### **Outpacing Nations: Could Firms Dwarf the U.S. GDP?**

As corporate giants expand at an unprecedented pace, some companies are on track to overtake entire G7 economies, including the United States itself. By 2050, Wall Street could become bigger than Washington.

April 2025 | By Nicolás Grimoldi Carpin





If we asked 100 economists about a company outgrowing the US economy, most would say it's unlikely or zero. And indeed, they are. However there are several science fiction films that present this scenario mixed with a dystopian world, as is the case with Cyberdyne Systems, developer of Skynet in Terminator, or Umbrella Corporation in Resident Evil. But in this set of reflections, I do not intend to question the morality of companies or assume that they would seize the opportunity to challenge states if they could. Rather, the goal is to measure the growth of companies and compare it to existing GDP forecasts for the major world powers. We will analyze whether any of the Magnificent 7 will be able to achieve such a feat or whether another company will emerge in the future. For these reasons, I'll structure this investigation into 7 parts:

- I will briefly explain the current economic landscape and the ongoing questions surrounding the U.S. economic leadership, a position it is competing for not only with China and India, but also with companies that are gaining a greater say in the economy.
- As a key factor in the analysis, we will assume possible slowdowns in major economies and in those companies that, despite having high market capitalization, have already reached maturity. This section explains why countries, as they reach higher levels of development, reorient their industries toward higher value-added sectors, and how this impacts the development of stock markets.
- 3. We focus on the Magnificent 7, measuring their share of the main index funds. It is assumed, in this case, that these are the main candidates to achieve the proposed scenario.

#### About the author



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- 4. We focus on Apple, a company competing for the highest market value and with a long history in the stock market and culture. We analyze its ratios, regardless of whether they are decisive in the long term, and anticipate the factors that could influence or drive the company's future sales.
- 5. We break down the various US GDP growth projections and compare them with Apple's compound growth rates
- A probability model is constructed using a normal distribution function with Apple's resulting compound growth rates. The probability that Apple's market value will exceed GDP by 2050 is presented.

**Reading Notes:** 

<sup>-</sup> The American numeric format is used: commas for thousands (million = 1,000,000), periods for decimals (1/2 = 0.5).

<sup>-</sup> In the American system, a trillion is 1,000,000,000,000.

7. The research concludes by offering an insight into investment possibilities that take full advantage of compound interest.

#### Clarifications

The comparison between GDP and stock market capitalization is inappropriate, as it would be equivalent to comparing a photo with a video. Despite this, many media outlets use these comparisons to generate sensationalism. Therefore, throughout the investigation, we will treat GDP as a monetary figure to be achieved and not as a measure of corporate power.

#### Global context

Since Donald Trump's first term accelerated the tariff war in an attempt to offset the trade deficit with China, the financial world knew that the leading power no longer enjoyed the same economic distance from certain emerging markets in Asia.

We have asked ourselves a multitude of questions since then: How many years will it take for the Chinese economy to surpass that of the United States? Will India be able to overtake the United States in third place? When will America stop having the largest nominal GDP? Analyses always point out that another country, probably Asian, will take the top spot as a world economic power, since they have gigantic populations. In the case of India, it has not yet suffered the demographic winter and, thanks to competitive wages, the commercial and industrial future of the region remains promising, above the estimates of any developed country.

But what about companies? Can the Magnificent Seven outperform the GDP of entire countries? The answer is yes, and in fact they already outperform the economies of many countries.

I will start by making a comparison between my country's economy and the one that until a year ago was the most valuable company in the S&P500. Uruguay's Gross Domestic Product (GDP) and Apple's market capitalization constantly vary as the market and state finances fluctuate. The technology company's valuation is estimated at around 1.3.3 trillion US dollars, with total revenue in 2024 exceeding 124.3 billion dollars. Uruguay's GDP for 2025, calculated at nearly 2 80 billion dollars, couldn't surpass Apple's revenue even with all its taxed production

Apple's valuation represents about 4,125% of Uruguay's GDP, so if we imagine a fantasy scenario in which the company wanted to become the owner of the country, monetarily speaking it could take over its sovereignty. If its reported net profit (approximately a 36.33 billion dollars) holds steady, it could cover the whole current GDP in less than three years.

r. El Observador. CompaniesMarketCap. (n.d.). Apple (AAPL) - Market capitalization.
 world Bank. (n.d.). GDP (current US\$) - Uruguay. The World Bank.

<sup>3.</sup> El País. (2025, January 30). Apple achieves record revenue and profits despite declining iPhone sales. El País.

In the real world, Apple has no demonstrated interest in buying countries, but it is undeniable that **the moneymaking capacity of companies has far surpassed that of entire nations.** 

However, no one can predict the reactions of those governments with greater global power if in the future there is a company that exceeds their economic reach.

To calculate a country's purchase price or value, we'd consider not just its gross domestic product but also citizens' democratic participation, national debt, shadow economy, and other factors. Even if this scenario is hypothetical, it's unsettling that some companies generate more money than entire countries, posing challenges for governments.

This isn't a widespread concern yet, and no relevant debate exists in the U.S. Congress. It may take decades for the American economy to be overtaken by another country and even longer for any company to do so. But it is interesting to preface the discussion and ask how politics might eventually react. Some propose regulatory measures, while free market advocates support the unchecked growth of mega corporations. If the current U.S. debate focuses on curbing emerging economies to preserve its negotiating and industrial dominance, we might see companies clashing with their home government in the coming decades.

#### Technology companies are not limited by national barriers and operate in all nations where the Internet is freely accessible.

Governments derive benefits from their revenues through taxation and skilled employment, akin to a gardener harvesting his garden's yield, but when stock market capitalization growth outpaces national projections, these entities expand rapidly, eventually forming a forest that reshapes the landscape and imposes its own regulations.

Should we consider a potential scenario, certain companies, by surpassing nations economically, will hold an advantageous position in negotiating tax or labor terms and even securing privileges unattainable by smaller enterprises..

Corporations neither maintain armies nor be subjects of international law, so if they exert influence on governments, it will primarily be executed through financial means rather than other considerations.

However, before we proceed with predictions regarding the outcomes of a potential scenario still distant, why not first evaluate the existing forecasts available to us?

#### When we examine the financial future, we anticipate not only growth but also potential slowdowns.

As economies mature, their growth rates decrease relative to net worth or production. This does not imply a nominal slowdown, but rather that percentage margins cannot sustain prior growth levels.

Suppose our sole income derives from collecting coins from the street. Initially, we possessed 10 coins, and within the first month, we gathered an additional 10 coins. Thus, we observe that our funds doubled from 10 to 20 coins in one month, reflecting a notable 100% growth. In the second month, we acquired even more coins, totaling 12 in all. Yet, upon calculation, our growth dropped from 100% in the first month to 60% in the second. Thus, month by month, despite collecting more coins from the ground, our percentage growth continued to decline.

#### China case: Economic **Development Triggers Economic Slowdown**

The economic reforms implemented in China since 1978 have transformed the Asian giant's industry,

Exhibit 1

#### 2024 Economic Growth Comparison



#### Note: The size of the circle represents the approximate growth percentage.

Exhibit 1. International Monetary Fund. (2024, October). World economic outlook: Navigating global divergences. IMF Publications.

lifting around 4.800 million people out of poverty and transforming world trade.

The country's practically uninterrupted economic arowth. barring occasional political events, has been responsible for the country being classified as a 5. upper-middleincome country, for some coastal and industrial cities reaching a level of well-being worthy of a rich country and for its GDP per capita rising from a few hundred dollars to more than tens of thousands.

Exhibit 1. Bureau of Economic Analysis (2025). US gross domestic product data.

National Statistics Office (2025). Advance estimates of GDP 2024/25.

National Bureau of Statistics of China (2025). China's economic growth 2024.

World Bank. (2022). Four decades of poverty reduction in China: Drivers, insights for the world, and the way ahead.
 Zuo, M. (2024, May 1). China has yet to join the 'rich country' club. Has the middle-income trap been sprung? South China Morning Post.

(Exhibit 2). With progress come new challenges, and in China's case, recent years have raised concerns for policymakers accustomed to doubledigit growth. A clear downward trend suggests a significant slowdown in growth over time, which China aims to avoid before achieving the world's largest nominal GDP. But how can we account for China's slowdown? Economic development increases wages, purchasing power, and consumption. Families relocate to cities, and universities expand entrance exams to manage the high number of applicants. Individuals train from a young age to compete in a system that rewards competitive achievement, and this focus on personal growth leads them to balance careers with the need for affiliation.



#### China's Annual GDP Growth Rate (1978-2024)

Exhibit 2

The development of a nation implies the evolution of its own society, which begins to demand greater well-being and then shifts away from offering the world the same contributions as societies that have not yet developed such well-being.

# When nations can no longer offer the same, as illustrated by the Smile Curve concept

This reflects a shift in economic roles. 'Made in China' remains a hallmark of the country's commercial success, yet in recent years, labels like 'Made in Vietnam,' 'Made in Pakistan,' and 'Made in Cambodia' have gained prominence, signaling their growing roles in global trade.

Exhibit 2. World Bank. (2025). World development indicators: China GDP growth (annual %). National Bureau of Statistics of China (2025). China's economic growth 2024.





Smile Curve - Value added across Production Stages

As labor costs rise in China, it has begun to lose its competitive edge in securing industrial offshoring and maintaining a supply of low-cost manufacturing. The millions of Chinese with university degrees have bolstered R&D, contributing to a global market shift from plastic toys labeled 'Made in China' under American brands to a wide range of Huawei and Xiaomi devices. If China aims to rival leading Western economies and solidify the status as a high-income country, it must focus on high-value segments that maximize economic returns. Returning to Apple's finances, it is estimated that approximately a \$300 to \$500 of the retail price of each iPhone is attributed to non-production costs such as research, marketing, and profit margins.

Economic development not only shifts the focus of industries, strengthening those that add greater value, but also tends to support stock market growth.

Exhibit 3. Mudambi, R. (2008). Location, control and innovation in knowledge-intensive industries. Journal of Economic Geography, 8(5), 699-725.

<sup>6.</sup> AppleInsider. (2024, October 1). iPhone 16 models cost a little more to make than the iPhone 15. Backlinko. (2025, January 29). iPhone users and sales stats for 2025.

FourWeekMBA. (n.d.). How much profit does Apple make per iPhone?

Investopedia. (2024, April 6). The cost of making an iPhone.

MacroTrends. (n.d.). Apple gross profit 2005-2024

MacroTrends. (n.d.). Apple net income 2010-2024. MacroTrends. (n.d.). Apple profit margin 2010-2024.

MacroTrends. (n.d.). Apple research and development expenses 2007-2024.

MacroTrends. (n.d.). Apple revenue 2010-2024.

MacroTrends. (n.d.). Apple SG&A expenses 2010-2024.

SimplyMac. (2024, September 26). How much does it cost Apple to make an iPhone?

Statista. (2024). Apple gross margin 2005-2024.

#### The development of robust stock markets results from a mix of economic innovation and low interest rates

Understanding the behavior of interest rates is essential to analyze the rise of companies. Workforce skills, confidence, and access to credit build developed markets with low interest rates, which in turn drive strong, competitive stock markets. When a country attains investment-grade status and its fixed income becomes attractive, risk-averse investors tend to be more hesitant about volatile assets. Based on this, one of the factors that could contribute to 2025 being a recessionary year for the U.S. economy is outlined. Combined with the trade war and a potential decline in immigrant labor contribution, the projected economic contraction could worsen, Increasing the odds to z 60%. Conversely, when inflation is under control and interest rates widen the gap between bond and equity yields, greater investments flow into corporate bonds, creating a bullish environment in the stock market.

Economic development can lead to slower growth in maturing economies, as it meets demand for basic services while shifting resources toward innovation. Establishing the capacity to foster an environment conducive to R&D is essential for nations to expand exports of software and high valueadded products.

# Technology is a significant contributor to stock market volatility

In the future, stock markets in more economies will expand as they develop and generate greater value. However, technology companies have significantly boosted the returns of major stock indices, increasing the tech-sector weighting in main exchange-traded funds and reducing their diversification. Currently, a 29.76 % of the S&P500 is composed of the technology sector, meaning that if we invest in a simulation of this index, our portfolio would not achieve the recommended diversification, as nearly 9. one-third of it would be concentrated in the same sector - far from the advised maximum of 20-25%.

#### Amazon, Apple, Alphabet, Microsoft, Meta, Nvidia, and Tesla—collectively known as the 'Magnificent Seven' may constitute approximately 10. 29.5% of the S&P 500's market capitalization

During periods of robust market performance, their disproportionately high returns can boost the index's average annual growth by an estimated 11.3 to 5 percentage points compared to an equal-weighted S&P 500 scenario.

<sup>12.</sup>The technology and consumer discretionary sectors significantly increase volatility in the index, amplifying potential gains and losses.

<sup>7.</sup> Siddarth, S. (2025, April 4). Global brokerages raise recession odds; J.P. Morgan sees 60% chance. Reuters.

<sup>8</sup> State Street Global Advisors. (2025). SPDR S&P 500 ETF Trust - Sector allocation.

<sup>9.</sup> Investopedia. (n.d.). Diversification.

Schwab Center for Financial Research. (2025, February 24). Monthly Stock Sector Outlook.

<sup>10.</sup> Nasdaq. (2024). 20 tech stocks make up over 35% of the S&P 500. Here's what that means for your portfolio. Nasdaq. 11. Treynor, J. L. (2005). Why fundamental indexing beats cap-weighted portfolios. Journal of Portfolio Management, 31(3), 50–61.

Arnott, R., Hsu, J., & McLeavey, D. (2007). Fundamental indexing: A better way to invest? Journal of Portfolio Management, 33(2), 50–63.

<sup>12.</sup> Schwab Center for Financial Research. (2025, February 24). Monthly Stock Sector Outlook. Charles Schwab.

Since the beginning of the new millennium, the Technology sector has grown to form a significant share of the S&P 500, steadily increasing its weighting. Before the widespread rise of technology companies, S&P 500 returns averaged around 13.7-8%, compared to the 10-12% expected in recent years. This not only makes the American stock market more appealing than fixed-income investments, but also increases its volatility.

(Exhibit 4). The S&P 500's strong returns are driven by the largest technology companies, as without them, returns would be lower and less competitive with U.S. bond yields. Conglomerates and holding companies have accumulated significant cash reserves, potentially influenced by broader market trends beyond the S&P 500 ex-Magnificent 7. In short, high-yield US corporate fixed income offers competitive returns, while holding cash allows you to cope with uncertainty, given a negative outlook for the stock market.



### Exhibit 4 2024 Investment Performance Comparison

#### Note: "Magnificent 7" refers to Apple, Microsoft, Alphabet, Amazon, Nvidia, Meta, and Tesla. The ranges should be interpreted with caution as they are extracted from media with different measurements.

13. State Street Global Advisors. (2025). SPDR S&P 500 ETF Trust - Sector allocation.. MacroTrends. (2025). S&P 500 historical annual returns. Investopedia. (2025). S&P 500 average returns and historical performance.

Exhibit 4. Bloomberg. (2025). Looking back at 2024: Fixed income.

CNBC. (2024, December 31). 'Magnificent 7' stocks responsible for more than half the S&P 500's 2024 gain. Morningstar. (2025). US high-yield corporate bond performance 2024. Visual Capitalist. (2025). Charted: The pyramid of S&P 500 returns (1874-2024).

Visual Capitalist, (2025), 2024 in review; Stock, bond, and real estate performance.

Automobile Production Comparison (1975-2024) in millions of units



Note: Data reflects verified production figures from national statistics and industry associations (BTS, JAMA, Destatis, NBS, ANFAVEA, CCFA). Estimates for 2024 are based on recent trends

#### Exhibit 6

### Estimated breakdown of the cost of a car in the US (2024)



(Exhibit 5). It should be noted that China's production has begun to slow, while India's is expected to continue rising. In developed economies, production has declined significantly.

(Exhibit 6). The graph illustrates the distribution of costs affecting the product's price. Increasing the costs of local labor and materials (often of foreign origin) results in a loss of competitiveness, given the significant role of manufacturing in the automotive sector. Profit ranges close to 10% correspond to luxury brands or those with high profit margins. There are also variations in the costs of batteries in electrical products.

Exhibit 5. Bureau of Transportation Statistics. (n.d.). Annual U.S. motor vehicle production and domestic sales (in thousands of units).

- Destatis. (n.d.). Revision of the industrial production index with regard to automotive production.
  - CEIC Data. (n.d.). Japan motor vehicle production, 1997-2024.

CEIC Data. (n.d.). China motor vehicle production, 1997-2024.

- CEIC Data. (n.d.). Brazil motor vehicle production, 1997–2024. CEIC Data. (n.d.). France motor vehicle production, 1997–2024.
- CEIC Data. (n.d.). Italy motor vehicle production, 1997-2024.

Exhibit 6. Consumer Reports. (2023). The hidden costs of buying a new car. Consumer Reports Edmunds. (2023). How car prices are determined. Edmunds.

### Growing industry in high and middle-income countries: Software Industry Revenue Trends (1975-2024)



Exhibit 8

#### Software Cost Breakdown Analysis (2024)



(Exhibit 9). Although the U.S. population is only 23.5% and 23.3% of China's and India's, respectively, it maintains its lead by hosting the largest companies in the sector.

(Exhibit 8). The software industry does not require physical manufacturing, as it produces intangible products. This eliminates the need to outsource manufacturing to countries with affordable labor. Consequently, net profits are higher, making it a favorable industry for economies that have achieved development or are transitioning their industries within the value chain.

Exhibit 7. Statista. (n.d.). Software - United States | Statista Market Forecast. Retrieved April

5, 2025. Statista. (n.d.). Software - Worldwide | Statista Market Forecast. Retrieved April 5, 2025.

Exhibit 8. Statista. (2021, July 27). Five-year annual revenue growth rate and average profit margin of listed software companies worldwide in 2020, by region [Graph].

Quora. (2010, November 11). What is the typical profit margin for software consulting companies? Vena Solutions. (2024, August 22). Industry benchmarks of gross, net and operating profit margins. Boston Consulting Group. (2022, May 24). The real rules of growth and profits in software. Seeking Alpha. (2006, May 7). Chart: Software companies - Gross profit margins.

# Analyzing economic development to explain the importance of technology in the stock market



- 1. Low-income economies: Cheap labor creates an enabling environment for manufacturing and industries that address basic needs and low-value-added production.
- 2. Middle-income economies: Intellectual human capital emerges, enabling a shift in production focus. Economic growth begins to slow as some nations foster favorable investment conditions..
- **3. High-income economies:** Expensive labor drives productivity to rely on highvalue-added industries. In this context, the economy becomes structured around technology and innovation.

Industries reliant on advanced innovation and technology dominate the world's leading index funds, with their holdings trending upward. This sector faces higher expectations than others and is not subject to constraints affecting other industries, such as tangibility, manufacturing, and high entry costs.

Investor enthusiasm has not only reshaped the composition of index funds but has also heightened demand for machine learning. Furthermore, many countries are projected to attain middleincome status in the coming decades, enabling them to establish robust stock markets that accommodate the growing demand for dollars. The rise of each of the 'Magnificent 7' is driven by the development of the U.S. economy, an environment with substantial innovation capacity, and investors able to fund ambitious projects. This reflects an optimistic perspective on how rising wages in developing economies might affect the profit margins of technology companies. Should the projected increase in global GDP materialize, the sector's market capitalization could rise significantly above its current levels.

Meanwhile, the integration of technology has become essential even in industries traditionally reliant on extensive manufacturing. It is now inconceivable for automobiles to lack consoles or for clothing brands to operate without an online presence.

### High-Value Industries as percentage of GDP in G20 Economies (2025)



(Countries sorted by GDP per capita)

#### Note: Data represents estimates based on multiple sources. Actual composition may vary based on national accounting methodologies.

(Exhibit 9). Note that as economies increase their GDP per capita, the share of GDP attributed to high-value-added industries rises. Within the G20, China and India stand out as exception. Together, these countries account for more than a third of the world's population and possess

vast human capital with exceptional talent, despite being classified as 14. upper-middleincome and lower-middle-income economies, respectively.

Exhibit 9. YCharts. (2024). US GDP - Contribution of Finance and Insurance Industries.

Bureau of Economic Analysis. (n.d.). GDP by Industry. U.S. Department of Commerce.

Statista. (2023). China digital economy GDP share 2023.

- Statista. (2023). US GDP share by industry 2023.
- IGTAI. (2021). Finance Sector in Germany. Forbes India. (2025, February 25). World GDP Rankings 2025 | Top 10 Countries Ranked By GDP.
- Eurostat. (n.d.). ICT sector value added, employment and R&D. 27 Advisory. (2022). China's GDP Breakdown.
- Statista. (2024). GDP per capita ranking in the G20 2024 and 2029.
- Visual Capitalist. (n.d.). Visualizing the \$105 Trillion World Economy in One Chart.
- Investopedia. (n.d.). Financial Services Sector. 14. World Bank. (s.f.). World Bank Country and Lending Groups.

Wikipedia. (n.d.). Developed country.



U.S. Total Market Capitalization and Buffett Indicator Trends (1970-2020)

Note: Buffett Indicator (%) = (Total Market Capitalization / GDP) × 100

#### (Exhibit 10). Key Events:

**1957**: The modern S&P 500 index was established.

1990: Buffett Indicator peaks, likely reflecting the dot-com bubble and potential overvaluation.
2008: Both indicators experienced a sharp decline during the financial crisis.
2015–2020: The S&P 500 market capitalization consistently exceeded U.S. GDP throughout this period, with the

Buffet indicator remaining above 1.0. **2021**: The Buffet indicator reached a post-pandemic peak of approximately 1.80. The fact that the S&P 500 index's market capitalization exceeds the GDP of the world's largest economy, is a relatively recent phenomenon. The stock market, through the global operations of its leading companies, can achieve profit levels that substantially outpace the economic output of its host economy over time. A similar trend can be observed in the performance of leading multinationals, which currently dominate in terms of growth and market capitalization. It is therefore not unrealistic to propose that the premise of this reflection may become a reality in the future.

Exhibit 10. Buffett, W. E. (2001). The Buffett Indicator: A measure of market valuation. Fortune Magazine.

Countryeconomy.com. (n.d.). GDP - United States).

Wikipedia. (n.d.). Buffett indicator. In Wikipedia, The Free Encyclopedia.

YCharts. (n.d.). US total market capitalization as % of GDP.

Federal Reserve Bank of St. Louis. (n.d.). Nonfinancial corporate business; corporate equities; liability, level (NCBEILQ027S). FRED, Federal Reserve Economic Data

#### Comparison: GDP of Major Economies vs. "Magnificent 7" Market Cap







(Exhibit 11). The market capitalization of companies such as Apple and Nvidia has surpassed the annual GDP of certain G7 countries. However, this does not imply that these companies possess greater wealth than the nations in question, as productive capacity, measured by GDP, does not account for the value of accumulated assets, human capital, institutional quality, untapped natural resources, or other critical factors. Furthermore, certain theorists employ speculative methods, such as 15. discounted cash flow analysis, to value companies. Consequently, **GDP and market capitalization alone are insufficient metrics for a comprehensive comparison between companies and national economies.** 

Exhibit 11. CompaniesMarketCap. (2025). Market capitalization data for major companies.

MacroTrends. (n.d.). Historical market cap data for major companies.

World Bank. (n.d.). GDP (current US\$). World Development Indicators.

15. Ruíz-Molina, O. E., & Carnevali-García, J. L. (2021). Valuation through discounted cash flow using the weighted average cost of capital and the adjusted present value, in Apple Inc. Journal of Management and Development Free, 6(12), 1–23.

Fernández, P. (2016). Business valuation and common sense. SSRN.

International Monetary Fund. (2024). World Economic Outlook database: October 2024.

#### Apple: Total DCF and MCAP vs Similar-Sized Economies (2025)

Comparing Apple's 5-year discounted cash flow valuation and MCAP to the projected GDPs of select economies in 2025.



# Note: The size of the circles is proportional to the economic values. Discrepancies in GDP values compared to the previous graphs may be due to measurements taken at different times, even within the same year.

(Exhibit). Apple's market capitalization currently exceeds the GDP of several high-income countries. It is worth noting that both market capitalization and valuations derived from the sum of projected cash flows discounted by the weighted average cost of capital (WACC) are approximate metrics for valuing a company. Furthermore, the discounted cash flow (DCF) valuation method, which is based on the future cumulative value of projected cash flows is not typically compared to an indicator of annual economic output, such as GDP, in this context. 16. The comparison between companies and countries often relies on the market capitalization of the former because the total value of a company's shares is readily observable and easily quantifiable.

Exhibit 12. Trading Economics. (n.d.). United Kingdom GDP.

Wikipedia contributors. (n.d.). Economy of France. Wikipedia, The Free Encyclopedia.

Wikipedia contributors. (n.d.). Economy of Canada. Wikipedia, The Free Encyclopedia.

Wikipedia contributors. (n.d.). *Economy of Italy*. Wikipedia, The Free Encyclopedia. Finbox. (2025). Apple Inc. WACC – Weighted Average Cost of Capital.

ValueInvesting.io. (2025). Apple Inc. DCF Valuation – Growth Exit 5Y.

<sup>16.</sup> Damodaran, A. (2012). Investment Valuation: Tools and Techniques for Determining the Value of Any Asset (3rd ed.). John Wiley & Sons.

#### An Apple performance prediction model based on accumulated value provides a more accurate estimate of the company's economic magnitude

While the current market value of a company can be determined by calculating the total value of its shares, this method is volatile and does not offer a reliable estimate of future cash flows. In contrast, models that incorporate discounted cash flow (DCF) valuations, which focus on a company's operating performance and sustainability, are less sensitive to market expectations.

Oer the past month, the stock market has experienced significant declines, primarily impacting technology companies. Estimates suggest that, since January 20, 2025, Apple's market capitalization has decreased by approximately 17.\$250 billion, with the ongoing tariff war being a central focus of fundamentalist analysis. If foreign policy adjustments are not implemented and President Trump persists with protectionist measures, it is possible to project that 2025 could be a year of economic recession for the United States, though such a forecast remains speculative at this stage.

In the face of a looming recession, forecasts based solely on market value may diverge from those grounded in a company's fundamentals, such as the Weighted Average Cost of Capital (WACC) and its capacity to generate sustainable profits over the medium term. Should recessionary conditions persist, adjusting these forecasts—by increasing risk premiums or revising projected growth rates—would better align them with economic realities. We will analyze a model based on the total value of discounted cash flows, followed by an examination of a graph projecting growth derived exclusively from market value. The latter is more sensitive to current economic conditions than the former.

# Comparing Two Approaches to Valuing Apple

We will evaluate Apple using two valuation methods: market capitalization, incorporating an average annual growth estimate of 8%, and the total value derived from discounted future cash flows (DCF), calculated with a weighted average cost of capital (WACC) of 8.6% and a constant terminal growth rate of 3%. Several key observations emerge from this comparison:

- The DCF model, which relies on projected cash flows and parameters such as the cost of capital and terminal growth rate, exhibits rational values and provides a more stable valuation compared to market-based approaches.
- 2. Should a recession occur, projections based on market capitalization may diverge significantly from the company's underlying fundamentals.
- **3.** DCF approach emphasizes Apple's capacity to generate sustainable profits over the medium term, offering a valuation less influenced by short-term investor sentiment.
- **4.** By integrating both models, it becomes apparent that Apple's valuation has the potential to reach levels commensurate with the scale of the world's largest economies.

<sup>17.</sup> Reuters. (2025, March 13). Apple market cap falls amid market volatility. Reuters. Yahoo Finance. (2025, January 20). Apple Inc. market cap data. Yahoo Finance.

#### Apple's Economic Scale: Intrinsic Value vs. Market Valuation

Comparing DCF Projections and Market Cap Growth (2025-2030)



#### **Key Assumptions:**

- \* DCF valuation updates annually: Values updated each year as cash flows are realized
- \* WACC: 8.6% (constant across all periods)
- \* Terminal Growth: 3% (constant)

- \* Market Cap Growth: 8% annual (projected)
- \* Shares Outstanding: 15.04B
- \* Forecast Period: 2025-2030
- \* Current price per share: USD 200

Exhibit 13. Finbox. (2024). Apple Inc. (AAPL) DCF Analysis and Fair Value Estimate.

Finbox. (2025). Apple Inc. (AAPL) DCF Model - 5 Year Forecast.

Damodaran, A. (2024). Investment valuation: Tools and techniques for determining the value of any asset (4th ed.). John Wiley & Sons. Koller, T., Goedhart, M., & Wessels, D. (2024). Valuation: Measuring and managing the value of companies (7th ed.). McKinsey & Company, John Wiley & Sons.

Mauboussin, M. J., & Callahan, D. (2023). Measuring the moat: Assessing the magnitude and sustainability of value creation (2nd ed.). Credit Suisse.

### Forecasts Based on Apple's Market Capitalization

We'll continue with our analysis of Apple stock, having analyzed its discounted cash flow (DCF) value, with its market capitalization rivaling Nvidia's for first place. The company's reputation and solid financial structure position it as a strong contender to lead in market capitalization in the coming years and possibly decades.

As noted earlier, we'll use Apple's market capitalization, as it simplifies forecasting based on its current value compared to prior methods. Researchers tend to base their studies on this value, leading to more optimistic outlooks, *18.* as market capitalization is shaped by multiple factors, including volatility. Forecasts using only market value often overlook factors like debt or shifts in consumer trends. They rely on historical results that may be replicated with varying accuracy depending on the company's maturity or investor expectations. That said, each forecast discussed in this report should be taken with caution, as accurately predicting the future is challenging, and these forecasts often overlook market cycles and recessions.



#### Extended Forecasts for Apple Stock (2024–2050)





# Note: These projections extend the banks 2040 targets (Goldman Sachs, Morgan Stanley, and J.P. Morgan) by applying their respective growth rates through 2050. Actual outcomes may differ significantly from these illustrative scenarios.

<sup>18.</sup> Bloomberg. (2025, March 12). Apple stock remains resilient despite market jitters. Bloomberg.

Reuters. (2025, March 13). Analysts see only temporary corrections in Apple shares amid market volatility. Reuters.

Exhibit 14. Goldman Sachs Investment Research. (2024). Long-term outlook for Apple Inc.: Innovation and growth prospects. Goldman Sachs.

Morgan Stanley Equity Research. (2024). Apple Inc.: Navigating future challenges and opportunities. Morgan Stanley.

J.P. Morgan Analyst Note. (2024). Projected share price trajectories for Apple Inc. to 2040. J.P. Morgan.

(Exhibit 15). As in the previous exhibit, projected average growth rates are extrapolated for an additional decade. Note that these averages account for potential recessions and slowdowns in stock value growth. These graphs shows growth based on the estimated average annual rate for the metric applied. As the graphs are extrapolated to 2050, these annual returns may vary, as growth often slows over time. The purpose of these analyses is not to provide concrete figures or metrics, as that would be unrealistic. It is intended to clarify an upward trend in Apple's market valuation, which over the decades will result in figures similar or close to those of the leading powers, with the US accounting for a larger percentage of its GDP. Without going any further, 19. in **2019, Apple's valuation represented around 6% of the US GDP, while in 2025 it is estimated to be approximately 12%.** 

Exhibit 15



#### Apple Market Value Forecast (2024–2050)

#### Notes:

Year

2040

2045

2035

#### \* All forecasts assume 15.04 billion shares outstanding \* Average is extrapolated past 2040 \* Initial share price in 2024: \$200 which is also the current price in April 2025

Exhibit 15. Goldman Sachs Investment Research. (2024). Long-term outlook for Apple Inc.: Innovation and growth prospects. Goldman Sachs. Morgan Stanley Equity Research. (2024). Apple Inc.: Navigating future challenges and opportunities. Morgan Stanley. J.P. Morgan Analyst Note. (2024). Projected share price trajectories for Apple Inc. to 2040. J.P. Morgan.

19. World Bank. (2023). GDP (current US\$) – United States. [Data set]. World Bank.

20'30

Yahoo Finance. (2025). Apple Inc. (AAPL) – Market Cap Data.

4

2024

2050

#### Apple as a long-term equity investment

Te compound annual growth rate (CAGR) smooths out fluctuations, offering investors a key advantage in analysis by integrating growth trends with compound interest. The above forecasts assume the expansion phase has slowed, suggesting limited market growth, and the high annual growth rates of over 20% seen in prior years are unlikely to persist. A CAGR below 6%, per three banks' forecasts, suggests that, over the long term, diversified ETFs may yield higher returns, along with the diversification factor.

If in 2007, instead of buying the first iPhone for \$499, we had bought Apple shares, today they would have a market value of between 20. \$22,310 and \$35,370, reflecting share price fluctuations over the past year. After deducting capital gains taxes 21. (about 15%) and adjusting for US inflation 22. (roughly 2.5%) annually), today we would have approximately \$15,000 in equivalent 2007 dollars. Interestingly, today original iPhones fetch 23. hundreds of dollars at auction, with sealed units reaching hundreds of thousands of dollars, so buying the first edition of such a legendary product would not have been a bad financial decision. However, this study aims to show how Apple investments have outperformed and may surpass returns from portfolios crafted by wealth managers. Since 2007, Apple's CAGR has exceeded 14%, so investing \$100 monthly in its stock, with dividends reinvested, could yield over \$80,000 by 2025.

Given Apple's declining Compound Annual Growth Rate (CAGR), we project a 5% total return over the next 15 years if we began investing \$100 monthly in Apple stock today with dividends reinvested. By 2040, our returns would be lower than those of the past 18 years, despite the 15-year forecast timeframe. This lower CAGR reflects the company's slowing growth; we could sell shares worth about \$26,500, with \$8,500 as gains before inflation adjustment.

#### Apple's ability to exceed market returns in market capitalization relies on its stock growth surpassing the S&P 500 benchmark

If an ETF including Apple shares proves safer due to diversification and potentially more profitable than a portfolio of only Apple shares, it would be less prudent to rely solely on Apple shares for wealth accumulation. Over the past year, Apple shares have outperformed the S&P 500, but if growth aligned, returns would still be significant, but this is unlikely due to the company's constrained growth potential.

22. U.S. Bureau of Labor Statistics. (2023). Consumer Price Index - U.S. city average.

<sup>20.</sup> Yahoo Finance. (2025). Apple Inc. (AAPL) - Historical Data.

MacroTrends. (n.d.). Apple - 45 year stock price history [APL. 21. Internal Revenue Service. (2023). Long-term capital gains and qualified dividends tax rates.

<sup>23.</sup> Green, D. (2020, May 5). First sealed iPhone 2G sells for record price at auction. The Verge.

The Guardian. (2023, July 17). First-generation Apple iPhone sells at auction in US for \$190,000.

Analysis shows Apple's stock growth may slow, reflecting a decline in its CAGR over recent years. Projections estimate that over the next 15 years, the stock may decreace below the index average but still raising its market value relative to the US GDP. At a CAGR of 5%, the company's market value could surpass \$6 trillion, nearly duplicating its current valuation. If US GDP growth remains modest, the company may account for a larger economic share, as recent trends suggest. Apple's market cap would need to grow significantly to approach US GDP, requiring a challenging 15% CAGR through 2040. This growth is below the company's historical compound annual growth rates, but profit and revenue may grow as in recent years, with rapid iPhone advancements, numerous subscription services added, and product offerings diversified.

Exhibit 16

#### Apple vs S&P 500 Annual Total Returns (2007-2024)

chart shows Apple's higher volatility compared to the S&P 500's more stable returns from 2007 to 2024.



Exhibit 16. Apple - 45 Year Stock Price History | AAPL | MacroTrends S&P 500 Total Returns by Year Since 1926 | Slickcharts Apple Inc. (AAPL) | PortfoliosLab Dividend History - Apple

#### However, the decline in CAGR affects not only Apple but also the other Magnificent 7 to varying degrees

If selecting a company to outpace US GDP growth, we would likely choose one of the Magnificent 7, leaders in market value. These firms lead their sectors, spanning technology and automotive, with the financial and human capital to drive future market innovations. Forecasts remain optimistic for these companies, though a growth slowdown is anticipated, constraining their longterm potential.

Applying Apple's analysis to the Magnificent Seven yields similar outcomes, with market caps remaining below US GDP for the next two decades. That these companies may not sustain CAGR above the S&P 500 average beyond 2040–2050 does not imply they will cease growing, but rather that the ambitious scenario outlined earlier will likely not materialize.

When discussing market capitalization thresholds for companies, I do not mean a fixed figure, as even during slower growth, stock values may rise. Using a coin analogy, suppose we have 1,000 coins, then add 10 in a month, reaching 1,010, reflecting a 1% growth rate, which is modest compared to higher rates seen when starting with 10 coins. Yet, our market cap still grows, with 10 more coins than the prior month. Market cap thresholds indicate the US GDP share these firms reach before their growth dips below national GDP growth rates. While the Magnificent Seven may increase their share of US GDP, growth constraints suggest none will dominate the national economy. Thus, we outline three potential scenarios for consideration:

- 1. Realistic scenario: Conservative forecasts prevail, with modest growth, yielding larger market capitalizations, but as growth trends downward and dips below the market average, achieving a substantial GDP share becomes highly improbable.
- 2. Less realistic scenario: Leading tech firms drive robust sales in emerging markets, supported by bold innovation, enabling them to reverse declining growth trends, attaining a CAGR that significantly boosts their market cap toward a major share of US GDP.
- **3. Unrealistic scenario:** A pioneering firm emerges, with revenue surpassing top firms and approaching a significant portion of US economic output. This demands a groundbreaking product, resistant to replication, yielding high profit margins, adaptable to global markets, with enduring growth potential.



### Magnificent 7 + S&P 500: Historical & Forecasted CAGR (2007-2040)



Comparing Growth Rates from the First iPhone Launch to 2040.

#### Note: Historical data run through 2024, and post-2025 values reflect forecasted CAGR under conservative assumptions. The methodology involved computing the CAGR from Meta's IPO date (May 18, 2012) to the end of each year

(Exhibit 17). Outcomes may vary if these companies leverage new market opportunities, achieve innovative breakthroughs, or face macroeconomic shifts that reshape their longterm growth paths. Note that all analyzed companies exhibit declining trends in their CAGR, reflecting slower growth rates over time. As emphasized throughout this report, for a company to significantly increase its US GDP share, it must sustain growth rates exceeding the market average for several decades.

Exhibit 17. Macrotrends. (2025). S&P 500 Total Return Data 2007-2025

Yahoo Finance. (2025). Apple Inc. (AAPL) Historical Data.

Yahoo Finance. (2025). Amazon.com Inc. (AMZN) Historical Data. Yahoo Finance. (2025). Tesla Inc. (TSLA) Historical Data.

Simply Wall St. (n.d.). Apple (NasdaqGS:AAPL) stock forecast & analyst predictions.

Yahoo Finance. (2025). Microsoft Corporation (MSFT) Historical Data.

Yahoo Finance. (2025). Alphabet Inc. (GOOGL) Historical Data.

Yahoo Finance. (2025). Meta Platforms Inc. (META) Historical Data. Yahoo Finance. (2025). NVIDIA Corporation (NVDA) Historical Data.

Bloomberg. (2025). Market Forecast Data for the Technology Sector.

#### Employing Technical Ratios to Evaluate Company Growth Declines

Beyond compound annual growth rate (CAGR) analysis for the Magnificent Seven, we will apply technical analysis ratios. Technical analysis contrasts with fundamental analysis, previously utilized in multiple assessments within this study. Certain technical ratios, widely used in candlestick charts, aid in predicting growth trends for these companies. We will commence with a previously introduced technical ratio, designed to evaluate growth without a formal definition.

#### **GDP** Participation Ratio

We have already described the importance of this ratio in assessing the economic weight of the largest companies in the S&P 500. While formal ratios of this type focus on markets or sectors rather than companies, the studied corporations surpass many global stock markets in market capitalization, justifying their analysis. Focusing on Apple, we estimate its US GDP share at approximately 0.12, with notable growth potential. The formula involves dividing its market value by US GDP; currently, no company significantly exceeds 0.12 of this ratio. Apple's high market value, as a significant US GDP share, underscores its broad economic influence, including innovation and revenue. Given that some S&P 500 firms have a GDP ratio below 24.0.0006, Apple's market cap leadership highlights its economic stature.



#### Apple's Bite of the Economy: Decades of Growth

14% 12% 10% 8% 6% 2008 4% 1.00% of US GDP iPhone Revolution 2% 0% 2007 2009 2011 2013 2015 2017 2019 2021 2023 iPhone Revolution \$1T Milestone iPod Era iPad Expansion Pandemic & Beyond

#### Apple's market capitalization as a percentage of US GDP (2005-2024)

24. KeyCorp is estimated to be the company with the lowest market capitalization in the entire index, with a value of \$12.5 trillion (0.05% of US GDP). Yahoo Finance. (2025). KeyCorp Inc. (KEY).

Bureau of Economic Analysis. (2024). Gross Domestic Product (GDP). Exhibit 18. MacroTrends. (n.d.). Apple market cap history 2010-2024.

McMahon, T. (2024, December 31). U.S. GDP by year compared to recessions and events. The Balance.

Oberman, M. (2023, February 24). If you had purchased \$100 of Apple in 2002. Investopedia

StatMuse. (n.d.). Apple market cap in 2024 on December 31..

U.S. Bureau of Economic Analysis. (n.d.). Nominal gross domestic product for United States [Data set]. Federal Reserve Economic Data (FRED), Federal Reserve Bank of St. Louis.

Analyst forecasts for Apple's market cap-to-GDP ratio vary significantly. Some predict the ratio could rise over 15 years with tempered growth, while others project it will fall below 0.12 by 2040. For the first scenario to occur, Apple must boost revenue in key emerging markets, requiring these nations to achieve development levels that enable middle and upper classes to demand advanced technological products and services. In the second scenario, conservative analysts project a decline to a 25. 0.07 ratio by 2040, indicating Apple's growth would lag behind US GDP growth.

(Exhibit 19). A lognormal distribution model is employed to analyze consumer demand for Apple's products.

Exhibit 19



Global Monthly Salary Distribution vs iPhone Affordability

Logonormal Distribution Model - iPhone SE (2022) - \$429 USD

# Note: The chart is a model rather than a precise reflection of real-world income data. Based on World Bank income distribution patterns (2023) and Apple Inc. (2024) pricing

<sup>25.</sup> Bloomberg. (2025, March). Apple's Market Cap Relative to US GDP: Long-Term Outlook.

Macrotrends. (2025). U.S. GDP and Market Capitalization Analysis. Exhibit 19. World Bank. (2023). Global income distribution data. World Bank Economic Review.

Exhibit 19. World Bank. (2023). Global income distribution data. World Bank Economic Review. Apple Inc. (2024). iPhone pricing and product information. Retrieved from Apple.com.

The logonormal distribution shown serves as a common approximation for representing global wages; however, it is a static model and does not seek to represent the purchasing power of nations or growth trends. The purpose of the graph above is to represent the approximate percentage of the population that could afford the cheapest iPhone with a single monthly salary, without discounting expenses derived from the cost of living and other variables. Furthermore, it seeks to establish the limitations of the consumption capacity of most countries. While the simplified indicator is imprecise in defining what proportions can afford to purchase the product, it is clear that in many countries, the savings capacity of an average salary does not allow for the consumption of high-end technological products, whose price represents a large proportion of the average monthly salary. Furthermore, the fact that the measure used to estimate the percentages is the average salary, rather than the minimum wage, is an additional factor to consider.

#### Materialization of the first scenario

In statistical terms, the parameter  $\mu$  (the average return on our variable) should increase, shifting the central tendency of the distribution toward higher values, which influences the mean and median. A rightward shift of the median, assuming the price of the iPhone remains fixed or increases by a smaller proportion than this shift, would allow more people to reach the threshold of those who can afford to purchase it. In addition, other variables that accompany the mean and median must be considered, such as a reduction in the product's price and a decrease in inequality by the same proportion, shifting the median to the right.

In essence, for the first scenario to occur, household incomes must rise faster than iPhone or other product prices. If more individuals gain purchasing power to become Apple customers, the company can sustain strong revenue growth. However, the analyzed iPhone price excludes shipping costs and countryspecific taxes, which increase effective costs. In South America, technology products may cost up to 26. twice as much as in major markets (e.g., US, South Korea, Japan, China), suggesting the model's affordability estimates may be overly optimistic. Emerging economies are pivotal, offering unsaturated markets where demand for leading technology brands continues to expand. This scenario extends to other mature S&P 500 technology firms, particularly the Magnificent Seven.

# Log-normal distribution applied to different continents

The model studied is applied to each continent separately, considering the percentage of the population that could not afford an iPhone or whose monthly salary is less than \$429. These percentages should be interpreted as part of the company's sales expansion potential, since in continents where incomes exceed the value of the iPhone. the market tends to become saturated and the growth of new buyers may slow. Therefore, in continents where incomes are still insufficient, the upward trend in economic growth should be studied. If salaries increase above the value of the product, this could be an indicator that we could be facing a new market for Apple.

<sup>26.</sup> GSMA Intelligence. (2022). Mobile Economy Latin America 2022.

Inter-American Development Bank. (2021). The high cost of technology in Latin America.

- **1. Average monthly salary in Africa:** With a mean of \$400 and a median of \$350, approximately 65% of the population could not afford the iPhone studied according to the simple criterion used by the model.
- 2. Average monthly salary in Asia: With a mean of \$1,000 and a median of \$700, approximately 28% of the population could not afford the iPhone studied according to the simple criterion used by the model.
- **3. Average monthly salary in Europe:** With a mean of \$2,500 and a median of \$2,000, less than 1% of the population could not afford the iPhone studied according to the simple criterion used by the model.
- 4. Average monthly salary in North America: With a mean of \$5,000 and a median of \$4,662, virtually everyone could afford the iPhone studied according to the simple criterion used by the model.
- 5. Average monthly salary in South America: With a mean of \$500 and a median of \$450, approximately 46% of the population could not afford the iPhone studied according to the simple criterion used by the model.
- 6. Average monthly salary in Oceania: With an average of \$3,200 and a median of \$3,000, again, almost the entire population could afford the iPhone studied under the simple criteria used by the model.

#### Materialization of the Second Scenario

Some analyses follow the line of conservatism applied to forecasts focused on compound growth for 2040. Based on this, we can expect Apple to continue growing, but at decreasing rates, until reaching a point where the stock grows below the market average. For this realistic scenario to materialize, the company must continue the expected market maturation while avoiding major innovations that would alter growth expectations. Of course, from the perspective of a long-term investor, this scenario is pessimistic and should be avoided. Apple should focus on innovation by offering market leadership in machine learning and augmented reality. Personally, I believe it has the resources and borrowing capacity necessary to achieve this desired level of creativity. Furthermore, it depends on low- and middle-income economies growing faster than inflation in technology products, generating greater purchasing power and, therefore, greater demand for Apple products, as described in the first scenario. As for potential declines, some forecasts estimate that Apple's market share will fall from the current range of 0.09-0.11 to a range of 25. 0.07-0.08 in less than 15 years, implying that the company's chances of surpassing US GDP in market value are zero.

As with the first scenario, this analysis can be extrapolated to the rest of the Magnificent 7. Let's consider Apple in the study, as it is a highly valued and studied company, which supports the author's consideration.

 Numbeo. (2025). Cost of Living Rankings: Average monthly net salary (after tax). WorldData.info. (2025). Average Income Around the World. OECD. (2023). Average annual wages.

### Analyzing the Apple/Standard & Poor's 500 ratio and a MACD indicator

Continuing our technical analysis using financial ratios, we will study Apple's growth compared to the US market, defining the ratio and its purpose in order to subsequently calculate its Moving Average Convergence Divergence (MACD).

(Exhibit 20). The top panel shows our R(t) ratio, which is obtained by dividing the return on Apple stock by the return of an ETF that tracks the S&P 500 index at the same point in time. It's more convenient to apply the index to the denominator than to US GDP, since the latter is published quarterly, making it difficult to track accurately..

The interpretation is straightforward, as when the R(t) ratio > 1, the tech company is growing faster than the index, indicating increases when Apple's performance increases proportionally. It is also noted that the ratio shows values close to 1.2 at the beginning of 2023, meaning that Apple has outperformed the index by 20% in relative terms. This value has increased dramatically throughout 2024, reaching R(t) > 2 at the end of the year. A dramatic increase in this ratio implies that investors have great confidence in the company's future, but this can lead to increased risk.

Exhibit 20

#### Apple vs. S&P500 Ratio MACD Analysis (2020-2025)



Exploring Relative Performance through a MACD Indicator

#### Note: Simulated data for demonstration purposes only

Wilder, J. W. (1978). New Concepts in Technical Trading Systems. Trend Research.

Exhibit 20. Murphy, J. J. (1999). Technical Analysis of the Financial Markets: A Comprehensive Guide to Trading Methods and Applications. New York, NY: New York Institute of Finance. Wilder, J. W. (1978). New Concepts in Technical Trading Systems. Trend Research

There may be situations that cause the ratio to decline, some independent of Apple's financial situation, such as an increase in the index's performance. If reductions in the ratio occur, they are likely due to slowdowns in the company's economic growth, changes in the macroeconomy, loss of market share, failure to meet investor expectations, and the dangerous lack of innovation I mentioned earlier. It's also pertinent to mention the sustained growth the ratio has experienced, which means the company generates high expectations, increases its profit generation, and has a solid financial situation. However, if this ratio increases dramatically, the stock could be overvalued. To avoid this scenario, financial fundamentals, such as cash flow and earnings, should be analyzed, along with other financial ratios such as the P/E ratio. In short, the drastic increase in the ratio indicates an optimistic outlook, but in this case, there are doubts about its exaggeration.

### Application of the MACD to the ratio in the lower panel

To calculate the MACD, we subtract the long-term average (26-month EMA) from the short-term average (12-month EMA) applied to our ratio R(t)MACD(t)=EMA12-month(t) – EMA26-month(t)

To obtain the signal line, we calculate the 9-period exponential moving average over the MACD. Signal(t) = EMA9-month(MACD(t))

To create the histogram, we find the difference between the MACD and the previously calculated signal line. Hist(t) = MACD(t) - Signal(t) When MACD(*t*)>Signal(*t*), our histogram is positive and is located above the 0 axis. On the contrary, a MACD(*t*)<Signal(*t*) indicates a negative histogram and whose graph is located below the 0 axis. Crosses of the MACD with the Signal(t) indicate possible changes in trend, bullish trends when it crosses above it and bearish trends when it crosses below it. The chart shows multiple crossovers between the MACD and the signal line, reflecting changes in the spread between Apple's market valuation (or, alternatively, its stock price) and the compared index. Crossovers with the zero axis indicate shifts in the averages. For example, a MACD crossing the zero level from negative to positive indicates a possible bullish reversal or that our short-term average is beginning to rise above the long-term average. When our ratio rises sharply (see the first panel), the MACD line remains above the Signal(t). The histogram, in turn, is mostly positive. In histogram analysis, positive values can often coincide with bullish phases, where the MACD surpasses the signal value. When the MACD fails to surpass the signal line (resulting in negative histogram values), it may indicate that Apple's growth momentum is waning.

At the end of 2022, the MACD declines, indicating a decline or possible correction in the ratio, although the other ratio remains above 1. The objective of these panels is: 1- Show the relative evolution of the ratio in the first panel 2- Indicate changes in behavioral trends based on crossovers and amplitudes 3- Analyze the relative strength of Apple to score its future outlook.

# Using the RSI (Relative Strength Index) to Predict Overvaluation

As with the previous ratio, we will continue analyzing a potential overpricing in Apple stock that could lead to future declines in its growth. This RSI, applied to 14 periods, evaluates whether price movements within the estimated time range have exceeded the upward trend and with what intensity, in order to predict overbought areas. (Exhibit 21). Fourteen intervals are used in the calculation, with each interval calculated as the difference between the current price and the previous price. Based on this, our price change ( $\Delta P$ ) must be > 0 for a profit to be used in the RSI calculation, or alternatively, for the ratio (Apple/US GDP) to increase from one period to the next. Otherwise, it is considered a loss taking the absolute value.

Exhibit 21



**RSI (14) for Apple vs. US GDP and Apple vs. S&P 500** Relative Momentum Analysis of Apple's Valuation Ratios

#### Note: RSI (14) measures momentum to signal potential trend reversals.

In these 14 early periods we will determine the average gain in the RSI (AG) and the average loss (AL):  $AG = \Sigma$  Earnings in 14 periods

#### <u>5 || 14 p</u> 14

To calculate the AL, we substitute the profits in the numerator over the 14 periods with the losses in the same time interval. For subsequent periods we use exponential smoothing:

### AGcurrent = (AGprevious . 13) + CG14

ALcurrent = <u>(ALprevious . 13)+ CL</u> 14

Where AG and AL mean Average Gain/Loss, CG and CL stand for Current Gain/Current Loss

Exhibit 21. Wilder, J. W. (1978). New Concepts in Technical Trading Systems. Trend Research.

Murphy, J. J. (1999). Technical Analysis of the Financial Markets: A Comprehensive Guide to Trading Methods and Applications. New York Institute of Finance.

To calculate Relative Strength Index (RSI), we find the ratio between average gains and losses:

#### RS = AG/AL

then: RSI = 100 - (100/1+RS)

Using the RSI, we can measure a company's relative momentum, in this case applying it to its share of the US economy and the market. In this context, an RSI above 70 indicates overbought areas, identifying rapid growth in market value compared to the benchmark index. Otherwise, an RSI below 30 indicates oversold or potential undervaluation. The RSI rarely exceeds these limits, as can be seen in the chart; however, corrections and trend reversals occur quickly. More conservative traders might use the 80/40 threshold, while more aggressive traders operate within a 60/40 range. The chart above shows a conservative threshold that follows the cautionary line of the previous analyses.

This ratio is very useful for technical analysts, as it can anticipate corrections or confirm trends.

Regarding Apple's performance, the company has maintained solid market performance. However, if these high RSI levels persist over the years due to investor optimism, we can confirm potential overvaluations in the stock price. This chart should be used as a complement to the previous analysis, as it cannot, on its own, indicate a possible permanent slowdown in the value of the company being analyzed. Concurrently, technical analysis should be integrated with fundamental analysis to enhance understanding of macroeconomic dynamics and corporate and consumer trends.

# Incorporating more Financial Ratios into Analysis

Continuing with the use of ratios for Apple, I emphasize that these will not only be viewed in the short term, but I will also attempt to break them down into some predictions for the coming years. Both indicators are based on profit-generating efficiency by subtracting the calculation from assets and available equity. If we seek to estimate the deceleration in the stock price, we can add these ratios, which interpret the current financial health with market expectations and the macroeconomic context, in order to be comprehensive in our hypotheses. I emphasize again, as with the rest of the ratios. that analyzing them alone is not sufficient to provide us with answers close to reality. This is why, throughout this report. I seek to find similarities between the conclusions offered by each tool.

ROA (Return on Assets) seeks to interpret a company's ability to generate profits from the assets available to Apple. From this indicator, conclusions can be drawn such as the company's attractiveness to investors, the relationship between profitability and investments made, and, specifically, a description of the level of operating efficiency.

When obtaining a specific ROA, it is not advisable to analyze all sectors equally, as the same profit margins are not expected for manufacturing sectors as for those that require less investment in assets, such as technology. The latter have higher standards for ROA results, specifically, up to double those in sectors such as construction. An excessively high ROA may pose significant risks. When ROA exceeds 20%, it may indicate underinvestment in assets. Consequently, firms may prioritize asset efficiency. potentially constraining expansion opportunities. For technology firms, the ROA threshold may increase to 30%. Conversely, an ROA below 5% harms firms, hindering asset reinvestment and

These conclusions should account for potential depreciation policies or accounting distortions affecting ROA.

increasing financial

vulnerability.

As for ROE (Return on Equity), it symbolizes the generation of profits on shareholders' equity.

When net worth is lower than that of shareholders. this indicator can be higher than ROA, reflecting leverage. Its interpretation also depends on the sector, and in Apple's case, it should ideally be significantly high, exceeding 50-60%. The Magnificent Seven are more adept at generating high profit margins despite sometimes operating with reduced asset bases. This is explained by their leadership in the technology sector and their ability to boost returns on shareholder capital. In Apple's specific case, if the indicator is below 50% (an acceptable value in traditional sectors), it can be interpreted as an insufficient return on investor capital.

(Exhibit 22). The ROE does not rise unusually, so there is no evidence of excessive debt or insufficient equity. Therefore, it is inferred that its high levels are due to the high profitability.

Exhibit 22

#### **ROA & ROE Metrics (2020-2024)**

**Apple Financial Performance** 



Exhibit 22. Apple Inc. (2020-2024). Annual Reports . Yahoo Finance. (2024). Apple Inc. (AAPL) Key Statistics.

The result of these ratios is decent, but it affects the current situation. I want to emphasize how small their weighting is relative to the total result in an analysis that seeks to project the coming decades. Apple's financial health is excellent, but it doesn't guarantee that the current levels of simple and compound growth will be maintained, as determined by expectations and macroeconomics. These ratios can reflect a lower bound on market value, indicating the lower range that separates a stock's value from undervaluation. However, they do not definitively indicate whether the stock will maintain its above-market growth over several years, as these ratios depend on expectations that influence the valuation of the stock price. Investors use these ratios to strengthen their decisions about whether to buy or not, but these expectations, to a certain extent, exceed the company's control limits.

# **ROIC (Return on Invested Capital) added to the analysis**

This fundamental ratio indicates the company's ability to generate profits with each dollar invested (including debt and equity). It reflects the board's operational efficiency and is relevant to analyze alongside ROA and ROE. When ROE is high and ROIC is low, we can deduce a possible excessive use of debt. In Apple's case, this once again confirms a high-profitability scenario, based on a high-leverage assumption. Leading technology companies have high ROIC standards, so percentages close to 30% are considered optimal, while those below 20% can be a red flag for investors who value efficiency. It's also appropriate to differentiate between ROICs inflated by asset sales and those obtained through solid operations. At the same time, companies must reinvest to continue growing, and an excessively high ROIC can be interpreted as a shortage of attractive investment projects.

ROIC should be closely related to the Weighted Average Cost of Capital (WACC) to strengthen the analysis of value creation. Companies are expected to significantly outperform the latter in their returns, as this establishes a return generation above the cost of capital. If the difference is high, optimal profitability is expected. Conversely, if ROIC is lower than WACC, financing at the expense of invested capital becomes a significant issue.

This ratio is used to measure a company's current financial health, but it can also provide an overview of how well it can survive in the coming years. If efficiency translates into successful investments, value creation helps sustain growth in subsequent periods.

Leading technology companies must maintain high operating efficiency with low utilization of physical capital, focusing their competitive advantages on intangibles such as intellectual property and the innovations they generate. ROIC is expected to significantly exceed WACC; otherwise, they would not be generating value.

(Exhibit 23). Leading technology companies have delivered excellent returns on their investments in recent years. The likelihood that these investments will remain at optimal levels in the medium term is high, given their operational excellence. A cyclical pattern can be seen, resulting from slight reductions in Net Operating Profit After Tax (NOPAT).



Comparison of ROIC and WACC (2020-2025)

ROIC and WACC of Apple, Nvidia, Microsoft and Alphabet



Note: The chart shows the spread between ROIC and WACC for each company from 2020-2025. All four tech companies consistently generate returns (ROIC) significantly higher than their WACC

# Confirmation of Apple's operational stability through the price-to-earnings (P/E) ratio.

This indicator establishes the relationship between the company's stock price and its earnings to represent market expectations. Therefore, it does not offer the best future forecast, as expectations are volatile, and if the company fails to meet them, the stock's value is interpreted as overvalued. While it is not the best measure for estimating the future, knowing how much investors are willing to pay for each unit of earnings generated by Apple is, in our case, essential for predicting possible levels of overvaluation. If the P/E ratio is higher than the ranges within which Apple has fluctuated, it may indicate the aforementioned overvaluation. While the company doesn't underperform in the ratios described above, the fact that its operations may eventually fall short of meeting shareholder expectations could lead to a possible correction that could affect performance in the coming years, decreasing the likelihood of exceeding the desired annual growth. Additionally, we must analyze high multiples across different periods. If successful product launches occur, the acceleration in sales can inflate shortterm expectations.

Exhibit 23. Apple Inc. (2023). Annual Reports. NVIDIA Corporation. (2023). Annual Reports. Microsoft Corporation. (2023). Annual Reports. Alphabet Inc. (2023). Annual Reports. Damodaran, A. (2023). Corporate Finance Data.

Apple vs S&P 500 P/E Ratio Comparison (2020-2025)



Historical and Projected P/E Ratios

#### Note: Data for 2020-2023 is historical. Data for 2024-2025 is projected based on analyst estimates

(Exhibit 24). The price-earnings ratio is a very complex indicator, as exact figures are rarely provided and, according to the study, reflects a fixed value. The forecast for 2024-2025 is derived from a consensus aggregated by financial data providers such as FactSet, Refinitiv, and Bloomberg. The forecast shows convergence between both multiples. which is a clear determining factor in predicting a slowdown or normalization of its growth expectations. While the company historically has a multiple higher than the index average, converging trends determine that the probability of Apple achieving the average annual growth rates of the last five years is zero.

This convergence is explained by the fact that investors now predict expected revenue more accurately. However, this prediction may indicate that the company is not innovating enough and therefore lacks the unpredictability of its earnings potential. We can also observe a certain cyclicality, as periods of expansion or recession affect earnings and growth expectations.

28. Some analysts estimate that the possible reduction in the annual growth rates of profits of the main technology companies to single-digit ranges could drop the P/E to ranges below the market average.

Exhibit 24. Damodaran, A. (2024). Historical P/E ratios by sector. NYU Stern School of Business.

Yahoo Finance. (2024). Apple Inc. (AAPL) - Historical data. S&P Dow Jones Indices. (2024). S&P 500 historical data.

FactSet Research Systems. (2024). Earnings insight: S&P 500 forward P/E ratios.

Bloomberg Terminal. (2024). Analyst consensus estimates for Apple Inc.

<sup>28.</sup> Emanuel, J. (2024). Market valuation adjustments in a decelerating growth environment. Evercore ISI Research.

### PEG (Price/Earnings/Growth) Ratio to Confirm Future Overvaluations

This metric relates the P/E ratio to earnings, indicating whether a stock's price is overvalued or undervalued relative to its growth potential. Like the previous ratio, it depends on historical research results, so projections should be taken with caution, as they may differ. In this context, a PEG close to 1 indicates a fair valuation of the stock's price compared to its current growth. However, results below 1 should not be considered bargaining opportunities by buying a stock at a lower value than it deserves, as the market sometimes shows skepticism about growth prospects or underlying risk. In cases where the PEG is above 2 or 3, or generally very high, the stock price is well above the price justified by growth expectations. In the latter case, buying is not recommended, as if the company doesn't grow in line with high demand, its value could be corrected. As with the rest of the ratios, high-growth industries have a higher PEG than those that have already reached maturity. Based on this last point, we can also deduce that if leading technology companies reach a PEG above 1, they could be reaching maturity, which predicts reduced growth in the coming years.

#### Exhibit 25

#### Apple vs S&P 500 PEG Ratio Comparison (2020-2025)



#### Price/Earnings-to-Growth Ratio Analysis

#### Note: Data for 2020-2023 is historical. Data for 2024-2025 is projected.

Exhibit 25. Damodaran, A. (2023). Growth rates and terminal value. NYU Stern School of Business.

FactSet Research Systems. (2024). Earnings insight: S&P 500 earnings growth and P/E ratios.

Morningstar. (2023). Apple Inc (AAPL) valuation & growth rates.

Standard & Poor's. (2024). S&P 500 earnings and estimate report.

Yardeni Research. (2024). S&P 500 forward earnings, valuation, and returns [Data file].

# Price-to-Earnings Ratio (P/E) to Interpret Sector Maturity

Dividing price by earnings per share provides an indicator that allows one to interpret overvaluation relative to current earnings and determine whether a given maturity exists. In established industries, such as certain financial services or utilities, the P/E can range between 10 and 15, while in the <sup>29</sup> technology sector or high-growth companies, it can reach values above 20.

We are experiencing a technology-driven industrial transformation. Artificial intelligence is poised to drive this transformation, with technology firms showing strong growth potential, supporting elevated P/E ratios on average for the sector. High long-term multiples are consistent with high growth expectations; however, as with the other ratios, future earnings must justify the current range. As mentioned, technology companies must continue to offer products that lead current trends. For example, with the rise of AI multi-tools, both Google and Microsoft have launched their own products. In the case of our preferred company for this study, Apple is expected to adapt its Apple Intelligence to its entire ecosystem, offering added value. This new product represents a great opportunity for revenue diversification and further sales growth. Therefore, companies must refine and adapt their services and wearables to current technological trends to ensure the sustainability of these high priceearnings ratios.

In the event of a correction in expectations, the stock price drop itself would reflect the existing overvaluation. The largest technology companies, referred to by the acronym FAANG (Facebook (Meta), Amazon, Apple, Netflix, and Alphabet (Google)), have, on average, a P/E ratio of between 30. 20x and 30x the price of the stock to earnings per share. In Apple's case, its multiple has even exceeded the industry average, although it has occasionally fallen below that of other software or e-commerce companies. Uncertainty in FAANG stocks is less than in startups, but they still have high multiples and an equally high level of risk.

#### Evaluating Apple's Operating Valuation Using the EV/EBITDA Ratio

This ratio is obtained by dividing the enterprise value (EV) by the EBITDA (earnings before interest, taxes, depreciation, and amortization). It allows us to eliminate the impact of capital structure, certain accounting differences, and, last but not least, taxation from our valuation calculations.

As with the other ratios, interpretation depends on the sector. In developed sectors, an EV/EBITDA ratio between <sup>30</sup>. 6 and 15 is considered reasonable, while in Apple's sector, it ranges from 15 to 25, or even higher multiples. For the analysis of this case, it is positive that Apple has ratios above the sector average, as, in my opinion, i attribute these results to high expectations, which fortunately remain high. If Apple had ratios similar to or lower than the average for the technology sector or established companies, we could predict a further economic slowdown.

29. Damodaran, A. (2023). Growth rates and terminal value. NYU Stern School of Business.

<sup>30.</sup> FactSet Research Systems. (2024). Earnings insight: S&P 500 earnings growth and P/E ratios.

#### Apple Valuation Metrics (2020–2025)



A Brief Comparison of FactSet and Morningstar Data

(Exhibit 26). A slight convergence toward 30 points has been observed in the price-toearnings (P/E) ratio over the past three years, while the second ratio has remained stable around 18-20 over the same period. Both results yield high multiples, even when compared to other established companies in the sector. These growth rates should continue, and based on investor expectations, it can be deduced that the stock will continue to grow in the coming years, with future results needing to be justified by sales to avoid confirming the overvaluation.

Over the next five years, we can expect these multiples to decline but remain above the industry average. For this to happen, a cycle of innovation is necessary, with disruptive product launches that modify the growth curve. Furthermore, current business lines must expand, achieving greater sales diversification. Interesting services are currently being developed that allow the iPhone to reduce its role as a top-selling product, and there is potential in the augmented reality/virtual reality (AR/VR), healthcare, Internet of Things (IoT), and automotive sectors.

For the next decade, if annual earnings growth (EPS) remains between 6% and 10%, it would be plausible for the P/E ratio to be above 25%, even reaching 30%. This indicates that the expectations of the last five years could be maintained, postponing the company's slowdown. There are more optimistic scenarios, which include innovations, where this range rises to between 30% and 35%, although this

Exhibit 26. Morningstar. (2023). Apple Inc (AAPL) valuation & growth rates.

FactSet Research Systems. (2024). Earnings insight: S&P 500 earnings growth and P/E ratios.

depends on the adoption of virtual reality among middle and upper-income earers, as well as the success of Apple Intelligence. As for the EV/EBITDA, it could fall within a similar range, provided that EBITDA prospects grow in line with revenue. If the best-case scenario holds, this could boost the ratio to values slightly above 20.

These two forecasts are consistent with a scenario in which the stock price doubles within 5 to 7 years, considering the remaining ratios and a possible share buyback. We must be conservative in our forecasts, considering the existing saturation in Apple's core markets. Both the iPhone and the Mac, the brand's two flagship products, are located in established markets with lower growth margins. If the company continues to rely on the revenue generated by these lines, its market value growth could be jeopardized if new lines are not adopted.

Since its launch, the iPhone has had a significant impact on the brand's sales. This is a problem because there is a lack of diversification, and it's unknown whether the phone will become obsolete in the coming decades with the development of brain chips, VR headsets, and other inventions. As I mentioned, it is necessary to take advantage of new technological disruptions (AI, virtual reality, smart cars, robotics, services, etc.) to diversify revenue, maintain high expectations, and ensure growth opportunities. But simply adopting these new technologies is not enough; it is necessary to create value based on what global competitors, who sometimes already have a larger market share, can offer.

#### Exhibit 27

### Comparison of Apple Revenue Segmentation (2010, 2016, 2024)



Exhibit 27. Morningstar. (2023). Apple Inc. (AAPL) valuation & growth rates. Apple Inc. (2016). Form 10-K for the fiscal year ended September 24, 2016. Apple Inc. (2010). Form 10-K for the fiscal year ended September 25, 2010. Interpreting Free Cash Flow Yield (FCF) to **Determine the Ability to Finance Growth** 

This ratio provides information about a company's ability to generate cash. This can be used to fund investments or distribute dividends. To calculate it. Free Cash Flow (FCF) is divided by market capitalization (Enterprise Value). It is useful for estimating a stock's attractiveness, as high earnings generate a large amount of free cash. However, excessive earnings can be interpreted as a reduction in future market growth expectations or a possible depreciation in market value. In these cases, a possible reduction in FC due to increased investments or certain operational issues should be analyzed.

As in the previous cases, the technology sector can have higher ceilings, and in the case of Apple, its earnings are typically above 3% (a low limit for it).

Results close to 5% in established companies can be interpreted as strong cash flow that allows for reinvestment, dividend payments, or debt settlement, which is perceived as a result of healthy financial performance. The companies analyzed in this report could increase their FCF if their operating margins expand, allowing for reinvestment.

Free Cash Flow (FCF) compression could occur it market capitalization increases due to continued high investor expectations. Furthermore, as mentioned in the ratios above, the increased risks depend on the innovative capacity of the ecosystem offered by these companies, along with the emergence of new competitors that match market share.



### Free Cash Flow Yield (2024) for the Magnificent 7

Exhibit 28

Exhibit 28, Exhibit 28, Finbox, (n.d.), Unlevered Free Cash Flow Yield For Apple Inc (AAPL),

GuruFocus, (n.d.), Apple (AAPL) FCF Yield %

Man Group, (2025, January 14). From Strength to Stretch: The Magnificent Seven in 2025. Barron's. (2025, February 8). The Magnificent 7 Stocks Are the New Staples. Is It Time to Worry?

#### **Obtaining Apple's Life Cycle and Growth** Model Using the Gordon Perpetual **Growth Method**

In this case, we will use this discounted cash flow (DCF)-centered method, as Apple distributes constant dividends, and these dividends are assumed to grow at a constant rate. In this case, we seek to determine the terminal value using a longterm growth rate significantly lower than the current annual revenue growth rate. First, let's express the mathematical formula for terminal value:

Terminal Value = FCFn X (1 + g)r - g

Where:

**FCFn** = Projected free cash flow for the last vear

r = Discount rate

g = Long-term growth rate

Free Cash Flow 2024: 31 It was calculated at around \$98,299 million for 2024, resulting in a decrease of approximately 8% compared to 2023.

Discount rate (r): we will use a WACC of 8.6% since it is the one we have used in other analyses

g = It is obtained by multiplying the 2024 ROE by the earnings retention ratio. To obtain the latter, we subtract 1 from the dividends paid divided by net income. Therefore, with a dividend payout ratio close to 20%, the earnings retention ratio is 32.80%. This means that Apple retained that percentage of its earnings for reinvestment and other purposes, rather than distributing them as dividends.

Regarding ROE, we cannot base *g* directly on the current ratio, nor can we normalize it in this case, since the results would be higher than the discount rate, rendering Gordon's formula inapplicable.

In 2024, an ROE of 33.152% was estimated; however, if we were to calculate projected growth based on this, we would obtain g =1.216 (121.6%), which is ridiculous. ROE has grown substantially in recent years, rising from 20.5% in 2007 to values above 100%, growing by approximately 12.5% each year. Therefore, if we continue this trend, we would reach a very high ratio that neither addresses potential overvaluation scenarios nor fits the formula. To demonstrate this, we will add a ratio based on the average ROE since that year (57.6%), another that uses the 2007 ratio, and finally two ratios lower than the current WACC.

g(ROE2024) = 1.52 x 0.80 = 1.216 (121.6%) -> Impossible scenario g(ROE(2007-2024) = 0.576 x 0.80 = 0.4608 (46.08%) -> Impossible scenario  $g(ROE2007) = 0.205 \times 0.8 = 0.164 (16.4\%)$ -> Impossible scenario g(ROE10.81%) = 0.1081 x 0.8 = 0.08648 (8.648%) -> Probable scenario g(ROE11.49%) = 0.1149 x 0.8 = 0.09192 (9.192%) -> Unlikely scenario

As you can see, the ROE must decrease dramatically to achieve a more realistic projected growth, even using an ROE Lower than in 2007, these projections are well above the market average, where g is typically around 2%-3%. If g is even lower, ROE must be reduced below 10% or the dividend payout ratio must be set significantly below the current figure, which is less likely.

<sup>31.</sup> Finance Charts. (n.d.). Apple (AAPL) Free Cash Flow: \$98.299B (TTM) 32. Yahoo Finance. (2024). Apple Inc. (AAPL) Key Statistics.

<sup>33.</sup> Macrotrends. (2024). Apple Inc. Return on Equity (ROE) 2005-2024.

## Terminal Value Based on the Different Growth Rates *g* Found

Gordon's perpetual growth model is based on the growth rate (g) being lower than the discount rate. In addition to the realism of the analysis, since high growth rates (g) are not economically sustainable, the mathematics must be valid. If our  $g \ge 8.6\%$ , our denominator would be 0 or negative, which would not make sense. Given this, we will only use the last two results of our growth rate (8% and 8.5%).

Probable scenario:

#### TV = <u>98,299.000.000 X (1 + 0,08)</u> = 17.69T 0,086 - 0,08

\$17,693,832 million would represent a 5.53x increase in Apple's value, which isn't so far-fetched considering that its value has doubled in recent years and that new value wouldn't exceed the GDP of the US.

Unlikely scenario:

#### TV = <u>98,299.000.000 X (1 + 0,085)</u> = 106T 0,086 - 0,085

This value would even exceed the possible values of US GDP, representing a 33.125-fold increase from the current value. This grotesquely high result is due to the minimal difference between *g* and *r*, which creates a denominator close to zero and triggers the terminal value.

For both outcomes to materialize, earnings, cash flow, and dividends must grow at an annual rate exceeding 8%. Therefore, this percentage would be the average expected year-over-year increase, a percentage similar to the ranges within which the S&P 500 has historically grown. I reiterate that while Apple is currently growing faster than the rest of the market, when forecasting in perpetuity, *g* growth similar to that of an index constantly updated with new companies seems unrealistic.

#### Safe scenario

For Apple to maintain its current market value of in perpetuity, under these assumptions (with free cash flow of \$98,299 billion and a discount rate of 8.6%), Gordon's perpetual growth model requires free cash flow to grow at a rate of approximately 5.37% per year indefinitely. This is a safe scenario, but it can be used as a starting point to determine lower bounds on Apple's growth over the coming decades. If actual growth is less than necessary to maintain its current market value, the model's projection would indicate that Apple's market value should be lower. However, it is important to remember that the perpetual growth model is a theoretical tool, and actual market value depends on many other factors, including investor sentiment, the macroeconomic environment, and market conditions.

For Apple's market capitalization to reach the \$11 trillion projected by major investment banks, under these assumptions, its free cash flow would have to grow continuously at an annual rate of 7.64%. This growth is also likely, and while it may be considered conservative, the date for Apple's market capitalization to reach this value was set for 2040, which is an optimistic forecast. Ultimately, we can expect the company's value to double or even triple under current forecasts, representing an even larger percentage of US GDP. But we must assume that US GDP will maintain stable growth over the coming decades, so we should analyze its growth accordingly.

### What is expected of US GDP in the coming decades?

I will use forecasts from renowned consulting firms and organizations to measure US growth from three different perspectives. While some studies estimate that the US economy will be overtaken by an Asian country by 2050, all predict that it will grow at a slower pace than the current rate, projecting between 1% and 2.2% for the following years. The demographic winter, competition with other emerging stock markets, worrying debt levels, and potential macroeconomic conflicts place the most optimistic opinions at thresholds close to the average annual growth recorded over the past five years, 34, 2.1%, a period in which the pandemic worsened the economic recession. Since the growth of the economy is less volatile and

therefore more predictable than the compound growth of a stock, it is easier to predict different future values and compare them with possible perpetual patterns of a stock.

(Exhibit 29). The various forecasts are shown with their respective levels of optimism. This also allows us to obtain concrete figures on the potential range of GDP fluctuations over the next 25 years, estimates that will be used to define the numerator of our Apple CAGR formula. This is how, by using future GDP values to recreate our final value and using the current market value as our initial value, we can complete the formula for the CAGR needed for the former to be overtaken by the latter within n=25.

#### Exhibit 29



#### Projected US GDP Growth (2025-2050)

 U.S. Bureau of Economic Analysis. (2025). Gross Domestic Product, Fourth Quarter 2024 (Second Estimate). Macrotrends. (2025). U.S. GDP Growth Rate 1961–2025.

Exhibit 29. Trading Economics. (n.d.). United States GDP.

International Monetary Fund. (2023). World Economic Outlook: Growth Slowdown Amid Uncertainties. Washington, DC: International Monetary Fund.

PwC. (2017). A look ahead: How will the world economic order change by 2050? PwC. OECD. (2019). OECD Economic Outlook. OECD Publishing

Reuters. (2024, September 26). US economic growth, corporate profits revised higher in 2023. Reuters.

## Obtaining Apple's CAGR to reach the three final projected GDP values

Next, I'll substitute the numerators into the CAGR formula to obtain the compound annual growth rates required to achieve market capitalization based on three different U.S. GDP projections. The formula for calculating the desired value is:

#### CAGR = (Final Value / Current Value)<sup>1/n</sup> -1

Where: **Final Value:** USA 2050 GDP **Current Value:** Apple's market capitalization in 2025 (MCAP) **n** = periods (years)

For this case:

CAGR<sub>Apple</sub> = (USA 2050 GDP / Apple's 2025 MCAP)<sup>1/25</sup> -1

#### Pessimistic projection for the US economy:

GDP will grow by an average of 1% annually by 2050, reaching a total of \$36.30 trillion.

 $CAGR_{Apple1} = (36,30T / 3,3T)^{1/25} -1 = 0.1006 (10.06\%)$ 

Moderate projection for the US economy: GDP will grow by an average of 1.6% annually by 2050, reaching a total of \$42.09 trillion.

CAGR<sub>App/e2</sub> =  $(42,09T/3,3T)^{1/25} -1 = 0,1072 (10.72\%)$ 

Optimistic projection for the US economy: GDP will grow by an average of 2.2% annually by 2050, reaching a total of \$48.76 trillion.

 $CAGR_{Apple3} = (48,76T / 3,3T)^{1/25} -1 = 0,1137 (11.37\%)$ 

### Analysis of Potential Projected Growth in Perpetuity

As I mentioned in the perpetuity calculation, technology companies and those that have not yet reached maturity present an additional challenge when projecting their stock value under the dividend discount model. This is because a high ROE cannot be used, and projected growth forecasts do not consider the point at which they begin to occur in perpetuity, despite current CAGRs being high. Apple is no exception to this problem, and when calculating projected long-term growth (df), we obtained results that, while well above the typical range established in these models, still contemplate growth levels far below current levels. Furthermore, we obtained the df necessary to ensure that the company's value does not decline, and this growth was close to half of these last calculated CAGRs.

Is Apple likely to average a compound annual growth rate (CAGR) above 10% through 2050?

The short answer is no; the long answer is that the market is unpredictable, and current models consider conservative scenarios where these results barely exceed half of that figure. If the results of recent years were replicated even at 70%, we could contemplate a scenario where Apple exceeded a CAGR of 10%-11%, but it would not be prudent to assume this given the macroeconomic factors we have analyzed before.

## Running the Probability Model for Apple's Growth versus US GDP in 2050

Next, we will dedicate some space constructing a model whose mathematical procedure can estimate the probabilities of the CAGR exceeding the thresholds required for Apple's CAGR to equal GDP in 25 years. Let's distinguish the key elements to perform the Estimation of Probabilities Based on Normal Distribution:

- **1. Sample space (\Omega):** The CAGR is a continuous variable and by taking all possible values of Apple's CAGR from 2025 to 2050, we establish a continuous range of growth rates (e.g.,  $[-\infty,\infty]$ ).
- 2. Defining events: We extract again those subsets of the sample space defined by a CAGR > threshold, where the thresholds are: 10.06% (pessimistic GDP scenario). 10.72% (moderate scenario). 11.37% (optimistic scenario).
- These events represent the condition for Apple's market value to exceed the projected GDP.

**3. Probability function:** The CAGR is assumed to follow a normal distribution:

CAGR ~ N( $\mu$ , $\sigma$ ^2), where:

 $\mu$ : Mean (expected value of the CAGR).

σ: Standard deviation (dispersion).

Equity instruments are valued based on their risk, symbolized by volatility, represented by deviations from the mean.

**Mean selection:** We project lower growth than current growth, assuming a slowdown. To obtain different forecasts, we chose three different means. In this case, as the mean decreases, the deviation in the data also decreases, making it consistent with more mature scenarios and, therefore, lower volatility in stocks with less uncertainty and risk.

 $\mu = 8\%, \sigma = 4.5\%$  $\mu = 8\%, \sigma = 4\%$  $\mu = 8\%, \sigma = 3.5\%$  Probability density calculation:

$$f(x) = 1 - \frac{1}{\sigma\sqrt{2\pi}} e^{-1} [(x-\mu)^2]/2\sigma^2$$

### 4. Calculate the probability for each scenario and threshold:

**Z-score** = (threshold -  $\mu$ )/ $\sigma$ , which is the standardized distance from the threshold to the mean. Standardizes the threshold value on a common scale (standard normal), allowing for comparison of different distributions. It is used to translate the threshold into a universal metric.

**CDF (Cumulative Distribution Function):**  $\Phi = (z) = P(Z \le z)$ , cumulative probability up to z in the standard normal distribution. It is essential to determine the proportion of the distribution less than or equal to the threshold. **Probability:** P(CAGR > threshold) = 1- $\Phi$  (z)

For example:  $\mu$ =8%,  $\sigma$ =4.5%, threshold = 10.06%: z= (10.06-8)/ 4.5 = 0.4578  $\Phi(0.4578) \approx 0.676$ P=1-0.676 = 0.324 or 32.4%. Represents the probability that the CAGR exceeds 10.06%, which is the growth required for the MCAP to exceed the GDP value obtained under the pessimistic estimate.

#### 5. Clarifications on the Confidence Interval (CI): The CI estimates the range within which the real value of μ is located, whose confidence level depends on the standard error. In this case, the CI was not

included because the model used predefined values for simulation, not for statistical inference. In other words, the CI was not part of the original model because we worked with assumptions, not empirical estimates. In an inferential context, where there is no absence of sample data, the CI would quantify the uncertainty of  $\mu$ , complementing the obtained probabilities.

6. Scenarios and Thresholds: Let's calculate the probabilities (P) that Apple's CAGR will exceed each of the three thresholds (10.06%, 10.72%, 11.37%) for the three CAGR scenarios defined by their means ( $\mu$ ) and standard deviations ( $\sigma$ ). This is based on the previously established probabilistic model, using the normal distribution.

#### **Scenarios:**

**1:**  $\mu$  = 8%,  $\sigma$  = 4.5% **2:**  $\mu$  = 8%,  $\sigma$  = 4% **3:**  $\mu$  = 8%,  $\sigma$  = 3.5%

**Thresholds:** 10.06% (pessimistic), 10.72% (moderate), 11.37% (optimistic).

**Scenario 1.0:**  $\mu = 8\%$ ,  $\sigma = 4.5\%$ , threshold = 10.06% z = (10.06%-8%)/4.5%  $\approx$  0.676 -->  $\Phi$ (0.676)  $\approx$  0.324 P1.0 = 1- 0.676 = 0.324 **P1.0 (X>10.06%) = 32.4%** 

**Scenario 1.1:**  $\mu = 8\%$ ,  $\sigma = 4.5\%$ , threshold = 10.72% z = (10.72%-8%)/4.5%  $\approx$  0.727 -->  $\Phi$ (0.727)  $\approx$  0.727 P1.1 = 1- 0.727 = 0.273 P1.1 (X>10.72%) = 27.3%

**Scenario 1.2:**  $\mu = 8\%$ ,  $\sigma = 4.5\%$ , threshold = 11.37% z = (11.37%-8%)/4.5%  $\approx 0.7489 \rightarrow 0.7489 \approx 0.773$ P1.2 = 1- 0.773 = 0.227 **P1.2 (X>11.37%) = 22.7%** 

**Scenario 2.0:**  $\mu = 7\%$ ,  $\sigma = 4.0\%$ , threshold = 10.06% z = (10.06%-7%)/4.0%  $\approx$  0.765 -->  $\Phi$ (0.765)  $\approx$  0.778 P2.0 = 1- 0.778 = 0.222 **P2.0 (X>10.06%) = 22.2%**  Scenario 2.1:  $\mu = 7\%$ ,  $\sigma = 4.0\%$ , threshold = 10.72% z = (10.72%-7%)/4.0%  $\approx 0.93$ -->  $\Phi(0.93) \approx 0.824$ P<sub>2.1</sub> = 1- 0.824 = 0.176 P<sub>2.1</sub> (X>10.72%) = 17.6%

Scenario 2.2:  $\mu = 7\%$ ,  $\sigma = 4.0\%$ , threshold = 11.37% z = (11.37%-7%)/4.0%  $\approx$  1.0925—>  $\Phi$ (1.0925)  $\approx$  0.863 P2.2 = 1- 0.863 = 0.137 P2.2 (X>11.37%) = 13.7%

Scenario 3.0:  $\mu = 6\%$ ,  $\sigma = 3.5\%$ , threshold = 10.06% z = (10.06%-6%)/3.5%  $\approx$  1.16 -->  $\Phi(1.16) \approx 0.877$ P<sub>3.0</sub> = 1- 0.877 = 0.123 P<sub>3.0</sub> (X>10.06%) = 12.3%

Scenario 3.1:  $\mu = 6\%$ ,  $\sigma = 3.5\%$ , threshold = 10.72% z = (10.72%-6%)/3.5%  $\approx$  1.3486 -->  $\Phi$ (1.3486)  $\approx$  0.911 P3.1 = 1- 0.911 = 0.098 P3.1 (X>10.72%) = 8.9%

Scenario 3.2:  $\mu = 6\%$ ,  $\sigma = 3.5\%$ , threshold = 11.37% z = (11.37%-6%)/3.5%  $\approx$  1.5343—>  $\Phi$ (1.5343)  $\approx$  0.938 P3.2 = 1- 0.938 = 0.062 P3.2 (X>11.37%) = 6.2%

(Exhibit 30). It is evident that the lower the average, the lower the probabilities, so if we had extracted the Apple CAGR projections prepared by the banks and shown in Exhibit 14, the probability would be practically 0.

### Normal Distributions of Apple's CAGR / Probability of Exceeding Thresholds / Summary of Probabilities for Apple's CAGR Exceeding Scenarios



	P(CAGR > 10.06%)	P(CAGR > 10.72%)	P(CAGR > 11.37%)
μ = 8%, σ = 4.5%	32.4%	27.3%	22.7%
μ = 7%, σ = 4.0%	22.2%	17.6%	13.7%
μ = 6%, σ = 3.5%	12.3%	8.9%	6.2%

Could Firms Dwarf the U.S. GDP?

6. Conclusion: The model, with a continuous sample space, thresholdbased events, and a normal distribution, estimates the probabilities of Apple surpassing US GDP by 2050. The example illustrates how z,  $\Phi(z)$ , and P transform raw data into interpretable metrics, reflecting different levels of growth and risk. These results should be interpreted as mere possibilities under a normal distribution, so deviations define the outcome. Reality will be determined by macroeconomics, socioeconomic expectations, and expectations about the company and its growth capacity.

#### Insight: From the investor's perspective

The Magnificent Seven have generated extraordinary returns in the short, medium, and long term. In a sense, they have defined the US economy, achieving a significant weighting relative to the S&P 500. Currently, there are index funds that track only these seven companies (YMAG), allowing us to create a portfolio with greater volatility by taking advantage of the growth of the technology sector. However, as I mentioned earlier, SP500 ETFs in the US market are already saturated with technology, and even if we consider our portfolio to be diversified, the power that companies like Apple, Amazon, and Meta wield in the stock market overshadows the returns of negatively correlated sectors.

Currently, the compound annual growth rates (CAGRs) of companies like Apple outperform the short-term market average, allowing for higher returns with greater risk. If compound growth is 8%, our capital could double approximately every nine years, while with a 6% CAGR, it would double every 12 years. These projections are close to the conservative forecasts of major U.S. investment banks. Since current risk is a product of past experience, we can project high growth in the stocks of these large companies and a wide margin between their current returns and potential returns close to or below the market average. Therefore, if a growth slowdown occurs, we could estimate at least a decade of higher average growth and deviation in these companies (always compared to the market average).

Investing in the S&P 500 is a simple way to create our own pension. If we harness the magic of compound interest and maintain discipline over enough decades. we could build a significant portfolio that benefits from both today's great tech companies and future industry-redefining companies. Based on current average growth, these portfolios offer higher returns than traditional investments focused on fixed income or real estate. But this isn't the only advantage. We also have significant liquidity and don't have to deal with the stress of being responsible for asset prices or the obligation to forgo returns over a given period (as is the case with undeveloped real estate).

#### As for the title of this document: Could a company's MCAP exceed the GDP of the U.S.?

It's possible. As we've seen, there are already companies whose MCAP exceeds the GDP of some major powers. However, the probability of this being a well-known company is low considering all the fundamental factors we've seen. If any of these companies manage to match the GDP of the United States by 2050, it would not only mark a success in the portfolios of those investors who have bet on compound interest, but it would also raise several questions about the power these corporations could wield.

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Additional Notes:

The document was distributed through DocWind and Nicolás Grimoldi's platforms.
 Programming languages such as Python and React were used to develop graphics, as well as R and R Studio to analyze the statistical model.