firms must demonstrate that those returns are aligned with sustainability, accountability, and trust. Markets now reward transparency, environmental commitment, and governance integrity. Those that fall short may still perform tactically but tend to lose structural investor backing in the long run [28].

This research suggests that the practice of valuation must evolve. Analysts must incorporate not only hard numbers, but also contextual fluency in technology, policy, and human behavior. Models will increasingly be hybrid - combining quantitative rigor with machine learning, sentiment analysis, and sustainability filters. Equity is no longer a reflection of static fundamentals; it is a signal of

dynamic potential in a world where perception, data, and narrative move markets as much as earnings do.

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