Lisbon School of Economics & Management
Universidade de Lisboa

MASTERS IN
FINANCE

MASTER'S FINAL WORK
PROJECT

EQUITY RESEARCH:
MERCK SHARP AND DOHME

ZIYAO JIN

JUNE 2025

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Abstract

We issue a "Hold" recommendation for Merck & Co. (MRK) with a 2026YE target price of $83.06, implying an 8.09% upside (7.44% annualized) from the current price of $76.84 as of May 31. The DCF valuation (absolute method) indicates that Merck is fairly valued, with limited upside potential of approximately 8% over the forecast period. Relative valuation metrics (P/E, EV/EBITDA, P/S) suggest that Merck trades in line with large-cap pharmaceutical peers, without a material discount. The company has a medium risk profile: strong cash flows and R&D leadership are offset by the looming Keytruda patent cliff in 2028 and elevated debt levels ($70.7B), which may constrain financial flexibility in a high-interest-rate environment.

Merck's R&D capabilities remain a strength, supported by $15.4B in strategic acquisitions (Prometheus, Imago) and its collaboration with Daiichi Sankyo, all of which enhance its oncology pipeline and partially mitigate Keytruda concentration risks. The dividend policy remains stable and attractive to income-oriented investors, though modest growth (~2–3% annually) limits re-rating potential. Low insider ownership (0.06%) raises concerns about management alignment, although high institutional ownership (e.g., Vanguard, BlackRock) adds stability. Merck's low trading liquidity may deter short-term investors but aligns well with long-term holding strategies.

While Merck is fundamentally solid with a robust pipeline, the limited upside does not justify a "Buy," and absent major negative catalysts, a "Sell" is unwarranted. We therefore recommend holding the stock until there is greater visibility on post-Keytruda revenue streams and/or meaningful improvement in debt metrics or interest rate conditions.

JEL classification: F01; G10; G17; J10; K41;

Key Words: Merck; R&D, Pharmaceutical; Animal Health; Oncology; M&A activity;

Resumo

Emitimos uma recomendação de “Manter” para a Merck & Co. (MRK), com um preço-alvo para o final de 2026 de $83,06, implicando um potencial de valorização de 8,09% (7,44% anualizado) face ao preço atual de $76,84 em 31 de maio. A avaliação pelo método do DCF (fluxos de caixa descontados) indica que a Merck está razoavelmente avaliada, com um potencial de valorização limitado, em torno de 8% no horizonte projetado. Os múltiplos de avaliação relativa (P/E, EV/EBITDA, P/S) sugerem que a Merck está alinhada com os seus pares farmacêuticos de grande capitalização, sem um desconto significativo. A empresa apresenta um perfil de risco médio: embora possua fortes fluxos de caixa e liderança em I&D, enfrenta riscos como a expiração da patente do Keytruda em 2028 e um nível elevado de dívida ($70,7 mil milhões), o que pode limitar a flexibilidade financeira num ambiente de taxas de juro elevadas.

As capacidades de I&D da Merck continuam a ser uma vantagem competitiva, impulsionadas por aquisições estratégicas no valor de $15,4 mil milhões (Prometheus, Imago) e pela colaboração com a Daiichi Sankyo, que reforçam a sua carteira oncológica e atenuam parcialmente a dependência do Keytruda. A política de dividendos é estável e atrativa para investidores com perfil de rendimento, embora o crescimento modesto (~2–3% ao ano) limite o potencial de reavaliação. A fraca participação de insiders (0,06%) levanta dúvidas quanto ao alinhamento da gestão, mas a forte presença de investidores institucionais (como a Vanguard e a BlackRock) confere estabilidade. A reduzida liquidez das ações pode afastar investidores de curto prazo, mas torna a Merck adequada para estratégias de investimento a longo prazo.

Embora a Merck seja uma empresa de elevada qualidade com uma carteira de produtos robusta, o potencial de valorização limitado não justifica uma recomendação de “Compra”. Por outro lado, na ausência de catalisadores negativos relevantes, também não se justifica uma recomendação de “Venda”. Assim, recomendamos manter a posição até que haja maior visibilidade sobre as fontes de receita após a exclusividade do Keytruda e/ou melhorias significativas nos indicadores de endividamento ou no ambiente de taxas de juro.

Classificação JEL: F01; G10; G17; J10; K41;
Palavras-Chave: Merck; R&D, Farmacêutica; Saúde Animal; Oncologia; Fusões e Aquisições;

Acknowledgements

I am indebted to my family for their steadfast support and encouragement, which have been essential to my academic pursuits. I would also like to acknowledge the invaluable guidance and mentorship of Professor Sumaira Ashraf and Victor Barros. His expertise in Equity Research has significantly contributed to my understanding of this subject.

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1. Research Snapshot

Our valuation analysis shows Merck's stock is undervalued. The DCF model suggests a 2026 target price of $83.06 (8.09% upside from May 31, 2025's $76.84), implying a 5.32% annualized return. Given medium risk, we maintain a Hold recommendation.

Despite recent price declines reflecting broader market trends and slower pharma growth, Merck's post-pandemic recovery remains strong, driven by R&D investments and strategic M&A. These efforts support revenue expansion and long-term growth, even amid current market pressures.

Research and Development: Rare Diseases and Tumors

While Merck largely avoided COVID-19 vaccine development, it doubled down on its core therapeutic areas - oncology, cardiovascular and rare diseases - with oncology drugs now representing 16.8% of global pharmaceutical revenue (Statista, 2024). The company set a record with over $30 billion in 2023 R&D spending, focusing on key strategic initiatives: preparing for Keytruda's 2028 patent cliff through autoimmune disease expansion and ADC cancer drug development with Daiichi Sankyo, while also pursuing acquisitions like Harpoon Therapeutics and EyeBio. Its innovation push extends to cutting-edge areas including synthetic biology with Pearl Bio and AI drug discovery via Variational AI. We anticipate sustained R&D investment growth to $17.82 billion by 2026 and $18.74 billion by 2030 as Merck positions itself for long-term growth beyond Keytruda

Dividend Policy

In November 2024, Merck agreed to increase its annual dividend from $2.96 per share to $3.12 per share, and this growth trend is likely to continue in recent years, which will result in a payment of more than $8.785 billion in fiscal year 2026. Positive FCF during 2024F-2030F supports the sustainability of this policy, with 2026F being $14.041 billion and 2027F-2030F also remaining stable between $13.52 billion and $14.56 billion.

Future development trends

Despite stable revenues and a diversified portfolio, Merck faces pressure to prioritize due to evolving industry trends and business risks. While pharmaceutical demand dipped only 0.1% as aging populations and demographic growth sustain the sector, the market remains dominated by major players with limited share-shifting opportunities, absent scientific breakthroughs. Merck's animal health division, projected to reach 9.55% market share by 2029, shows consistent revenue growth but lags behind international expansion rates, necessitating greater focus on boosting demand and R&D investment in this segment to remain competitive.

Table 1: Valuation Recommendations

Recommendation	Hold
Ticker	MRK
Current Price (May 31 2025)	76.84
Price Target	**83.06**
Upside Potential	8.09%
Sector	Pharmaceutical
Market Cap ($M)	278896.80
Free Float (%)	99.40%
Total Shares Outstanding (#M)	2554
52-Week Range	$73.13-$134.63

Source：Author's Analysis &Yahoo Finance (2025)

Figure 1: Relative Price Performance (Merck Vs. S&P 500)

Source: Yahoo Finance (2025)

Figure 2: Relative Price Performance (5 Years Stock Price Vs Target Price)

Source：Yahoo Finance (2025)

Table 2: Financial Highlight

Mln	2023	2024	2025F	2026F	2027F	2028F
Revenues	60111.00	64168.00	65733.00	67290.02	69288.78	71312.73
EBTDA	6277.00	24411.00	22826.95	23144.28	24678.05	25521.17
EBTDA Margin	0.10	0.38	0.35	0.34	0.36	0.36
NOPLAT	3409.46	16007.74	13469.94	15458.24	16724.03	17437.63
NOPLAT Margin	0.06	0.25	0.20	0.23	0.24	0.24
Net Income	365.00	17317.00	16530.31	16934.31	18456.43	19405.28
Interest Coverage	1.65	10.69	14.56	15.36	17.46	19.25
DA	0.65	0.60	0.57	0.54	0.51	0.48
ADC	0.03	0.19	0.17	0.16	0.17	0.16
CAPEX	0.03	0.17	0.21	0.28	0.26	0.26
CAPEX	3963.00	3372.00	5239.39	5939.35	5921.50	6308.08
FCF	13006.00	21488.00	21081.89	22236.60	23716.87	24391.98

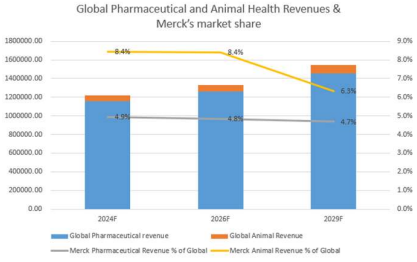
Source: Merck Financial Report 2024 (2025)

Table 3: Dividend Policy

	Shareholder Dividend Policy							
	2023	2024	2025F	2026F	2027F	2028F	2029F	2030F
Dividend ($/share)	2.96	3.12	3.28	3.44	3.6	3.76	3.92	4.08
Payout Ratio (%)	2002.9%	46.4%	57.2%	60.0%	59.7%	61.4%	62.8%	64.8%
Dividend Yield (%)	2.72%	2.74%	2.79%	2.85%	2.87%	2.96%	3.01%	3.07%
Share Repurchase	19	22	22	22	22	22	22	22

Source：Merck Financial Report 2024 (2025)

Figure 3: Global Pharmaceutical and Animal Health Revenue & Merck Market Share



Source：Statista (2024)

2. Business Description

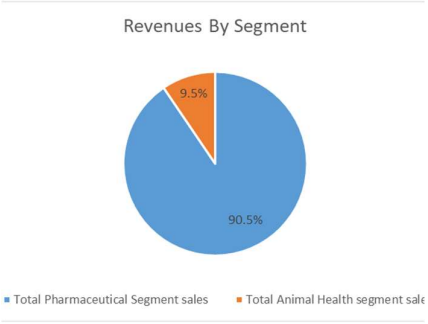
2.1 Company Overview

Merck & Co., Inc. is a world-renowned healthcare company specializing in the development and production of pharmaceuticals, vaccines, biologic therapies, and animal health products. Established in 1891 and headquartered in Kenilworth, New Jersey, USA, the company operates across more than 140 countries and regions worldwide.

Merck has a long-standing legacy of innovation in medical science, particularly distinguished by its robust research and development capabilities. Over the years, it has developed numerous critical therapies for conditions such as cancer, diabetes, and infectious diseases. Among its most notable achievements is Keytruda, a flagship immunotherapy drug widely used in the treatment of various cancers.

The company has also made significant strides in vaccine development, with Gardasil standing out as a landmark product. Primarily designed to prevent human papillomavirus (HPV) infection, Gardasil has played a pivotal role in public health efforts to reduce HPV-related diseases.

Figure 4: Revenues By Segment

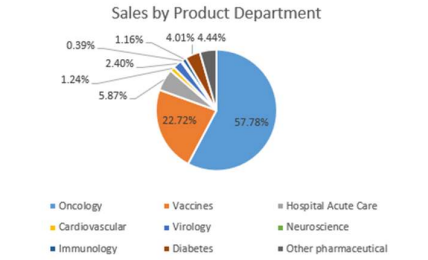


Source：Merck Financial Report 2024 (2025)

2.2 Business Segments

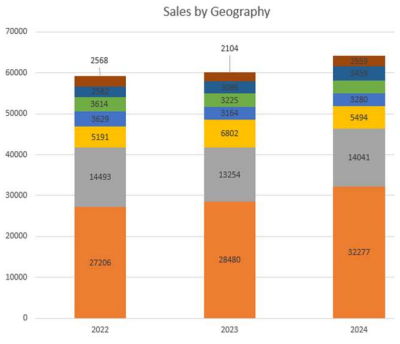
Merck's operations are centered around two core segments: Pharmaceuticals and Animal Health. As pets play a larger role in people's lives, the Animal Health segment has gained significance, with sales steadily rising since 2020. In 2024, it generated $5.877 billion (excluding other revenues), accounting for 9.5% of total revenue, mainly driven by international expansion. Despite this growth, Pharmaceuticals remains Merck's primary revenue source, contributing 90.5% of 2024 sales. That year, it reached $57.4 billion, up 7.12% from $53.583 billion in 2023, with Keytruda alone accounting for 258% of the segment's growth. The oncology category, led by Keytruda, reinforces this segment's dominance. However, high R&D costs and long development cycles (10–15 years) raise concerns about pricing and investment recovery. Other pharmaceutical income comes from low-volume products and third-party manufacturing, hedging, and interest activities. In FY2024, Merck's revenue distribution was 50.3% from the U.S., 21.88% from EMEA, 8.56% from China, 5.11% from Japan, 4.77% from Asia-Pacific, 5.39% from Latin America, and 3.99% from other regions. Only the U.S. (+13.3%), EMEA (+5.9%), Japan (+3.7%), and Latin America (+12.1%) showed positive growth over 2022, with the U.S. leading, highlighting the effectiveness of Merck's emerging market strategy. Performance in other regions varied from -18.1% to +21.6%.

Figure 5: Revenues By Product Department



Source：Merck Financial Report 2024 (2025)

Figure 6: Revenues By Product Department



Source：Merck Financial Report 2024 (2025)

2.3 History

Merck's origins date back to 1891 when George Merck founded a U.S. pharmaceutical chemical distribution subsidiary, which gained independence

after World War I asset seizures. Under George W. Merck's leadership (1925-1950), the company established its patient-first philosophy while achieving major breakthroughs, including the 1943 discovery of streptomycin - the first effective TB treatment - through its funded research at Rutgers University. Strategic mergers with Powers-Weightman-Rosengarten and Sharp & Dohme (1953) expanded its vaccine capabilities, making it America's top pharma firm, while its 1940s penicillin mass production revolutionized antibiotic access. Landmark innovations continued with 1987's Mectizan for river blindness and the $41 billion Schering-Plough acquisition (2009) that brought Keytruda, now its oncology cornerstone following 2014 FDA approvals. Recent progress stems from collaborations like AstraZeneca's Lynparza and Ridgeback's molnupiravir, complemented by strategic moves including Organon's 2021 spinoff and major acquisitions like Prometheus Biosciences ($10.8B, 2023) and Harpoon Therapeutics ($680M, 2024), the latter adding T-cell activator HPN328 to strengthen its cancer pipeline.

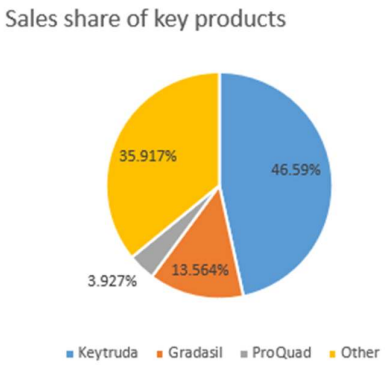
2.4 Merck's Key Products

Merck's portfolio includes 26 pharmaceuticals and animal health products, led by Keytruda (pembrolizumab), an immunotherapy targeting the PD-1 checkpoint that transformed cancer treatment by activating T-cells against tumors. Approved in 2014 for melanoma, Keytruda now treats 40+ indications in solid and hematologic cancers, making it the highest-grossing oncology drug worldwide. Evaluate Pharma's 2023 forecast projects Keytruda sales reaching $30 billion by 2028. In FY 2024, it generated $29.482 billion, or 45.95% of Merck's total sales. Other key drivers include Gardasil (HPV vaccine) with $8.583 billion (+15.7% YoY) supported by expanded screening and vaccination, and ProQuad (MMR vaccine) at $2.485 billion, boosted by post-pandemic pediatric demand. These two non-Keytruda products account for 17.25% of sales, showing portfolio balance. Nevertheless, Keytruda's growth—driven by combination therapies and new indications—continues to outpace others. Strategic efforts to extend its lifecycle via biosimilar defense and novel formulations (e.g., subcutaneous injection) are vital amid patent expiry risks after 2028. This mix underscores Merck's dual reliance on oncology leadership and vaccine resilience, positioning it to adapt to global healthcare shifts.

2.5 Financial Performance

Merck has maintained steady sales growth over the past five years with an 11.5% average annual increase, reaching $64.168 billion revenue in 2024 alongside $19.912 billion EBIT and $17.117 billion net income. However, 2023 net income plummeted 97.49% year-over-year due to a 125.4% R&D spending surge to $30.531 billion, which included 50.8% for core R&D, $5.5 billion for ADC development with Daichi Sankyo, and $11.4 billion for Prometheus/Imago acquisitions. Excluding these extraordinary costs, normalized R&D was $13.6 billion (up $100 million), representing 23% of revenue. The profit collapse drove key metrics to decade lows (ROE 0.97%),

Figure 7: Sales Share of Key Products



Source: Merck Financial Report 2024 (2025)

Table 4: Financial Performance

Metric/Year	2022	2023	2024
Revenue	-	-	$64.168B
EBIT	-	-	$19.912B
Net Income	-	-97.49% YoY	$17.117B
Total R&D Spend	-	$30.531B	-
∟ Core R&D	-	50.8%	-
∟ ADC Development	-	$5.5B	-
∟ M&A	-	$11.4B	-
Normalized R&D	$13.5B	$13.6B	-
ROE	31.53%	0.97%	-
EBITDA Margin	36.86%	-	-
ROA	13.3%	-	-
Asset Turnover	-	56.4%	-
Fixed Asset Turnover	-	1.46	-

Source: Merck Financial Report 2024 (2025)

though adjusted ROE stood at 37.1% - a 5.58% improvement over 2022. Operational efficiency gains were evident through a record 56.4% asset turnover and improved 1.46 fixed asset turnover. Prior to 2023's acquisition-driven anomalies, 2022 metrics peaked at 36.86% EBITDA margin, 13.3% ROA, and 31.53% ROE, suggesting Merck's post-2023 performance should surpass historical levels absent major M&A activity.

2.6 Strategy

According to the Notice of Annual Meeting and Proxy Statement issued by Merck in 2024, Merck's long-term and short-term strategies mainly focus on the following five points:

1. Scientific breakthroughs and drug innovations

Merck's substantial R&D focus on oncology, vaccines, and infectious diseases is exemplified by Keytruda's clinical success, approved for 30+ cancer indications. Phase 3 data show Keytruda reduces death risk by 76% in advanced NSCLC (Merck, 2024), with KEYNOTE-522 confirming significant OS gains in triple-negative breast cancer (Keylor, 2021), underpinning its blockbuster revenue and enhancing NPV in our DCF. The pipeline includes 80+ Phase II and 30+ Phase III drugs, with late-stage assets like Patritumab (anti-HER3 ADC) and WELIREG (HIF-2α inhibitor) targeting NSCLC and renal carcinoma, incorporated via probability-adjusted forecasts. Keytruda's potential 11 new indications may add 1% to peak sales, modeled in scenario analysis. Merck's vaccine pipeline leverages mRNA and adjuvant platforms, with candidates such as CAPVAXIVE (COVID-19), V940 (shingles), and V181 (RSV) addressing unmet needs and valued through risk-adjusted TAM, projecting significant post-launch revenue contributions.

2. Strategic Acquisitions & Partnerships

Merck has pursued an acquisition strategy to diversify and expand its product portfolio. The company's acquisitions—including Acceleron Pharma (2021, rare diseases), Imago BioSciences (November 2022), and Prometheus Biosciences (2023)—along with strategic collaborations with biotechnology firms, have strengthened its presence in high-growth therapeutic areas such as oncology, cardiovascular diseases, autoimmune disorders, and vaccines.
In addition to its expansion through acquisitions, Merck has embraced digital transformation to enhance operational efficiency. A 2024 partnership with Siemens underscores the company's commitment not only to broadening its product offerings but also to optimizing manufacturing processes, ensuring the highest standards of quality and safety in production.

3. Global Expansion & Diversification

North America, especially the U.S., is Merck's largest pharmaceutical market, contributing ~60% of current pharmaceutical revenue and forming the core of our base-case projections. Europe, the second-largest market, supports premium pricing due to high healthcare spending and market maturity. Together, these established markets account for ~72.2% of Merck's

profitability and underpin our conservative revenue growth assumptions (3.83% CAGR). China, Merck's third-largest market, adopts a low pricing strategy given its large population, while Japan's pricing aligns with developed markets. Though the Asia-Pacific (excluding China and Japan) and Asia-Africa regions require further development, their potential justifies our upward revision of the long-term terminal growth rate from 1.7% to 2.12%. Merck accelerates entry and capacity expansion through M&A in key regions, supporting product portfolio diversity and reducing reliance on specific markets or products, thereby mitigating business risk through geographic and operational diversification.

4. Commitment to Sustainability and ESG Goals

Merck integrates ESG principles into its core strategy, focusing on achieving net-zero greenhouse gas emissions by 2045 through carbon reduction, expanding global medicine access via commercial, clinical, licensing, and donation initiatives, and advancing workforce diversity with measurable gender pay equity goals. Executive compensation partially depends on ESG performance, linking incentives to specific sustainability and social impact targets.

5. Capital Allocation

Given current market conditions and Merck's competitive strengths, the company pursues a balanced capital allocation strategy emphasizing shareholder returns and long-term growth. Quarterly dividends will increase by $0.04 per quarter (annual $0.16), targeting a 45–50% payout ratio of adjusted net income. Annual strategic reinvestment of $17–20 billion (25–27% of revenue) allocates 60% to oncology (Keytruda and IO therapies), 25% to vaccines (mRNA, RSV/COVID-19), and 15% to infectious diseases. Merck commits $2.3 billion to emerging markets, including $500M for Wuxi Pharmaceutical acquisitions, $800M in Asia-Pacific infrastructure, and $1B for Africa/Middle East market access. Manufacturing investments total $1.9 billion, with $1B for a North Carolina facility and $900M to modernize mRNA production. ESG initiatives receive $1.5 billion, split as $1B for carbon-neutral operations and $500M for global health equity. Financial optimization includes $6–7 billion in M&A focused on late-stage oncology/vaccine assets, $8 billion U.S. investment by 2028, $2.5 billion in share repurchases to reduce shares by 1–2% annually, and $4 billion in annual capital expenditure from 2024 to 2028 to maintain disciplined spending while supporting diversified growth.

2.7 Stock Price

Figure 8 illustrates Merck's stock price trajectory from January 1, 2014 to June 1, 2025, benchmarked against the S&P 500 index. During this period, Merck's share price demonstrated consistent growth, rising from $50.54 to $76.84, representing a $26.30 increase. This upward trend primarily reflects:

1. Revenue Growth: Sustained financial performance driven by successful product commercialization

Figure 8: Merck vs S&P 500 (Jan 14 – OCT 24)

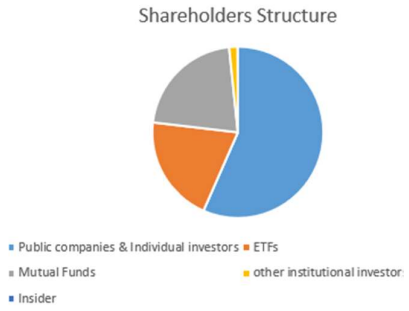
Source: Yahoo Finance (2024)

2. Investor Confidence: Positive market reception of Merck's dividend policy and capital allocation strategy

a) Shareholder Structure

As of May 31, 2025, Merck had 90,400 shareholders: 56.6% public companies and individuals, 20.26% ETFs, 21.5% mutual funds, 1.6% institutional investors, and only 0.04% insiders. With 99.4% of shares publicly traded, Merck shows high market accessibility. While institutional investors boost liquidity, short-term-focused ETFs and mutual funds may pressure management for quick returns, risking cuts to R&D or strategic divestitures (Arena & Julio, 2015), a concern in long-cycle pharma. Although the dividend payout ratio is stable, institutional demands for higher dividends during downturns could divert funds from critical acquisitions like Prometheus and Imago (Li et al., 2004). The minimal 0.04% insider ownership, unlike family-controlled firms in emerging markets that align long-term interests (Tayeh et al., 2023), coupled with the large public float, may reduce accountability and impair capital allocation efficiency (Yao, 2018). Merck's approximately 2.535 billion shares trade on the NYSE. Despite a 2023 EPS decline due to acquisition-related profit dips, acquisitions of CN201, Prometheus, and Imago in August 2024 promise significant future revenue and profit growth, supporting shareholder base expansion and a robust dividend outlook.

Figure 9: Shareholder Structure



Source: Yahoo Finance (2024)

b) Dividend Policy

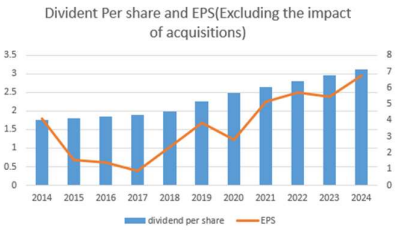
In 2024, Merck plans to distribute $7.943 billion in dividends, with a per-share payout of $3.12, reflecting annual increases of 5.19% and 5.41% since 2015. The 2024 report confirms commitment to dividends, projecting growth to $3.30 in 2025 and $4.08 by 2030 based on a 10-year average growth rate of 5.89%. Supported by a 6.35% net income CAGR exceeding dividend growth, the payout ratio remains sustainable. However, geopolitical tensions—including the prolonged Russia-Ukraine conflict and escalating Israel-Hamas war (Liu, 2024)—and subdued global GDP (2.7%) and trade growth (2.8%) forecasts versus 2000–2019 averages (5.1%) (Subran et al., 2024) present challenges. Stress tests indicate dividends could still rise by $0.16 annually under geopolitical shocks but would freeze for two years in recession. Historically, payout ratios averaged 40–50% in stable periods, spiking to 139.4% during crises like COVID-19. Ratios above 100% risk liquidity strain for M&A, while ~90% preserves BBB+ credit rating despite a 15% EBIT drop. Capital allocation is crucial: a 1% dividend cut frees $80M for R&D, enough for one Phase II trial. Maintaining 2024 dividends may lower 2030 EPS by $0.96 under reinvestment scenarios. Merck must thus balance dividend stability with external risk management and long-term growth funding.

Figure 10: Dividend Per share and EPS

Source: Merck Financial Report 2024 (2025)

Figure 11: Dividend Per share and EPS

(Excluding the impact of acquisitions)



Source: Merck Financial Report 2024 (2025)

3. Management and ESG

3.1 Governance structure

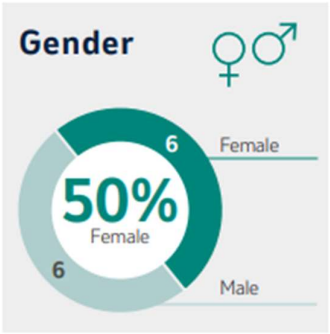
Merck's Board of Directors is led by Robert M. Davis, Chairman and CEO, and Thomas H. Glocer, independent lead director. The Board believes that a company needs a flexible leadership structure at different stages, and that such selection should be based on multiple factors such as leadership capabilities, experience, and company needs, and should not be set in advance. The independent board reviews the leadership structure annually.

As Chairman, Davis chairs the Board and shareholder meetings and works closely with Glocer to ensure effective governance. He oversees the company's overall business and provides advice on strategic direction while being supervised by the Board. Glocer chairs independent director meetings to discuss succession planning and strategic issues. The Board also oversees the company through four independent committees to ensure transparent and independent governance.

3.2 Board of Directors

Merck's board comprises 12 members with diverse expertise and experience, including 11 independent directors (92%) and CEO Robert M. Davis as the sole executive, reflecting strong governance aligned with best practices to reduce agency costs and enhance oversight. Research links high board independence to improved financial transparency and risk management (Li et al., 2024), though exceeding 80% independence may reduce decision-making efficiency and weaken board-management synergy. Gender parity at 50% female aligns with global trends and supports better risk management and stakeholder communication (Dwekat et al., 2025). The board oversees corporate strategy, policies, major decisions like M&A and financial planning, and evaluates CEO and management performance to ensure alignment with shareholder and regulatory interests. Its four committees are: Audit (reviews ERM effectiveness), Compensation and Management Development (balances executive incentives with risk, e.g., drug pricing), Governance (oversees board structure and candidate selection), and Research (guides vaccine and drug R&D strategy). The Audit Committee meets SEC and FDA standards but should enhance supply chain risk review and incorporate supply chain experts (Petitprez et al., 2020). The Compensation Committee should quantify drug pricing impact on incentives, referencing Johnson & Johnson's "Risk Adjusted Compensation Model" including drug accessibility metrics (Armstrong et al., 2015). Governance recommends external headhunters to ensure candidate independence and avoid insider bias (Prashar & Gupta, 2020). The Research Committee must clarify oversight in emerging fields like AI drug development and gene therapy, taking cues from Moderna's "Innovation Technology Committee" that accelerates mRNA innovation (Petitprez et al., 2020).

Figure 12: Gender



Source: Merck Proxy Report (2024)

Figure 13: Gender and Ethnicity

Source: Merck Impact Report (2024)

Table 5: Gender and Ethnicity

Gender and ethnicity	2019	2020	2021	2022	2023
Women in the workforce	49%	50%	50%	50%	51%
Women on the Board[1]	46%	46%	43%	46%	50%
Women in executive roles[2]	20%	33%	33%	23%	23%
Women in senior management roles[3]	30%	31%	36%	34%	37%
Women in management roles[4]	42%	42%	44%	45%	46%
Members of underrepresented ethnic groups on the Board[1]	23%	31%	21%	15%	17%
Members of underrepresented ethnic groups in executive roles (U.S.)[2]	40%	25%	42%	39%	39%
Members of underrepresented ethnic groups in senior management roles (U.S.)[3]	21%	20%	25%	28%	26%
Members of underrepresented ethnic groups in the workforce (U.S.)	29%	30%	32%	34%	35%
Members of underrepresented ethnic groups in management roles (U.S.)[4]	23%	25%	26%	27%	29%
New hires that were female	51%	50%	53%	52%	53%
Promotions that were female	53%	52%	53%	54%	55%
New hires that were members of underrepresented ethnic groups (U.S.)	35%	40%	46%	47%	47%
Promotions that were members of underrepresented ethnic groups (U.S.)	30%	32%	34%	37%	37%

Source: Merck Impact Report (2024)

3.3 Executive Board

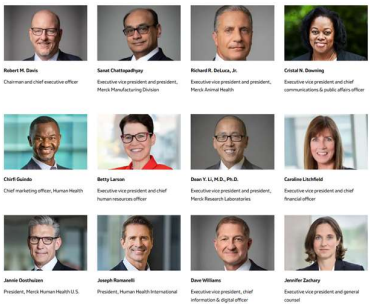
Merck currently has 12 executives responsible for the daily operations of Merck's various areas and businesses.

Robert M. Davis: Chairman and chief executive officer

Sanat Chattopadhyay: Executive vice president and president, Merck Manufacturing Division

- Richard R. DeLuca, Jr.: Executive vice president and president, Merck Animal Health
- Cristal N. Downing: Executive vice president and chief communications & public affairs officer
- Chirfi Guindo: Chief marketing officer, Human Health
- Betty Larson: Executive vice president and chief human resources officer
- Dean Y. Li, M.D., Ph.D.: Executive vice president and president, Merck Research Laboratories
- Caroline Litchfield: Executive vice president and chief financial officer
- Jannie Oosthuizen: President, Merck Human Health U.S.
- Joseph Romanelli: President, Human Health International
- Dave Williams: Executive VP, chief information & digital officer
- Jennifer Zachary: Executive vice president and general counsel

Figure 14: Executive Board

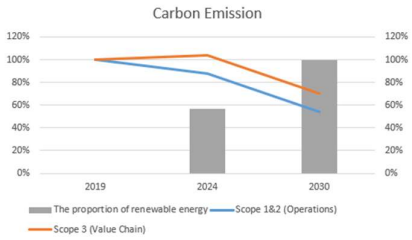


Source: Merck (2024)

3.4 ESG Metrics

ESG, encompassing environmental, social, and governance factors, guides Merck's risk management and sustainability. Its ESG Strategy Management Team prioritizes Access to Health, Employees, Environmental Sustainability, and Ethics and Values. Merck targets equity by 2025, aiming to reach 50 million people in LMICs and underserved populations in high-income countries, with 75% global product coverage and access for 350 million individuals. On workforce inclusion, Merck commits to equal recruitment and promotion opportunities, striving to maintain or improve inclusion metrics by 2025. Environmentally, Merck plans to cut Scope 1 and 2 GHG emissions by 46% by 2030 (currently 12% below 2019 levels), reduce Scope 3 by 30% (currently 4% above), achieve 100% renewable electricity by 2025 (now 57%), and reach net-zero by 2045. Ethics efforts focus on safety, integrity, and accountability, with over 99% Ethics & Integrity training and goals to sustain high reporting willingness. Research shows a 1-point ESG score rise reduces debt costs by 0.5%–1.2% (Wang & Yang, 2024); Merck's emission goals align with carbon pricing, enhancing cash flow stability. Leading ESG pharma firms enjoy 15%–20% higher P/E ratios (Li, 2023), diversity boosts R&D efficiency by 10%–15% (Li, 2024), and Merck's LMIC strategy mitigates costs and saturation risks. Every 10% emerging market revenue growth correlates with 2.3% total revenue increase (Sun, 2023). Ethical training cuts legal losses by 23% (Qiu & Yu, 2023), and ESG-linked incentives advance UN SDGs (Wang & Yang, 2024). Transparent governance reduces agency costs and raises ROA by 0.8%–1.5% (Li, 2024), while full supply chain compliance prevents fines, as environmental breaches cost pharma firms an average 4.7% of revenue annually (Qiu & Yu, 2023).

Figure 15: Carbon Emission



Source: Merck Impact Report (2024)

Table 6: The impact of ESG performance on the financial indicators of pharmaceutical enterprises

Financial indicators	Industry average	Leading ESG enterprises (Top 25%)	Data source
Debt financing cost	4.20%	Reduce 0.5%-1.2%	Wang & Yang (2024)
P/E	22	15%-20%	Li(2023)
The R&D cycle has been shortened.	0	10-15%	Li(2024)
Legal litigation losses (accounting for revenue)	4.70%	Reduce 23%	Qiu & Yu (2023)
Revenue growth contribution from emerging markets	0	Every 10% of the proportion --+2.3% growth rate	Sun (2023)
ROA	0	increase 0.8%-1.5%	Li(2024)

Source: Author`s Analysis & Li, et al. (2024)

4. Industry Overview and Competitive Positioning

4.1 Pharmaceutical Industry Overview

The pharmaceutical industry, a multidisciplinary healthcare sector covering drug discovery, development, production, and commercialization, extends beyond therapy to prevention and health maintenance. Skyquestt (2024) reports the global market grew from $209.85 billion pre-pandemic to $401 billion by 2024, fully recovering from COVID-19 disruptions. It is projected to sustain an 8.1% CAGR from 2023 to 2032, reaching $740.5 billion. The pandemic created divergent impacts, with vaccine developers maintaining stable growth amid economic challenges, highlighting the industry's unique role at the nexus of public health and commercial value creation.

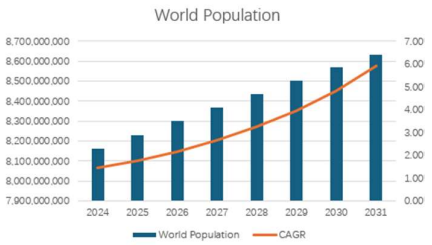
Population Growth

Historical data indicate that the global population grew at an annual rate of 1.2% between 2000 and 2020. However, the UN projections suggest a significant demographic transition in coming decades. From 2024 to 2031, the growth rate is expected to decline to 0.81%, continuing its downward trajectory through 2084. Notably, population growth is projected to turn negative after 2084. This demographic shift will see the global population reach approximately 9.7 billion by mid-century, representing an 18.8% increase from current levels. The slowing growth rate reflects changing fertility patterns and demographic transitions occurring worldwide, with important implications for economic and social systems across all sectors.

Major Trend

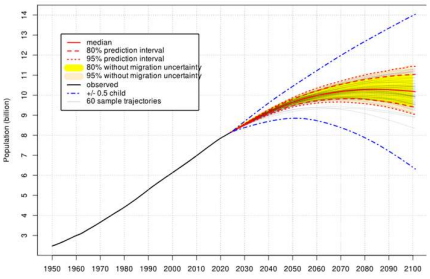
The pharmaceutical industry's future hinges on high-tech transformation driven by digitalization, AI, and big data. AI improves R&D efficiency via target screening—deep learning analyzes 1.7 billion molecules (Leng & Feng 2025)—and optimizes clinical trials with wearable devices, increasing patient participation by 40% (Li, 2024). Prognosis models reach 82% efficacy prediction accuracy (State Information Centre, 2025), shortening development from 5–7 to 3–4 years and cutting R&D costs by 60% (Leng & Feng, 2025). McKinsey projects AI can boost top 10 pharma R&D output by 25% (Liu, 2024). COVID-19 and geopolitical risks raised API supply disruption risk by 37% (CPEMA, 2025); digital supply chains can reduce losses by 45% (CPEMA, 2024). China's DRG/DIP reform caused a 53% generic drug price drop (ZPIRI, 2025), fueling payment innovations like Northland's "efficacy insurance," which increased valuation by 34.9% post-Phase III (Caixin Scotia, 2025). Digital twin technology raised Guorui Pharmaceutical's efficiency 50% (Leng & Feng, 2025), with industry digitalization expected to exceed 65% by 2025, reducing energy use per unit

Figure 16: World population



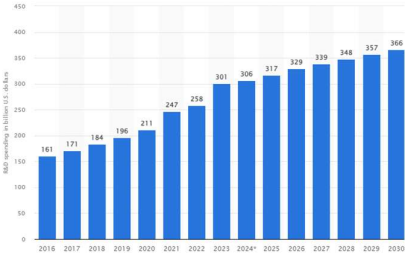
Source: United Nations (2024)

Figure 17: World population



Source: United Nations (2024)

Figure 18: Total R&D Expenditure



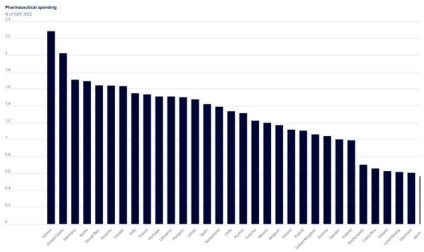
Source: Statista (2024)

by 18% (State Information Centre, 2025). Intelligent manufacturing may add 5–8 margin points; microbial fermentation cuts API carbon footprints 40%, and recycled packaging may reach 80% (CPEMA, 2024). Driven by technology, policy, and market forces, pharma firms must adopt digital infrastructure and agile organizations. Within five years, leaders in AI R&D, digital supply chains, and payment innovation will dominate over 75% of the high-end market.

Global Economic Outlook

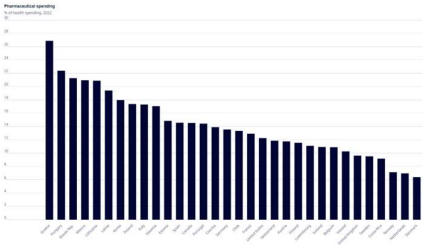
According to OECD statistics, the pharmaceutical industry generally accounts for 0.6%-2.3% of GDP, with Greece reaching the highest at 2.3%, the rapid recovery of the Greek economy is conducive to Merck's business in emerging markets, the United States at 2%, and Germany at 1.7%. As for medical expenditures, many countries exceed the 9% average. This indicator in European and American countries is also gradually rising.

Figure 19: Pharmaceutical spending % of GDP



Source: OECD (2024)

Figure 20: Pharmaceutical spending % of health spending



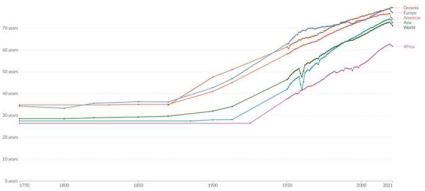
Source: OECD (2024)

4.2 Key Drivers of Profitability

Life Expectancy/Aging of Population

The aging population and rising life expectancy are creating favorable conditions for pharmaceutical companies. Longevity is positively correlated with disease incidence, prompting governments to increase healthcare spending. In China, those aged 60+ account for nearly 80% of total medical expenditures (Wu, 2025), driven by chronic diseases affecting over 80% of the elderly (Bishof N, et al., 2019). By 2030, global healthcare spending will reach 1.135 trillion yuan, growing at 6.8% annually, with elderly care and chronic disease management as key areas (ZPIRI, 2025). Merck's strategic presence in China, Europe, and the U.S. ensures stable future income. Age-related immune decline and chronic disease risks—especially cancer—offer strong revenue prospects, while disease prevention in this demographic further supports Merck's growth.

Figure 21: Life Expectancy



Source: Our World in Data (2024)

R&D

Innovation and new drug development are vital for profitability, especially breakthrough treatments for complex diseases that offer high returns. However, drug development often exceeds expected timelines, increasing investment, and failures in Phase III trials result in sunk costs. Merck, like other pharma firms, has faced many R&D setbacks, with R&D being both a profit driver and major expense. Drug development requires long-term investment and regulatory approval, with risks until market launch. Merck's focus on oncology reflects this high-return, high-cost, high-risk profile.

Patent

During the patent protection period, Merck can sell its drugs with minimal or no competition, allowing the company to recoup R&D costs through premium pricing. However, once the patent expires, generic alternatives enter the market, significantly reducing profitability. The exclusivity period is therefore critical for sustaining long-term profitability. In the near term,

Merck faces a key challenge as the patent for Keytruda—one of its most relied-upon drugs—is set to expire in 2028. This may pressure the company to accelerate the development of new treatments and seek alternative revenue sources.

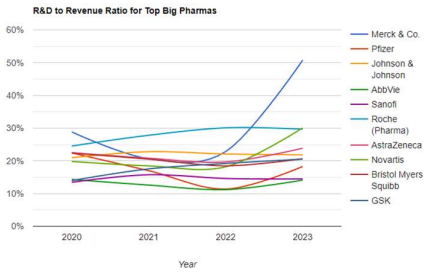
Market Access and Global Expansion

Rising healthcare expenditures in certain countries are creating opportunities in emerging markets like the Asia-Pacific region and Latin America, offering new revenue streams for Merck. China has already emerged as the company's third-largest global revenue source. Notably, the international sales growth of Gardasil—Merck's second best-selling product and a leading HPV vaccine—is driven almost entirely by demand in the Chinese market.

Merger, Acquisitions and Collaborations

Strategic acquisitions of pharmaceutical and biotech companies, whether large or small, enable Merck to broaden its product pipeline and enhance its portfolio to drive profitability. A prime example is the recent acquisition of Prometheus Biosciences, which accelerates Merck's immunology research and unlocks potential breakthroughs. This deal brought MK-7240, a promising new therapy for autoimmune diseases, into Merck's pipeline. By diversifying its product offerings, Merck can distribute costs across a wider range of treatments, improving profit margins and achieving greater economies of scale (Springer Nature, 2024).

Figure 22: R&D to Revenue Ratio



Source: Drug Discover (2024)

4.3 Key Drivers of Cost

Pricing Pressure and Legislation

As healthcare costs continue to grow as a percentage of GDP, as shown in Figure 18, governments will inevitably control drug prices. The risk of drug pricing restrictions and reimbursement cuts will lead to lower profits. The risk of unpredictable side effects from new drugs will lead to litigation costs and compensation.

4.4 Key Drivers of Demand

Growing demand for pharmaceuticals is driven by population growth and aging, especially in high life expectancy countries, increasing needs for chronic disease treatments such as cardiovascular, cancer, and neurological disorders. Changing diets and lifestyles also raise disease prevalence. Expanded global healthcare coverage improves treatment accessibility—China's drug price negotiation system notably enhanced affordability and usage (Caixin Global, 2024). Additionally, rising health education and consumer awareness lead patients to seek pharmaceutical treatments more proactively.

4.5 Key Drivers of Supply

The pharmaceutical supply chain is increasingly globalized, relying on international networks for raw materials, manufacturing, and distribution. Efficient supply chain management is vital for uninterrupted product availability and sales. Technological advances—such as automation, digital

production, and improved transportation—have enhanced manufacturing scale, efficiency, and delivery speed, enabling pharmaceutical companies to meet rising demand while maintaining operational effectiveness.

4.6 PESTLE Analysis

The constant changes in external factors will have a long-term impact on the company's decision-making, which requires the company to study its response plans.

Table 7: Pestle

Political	Economic	Social
Policy changes, especially in the healthcare industry, including pressure and restrictions Price Regulations	Global economic crisis; Changes in GDP, unemployment, taxation and the environment; Increase in per capita healthcare investment; Decrease in consumer disposable income; Price pressures;	Changes in people's medical awareness and social concerns; Growth of the aging population; Cultural changes; Increase in chronic diseases;
Technology	**Legal**	**Environmental**
More innovation and technological developments will impact service delivery, customized treatments, and product marketing; New digital opportunities (apps, social media); Innovations in biotechnology; Developments in machine learning;	High regulatory and legislative restrictions; Changes in advertising laws;	Increased awareness of environmental issues around the world, such as pollution and waste; Enhanced environmental laws. For example, higher pollution emission standards for production processes

Source: Author`s Analysis (2024)

4.7 Legal Framework of the Industry

Patents are crucial pharmaceutical assets granting exclusive rights, but their expiration enables lower-priced generics to enter the market. Drug approval and maintenance undergo strict regulatory oversight: in the U.S., the FDA solely authorizes market eligibility; in Europe, the EMA or national bodies evaluate based on market scope. Globally, companies must meet rigorous quality, safety, and efficacy standards to obtain and sustain marketing authorization, ensuring patient safety and market integrity.

4.8 Industry Segmentation

pharmaceutical ingredients and face high fragmentation, intense competition, capital constraints, and limited pricing power, challenging new entrants without significant investment. Formulation manufacturers convert APIs into finished products, divided into innovative companies—investing heavily in R&D to develop high-risk, high-margin blockbuster drugs—and generic drug firms that offer lower-cost alternatives at 80–90% discounts, competing mainly on price with minimal R&D. Contract research and manufacturing

Figure 23: Launching and maintenance process of medicines in the market

Source: FDA (2024)

Figure 24: Major pharmaceutical companies US

Source: Yahoo Finance (2024)

Figure 25: Major pharmaceutical companies EU

Source: Yahoo Finance (2024)

services (CRAMS) provide R&D and manufacturing for innovative firms but have limited bargaining power due to customer concentration and strict compliance (e.g., KYB). Pharmaceutical distributors manage the supply chain from manufacturers to retailers and consumers, encompassing customs, freight forwarding, wholesalers, and retailers.

Table 8: Peer Group

Name	Ticker	Market Cap	P/S	P/B	P/E	ROA	ROE
AstraZeneca PLC	0A4J	220.37B	5.3	6.2	40.6	7.68%	16.74%
AbbVie Inc	ABBV	359.54B	6.1	32.1	68.6	3.6%	46.8%
Bayer AG	BAYA	24.36B	0.5	0.7	-8.1	3.71%	-3.45%
Bristol-Myers Squibb Company	BMY	110.17B	2.4	3.7	13.4	6.07%	-31.33%
Eli Lilly and Company	LLY	777.43B	25.6	80.3	166.5	13.95%	65.32%
GSK PLC	GSK	74.7B	2.1	4.9	13	7.24%	21.85%
Johnson & Johnson	JNJ	385.53B	4.7	5.8	11.3	8.4%	20.89%
Merck & Co., INC	MRK	258.25B	4.6	7.3	754.9	0.3%	0.87%
Novartis Inc.	NVS	221.05B	5.5	5.5	17.2	9.57%	28.79%
Novo Nordisk A/S	NVO	499.24B	11.8	25.2	32.7	22.8%	88.57%
Pfizer Inc	PFE	159.18B	2.8	1.9	78.1	0.08%	0.18%
Roche Holding Ltd	0TDF	255.01B	4	6.5	20.2	11.9%	32.4%
Sanofi SA	SNY	134.67B	2.8	1.7	23.7	4.2%	7.1%

Source: Yahoo Finance，2024

Comparative Analysis of Merck

Market Share

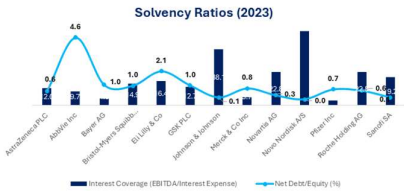
Merck holds a prominent position in the global pharmaceutical market, consistently ranking among the top five pharmaceutical companies worldwide by revenue. In 2024, Merck's total pharmaceutical sales exceeded $60 billion, representing approximately 4.5% of the global pharma market, which was valued at $1.35 trillion.

Sales by Therapeutic Category

Oncology: Merck is the global market leader in immuno-oncology, primarily driven by its blockbuster drug Keytruda (pembrolizumab). In 2024, Keytruda generated over $25 billion in global sales, commanding an estimated 45% share of the PD-1/PD-L1 checkpoint inhibitor market, ahead of Bristol Myers Squibb's Opdivo and Roche's Tecentriq. Its dominance is especially pronounced in the U.S. non-small cell lung cancer segment, where it accounts for over 60% of first-line treatment regimens.

Vaccines: In the HPV vaccine space, Gardasil/Gardasil 9 continues to lead with over 80% market share globally, driven by strong uptake in the U.S., EU, and China. Its only significant competitor is GSK's Cervarix, which has limited global penetration. Animal Health: Merck Animal Health, a top-tier player in the sector, accounts for approximately 18% of the global animal health market, second only to Zoetis. Growth is driven by parasiticides, vaccines, and digital livestock management solutions.

Figure 26: Major Pharmaceutical Companies Solvency Ratios



Source: Yahoo Finance (2024)

Regional Breakdown: Merck maintains a dominant presence in the U.S., where it derives over 40% of its pharmaceutical revenue. In emerging markets such as China and Latin America, Merck's market share is growing steadily, particularly in oncology and vaccines.

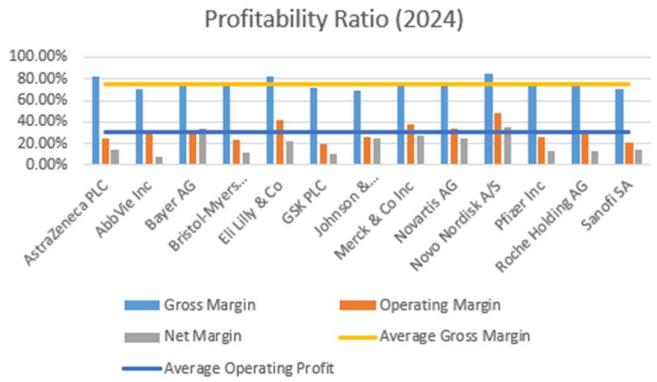
Overall, Merck's market leadership in oncology and vaccines underpins its competitive edge and justifies its premium relative to peers in selected therapeutic areas.

Comparative Analysis

Merck demonstrates strong profitability metrics, particularly due to the high-margin contribution from its blockbuster oncology drug, Keytruda, and its vaccine portfolio.

In 2024: Gross Margin: Merck posted a gross margin of 74.5%, outperforming the industry average of 68%. Operating Margin: Merck's operating margin stood at 31%, slightly below the pharma industry average of 31%, largely due to its elevated R&D investments (approximately 25% of revenue). Net Profit Margin: Merck reported a net margin of 26.68%, higher than Pfizer (18.2%) and close to Bristol-Myers Squibb (22.1%).

Figure 29: Peers Profitability Ratios



Source: Yahoo Finance (2024)

Merck maintains a robust liquidity position, reflecting both its stable cash flow generation and conservative balance sheet management. As of FY2024: Current Ratio: 1.36. Quick Ratio: 0.83. Cash Ratio: 0.47.

These are all comfortably above industry averages, suggesting low short-term solvency risk. The industry averages are: Average Current Ratio (Pharma): 1.13. Average Quick Ratio: 0.76. Average Cash Ratio: 0.36

Figure 31: Peers Liquidity Ratios

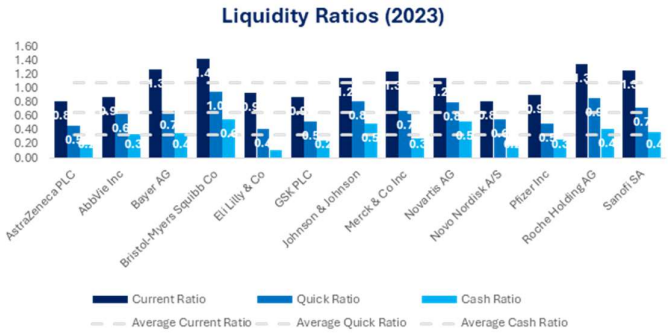
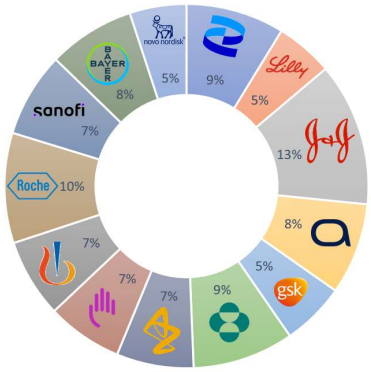


Figure 27: Market Share Major Pharmaceutical Companies

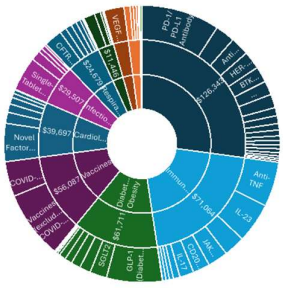


Source: Statista (2024)

Figure 28: Risk Rating-Sustainalytics

Source: Statista (2024)

Figure 30: Market Share by Therapeutic Category

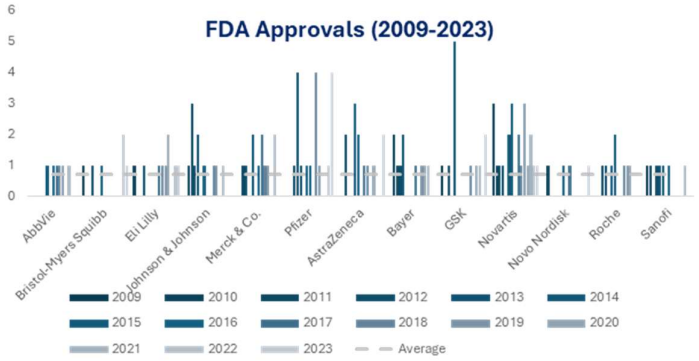


Source: Statista (2024)

Source: Yahoo Finance (2024)

According to Sustainalytics, Bayer and Abbvie lead ESG ratings, with Bayer also top in Bloomberg's ranking. Merck's Sustainalytics risk score is 23.1, indicating medium risk and average industry performance. Key improvement areas include expanding Gadosi vaccine access in low-income countries, achieving carbon neutrality for Scope 1 and 2 emissions by 2025, and promoting gender equality in leadership (43% women managers). Merck's integrated ESG strategy positively impacts its valuation and stakeholder perception. In 2023–2024, Merck maintained strong regulatory productivity with 7 FDA approvals in 2023 (including Keytruda's expanded indications) and 4 approvals YTD in 2024 (e.g., V116 pneumococcal vaccine). Compared to Pfizer's 5 approvals in 2023 focused on rare diseases and RSV and BMS's 3 label expansions, Merck's high approval rate demonstrates robust pipeline strength and regulatory execution, underpinning long-term revenue sustainability.

Figure 34: FDA Approvals



Source: FDA (2024)

The proportion of R&D sales of Bristol-Myers Squibb and Merck has remained high over the years. In particular, Merck's major acquisition in 2023 caused R&D costs to soar to the highest level in nearly 14 years, which also reflects Merck's determination to provide room for future sales growth.

4.9 SWOT Analysis of Merck

SWOT analysis enables investors and Merck to assess its strengths—global reach, robust finances, leading R&D, substantial investments, and diverse portfolio—alongside weaknesses such as Keytruda dependency, R&D setbacks, patent and regulatory risks, and competition. Opportunities include mergers, partnerships, digital transformation, and emerging market growth, while threats encompass these internal vulnerabilities and broader macroeconomic challenges impacting the sector.

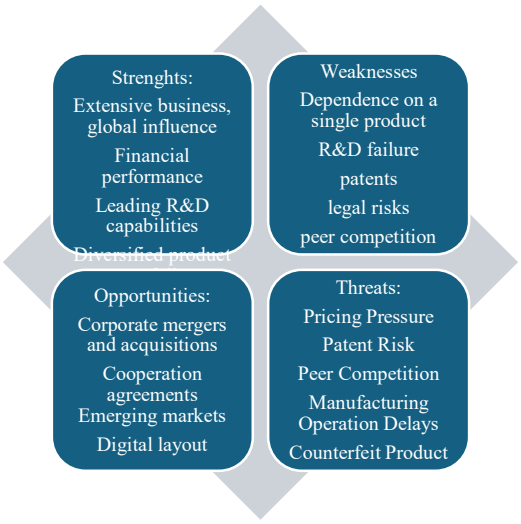
Figure 32: ESG Disclosure Score-Bloomberg

Source: Statista (2024)

Figure 33: Market Share Major Pharmaceutical Companies

Source: Statista (2024)

Figure 35: SWOT



Source: Author`s Analysis (2024)

Figure 36: Market Share Major Pharmaceutical Companies

Source: Wikipedia (2024)

- Strengths

Merck’s revenue mainly comes from the U.S., with 22% from EMEA, 11.32% from China, 5.26% from Japan, 5.37% from Asia Pacific (excluding China and Japan), 5.13% from Latin America, and 3.5% from other regions, showing broad geographic coverage that reduces dependence on any single area. Market share is gradually rising in developed markets and China, offering growth potential. In 2023, Merck employed 21,800 in R&D and invested $30.5 billion, producing over 1,400 publications. That year, acquisitions of Prometheus and Imago Biosciences enhanced R&D in autoimmune and bone marrow disorders, while collaboration with Daiichi Sankyo on antibody-drug conjugates strengthened oncology efforts, underscoring R&D as a key competitive edge and barrier to competition. Overall financial performance improved, though acquisition-related costs caused some declines; excluding these, net profit steadily grew. Dividends rose consistently year-on-year, increasing shareholder returns and attracting investors seeking stable income.

- Weaknesses

Merck's revenue heavily depends on blockbuster drugs like Keytruda and Gardasil, which represent both its core strength and a potential vulnerability. Any demand fluctuation or adverse developments could significantly impact sales. Keytruda faces multiple challenges as its 2028 patent expiration approaches—generic competition and rival PD-1 inhibitors (including Opdivo and Imfinzi) threaten Merck's market dominance in cancer immunotherapy.

Regulatory barriers further complicate Merck's position in certain markets. In countries like India, where product patent protections are limited, the company struggles to compete against generic manufacturers. These combined factors—patent cliffs, therapeutic competition, and legal constraints—create substantial risks to Merck's future earnings stability.

- Opportunities

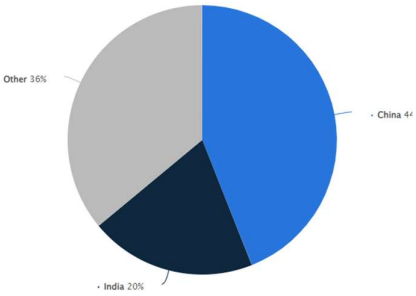
Merck's growing presence in China has delivered consistent year-over-year sales growth, demonstrating the strategic value of its Asia-Pacific expansion. With the region's massive population of 4.4 billion, further development of these markets represents a significant growth opportunity for the company.

Merck has actively pursued strategic acquisitions and partnerships to accelerate its market access and technological capabilities. In 2024, the company strengthened its oncology portfolio through the acquisition of CN201, a promising therapy for B-cell malignancies and autoimmune diseases. That same year, Merck entered into a collaboration agreement with Exelixis, Inc. to investigate combination therapy approaches - specifically evaluating a tyrosine kinase inhibitor (TKI) alongside Keytruda in a Phase III clinical trial for head and neck squamous cell carcinoma (HNSCC) (Merck, 2024). These strategic moves demonstrate Merck's commitment to expanding its therapeutic reach through both internal development and external innovation.

- Threats

Merck's revenue is primarily from the U.S., with 22% from EMEA, 11.32% from China, and smaller shares from Japan, Asia Pacific, Latin America, and others, reflecting broad geographic diversification and growing market share in developed regions and China. In 2023, Merck invested $30.5 billion in R&D with 21,800 employees and over 1,400 publications. Acquisitions of Prometheus and Imago Biosciences boosted R&D in autoimmune and bone marrow disorders, while partnering with Daiichi Sankyo on antibody-drug conjugates enhanced oncology, highlighting R&D as a core competitive advantage. Financial performance improved overall despite acquisition costs, with net profit growing when excluding those expenses. Dividends increased yearly, enhancing shareholder returns and attracting income-focused investors.

Figure 37: API production volume worldwide



Source: Statista (2024)

4.10 Porter´s 5 Forces- Pharmaceutical Industry

Bargaining Power of Suppliers – Weak (2)

As a global pharmaceutical leader, Merck controls much of its supply chain by producing many APIs, chemicals, and raw materials in-house, reducing supplier dependence, though some imported materials remain necessary. Smaller manufacturers lacking vertical integration face greater supplier leverage, as suppliers also provide essential R&D services and specialized equipment. However, Merck's scale and purchasing power minimize supplier risks, as most suppliers operate in a competitive, standardized market and are relatively easy to replace, giving Merck strong bargaining power and limiting supplier threats in contract negotiations.

Bargaining power of buyers-Medium High (4)

In the pharmaceutical industry, buyers hold significant bargaining power that affects Merck's operations. Key customer hospital networks, distributors, government agencies like NHS and NHSA, and insurers—strongly influence

pricing. For example, China's centralized procurement cut Keytruda's annual treatment cost to $22,640, the lowest globally, with negotiated drugs averaging 50.64% price reductions. Large insurers also pressure pricing through formularies and reimbursement policies, limiting Merck's pricing flexibility and margins. Additionally, crowded therapeutic areas with overlapping R&D pipelines reduce patient brand loyalty, while low switching costs enable providers and payers to demand better terms, sustaining downward pressure on Merck's drug prices.

Threat of New Entrants – Weak (2)

The pharmaceutical industry's high technological and capital barriers limit new entrants, primarily due to massive R&D costs, long clinical trials, and strict regulatory approvals. Startups often lack the financial resources and scientific talent needed for such prolonged, complex development. Merck's strong market position adds further advantages—decades of brand equity, a global distribution network, and a robust patent portfolio—that startups cannot easily match. While startups may disrupt niche areas, overall, industry complexity, regulation, and required infrastructure sustain Merck's competitive insulation from most new competitors.

Threat of Substitutes – Medium High (4.5)

Although high industry barriers limit new entrants, Merck faces significant substitution threats from existing players. Patients and providers easily switch among alternatives from established firms, especially as generic drugs enter at much lower prices post-patent expiration, bypassing original R&D costs. This threat is heightened by biotech innovations like gene editing and cellular therapies from specialized firms, offering new treatment modalities that may gradually replace traditional drugs. Merck must adapt its product strategy to stay competitive amid this evolving landscape.

Rivalry Among Existing Competitors – Medium High (4)

The pharmaceutical competitive landscape is currently characterized by an oligopolistic structure, dominated by a dozen multinational corporations alongside specialized biotechnology firms. While these major players operate in overlapping therapeutic areas, the industry has reached relative pricing equilibrium among established competitors.

Large pharmaceutical companies routinely acquire smaller firms to neutralize potential threats, maintaining a carefully balanced competitive environment. However, this equilibrium remains vulnerable to disruption should any competitor develop transformative therapies capable of capturing significant market share.

To safeguard its market position, Merck must sustain substantial R&D investments to maintain technological leadership. This strategic focus positions the company to either develop breakthrough treatments itself or effectively respond to innovations by rivals that could potentially reshape the industry's competitive dynamics.

5. Investment Summary

Through comprehensive financial forecasting spanning six years and the application of five distinct valuation models, we have established a **Hold** recommendation for Merck's 2026 valuation with a target price of $83.06 per share. When compared to May 312025, closing price of $76.84, this analysis indicates the stock is currently undervalued, presenting a projected upside potential of 8.09% and an estimated annualized return rate of approximately 5.32%. After careful consideration of prevailing industry conditions, market dynamics, and macroeconomic factors, we have determined that this **Hold** recommendation carries a medium risk profile.

Merck's comparative performance relative to industry peers remains at a median level, a position that appears fundamentally linked to two key operational factors: the deceleration of sales growth observed during fiscal year 2023, coupled with inventory accumulation and softening demand for the Gardasil vaccine within the Chinese market.

The current valuation yields a moderate target price due to several constraining factors: conservative projections of future revenue growth, uncertain sales trajectories for products beyond Keytruda (which is expected to maintain stable growth until its 2028 patent expiration), and volatility in the animal health care segment. Additional macroeconomic headwinds include unpredictable US economic policies, rising trade protectionism, and projected GDP slowdowns across major markets (US, Europe, and China). While Merck's overall revenue is anticipated to grow, the pace will likely decelerate. The company faces particular challenges in China, where Gardasil (Merck's second-largest revenue generator) confronts weak vaccine demand and inventory reductions among distributors (Michael, 2024). Offsetting these pressures is the recent US approval of Winrevair for pulmonary arterial hypertension (affecting approximately 40,000 patients), which analysts project could generate up to $7.5 billion in annual sales (Peter, 2024), representing a significant potential growth driver amidst broader market uncertainties.

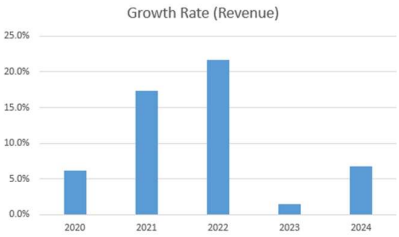
Merck is diversifying its portfolio by expanding into cardiovascular and rare diseases, highlighted by Winrevair's projected $4.9 billion sales by 2029. The company is strengthening its pipeline through partnerships like that with Tongrun Biotech to co-develop CN201, targeting B-cell malignancies and autoimmune disorders. These strategic investments and rising R&D spending reflect Merck's deliberate effort to maintain industry leadership and long-term competitiveness amid evolving market challenges, positioning it to sustain market dominance while meeting future healthcare needs.

The current macroeconomic landscape presents significant challenges for Merck, characterized by geopolitical volatility, the potential implications of a Trump administration's economic policies, rising trade protectionism in the United States, and fragile global economic recovery prospects. These factors have contributed to Merck's share price decline from $128.97 on May 31,

Figure 38: Price Target vs Current Price

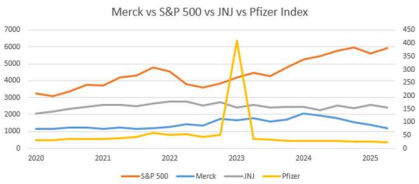
Source: Author`s Analysis & Merck Financial Report (2024)

Figure 39: Growth Rate (Revenue)



Source: Merck Financial Report (2024)

Figure 40: Merck VS Peers VS S&P 500



Source: Yahoo Finance (2024)

2024 to $76.84 on May 31, 2025. We focused on adjusting MRP, Risk free rate, cost of debt and terminal growth rate in the valuation model to ensure that our valuation model is in line with the current macroeconomic situation. Our analysis projects a modest 8.09% upside potential for Merck's stock, reflecting a balanced assessment of current market conditions, with a best-case scenario potentially reaching 22.7% growth, leading us to maintain a Hold recommendation. The impending 2028 patent expiration of Keytruda - Merck's flagship product currently without market-ready alternatives - presents additional headwinds that may further dampen market sentiment. While Merck demonstrated strong revenue growth during the pandemic years (2021-2022), performance weakened in 2023, and though 2024 shows improvement, Gardasil's persistent underperformance in China - Merck's second-largest revenue stream - introduces substantial earnings volatility. On a positive note, Merck has demonstrated consistent dividend growth, maintaining a steady $0.16 annual increase per share over the past three years. While this absolute amount is expected to continue, the corresponding growth rate will gradually decline as the dividend base expands. This comprehensive evaluation suggests Merck faces a complex operating environment where the projected 9.47% growth represents a median outlook between conservative estimates and more optimistic scenarios.

Figure 41: Scenarios Based on Revenue

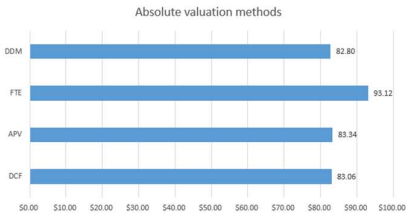
Source: Author`s Analysis & Merck

Valuation Methods

Our analysis employed both absolute and relative valuation methodologies, yielding a valuation range of $82.79 to $93.12 per share. We consider the absolute valuation approach to be more reliable and accordingly place greater emphasis on its results. Within this framework, Flow-to-Equity (FTE) produced the highest target price of $93.11 per share. The elevated valuation results from the Flow-to-Equity (FTE) approach can be attributed to two key factors: First, FTE exclusively considers cash flows attributable to shareholders, and Merck's high dividend payout ratio (approximately 50% in 2024) directly amplifies the shareholder cash flow measure. More fundamentally, FTE directly yields equity value by discounting levered cash flows at the cost of equity, whereas the WACC/APV approaches first derive enterprise value (EV) and then adjust for net debt and other obligations to arrive at equity value - this structural difference in valuation methodology constitutes the primary reason for FTE's higher valuation output.

While the Dividend Discount Model (DDM) analysis generated the most conservative estimate at $82.79 per share. Based on the collective findings from all five valuation models implemented in our study, we have arrived at a **Hold** recommendation for the Merck.

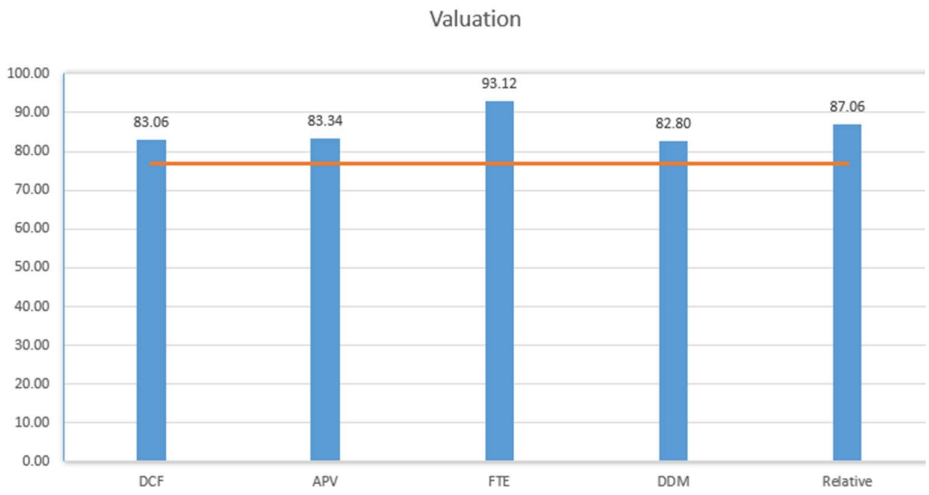
Figure 42: DCF Valuation Relevant Rate



Source: Author`s Analysis & Merck Financial Report 2024 (2025)

6. Valuation

Figure 43: Valuation



Source：Author`s Analysis & Merck Financial Report 2024 (2025)

We issue a **Hold** rating on MERCK with a 2026 target price of $83.06, which represents a 8.07% upside potential from the closing price of $76.84 per share on May 31, 2025. We believe Merck's stock price is undervalued. Our forecast is mainly based on DCF analysis, with reference to Adjusted Present Value (APV), Flow to Equity (FTE), Dividend Discount Model (DDM) and relative valuation. 1. Discounted Cash Flow 2. Adjusted Present Value 3. Free Cash Flow to Equity 4. Dividend Discount Model 5. Relative Valuation.

Table 11: Revenue Forecasted

Revenue						
Years Ended December 31	2025	2026	2027	2028	2029	2030
	Total	Total	Total	Total	Total	Total
Pharmaceutical:						
Oncology	33224.83	33731.86	34255.99	34798.97	35362.77	35949.69
Vaccines	13379.85	13781.42	14199.78	14635.25	15088.20	15559.02
Hospital Acute Care	3392.63	3469.93	3550.01	3632.98	3718.95	3808.04
Cardiovascular	1399.07	1846.83	2571.74	3749.52	5667.49	8795.51
Virology	1742.52	1716.76	1691.72	1667.36	1643.67	1620.64
Neuroscience	212.57	203.53	194.88	186.60	178.67	171.07
Immunology	652.88	649.17	645.87	642.95	640.38	638.14
Diabetes	2243.54	2229.53	2226.31	2233.30	2250.00	2275.99
Other pharmaceutical	2511.00	2511.00	2511.00	2511.00	2511.00	2511.00
Total Pharmaceutical segment sales	58758.87	60140.04	61847.30	64057.92	67061.13	71329.11
Animal Health:						
Livestock	3538.87	3618.50	3699.91	3783.16	3868.28	3955.32
Companion Animals	2488.48	2563.13	2640.03	2719.23	2800.81	2884.83
Total Animal Health segment sales	**6027.35**	**6181.63**	**6339.94**	**6502.39**	**6669.09**	**6840.15**
Total segment sales	64786.22	66321.67	68187.25	70560.31	73730.22	78169.26
Other	928.87	968.34	1009.50	1052.40	1097.13	1143.76
Total Revenue	**65715.09**	**67290.02**	**69196.74**	**71612.71**	**74827.35**	**79313.02**

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Discounted Cash Flow-WACC Method

According to relevant cases, Merck is suitable for adopting the DCF valuation model. DCF-WACC is widely used for mature pharma firms with established products. For example, Pfizer's valuation during its COVID-19 vaccine rollout relied on DCF to model post-pandemic cash flows, similar to Merck's

Table 9: Valuation Methodologies

Valuation	2026 YE
DCF	83.06
APV	83.34
FTE	93.12
DDM	82.80
Relative	87.06

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Table 10: DCF Valuation Relevant Rate

DCF	Rate	Source
Risk Free rate	4.1%	Pablo Fernandez et al (2025)
MRP	5.50%	Statista Historical Average
Equity Beta	0.87	Yahoo Finance (2025)
Cost of Equity	8.84%	
Cost of Debt	4.45%	NYU Stern (2025)
Tax	21%	Merck Financial Report (2024)
WACC	8.38%	

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Table 12: DCF Target Price

Enterprise Value	229652.95
Net Debt	22250.40
Operating Lease	1322.41
Non-Core Invested Capital	6066.48
Non-Controlling Interests	23.67
Equity Value	**212122.96**
Shares Outstanding	2554.00
Price	**83.06**

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

approach for Keytruda® 's post-peak performance (Zhang & Hu, *2021) (*Caishui Free*, 2020)*. On the other hand, according to the industry benchmark, pharmaceutical firms with annual revenue >50B (Merck: 64B in 2024) typically show DCF-WACC convergence due to stable FCF margins (~25-30%). This is supported by regression analyses of S&P 500 pharma stocks (Yingjiazhilu, 2025).

Table 13: DCF Model

DCF Model								
	2024	2025	**2026**	2027	2028	2029	2030 Terminal	
FCFF	18,299.56	10,870.39	**13,444.92**	14,300.77	14,277.95	14,886.77	15,356.32	250,381.96
WACC	8.38%	8.38%	**8.38%**	8.38%	8.38%	8.38%	8.38%	8.38%
Present Value	18,299.56	10,029.99	**11,446.39**	11,233.75	10,348.71	9,955.80	9,475.84	154,501.89
PV(FCF)-VL	216,992.37	224,303.63	**229,652.95**	234,594.65	239,973.23	245,193.66	250,381.96	
(-)Net Debt	25,076.36	24,778.40	**22,250.40**	20,102.75	17,212.70	14,791.40	12,284.09	
(-) Operating Lease	2,160.89	1,721.57	**1,322.41**	995.74	695.26	205.29	205.29	
(-) Non core Investment	5,268.00	5,653.54	**6,066.48**	6,384.52	6,751.68	7,107.74	7,548.59	
(-) Non-Controlling Interests	16.00	23.11	**23.67**	25.80	27.13	29.02	31.44	
Equity Value	184,471.12	192,127.01	**212,122.96**					
Target Price (DCF Model)			**83.06**					

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

The first valuation method to calculate Merck's target price is the discounted cash flow method. I will calculate the free cash flow using the following formula $FCFF = NOPAT + D\&A - CAPEX - \Delta Net\ WC$. And apply the calculated WACC=8.38% as the discount factor to discount the FCFF.

Key Value Drivers and Their Incorporation into the Model:

1. Income growth is based on historical trends, industry outlook, and analyst consensus, directly impacting NOPAT and working capital. It flows through to EBIT, with NOPAT derived post-tax.
2. Operating profit margin (NOPAT) reflects cost control, pricing, and R&D intensity. EBIT margin is applied to revenue to estimate NOPAT after tax.
3. Depreciation and amortization follow historical CAPEX and asset lifespans, typically modeled using past D&A/revenue ratios or guidance.
4. CAPEX reflects Merck's reinvestment needs (e.g., R&D, manufacturing), projected as a revenue percentage or per strategic plans.
5. Δ Net working capital tracks changes in receivables, inventory, and payables, modeled as a revenue ratio, with annual shifts adjusting FCFF.
6. Discounting process: The predicted FCFF was discounted using WACC (8.38%) to reflect the risk-adjusted cost of capital. The final value is calculated using the Gordon growth model, and the assumption of the sustainable growth rate conforms to the long-term trend of the industry.

The data for the **risk-free rate** comes from 1079 finance professors, analysts, and company managers. The average risk-free rate in the United States is 4.1%, and this rate is mainly applied because Merck is a US company with its main business located in the United States.

Appendix 12 also lists the 5-year and 10-year average values of 5-year and 10-year US Treasuries and the current yields of US Treasuries

We finally decided to use the average of 1,079 data collected from the Pablo Fernandez questionnaire survey because it is the most liquid among all alternatives, relatively close to the current yield of US Treasury bonds and provides a certain degree of flexibility for future interest rate changes.

Table 14: Risk Free Rate

Risk Free Rate		
Treasury Yield 10 Years	Spot Price	4.31%
Treasury Yield 10 Years	5 Years Average	2.69%
Treasury Yield 10 Years	10 Year Average	2.48%

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

For the **beta coefficient**, we used the average of Merck's own beta coefficient and its competitors' beta coefficients. Specifically, I adopted the Beta data of a total of seven pharmaceutical companies, including Merck itself, and calculated the average value to be 0.8. The beta values of the seven companies ranged from 0.4 to 1.18, with a median of 0.77.

The **market risk premium** is based on Statista's historical average for the US market, which is 5.5%.

The **cost of debt** was calculated by determining the interest coverage ratio to derive the credit spread, which was then applied to the risk-free rate of 4.1% with an additional credit spread of 0.35%, yielding a final cost of debt of 4.45% for Merck. This 4.45% figure is adopted as Merck's cost of debt in our valuation model.

Terminal Growth Rate & Terminal value

We set the terminal growth rate to 2.12% based on the following factors:

The average long-term GDP growth rate of OECD members is 1.5%.

The average long-term GDP growth rate of Emerging countries is 3.7%.

Our terminal value is based on the perpetual growth model, with a terminal value WACC of 8.52% and a perpetual growth rate (g) of 2.12%. Our equity value reaches $188,864.7Mn and the number of shares outstanding is 2,544Mn.

The ROE value is not used because it is too high, exceeding 2.5%, while the ROC value is close to the value we obtained. Therefore, we compromised and chose the weighted average of the OECD and Emerging countries.

Based on Merck's revenue share in various regions around the world in 2024, it is concluded that developed markets accounted for 72% and emerging markets for 28%. The reasons for adopting this calculation method are as follows: In its 2023 report, Evaluate Pharma assumed that Pfizer's terminal growth rate would be a compound growth rate of 1.5% in "the United States + Europe", 3.0% in emerging markets, and an implied weighted growth rate of approximately 1.8%(Chen, 2022). According to Global Pharma Valuation Practices (2023), regional economic growth rate weighting is the mainstream method for the valuation of pharmaceutical enterprises, which can reduce the forecast bias of a single market (Lai, 2009).

Capex and D&A

For the calculation of depreciation, we assume that the useful life of Land and construction in progress is infinite, and the useful life of Buildings and Machinery, Equipment & Office furnishings is 32.5 years and 9 years respectively from the annual financial report. We consider the new depreciation and the depreciation of some assets that have been fully depreciated. In capital expenditure, we use the average proportion of PPE to Revenue in the past ten years to calculate the Total PPE in 2030 and calculate the CAGR with the Total PPE in 2030 and 2023. The change of intangible assets follows the growth rate of Revenue, while taking into account the impact of amortization. As the company will continue to grow during the forecast period, capital expenditure will also increase.

Table 15: Calculating Beta

Beta	Ticker	Market Cap (Equity Value)	Net Debt	Levered Beta	D/E	Unlevered Beta
Merck	MRK	259,362.00	29,348.30	0.58	0.11	0.53
AstraZeneca PLC	AZN	222,389.00	21,129.00	1.13	0.10	1.05
Bristol-Myers Squibb Co.	BMY	113,068.00	12,360.00	1.07	0.11	0.98
Eli Lilly and Co	LLY	494,310.00	22,389.40	0.68	0.05	0.66
Pfizer Inc	PFE	158,933.00	17,552.00	0.44	0.11	0.40
Sanofi	SAN	112,261.00				
Novo Nordisk	NVO	3,452,603.00		1.18		1.18
Novartis	NOVN	211,804.00				
Union Chimique Belge	UCB	19,923.00				
Johnson & Johnson		384,945.00	16,000.00	0.80	0.04	0.77
Corporate Tax	21%				Average	0.80
					Median	0.77

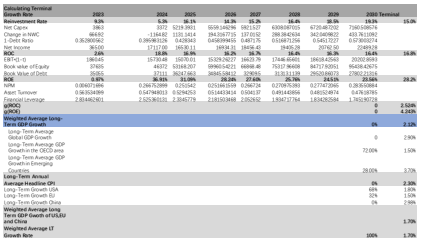
Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Table 16: Calculating Cost of Debt

	Cost of Debt	
Interest Rate	1.98%	
Credit Spread	**4.45%**	
Interest Coverage	15.68528718	
Spread	0.35%	Damodaran
Risk Free Rate	4.10%	
Industry Cost of Debt	7.58%	Damodaran
Average of Credit Spread and Industry Rd	6.02%	

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Table 17: Calculating Terminal Growth Rate



Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Net Working Capital

Accounts receivable is based on the historical average of the past ten years, accounts payable is extrapolated based on the historical average ratio to COGS, and inventory follows the annual growth rate of Revenue.

Adjusted Present Value

We also used the APV valuation method, which resulted in an equity value of $216328.98Mn and a target price of $83.33 per share. This method takes into account the unlevered value and tax shield value, reflects the impact of capital structure on stock prices, and all components that may affect stock prices are taken into account. Due to consideration of the tax shield value, the target price is higher than the results of the other four valuations.

The enterprise value is equal to the discounted sum of FCFF from 2027 to 2030, with a discount rate of 8.46%

The reason for adopting APV is that Merck has a large number of mergers and acquisitions. The APV method is irreplaceable in the major capital structure changes of pharmaceutical enterprises.

For instance, after the $43 billion acquisition of Seagan, Pfizer's debt-to-EBITDA ratio rose from 1.2 to 3.5 times after the transaction was completed. In this merger and acquisition, the logic of the APV approach is to assess Seagen's independently operated cash flow (such as ADC drugs Padcev, Enhertu, etc.) and eliminate the impact of debt. Meanwhile, the APV method takes into account the tax shield, and the interest on the newly added debt is tax-deductible. Ultimately, Pfizer actually paid a 37% premium, reflecting the market's recognition of Seagen's unleveraged value (1.2 times EV/EBITDA) and tax shield under the APV framework (Pfizer Inc., 2023).

Table 18: APV Target Price

Enterprise Value	226725.33
Value of Tax Shield	3620.08
Net Debt	22250.40
Operating Lease	1322.41
Non-Core Invested Capital	6066.48
Non-Controlling Interests	23.67
Equity Value	**212815.42**
Shares Outstanding	2554.00
Price	**83.33**

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Table 19: Calculating FCFF

Calculating FCFF							
	2024	2025	2026	2027	2028	2029	2030 Terminal
FCFF	**18,299.56**	**10,870.39**	**13,444.92**	**14,300.77**	**14,277.95**	**14,886.77**	**15,356.32**	**250,381.9**
NOPAT	16,007.74	13,469.94	15,458.24	16,724.03	17,437.63	18,704.19	19,739.89	
+ D&A	4,499.00	3,750.99	3,740.15	3,635.28	3,436.79	3,245.11	3,210.69	
- NWC.change	-1,164.82	1,131.14	194.32	137.02	288.38	342.04	433.76	
- CAPEX	3,372.00	5,219.39	5,559.15	5,921.53	6,308.09	6,720.49	7,160.51	

Table 20: APV Model

APV Model								
	2024	2025	2026	2027	2028	2029	2030 Terminal	
FCFF	18,299.56	10,870.39	**13,444.92**	14,300.77	14,277.95	14,886.77	15,356.32	247,197.57
Ru	8.46%	8.46%	**8.46%**	8.46%	8.46%	8.46%	8.46%	8.46%
g								2.12%
Present Value u	18,299.56	10,022.53	**11,429.37**	11,208.70	10,317.96	10,757.92	10,231.68	164,703.93
Vu	214,188.39	221,437.50	**226,725.33**	231,604.65	236,919.55	242,075.26	247,197.57	
Tax Shield	270.72	276.07	**271.54**	256.98	245.72	236.87	230.29	
V Tax Shield	3,562.76	3,588.08	**3,620.08**	3,669.35	3,734.04	3,813.05	3,707.12	
(-) Net Debt	25,076.36	24,778.40	**22,250.40**	20,102.75	17,212.70	14,791.40	12,284.09	
(-) Operating Lease	2,160.89	1,721.57	**1,322.41**	995.74	695.26	205.29	205.29	
(-) Non-Core Invested Capital	5,268.00	5,653.54	**6,066.48**	6,384.52	6,751.68	7,107.74	7,548.59	
(-) Non-Controlling Interests	16.00	23.11	**23.67**	25.80	27.13	29.02	31.44	
Equity Value	185,245.89	192,848.97	**212,839.09**	207,790.99	215,993.95	223,783.89	230,866.73	
Share Outstanding	2,554.00	2,554.00	**2,554.00**	2,554.00	2,554.00	2,554.00	2,554.00	
Target Price (APV Model)			**83.34**					

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Flow-To-Equity

Merck's 2024 debt-to-asset ratio is 60.4% (liabilities: $70.734Bn), with cyclical debt such as long-term bonds, making the FTE method suitable for isolating equity cash flows from debt costs. The 2023 Pfizer–Seagen acquisition validates FTE feasibility under complex capital structures:

analysts used a 10.2% Re (based on Pfizer's β) to discount FCFE tied to Padcev, supporting a $43Bn valuation (Pfizer, 2023). Unlike DCF and APV, which derive FCFF from NOPAT, FTE uses net income to compute FCFE, capturing non-operating items. Merck's stable yet slightly fluctuating capital structure still impacts valuation. The model applies an 8.84% Re (risk-free rate plus β × market premium) and yields a 2026 target price of $93.12, closely aligning with DCF and APV outcomes.

Table 21: FTE Target Price

Equity Value	**237820.19**
Shares Outstanding	2554.00
Price	**93.12**

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Table 22: Calculating FCFE

Calculating FCFE							
FCFE	**15,023.18**	**13,067.22**	**13,518.92**	**14,097.09**	**14,649.21**	**15,152.83**	**16,387.05**
NI	17,117.00	16,530.11	16,934.31	18,456.43	19,405.28	20,762.50	22,489.28
(+) D&A	4,499.00	3,750.99	3,740.15	3,635.28	3,436.79	3,245.11	3,210.69
(-) NWC,change	-1,164.82	1,131.14	194.32	137.02	288.38	342.04	433.76
(-) Capex	3,372.00	5,219.39	5,559.15	5,921.53	6,308.09	6,720.49	7,160.51
(+) Net Borrowing	2,056.00	-863.34	-1,402.08	-1,936.08	-1,596.39	-1,792.25	-1,718.65

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Table 23: FTE Model

FTE Model								
	2024	2025	**2026**	2027	2028	2029	2030	Terminal
FCFE	15,023.18	13,067.22	**13,518.92**	14,097.09	14,649.21	15,152.83	16,387.05	265,309.83
Re	8.84%	8.84%	**8.84%**	8.84%	8.84%	8.84%	8.84%	
g								2.1%
Present Value	15,023.18	12,006.07	11,412.40	10,934.07	10,439.61	9,921.59	9,858.39	
EV	224,181.49	230,928.52	**237,820.19**	244,742.81	251,725.15	258,821.02	265,309.83	
Share Outstanding	2,554.00	2,554.00	**2,554.00**	2,554.00	2,554.00	2,554.00	2,554.00	
Target Price (FTE Model)			**93.12**					

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Dividend Discount Model

A two-stage DDM is applied, with a 5.91% growth rate to 2030 based on historical trends, followed by 3.2% aligned with 2025–2030 dividend growth. While Merck's earnings outlook remains strong, current data does not justify further DPS increases, reflecting capital allocation discipline. Using an 8.84% Cost of Equity, the target price is $82.79. DDM suitability is supported by Merck's 38-year dividend growth record since 1986 and a 10-year CAGR of 5.5%. In 2024, Merck's DPS was $3.2, FCF/share $6.77, and a 47.25% payout ratio—well below Pfizer (86.14%) and Novartis (57.72%)—underscoring dividend sustainability (Lixingren, 2025; Merck, 2025; Finance Charts, 2025).

Table 24: DDM Target Price

Present Value of Sum of Stage 1 Dividend	**14.00**
Stage 2 Dividend	4.60
Stage 2 Terminal Value	105.08
Stage 2	**68.80**
Price	**82.80**

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Table 25: DDM Model

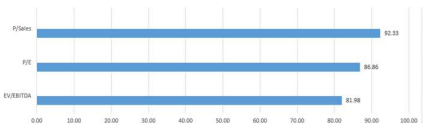
Dividend Discount Model								
	Stage 1	Stage 2	Stage2 (Adjusted)					
Dividend Growth Rate	5.91%	4.46%	4.46%					
	0	1	**2**	3	4	5	6	
Stage 1	2024	2025	**2026**	2027	2028	2029	2030	Terminal
Dividend Per share	3.12	3.304306482	**3.499500425**	3.70622498	3.92516129	4.157030735	4.402597309	
Cost of Equity	8.84%	8.84%	**8.84%**	8.84%	8.84%	8.84%	8.84%	
PV of Dividend	3.12	3.04	**2.95**	2.87	2.80	2.72	2.65	
PV of Sum of stage 1 Dividend	17.50	14.38	**14.00**					
Year 6 Divident*(1+stage 2 r)	4.60	4.60	**4.60**					
Stage 2 Terminal Value	105.08	105.08	**105.08**					
PV of stage 2 Terminal Value	63.21	68.80	**68.80**					
Tartget Price (DDM)			**82.80**					

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Relative Valuation

The pharmaceutical industry, particularly large firms like Merck, features stable profits and predictable cash flow conditions well-suited for relative valuation (Yidao Investment Research, 2025; Merck, 2024). Merck's top five global position, reliance on stable revenue from Keytruda, and risk diversification across vaccines, oncology, and autoimmune drugs meet the criteria for comparability. While DCF reflects intrinsic value and future

Figure 44: Multiples Valuation



Source: Author`s Analysis & Merck Financial Report 2024 (2025)

potential, relative valuation captures peer benchmarks. Using EV/EBITDA (mean 10.07, median 9.1), we derive an enterprise value of $232,985.75Mn and a target price of $81.98. P/E (mean 12.93, median 13.1) yields $221,839.46Mn and $86.86/share. P/Sales (mean 3.5, median 3.6) gives $235,814.12Mn and $92.33/share.

Table 26: Relevant Valuation

Relative Valuation						
	2025	2026	2027	2028	2029	2030
EV	229,791.28	232,985.75	248,425.74	256,913.09	269,914.87	289,758.24
Total Debt	26,499.96	23,572.81	21,098.48	17,907.97	14,996.69	12,489.38
Non-Controlling interests	23.11	23.67	25.80	27.13	29.02	31.44
Market Value of Equity	203,268.21	209,389.27	227,301.46	238,978.00	254,889.16	277,237.43
Share Price calculate by EV/EBIT	**79.59**	**81.98**	**89.00**	**93.57**	**99.80**	**108.55**
	213,789.39	221,839.46	238,703.16	250,974.99	268,528.31	290,861.31
Share Price calculate by P/E	**83.71**	**86.86**	**93.46**	**98.27**	**105.14**	**113.88**
Market Value of Equity	230,294.88	235,814.12	242,496.15	250,962.77	262,228.28	277,948.07
Share Price calculate by P/Sales	**90.17**	**92.33**	**94.95**	**98.26**	**102.67**	**108.83**

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Sensitivity Analysis

WACC reflects the cost of equity (Re) and debt (Rd), both shaped by macroeconomic factors (interest rates, inflation) and company-specific financial structure (debt ratio, credit rating), acting as key transmission channels of external shocks. The sustainable growth rate (g) critically influences the terminal value, which typically comprises 60%–70% of a DCF valuation—75% in Google's case—with changes in WACC and g explaining 80% of valuation variability (Radojicic, 2025). Revenue growth rate directly impacts forecast-period cash flow, especially in high-growth sectors like tech and renewables, where its sensitivity may exceed that of terminal growth. Capex affects free cash flow—its increase, or higher working capital needs, reduces cash flow. We conducted a sensitivity analysis on Merck's main value drivers: WACC, terminal growth rate, tax rate, revenue growth, and Capex growth. We modeled ±0.15% changes in WACC, g, revenue growth, and Capex. Under a scenario of rising g, falling WACC, rising revenue growth, and declining Capex growth, we issued a hold recommendation.

Table 27: Sensitivity Analysis

		Growth rate									
	83.05519	1.52%	1.67%	1.82%	1.97%	2.12%	2.27%	2.42%	2.57%	2.72%	
	7.78%	82.62	85.00	87.49	90.11	92.86	95.76	98.82	102.04	105.45	-0.60%
	7.93%	80.46	82.73	85.11	87.60	90.22	92.97	95.87	98.93	102.15	-0.45%
	8.08%	78.40	80.57	82.84	85.22	87.71	90.33	93.08	95.98	99.03	-0.30%
	8.23%	76.43	78.51	80.68	82.95	85.33	87.82	90.44	93.19	96.08	-0.15%
WACC	8.38%	74.55	76.54	78.62	80.79	83.06	85.43	87.92	90.54	93.29	0.00%
	8.53%	72.75	74.66	76.64	78.72	80.89	83.16	85.54	88.03	90.64	0.15%
	8.68%	71.02	72.85	74.76	76.75	78.82	80.99	83.26	85.64	88.13	0.30%
	8.83%	69.37	71.13	72.96	74.86	76.85	78.93	81.09	83.36	85.74	0.45%
	8.98%	67.78	69.47	71.23	73.06	74.96	76.95	79.03	81.19	83.46	0.60%
	78.70%	-0.60%	-0.45%	-0.30%	-0.15%	0.00%	0.15%	0.30%	0.45%	0.60%	

CAPEX

Revenue Growth rate

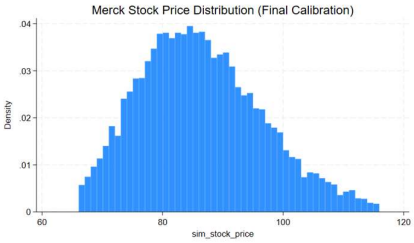
Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Monte Carlo Simulation

In addition to the previous analysis, we also conducted Monte Carlo simulation, in which WACC, terminal growth rate, revenue growth rate and EBITDA Margin were the main test factors.

We conducted 10,000 simulations. The results showed that the target average price and median were $86.35 and $85.46 respectively, which was in line with our **Hold** recommendations. We adopt the Truncated Normal Distribution. The expected WACC is 8.38%, the expected growth rate G is 2.12%, and the expected growth rate COGS is 1.92%. The expected Revenue growth rate is 3.83%. The fluctuations of WACC and growth rate G are 0.5%, the fluctuation of COGS growth rate is 5% of the benchmark (1.96%*5%=0.096%), and the fluctuation of Revenue growth rate is 2% of the benchmark (3.83% * 2% = 0.0766%). In our simulation, the Revenue Growth rate is the main driver of variance, followed by COGS growth rate, WACC and terminal growth rate.

Figure 45: Monte Carlo Simulation

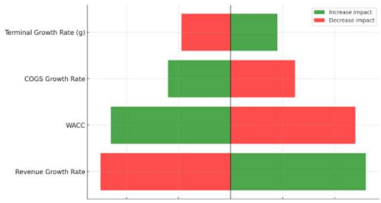


Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Sell, Reduce or Hold	Buy
75%	25%

Scenario Analysis

Merck's revenue is highly dependent on Keytruda, which contributed 46% of total revenue ($29.482 billion) in 2024, making the company's valuation particularly sensitive to its performance. From 2020 to 2024, Keytruda's CAGR reached 11.5%. Sensitivity analysis suggests that a decline in this rate to 5% could reduce Merck's valuation by 25% (Merck, 2025). Despite a strong gross profit margin of 76.32% in 2024, profitability remains exposed to COGS fluctuations; for example, supply chain inflation caused COGS to rise 2 percentage points above forecasts (+1% vs. -1%), compressing margins and free cash flow. Keytruda's therapeutic expansion has historically driven valuation gains. Its 2022 mesothelioma approval accelerated revenue growth from 15% to 22%, translating into a 12% valuation uplift (Liu, 2023). Operational efficiencies have also been impactful: a 2023 Catalent manufacturing agreement reduced COGS growth from 5.2% to 3.8%, improving gross margin by 150 basis points. Our scenario analysis includes two valuation cases. The optimistic case, assuming a 2% revenue increase driven by market expansion and adjusted for Keytruda's 2028 patent expiration, yields a target price of $106.09—a 27.73% premium over the base case, supporting a Buy recommendation. The pessimistic case, assuming a 2% revenue decline, results in a $62.18 target price (25.14% below base), suggesting a Reduce rating. COGS sensitivity is limited due to historical outperformance relative to the decade average. Nonetheless, stress testing reveals that a 5% increase in the COGS-to-revenue ratio would reduce the target price to $67.53 (−18.7%), whereas a 5% decrease would raise it to $99.05 (+19.25%). These outcomes are contingent on macroeconomic disruptions, given current operational efficiencies.



Obs	10000
Mean	86.35
Median	85.46
Std.Dev.	10.06
Min	66.09
Max	115.94
Variance	101.2847
Skewness	0.404816
Kurtosis	2.723833

Source: Authors`s Analysis & Merck (2024)

Table 28 Scenario Analysis

Variables	Pessimist Case	Base Case	Optimistic Case
Rvenue Growth	1.60%	3.60%	5.60%
Target Price	**62.18**	**83.06**	**106.09**
COGS % of Revenue	25.50%	20.50%	15.50%
Target Price	**67.53**	**83.06**	**99.05**

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

7. Financial Analysis

7.1 Revenue will continue to grow in the future

Merck's revenue is divided into Pharmaceuticals (90.8% of 2024 revenue) and Animal Health (9.2%). We examine revenue evolution across 2014–2030 in

three phases, linking trends to strategic and external factors to support forecasts.

From 2014–2019, revenue stagnated between $39–42B due to patent cliffs, notably dropping to $39.5B in 2015 (-6.9% YoY), reflecting limited portfolio momentum before Keytruda scaled. In 2020–2024, COVID-19 led to modest 2020 growth ($41.5B, +6.12%), followed by a strong rebound to $59.3B in 2022 (+51.53% vs. 2019), driven by Keytruda ($29.48B in 2024, 21% avg. profit contribution before 2028 patent expiry), vaccine expansion (Gardasil projected to grow 13% annually, 13.3% of revenue by 2030), and acquisitions (e.g., Acceleron's Winrevair contributing $419M/year from 2024, reaching $4.9B by 2029).

From 2025–2030, growth moderates (3.83% CAGR vs. 11.5% prior) with key shifts: $5–7B risk from Keytruda's 2028 patent expiry, Animal Health rising to 8.5% of revenue by 2030, and late-stage pipelines contributing ~$3B/year by 2030. Post-2028, new drugs and Animal Health are expected to offset Keytruda losses.

Contrasts show variance narrowing (2014–2019: ±3.5% vs. 2025–2030F: 2.35–5.65%), with Keytruda's share falling (2020–2024: 59% vs. 2025–2030F: 43.31%), and revenue concentration easing (Top 3 drugs: 60.02% in 2023 vs. 55% in 2030F). This marks Merck's shift from patent reliance to diversified therapeutic leadership, supporting long-term competitiveness.

7.2 Activity

This study identifies three evolutionary phases in Merck's operational efficiency from 2015 to 2030. In the first phase (2015–2022), Merck achieved notable improvements in both Operating Cash Cycle (OCC) and Total Asset Turnover (TAT) despite external shocks. OCC fell by 48.24% from its 2019 peak of 142.7 days to 73.86 days in 2022, exceeding the 17.81% increase in TAT (0.47 to 0.55), reflecting a focus on working capital efficiency, particularly during the pandemic. The simultaneous TAT rise suggests enhanced capacity utilization—likely driven by Keytruda's success—rather than asset downsizing. The normalization phase (2023–2028) highlights tensions between short- and long-term metrics. OCC initially rebounded to 117.87 days in 2024, then improved to 93.92 by 2028, while TAT peaked at 0.57 in 2024 but declined thereafter. Between 2024–2028, each 1% OCC gain corresponded to a 0.8% TAT decline, implying working capital gains came at the cost of asset productivity—possibly due to aging infrastructure or elevated inventory buffers. In the maturity phase (2029–2030), OCC stabilizes near 95 days (a 22.76% improvement vs. 2015), while TAT declines to 0.49. Though TAT has risen 25.64% since 2015, diminishing returns in working capital gains and sustained asset inefficiencies persist. Notably, fixed asset turnover improves to 2.18 by 2030, contrasting stagnant working capital metrics. These trends raise concerns over Merck's operational resilience post-Keytruda.

Strategically, the negative OCC–TAT correlation post-2022 suggests over-optimization of working capital at the expense of asset efficiency. Accounts

Figure 46: Operating Cash Cycle

Source: Author`s Analysis & Merck Financial Report 2024 (2025)

payable extension (63 to 99 days from 2015 to 2030) likely aided OCC reduction. Meanwhile, stable receivables (~60 days) and volatile inventory days (125–173) indicate inventory management drove OCC fluctuations. These dynamics underscore the trade-offs pharmaceutical firms face in balancing liquidity and productivity.

7.3 Liquidity

This analysis examines Merck's liquidity position through three key ratios from 2014 to 2030, revealing nuanced trends that reflect strategic shifts in working capital management.

The current ratio demonstrates the most volatility, declining from 1.77 to 1.38 (-22%), with particularly severe deterioration during the COVID-19 pandemic (1.02 in 2020). This suggests reduced coverage of current liabilities by total current assets, potentially due to inventory accumulation or increased short-term obligations.

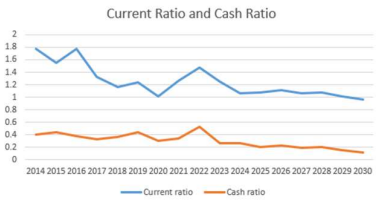
In contrast, the quick ratio (excluding inventories) shows moderate improvement from 0.76 to 0.86 (+13%), while the cash ratio exhibits the strongest positive trend, increasing from 0.40 to 0.48 (+20%). This divergence indicates that while Merck's overall current assets may be stretched thinner relative to liabilities, the company has strategically enhanced its holdings of the most liquid assets.

Three key insights emerge:

1. The decreasing differential between current and quick ratios (from 1.01 to 0.52 points) signals diminishing inventory dependence within the working capital framework.
2. The consistent outperformance of quick ratio over cash ratio demonstrates maintained receivables liquidity
3. The post-2020 recovery in all ratios, particularly cash positions, reflects improved crisis preparedness

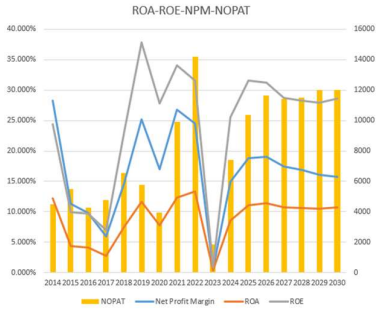
These trends collectively suggest Merck is transitioning toward a more conservative liquidity profile, prioritizing cash and near-cash assets over inventory-heavy working capital - a prudent approach given upcoming patent expiration. The improved cash conversion capability may offset concerns from the declining current ratio.

Figure 47: Current Ratio and Cash Ratio



Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Figure 48: ROA&ROE&NPM&NOPAT

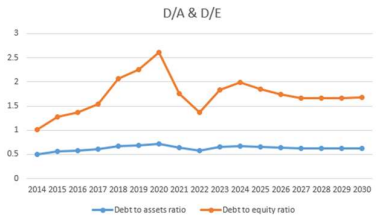


Source: Author`s Analysis & Merck Financial Report 2024 (2025)

7.4 Profitability

This analysis evaluates Merck's profitability across operational efficiency (ROA, NOPAT), shareholder returns (ROE), and earnings quality (Net Profit Margin), revealing structural evolution across business cycles. ROA fluctuated between 2.7–13.3% (2014–2018) but stabilized at 13–14% post-2024, indicating effective Keytruda integration. NOPAT surged from $4.47B (2014) to $19.79B (2030F), up 341%, with a 152.2% jump in 2020–2021 as operational efficiency caught up with revenue. ROE exhibited three phases: volatile restructuring (6.93–24.4%, 2014–2018), peaking growth (37.9%, 2019), and maturing stability (24–31%, 2023–2030F) amid deleveraging (leverage ratio down from 3.07 in 2020 to 1.75 in 2030F), reflecting a shift

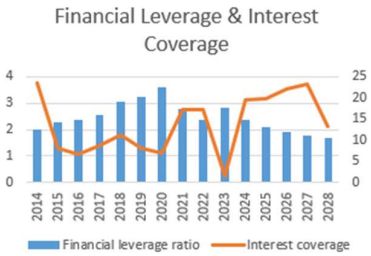
Figure 49: D/A & D/E



Source: Author`s Analysis & Merck Financial Report 2024 (2025)

from financial leverage to operational drivers. Net Profit Margin improved from 6–28% (2014–2018) to a consistent 27–29% post-2025F, despite a 2023 acquisition-driven dip (0.6% NPM, 0.3% ROA, 0.97% ROE) and R&D intensity rising to 47.7% of revenue. Gross margin expanded from 60.3% to 76.3% (2014–2024), supporting sustained premiumization. ROA stability vs. ROE decline signals reduced leverage impact. NOPAT grew 342% vs. a 28% NPM gain, confirming profit scalability. Yet, falling capital turnover (1.63 to 0.83) post-Keytruda raises asset productivity concerns, necessitating either pipeline breakthroughs or operational reinvention to maintain >25% ROE.

Figure 50: Financial Leverage and interest coverage



Source: Author`s Analysis & Merck Financial Report 2024 (2025)

7.5 Solvency

Merck's capital structure evolution (2014–2030) reflects a deliberate deleveraging strategy across three phases. From 2014 to 2020, the company aggressively leveraged its balance sheet, raising its debt-to-equity ratio from 1.01 to 2.61 to fund therapeutic expansion, while interest coverage fell from 23.6x to 7.05x and financial leverage peaked at 3.6x, signaling elevated risk. Post-2020, Merck initiated a structural shift, with its debt-to-assets ratio improving from 0.72 (2018) to a projected 0.43 (2030) through debt reduction and asset growth. Simultaneously, interest coverage recovered to a projected 23.7x by 2030, underscoring earnings strength amid risk mitigation. Despite broad improvements, the financial leverage ratio's slower decline (3.6x to 1.8x) relative to debt-to-equity (2.6x to 0.75x) indicates a strategic balance between maintaining operational flexibility and reducing balance sheet risk. The sustained high interest coverage highlights Merck's durable debt servicing capacity and financial resilience throughout both expansionary and deleveraging periods.

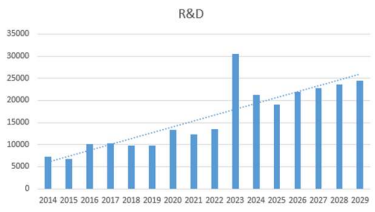
8. Investment Risks

8.1 OPERATIONAL RISKS

Research and Development

Developing new products remains a costly, protracted, and uncertain endeavor. Merck's R&D expenses have risen sharply, with acquisition-related R&D reaching 51% of total sales in 2023 and 23% in 2022. While R&D investment has outpaced sales growth, the pipeline faces mounting uncertainty due to reliance on Keytruda (47% of 2023 pharmaceutical revenue) and Gardasil, both approaching patent expiry in 2028 and 2025, respectively (Manalac, 2025). Between 2024 and 2030, revenue is expected to grow at a modest 2.7% CAGR. Clinical failures could disrupt this trajectory—for example, despite Keytruda's expansion into early-stage breast and endometrial cancers, its mechanism faces rising competition from bispecific antibodies and ADCs (Torres & Emens, 2021; Khongorzul et al., 2020). Gardasil sales plunged 41% in Q1 2025 due to demand saturation in

Figure 51: R&D



Source: Author`s Analysis & Merck Financial Report 2024 (2025)

China and emerging local competition (Gatlin, 2025). Furthermore, only 10% of oncology drugs entering Phase I gain market approval, with Phase III failures costing $500 million to $1 billion per asset (Wessel, 2024). Merck's 2025 pipeline includes just three Phase III candidates, trailing behind Chinese firms like Hengrui, and reflecting a broader R&D gap with only 11 drugs in late-stage development (BioSpace, 2023)

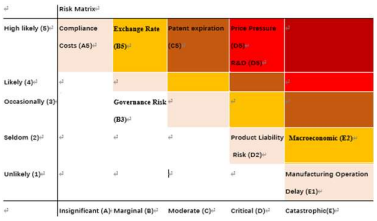
Table 29: R&D Efficiency Metrics

Period	R&D/Sales Ratio	Subsequent 5-Yr CAGR	Success Rate
2014-2018	18-22%	4.2%	1 approved/8.3 candidates
2019-2023	23-51%	9.7%	1 approved/12.1 candidates

Source: Merck 10-K filings (2014-2023), BIO industry reports (2025)

Merck's 2024 revenue reflects the cumulative yield of past R&D, with 68% ($43.63B) generated from products launched within the last decade. Keytruda, originating from 2014 R&D efforts, contributed $29.48B (45.95%), while HPV vaccines, developed between 2006–2010, accounted for $12.85B (20.02%). In the valuation model, future pipeline contributions (e.g., Winrevair) are upward adjusted based on Merck's 8.3% historical approval rate. Per DCF methodology, 70% of 2023's $17.94B R&D spending is capitalized over 7 years. Keytruda's post-2028 revenue is projected to maintain low growth amid patent expiry. Clinical trial failure poses significant risk—each Phase III failure reduces NPV by $1.8B, implying a cumulative risk of $4.9B in 2025 (3 candidates × 90% failure × $1.8B). Mitigation strategies include biotech collaborations (e.g., Kelun Biotech for ADCs) to share risk and adaptive trial designs leveraging real-world data and biomarker stratification to reduce late-stage attrition.

Figure 52: Risk Matrix



Source: Author`s Analysis & Merck Financial Report 2024 (2025)

Manufacturing operation delays

Roughly 80% of global APIs depend on China and India, with China alone holding 40% of global API production capacity, particularly for antibiotics and antivirals (Horner, 2024). The 2020 COVID-19 outbreak caused API factory shutdowns in China, triggering antihypertensive drug shortages in the West (Pisani, 2020). US–China trade tensions have intensified supply chain fragility; the 2025 US tariff list raised rates on key intermediates like heparin and 7-ACA to 25%, prompting capacity relocation (Mulloy et al., 2025). Natural disasters also pose disruption risks—as seen in 2024, when Typhoon Berti destroyed a Jiangsu API plant, cutting Merck's HPV vaccine output by 12% (Maroo, 2024). Notably, 35% of Merck's APIs come from three major Chinese suppliers (e.g., WuXi Biologics), with one critical enzyme sourced exclusively from a single firm (Arizton, 2022), exposing the firm to single-source risk.

To mitigate this, Merck should implement a multi-stage strategy: in the short term, diversify suppliers and reduce costs via joint procurement (e.g., with Pfizer); in the medium term, invest $500M in Southeast Asian API capacity

to cut China's supply share below 20% by 2027; and in the long term, deploy AI-powered digital twins to monitor 10,000+ supplier nodes in real time.

Governance Risk

Merck & Co., as a U.S.-listed entity, adheres to SOX Section 404, holding management accountable for internal control effectiveness. Its 2020 report confirmed an independent audit committee and third-party financial review (Merck & Co., Inc., 2021). However, a $5M SEC fine in 2023 for inventory discrepancies revealed control weaknesses (Merck & Co., Inc., 2021). OCEG's 2023 model showed only 35% of board members have cross-sector expertise, below Pfizer's 60%, limiting strategic foresight (OCEG, 2024).

Governance challenges extend to executive compensation: 65% of CEO pay is short-term stock-linked, despite three consecutive years of below-industry R&D spending (18% vs. 22%). CEO Rob Davis' bonus fell from $4.1M to $2.8M by 2024 (Dunleavy, 2025), prompting investor calls to raise long-term KPI weight (e.g., pipeline success) to 40%. Weak board effectiveness may lead to suboptimal decisions. In 2024, inadequate GxP-compliant lab backup at a Chinese facility triggered a three-day shutdown (APIC, 2022). While only 42% of peers enable real-time encryption, Merck minimized data tampering risk to 0.03% via blockchain (Guo & Dong, 2023).

Merck employs the COSO ERM framework and a Global Risk Committee to monitor 200+ risk metrics. In 2023, it avoided $230M in losses via rapid response to API supply disruptions (Merck, 2021). Recommended improvements include enhancing board diversity with tech-health experts, adopting ISO 8000-compliant lifecycle data governance, and aligning executive KPIs with pipeline progress to reconcile short- and long-term value creation.

Compliance Costs

Merck incurs significant compliance costs to meet global regulatory standards. In manufacturing, adherence to Cleaning Validation protocols—involving analytical residue limit (ARL) calculations based on dosage and contact surfaces—costs $0.5Mn–$1Mn per verification, including analytical development and three-batch validation (ECOLAB, 2019; Garvey, 2005). While top pharmaceutical firms allocate 3.2% of production costs to such validation, Merck's cost is 15% higher, driven by complex formulations such as Keytruda injections (Forsyth, 2015). Merck China undergoes annual joint FDA/NMPA audits, each costing approximately $2 million (Wang & Ma, 2023). In Phase III trials, protocols are revised 2.3 times per project on average, with each revision requiring resubmissions to FDA/NMPA and ethics committee updates, costing $500,000–800,000 (COFR, 2025; Getz et al., 2016). These revisions account for 12–18% of clinical budgets for multinational companies, rising to 22% in Merck's global trials (e.g., Keytruda–lung cancer) due to tight regulatory synchronization (COFR, 2025). Such obligations in testing, monitoring, and reporting significantly raise operational expenditures. Mitigation strategies include establishing regional compliance hubs in India and Southeast Asia to reduce cross-border delays,

expanding AI and blockchain systems to cut manual reviews by 30% by 2027, and increasing pre-submission engagements with FDA/NMPA to minimize costly protocol amendments.

8.2 Market Risks

Exchange Rate

Merck's global operations expose it to significant exchange rate risks. In 2024, the U.S. accounted for 50.3% of revenue, followed by EMEA (21.9%), China (8.6%), Japan (5.1%), Asia-Pacific ex-China/Japan (4.8%), and Latin America/others (9.4%). A 5%-euro depreciation reduced annual revenue by $320M, while a 15%-yen depreciation caused a $72M FX loss in Japan's generic drug segment (e.g., Januvia) (Merck, 2024). On the cost side, a 6.2% RMB depreciation in 2023 increased Merck's China production costs by $41M due to RMB-denominated API procurement (Merck, 2023). In Brazil, Merck incurred a $9M FX loss in 2023 due to swap contract execution failures (Merck, 2023). These risks affect not only sales but also the valuation of assets, liabilities, and production costs.

Mitigation strategies include using long-term currency swaps to hedge USD/EUR and USD/RMB exposures, employing NDF+options for emerging market currencies like BRL and INR, and deploying an AI-driven FX risk dashboard to monitor G10 currency volatility in real time.

Macroeconomic

Merck faces significant external risks, including the COVID-19 pandemic, Brexit, and ongoing geopolitical conflicts. The Russia-Ukraine war disrupted palladium supply, forcing Merck to procure from South Africa at a $150,000 premium per batch, totaling $80M annually (Merck, 2023). DHL reported that HPV vaccine export costs to Saudi Arabia rose by $8M in 2024, impacting 3.2% of regional sales (Altman & Bastian, 2023). In its largest market—the U.S. (50.3% of 2024 revenue)—the Inflation Reduction Act mandates renegotiation of drug prices from 2026 for products exceeding $1B in sales. Keytruda, likely to be price-capped by 2028, may face a $5B annual revenue loss (Grez, 2024). Meanwhile, U.S. biosafety scrutiny halted Merck's partnership with Wuxi Biologics, risking $230M in R&D funds (Hargreaves, 2024).

Although emerging markets—especially China—now contribute 18% of revenue (up from 9% in 2021), revenue volatility in these regions remains high at 25% versus 9% in mature markets (Fernandes, 2025). Despite China's sustained GDP growth since 1977, Merck's diversification into such markets remains constrained by unpredictable and uncontrollable geopolitical dynamics.

8.3 Regulatory and Legal Risks

Product Liability Risk

Despite lengthy approval processes, Merck's drugs may still cause unforeseen side effects, resulting in recalls, deregistrations, and litigation. In 2004, Merck withdrew Vioxx after post-marketing studies linked long-term use to cardiovascular events, triggering over 30,000 lawsuits and $4.85B in settlements and damages (Krauskopf, 2007). In 2007, Merck faced 1,288 lawsuits over Fosamax, incurring $27.7M in legal costs (Lawson & Llamas, 2025). These events, widely reported, significantly harmed Merck's reputation and prompted stricter regulatory scrutiny.

Mitigation strategy: Merck mitigates product liability risks via substantial litigation reserves, blockchain-based traceability, and regulatory compliance, though immune-related side effects and legacy litigations remain material concerns.

Pricing Pressure

Merck faces significant pricing pressure globally due to government-imposed pricing models and negotiations. In China, Keytruda's base price was $2,613 per 100mg—only one-third of the U.S. price and 30% lower than in Hong Kong—alongside a patient assistance program offering three months of free medication with a three-month purchase (Yan & Cao, 2018). In 2023, Merck sued the U.S. government over the Inflation Reduction Act's Medicare price negotiations, arguing that forced price cuts on Keytruda, which required over $20B in R&D, violate constitutional rights and undermine innovation (Newman, 2023).

Mitigation strategy: In mature markets, pricing pressure is offset through selective price increases and legal action, while in emerging markets, Merck relies on volume-driven growth to compensate for ultra-low pricing.

Patent Expiration

Following patent expiration, generic drugs—equivalent in quality and efficacy—typically enter the market at lower prices, compelling originators like Merck to reduce prices. Keytruda's (pembrolizumab) core U.S. patent expires in 2028, while its EU patent remains valid until 2031. Evaluate Pharma (2024) projects that biosimilar entry in the U.S. by 2029 will cause a 20% decline in Merck's oncology revenue. Notably, India's exclusion of product patents allows early biosimilar development, intensifying pressure from generic manufacturers such as Cipla and Dr. Reddy's, whose applications for Keytruda generics are underway. Upon launch in 2028, prices may fall to one-fifth of the original drug. Nature Reviews Drug Discovery estimates that Keytruda biosimilars will capture 35% of the U.S. market by 2028, reducing Merck's annual revenue by $570 million (Verdin, 2024).

Mitigation Strategy: Merck may seek patent term extensions or accelerate investment in pipeline innovation. Products like Winrevair and oral PCSK9 inhibitors are expected to generate $2.5 billion in incremental revenue, offsetting approximately 40% of Keytruda-related losses (Merck Pipeline, 2024).

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Appendices

Appendix 1: Statement of Financial Position ($M)

PRO Forma Balance Sheet											
	Historical					Forecast					
Iterm	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Assets											
Current Asset											
Cash and cash Equivalents	8,050.00	8,096.00	12,694.00	6,841.00	13,318.00	12783.57	13940.99	14190.69	15532.67	16226.01	17104.38
Short-term Investments	-	-	498.00	252.00	447.00	447.00	447.00	447.00	447.00	447.00	447.00
Accounts Receivable	6,803.00	9,230.00	9,450.00	10,349.00	10,278.00	11107.17	11373.36	11695.64	12103.99	12647.32	13405.49
Inventorires	5,554.00	5,953.00	5,911.00	6,358.00	6,109.00	6256.29	6406.23	6587.75	6817.76	7123.80	7550.85
Other Current Assets	4,674.00	6,987.00	7,169.00	8,368.00	8,630.00	8838.07	9049.88	9306.32	9631.24	10063.58	10666.86
Current assets of discontinued operations	2,683.00	-	-	-	-	-	-	-	-	-	-
Total Current Assets	27,764.00	30,266.00	35,722.00	32,168.00	38,782.00	39,432.09	41,217.46	42,227.40	44,532.66	46,507.72	49,174.59
Non-Current Asset											
Investments	785.00	370.00	1,015.00	252.00	463.00	477	491	505	519	533	547
Property,Plant and Equipment (at cost)											
Land	336.00	326.00	295.00	326.00	307.00	348.15	394.81	447.73	507.74	575.79	652.97
Buildings	11,998.00	12,529.00	13,166.00	14,966.00	16,360.00	17175.61	18031.87	18930.83	19874.60	20865.42	21905.64
Manchinery、Equipment and Office furnishings	15,860.00	16,303.00	16,760.00	17,763.00	18,283.00	19561.43	20929.26	22392.73	23958.54	25633.83	27426.27
Construction in Progress	6,968.00	8,313.00	9,186.00	8,262.00	7,984.00	8499.19	9047.61	9631.43	10252.92	10914.51	11618.80
Sub-total for PPE	35,162.00	37,471.00	39,407.00	41,317.00	42,934.00	45584.37	48403.56	51402.72	54593.80	57989.56	61603.68
Less: Accumulated depreciation	18,162.00	18,192.00	17,985.00	18,266.00	19,155.00	20505.99	21946.14	23481.42	25118.21	26863.32	28724.01
Net sub-total for PPE	17,000.00	19,279.00	21,422.00	23,051.00	23,779.00	25078.39	26457.42	27921.30	29475.59	31126.24	32879.66
Goodwill	18,882.00	21,264.00	21,204.00	21,197.00	21,668.00	25703.03	27129.77	28556.51	29983.25	31807.37	33631.49
Other intangibles、Net	14,101.00	22,933.00	20,269.00	18,011.00	16,370.00	17003.99	18683.88	20746.17	23303.10	26713.11	30494.78
Other Non current Assets	9,881.00	11,582.00	9,528.00	11,996.00	16,044.00	16430.82	16824.60	17301.34	17905.41	18709.17	19830.73
Noncurrent Assets of Discontinued Operations	3,175.00	-	-	-	-	-	-	-	-	-	-
Total Non-Current Assets	**63,039.00**	**75,058.00**	**72,423.00**	**74,255.00**	**77,861.00**	**84,216.23**	**89,095.67**	**94,525.32**	**100,667.35**	**108,355.89**	**116,836.66**
Total Assets	**91,588.00**	**105,694.00**	**109,160.00**	**106,675.00**	**117,106.00**	**124,125.32**	**130,804.13**	**137,257.72**	**145,719.01**	**155,396.61**	**166,558.26**
Liabilities											
Current Liabilities											
Loans payable and current portion of long-term debt	6,431.00	2,412.00	1,946.00	1,372.00	2,649.00	3960.662951	4055.584118	4170.503066	4316.113904	4509.860733	4780.213157
Trade accounts payable	4,327.00	4,609.00	4,264.00	3,922.00	4,079.00	4897.825892	4970.751924	4978.408394	5043.032083	5154.295707	5382.007409
Accrued and other current liabilities	12,212.00	13,859.00	14,159.00	15,766.00	15,694.00	16072.38201	16457.57239	16923.91382	17514.80303	18301.02824	19398.11918
Income taxes Payable	1,597.00	1,224.00	1,986.00	2,649.00	3,914.00	2863.001974	2933.009617	3196.639611	3360.98012	3596.048892	3895.125539
Dividends Payable	1,674.00	1,768.00	1,884.00	1,985.00	2,084.00	2084	2084	2084	2084	2084	2084
Current liabilities of discontinued operations	1,086.00	-	-	-	-	0	0	0	0	0	
Total Current Liabilities	**27,327.00**	**23,872.00**	**24,239.00**	**25,694.00**	**28,420.00**	**29,877.87**	**30,500.92**	**31,353.46**	**32,318.93**	**33,645.23**	**35,539.47**
Non-Current Liabilities											
Long-Term Debt	25,360.00	30,690.00	28,745.00	33,683.00	34,462.00	32287	30790	28739	26997	25011	23022
Deferred Income Taxes	1,005.00	3,441.00	1,795.00	871.00	1,387.00	2171.370266	2773.123847	3325.122737	3870.048514	4483.510569	4567.487334
Other Non-current Liabilities	12,306.00	9,434.00	8,323.00	8,792.00	6,465.00	6620.871014	6779.546673	6971.651768	7215.063183	7538.941478	7990.878075
Noncurrent Liabilities of Discontinued Operations	186.00	-	-	-	-	0	0	0	0	0	0
Total Non-Current Liabilities	**38,857.00**	**43,565.00**	**38,863.00**	**43,346.00**	**42,314.00**	**41,079.24**	**40,342.67**	**39,035.77**	**38,082.11**	**37,033.45**	**35,580.37**
Equity											
Common Stock, $0.5 par value Authorized-6.5B shares,Issued-3,577,103,522 shares in 2023 and 2022	1,788.00	1,788.00	1,788.00	1,788.00	1,788.00	1788.00	1788.00	1788.00	1788.00	1788.00	1788.00
Other paid-in capital	39,588.00	44,238.00	44,379.00	44,509.00	44,704.00	44675.30	44664.64	44673.94	44688.47	44713.69	44761.93
Retained earnings	47,362.00	53,696.00	61,081.00	53,895.00	63,069.00	71221.99	79370.54	88632.57	98434.81	109185.63	121254.58
Accumulated other comprehensive loss	-6,634.00	-4,429.00	-4,768.00	-5,161.00	-4,945.00	-4729.00	-4513.00	-4297.00	-4081.00	-3865.00	-3649.00
Sub total	82,104.00	95,293.00	102,480.00	95,031.00	104,616.00	112,956.29	121,310.17	130,797.51	140,830.28	151,822.31	164,155.51
Less Treasury Stock at cost : 1,045,470,249 shares in 2023 and 1,039,269,638 shares in 2022	56787.00	57109.00	56489.00	57450.00	58303.00	59870.19	61455.41	64060.60	65671.02	67292.12	68936.25
Total Merck & Co.,Inc. Stockholders`Equity	**25,317.00**	**38,184.00**	**45,991.00**	**37,581.00**	**46,313.00**	**53,086.10**	**59,854.76**	**66,736.91**	**75,159.26**	**84,530.20**	**95,219.27**
Non-controlling Interests	87.00	73.00	67.00	54.00	59.00	82.10625918	105.7775249	131.5764534	158.7017151	187.7241323	219.1602895
Total Equity	**25,404.00**	**38,257.00**	**46,058.00**	**37,635.00**	**46,372.00**	**53,168.21**	**59,960.54**	**66,868.48**	**75,317.97**	**84,717.92**	**95,438.43**
Total Liabilties and shareholders` equity	**91,588.00**	**105,694.00**	**109,160.00**	**106,675.00**	**117,106.00**	**124,125.32**	**130,804.13**	**137,257.72**	**145,719.01**	**155,396.61**	**166,558.26**

Appendix 2: Income Statement ($M)

PRO Forma Income Statement											
	Historical					Forecast					
Iterm	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Sales											
Revenue	41,518.00	48,704.00	59,283.00	60,115.00	64,168.00	65,715.09	67,290.02	69,196.74	71,612.71	74,827.35	79,313.02
Cost, Expenses and other											
Cost of sales	13,618.00	13,626.00	17,411.00	16,126.00	15,193.00	17,336.42	17,594.55	17,621.65	17,850.39	18,244.22	19,050.24
Selling, general and administrative	8,955.00	9,634.00	10,042.00	10,504.00	10,816.00	11,093.11	11,558.05	11,976.43	12,399.34	12,815.68	13,258.13
Research and development	13,397.00	12,245.00	13,548.00	30,531.00	17,938.00	17,566.74	18,044.53	17,817.96	18,487.97	19,352.72	20,523.82
Restructuring costs	575.00	661.00	337.00	599.00	309.00	642.85	688.76	737.94	790.64	847.10	907.59
Total Cost	36,545.00	36,166.00	41,338.00	57,760.00	44,256.00	46,639.13	47,885.89	48,153.97	49,528.34	51,259.72	53,739.78
Operating EBIT	**4,973.00**	**12,538.00**	**17,945.00**	**2,355.00**	**19,912.00**	**19,075.96**	**19,404.13**	**21,042.77**	**22,084.37**	**23,567.63**	**25,573.24**
Other (Income) expense, Net											
Interest income	-59.00	-36.00	-157.00	-365.00	-415.00	-415.00	-415.00	-415.00	-415.00	-415.00	-415.00
Interest expense	831.00	806.00	962.00	1,146.00	1,271.00	1,296.11	1,274.83	1,206.47	1,153.63	1,112.08	1,081.18
Exchange losses(Gains)	145.00	297.00	237.00	370.00	227.00	432.41	320.46	289.93	301.24	276.75	342.11
Income from investments in equity securities, net	-1,338.00	-1,940.00	1,419.00	-340.00	-14.00	-14.00	-14.00	-14.00	-14.00	-14.00	-14.00
Net Periodic defined benefit plan (Credit) Cost other than service cost	-339.00	-212.00	-279.00	-498.00	-633.00	-633.00	-633.00	-633.00	-633.00	-633.00	-633.00
Other, Net	-130.00	-256.00	-681.00	153.00	-460.00	-460.00	-460.00	-460.00	-460.00	-460.00	-460.00
Total other income expnense Net	-890.00	-1,341.00	1,501.00	466.00	-24.00	206.53	73.29	-25.60	-67.13	-133.17	-98.70
Operating EBT (Income Before Taxes)	**5,863.00**	**13,879.00**	**16,444.00**	**1,889.00**	**19,936.00**	**18,869.44**	**19,330.84**	**21,068.37**	**22,151.50**	**23,700.79**	**25,671.94**
Taxes on Income from continuing operations	1,340.00	1,521.00	1,918.00	1,512.00	2,803.00	2,316.22	2,372.86	2,586.14	2,719.10	2,909.27	3,151.23
Net Income from continuing operations	**4,523.00**	**12,358.00**	**14,526.00**	**377.00**	**17,133.00**	**16,553.21**	**16,957.98**	**18,482.23**	**19,432.41**	**20,791.52**	**22,520.71**
Less: Net (Loss) Income Attributable to Non-Controlling Interests	4.00	13.00	7.00	12.00	16.00	23.11	23.67	25.80	27.13	29.02	31.44
Net Income from continuing operations Attributable to Merck & Co., Inc	**4,519.00**	**12,345.00**	**14,519.00**	**365.00**	**17,117.00**	**16,530.11**	**16,934.31**	**18,456.43**	**19,405.28**	**20,762.50**	**22,489.28**
Income from Discontinued Operations，Net of Taxes and Amounts Attributable to NonControlling interests	2,548.00	704.00	-	-	-	-	-	-	-	-	-
Net Income Attributable to Merck & Co., Inc	**7,067.00**	**13,049.00**	**14,519.00**	**365.00**	**17,117.00**	**16,530.11**	**16,934.31**	**18,456.43**	**19,405.28**	**20,762.50**	**22,489.28**

Appendix 3: Cash Flow Statement ($M)

PRO Forma Cash Flow Statement						
	Forecast					
Item	2025	2026	2027	2028	2029	2030
Cash Flows from Operating Activities						
Net Income	16,553.21	16,957.98	18,482.23	19,432.41	20,791.52	22,520.71
Adjustments to reconcile net income to net cash provided by operating activities:						
Depreciation and amortization	-	-	-	-	-	
Amortization	2,400.00	2,300.00	2,100.00	1,800.00	1,500.00	1,350.00
Depreciation	1,350.99	1,440.15	1,535.28	1,636.79	1,745.11	1,860.69
Intangible asset impairment charges	-	-	-	-	-	-
Loss (income) from investments in equity securities, net	-14.00	-14.00	-14.00	-14.00	-14.00	-14.00
Deferred income taxes	784.37	601.75	552.00	544.93	613.46	83.98
Share-based compensation	675.87	675.87	675.87	675.87	675.87	675.87
Other	216.00	216.00	216.00	216.00	216.00	216.00
Net changes in assets and liabilities:						
Accounts receivable	-829.17	-266.19	-322.28	-408.35	-543.34	-758.17
Inventories	-147.29	-149.94	-181.53	-230.01	-306.04	-427.05
Trade accounts payable	818.83	72.93	7.66	64.62	111.26	227.71
Accrued and other current liabilities	378.38	385.19	466.34	590.89	786.23	1,097.09
Income taxes payable	-1,051.00	70.01	263.63	164.34	235.07	299.08
Noncurrent liabilities	155.87	158.68	192.11	243.41	323.88	451.94
Other	-208.07	-211.81	-256.44	-324.93	-432.34	-603.28
Net Cash Provided by Operating Activities	**21,083.99**	**22,236.60**	**23,716.87**	**24,391.98**	**25,702.67**	**26,980.562**
Cash Flows from Investing Activities						
Capital expenditures	-5,219.39	-5,559.15	-5,921.53	-6,308.09	-6,720.49	-7,160.51
Acquisition of MoonLake	-3,000.00					
Acquisition of WuXi Vaccines manufacturing facility	-500.00					
Manufacturing at Merck's Durham, North Carolina	-1,000.00					
Long Term Investment in US Unitl 31 DEC 2028		-2,666.67	-2,666.67	-2,666.67		
Based on Merck's current strategy, predict the investment and mergers and acquisitions from 2029 to 2030					-3,409.40	-3,409.40
Other	-386.82	-393.78	-476.74	-604.07	-803.76	-1,121.56
Net Cash (Used in) Provided by Investing Activities	**-10,106.21**	**-8,619.59**	**-9,064.94**	**-9,578.82**	**-10,933.65**	**-11,691.47**
Cash Flows from Financing Activities						
Net change in short-term borrowings	1,311.66	94.92	114.92	145.61	193.75	270.35
Payments on debt	-2,175.00	-1,497.00	-2,051.00	-1,742.00	-1,986.00	-1,989.00
Proceeds from issuance of debt	-	-	-	-	-	-
Distribution from Organon & Co.	-	-	-	-	-	-
Purchases of treasury stock	-2,442.45	-2,442.45	-3,442.45	-2,442.45	-2,442.45	-2,442.45
Dividends paid to stockholders	-8,377.12	-8,785.76	-9,194.40	-9,603.04	-10,011.68	-10,420.32
Proceeds from exercise of stock options	170.70	170.70	170.70	170.70	170.70	170.70
Net Cash Used in Financing Activities	**-11,512.21**	**-12,459.59**	**-14,402.23**	**-13,471.18**	**-14,075.68**	**-14,410.72**
Cash Flows From Discontinued Operations						
Net Cash Provided by Operating Activities	-	-	-	-	-	-
Net Cash Used in Investing Activities	-	-	-	-	-	-
Net Cash Used in Financing Activities	-	-	-	-	-	-
Net Cash Flows Provided by Discontinued Operations	**-**	**-**	**-**	**-**	**-**	**-**
Effect of Exchange Rate Changes on Cash, Cash Equivalents and Restricted Cash	-	-	-	-	-	-
Net Increase (Decrease) in Cash, Cash Equivalents and Restricted Cash	-534.43	1,157.42	249.70	1,341.98	693.34	878.38
Cash, Cash Equivalents and Restricted Cash at **Beginning of Year** (includes $2 million of restricted cash at January 1, 2019 included in Other Assets)	13,318.00	12,783.57	13,940.99	14,190.69	15,532.67	16,226.01
Less: Cash and cash equivalents related to discontinued operations	-	-	-	-	-	
Cash, Cash Equivalents and Restricted Cash at End of Year (includes $258 million of restricted cash at December 31, 2019 included in Other Assets - see Note 6)	**12,783.57**	**13,940.99**	**14,190.69**	**15,532.67**	**16,226.01**	**17,104.38**

Appendix 4: Key Financial Ratios

Financial Ratio											
	Historical					Forecast					
Item	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Activity Ratios											
Working capital turnover	14.57	14.26	6.63	6.70	7.62	6.60	6.64	6.41	6.20	5.97	5.99
Fixed asset turnover	1.11	1.18	1.44	1.46	1.50	1.58	1.65	1.74	1.86	1.99	2.18
Total asset turnover	0.47	0.49	0.55	0.56	0.57	0.54	0.53	0.52	0.51	0.50	0.49
Inventory turnover	2.36	2.17	2.70	2.63	2.44	2.80	2.78	2.71	2.66	2.62	2.60
Days of inventory on hand	154.54	167.97	135.20	138.85	149.75	130.17	131.34	134.57	137.06	139.46	140.58
Receivables turnover	6.11	6.08	6.35	6.07	6.22	6.15	5.99	6.00	6.02	6.05	6.09
Days of sales outstanding	59.70	60.08	57.51	60.11	58.67	59.39	60.97	60.84	60.65	60.37	59.95
Payables turnover	3.38	3.05	3.92	3.94	3.80	3.86	3.57	3.54	3.56	3.58	3.62
Number of days of payables	108.08	119.68	93.01	92.64	96.11	94.50	102.36	103.04	102.46	102.01	100.94
Operating Cash Cycle	106.16	108.36	99.70	106.31	112.31	95.06	89.95	92.38	95.25	97.82	99.59
Liquidity Ratios											
Current ratio	1.02	1.27	1.47	1.25	1.36	1.32	1.35	1.35	1.38	1.38	1.38
Quick ratio	0.54	0.73	0.91	0.67	0.83	0.80	0.83	0.83	0.86	0.86	0.86
Cash ratio	0.29	0.34	0.52	0.27	0.47	0.43	0.46	0.45	0.48	0.48	0.48
Solvency Ratios											
Debt to assets ratio	0.72	0.64	0.58	0.65	0.60	0.57	0.54	0.51	0.48	0.45	0.43
Debt to capital ratio	0.72	0.64	0.58	0.65	0.60	0.57	0.54	0.51	0.48	0.45	0.43
Debt to equity ratio	2.61	1.76	1.37	1.83	1.53	1.33	1.18	1.05	0.93	0.83	0.75
Long term debt to capitalization ratio	0.60	0.53	0.46	0.54	0.48	0.44	0.40	0.37	0.34	0.30	0.27
Financial leverage ratio	3.61	2.76	2.37	2.83	2.53	2.33	2.18	2.05	1.93	1.83	1.75
Interest coverage	7.06	17.22	17.09	1.65	15.69	14.56	15.16	17.46	19.20	21.31	23.74
Fixed charge coverage											
Profitability Ratios											
Gross Profit Margin	0.67	0.72	0.71	0.73	0.76	0.74	0.74	0.75	0.75	0.76	0.76
EBITDA Margin	0.20	0.32	0.37	0.10	0.38	0.35	0.34	0.36	0.36	0.36	0.36
EBIT Margin	0.12	0.26	0.30	0.04	0.31	0.29	0.29	0.30	0.31	0.31	0.32
Net Profit Margin	0.17	0.27	0.24	0.01	0.27	0.25	0.25	0.27	0.27	0.28	0.28
ROA	0.08	0.12	0.13	0.00	0.15	0.13	0.13	0.13	0.13	0.13	0.14
Operating Margin	0.12	0.26	0.30	0.04	0.31	0.29	0.29	0.30	0.31	0.31	0.32
Capital Turnover	1.63	1.27	1.29	1.60	1.38	1.24	1.12	1.03	0.95	0.88	0.83
ROE	0.28	0.34	0.32	0.01	0.37	0.31	0.28	0.28	0.26	0.25	0.24
Pretax Margin	0.14	0.28	0.28	0.03	0.31	0.29	0.29	0.30	0.31	0.32	0.32
Interest burden	1.18	1.11	0.92	0.80	1.00	0.99	1.00	1.00	1.00	1.01	1.00
Tax burden	1.21	0.94	0.88	0.19	0.86	0.88	0.88	0.88	0.88	0.88	0.88
Equity turnover	1.63	1.27	1.29	1.60	1.38	1.24	1.12	1.03	0.95	0.88	0.83
Asset turnover	0.45	0.46	0.54	0.56	0.55	0.53	0.51	0.50	0.49	0.48	0.48
Financial leverage ratio	3.61	2.76	2.37	2.83	2.53	2.33	2.18	2.05	1.93	1.83	1.75
ROIC	0.09	0.14	0.24	0.06	0.23	0.20	0.21	0.22	0.21	0.21	0.20
NOPAT	3928.67	9905.02	14176.55	1860.45	16007.74	13469.94	15458.24	16724.03	17437.63	18704.19	19739.89
COGS/Revenue	0.28	0.25	0.26	0.23	0.20	0.23	0.23	0.22	0.22	0.22	0.22
R&D/Revenue	0.28	0.22	0.20	0.48	0.25	0.25	0.25	0.24	0.24	0.24	0.24
Equity Multiplier	3.61	2.76	2.37	2.83	2.53	2.33	2.18	2.05	1.93	1.83	1.75
Dupont Analysis	0.28	0.34	0.32	0.01	0.37	0.31	0.28	0.28	0.26	0.25	0.24

Appendix 5: Common-Size Statement of Financial Position

PRO Forma Balance Sheet-Common Size											
	Historical					Forecast					
Iterm	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Assets											
Current Asset											
Cash and cash Equivalents	9%	8%	12%	6%	11%	10%	11%	10%	11%	10%	10%
Short-term Investments	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Accounts Receivable	7%	9%	9%	10%	9%	9%	9%	9%	8%	8%	8%
Inventorires	6%	6%	5%	6%	5%	5%	5%	5%	5%	5%	5%
Other Current Assets	5%	7%	7%	8%	7%	7%	7%	7%	7%	6%	6%
Current assets of discontinued operations	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total Current Assets	**30.3%**	**28.6%**	**32.7%**	**30.2%**	**33.1%**	**31.8%**	**31.5%**	**30.8%**	**30.6%**	**29.9%**	**29.5%**
Non-Current Asset											
Investments	1%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%
Property,Plant and Equipment (at cost)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Land	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Buildings	13%	12%	12%	14%	14%	14%	14%	14%	14%	13%	13%
Manchinery、Equipment and Office furnishings	17%	15%	15%	17%	16%	16%	16%	16%	16%	16%	16%
Construction in Progress	8%	8%	8%	8%	7%	7%	7%	7%	7%	7%	7%
Sub-total for PPE	38%	35%	36%	39%	37%	37%	37%	37%	37%	37%	37%
Less: Accumulated depreciation	20%	17%	16%	17%	16%	17%	17%	17%	17%	17%	17%
Net sub-total for PPE	19%	18%	20%	22%	20%	20%	20%	20%	20%	20%	20%
Goodwill	21%	20%	19%	20%	19%	21%	21%	21%	21%	20%	20%
Other intangibles、Net	15%	22%	19%	17%	14%	14%	14%	15%	16%	17%	18%
Other Non current Assets	11%	11%	9%	11%	14%	13%	13%	13%	12%	12%	12%
Noncurrent Assets of Discontinued Operations	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total Non-Current Assets	**69%**	**71%**	**66%**	**70%**	**66%**	**68%**	**68%**	**69%**	**69%**	**70%**	**70%**
Total Assets	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Liabilities											
Current Liabilities											
Loans payable and current portion of long-term debt	7%	2%	2%	1%	2%	3%	3%	3%	3%	3%	3%
Trade accounts payable	5%	4%	4%	4%	3%	4%	4%	4%	3%	3%	3%
Accrued and other current liabilities	13%	13%	13%	15%	13%	13%	13%	12%	12%	12%	12%
Income taxes Payable	2%	1%	2%	2%	3%	2%	2%	2%	2%	2%	3%
Dividends Payable	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Current liabilities of discontinued operations	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total Current Liabilities	**30%**	**23%**	**22%**	**24%**	**24%**	**24%**	**23%**	**23%**	**22%**	**22%**	**21%**
Non-Current Liabilities	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Long-Term Debt	28%	29%	26%	32%	29%	26%	24%	21%	19%	16%	15%
Deferred Income Taxes	1%	3%	2%	1%	1%	2%	2%	2%	3%	3%	3%
Other Non-current Liabilities	13%	9%	8%	8%	6%	5%	5%	5%	5%	5%	5%
Noncurrent Liabilities of Discontinued Operations	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total Non-Current Liabilities	**42%**	**41%**	**36%**	**41%**	**36%**	**33%**	**31%**	**28%**	**26%**	**24%**	**21%**
Equity											
Common Stock, $0.5 par value Authorized-6.5B shares,Issued-3,577,103,522 shares in 2023 and 2022	2%	2%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Other paid-in capital	43%	42%	41%	42%	38%	36%	34%	33%	31%	29%	29%
Retained earnings	52%	51%	56%	51%	54%	57%	61%	65%	68%	70%	78%
Accumulated other comprehensive loss	-7%	-4%	-4%	-5%	-4%	-4%	-3%	-3%	-3%	-2%	-2%
Sub total	90%	90%	94%	89%	89%	91%	93%	95%	97%	98%	99%
Less Treasury Stock at cost : 1,045,470,249 shares in 2023 and 1,039,269,638 shares in 2022	62%	54%	52%	54%	50%	48%	47%	47%	45%	43%	44%
Total Merck & Co.,Inc. Stockholders'Equity	**28%**	**36%**	**42%**	**35%**	**40%**	**43%**	**46%**	**49%**	**52%**	**54%**	**57%**
Non-controlling Interests	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total Equity	**28%**	**36%**	**42%**	**35%**	**40%**	**43%**	**46%**	**49%**	**52%**	**55%**	**57%**
Total Liabilties and shareholders` equity	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Appendix 6: Common-Size Income Statement

PRO Forma Income Statement											
	Historical					Forecast					
Iterm	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Sales											
Revenue	41,518.00	48,704.00	59,283.00	60,115.00	64,168.00	65,715.09	67,290.02	69,196.74	71,612.71	74,827.35	79,313.02
Cost, Expenses and other											
Cost of sales	13,618.00	13,626.00	17,411.00	16,126.00	15,193.00	17,336.42	17,594.55	17,621.65	17,850.39	18,244.22	19,050.24
Selling, general and administrative	8,955.00	9,634.00	10,042.00	10,504.00	10,816.00	11,093.11	11,558.05	11,976.43	12,399.34	12,815.68	13,258.13
Research and development	13,397.00	12,245.00	13,548.00	30,531.00	17,938.00	17,566.74	18,044.53	17,817.96	18,487.97	19,352.72	20,523.82
Restructuring costs	575.00	661.00	337.00	599.00	309.00	642.85	688.76	737.94	790.64	847.10	907.59
Total Cost	36,545.00	36,166.00	41,338.00	57,760.00	44,256.00	46,639.13	47,885.89	48,153.97	49,528.34	51,259.72	53,739.78
Operating EBIT	**4,973.00**	**12,538.00**	**17,945.00**	**2,355.00**	**19,912.00**	**19,075.96**	**19,404.13**	**21,042.77**	**22,084.37**	**23,567.63**	**25,573.24**
Other (Income) expense, Net											
Interest income	-59.00	-36.00	-157.00	-365.00	-415.00	-415.00	-415.00	-415.00	-415.00	-415.00	-415.00
Interest expense	831.00	806.00	962.00	1,146.00	1,271.00	1,296.11	1,274.83	1,206.47	1,153.63	1,112.08	1,081.18
Exchange losses(Gains)	145.00	297.00	237.00	370.00	227.00	432.41	320.46	289.93	301.24	276.75	342.11
Income from investments in equity securities, net	-1,338.00	-1,940.00	1,419.00	-340.00	-14.00	-14.00	-14.00	-14.00	-14.00	-14.00	-14.00
Net Periodic defined benefit plan (Credit) Cost other than service cost	-339.00	-212.00	-279.00	-498.00	-633.00	-633.00	-633.00	-633.00	-633.00	-633.00	-633.00
Other, Net	-130.00	-256.00	-681.00	153.00	-460.00	-460.00	-460.00	-460.00	-460.00	-460.00	-460.00
Total other income expnense Net	-890.00	-1,341.00	1,501.00	466.00	-24.00	206.53	73.29	-25.60	-67.13	-133.17	-98.70
Operating EBT (Income Before Taxes)	**5,863.00**	**13,879.00**	**16,444.00**	**1,889.00**	**19,936.00**	**18,869.44**	**19,330.84**	**21,068.37**	**22,151.50**	**23,700.79**	**25,671.94**
Taxes on Income from continuing operations	1,340.00	1,521.00	1,918.00	1,512.00	2,803.00	2,316.22	2,372.86	2,586.14	2,719.10	2,909.27	3,151.23
Net Income from continuing operations	**4,523.00**	**12,358.00**	**14,526.00**	**377.00**	**17,133.00**	**16,553.21**	**16,957.98**	**18,482.23**	**19,432.41**	**20,791.52**	**22,520.71**
Less: Net (Loss) Income Attributable to Non-Controlling Interests	4.00	13.00	7.00	12.00	16.00	23.11	23.67	25.80	27.13	29.02	31.44
Net Income from continuing operations Attributable to Merck & Co., Inc	**4,519.00**	**12,345.00**	**14,519.00**	**365.00**	**17,117.00**	**16,530.11**	**16,934.31**	**18,456.43**	**19,405.28**	**20,762.50**	**22,489.28**
Income from Discontinued Operations，Net of Taxes and Amounts Attributable to NonControlling interests	2,548.00	704.00	-	-	-	-	-	-	-	-	-
Net Income Attributable to Merck & Co., Inc	**7,067.00**	**13,049.00**	**14,519.00**	**365.00**	**17,117.00**	**16,530.11**	**16,934.31**	**18,456.43**	**19,405.28**	**20,762.50**	**22,489.28**

Appendix 7: Forecasting Assumptions – Revenues

Revenue						
Years Ended December 31	2025	2026	2027	2028	2029	2030
	Total	Total	Total	Total	Total	Total
Pharmaceutical:						
Oncology	33224.83	33731.86	34255.99	34798.97	35362.77	35949.69
Vaccines	13379.85	13781.42	14199.78	14635.25	15088.20	15559.02
Hospital Acute Care	3392.63	3469.93	3550.01	3632.98	3718.95	3808.04
Cardiovascular	1399.07	1846.83	2571.74	3749.52	5667.49	8795.51
Virology	1742.52	1716.76	1691.72	1667.36	1643.67	1620.64
Neuroscience	212.57	203.53	194.88	186.60	178.67	171.07
Immunology	652.88	649.17	645.87	642.95	640.38	638.14
Diabetes	2243.54	2229.53	2226.31	2233.30	2250.00	2275.99
Other pharmaceutical	2511.00	2511.00	2511.00	2511.00	2511.00	2511.00
Total Pharmaceutical segment sales	58758.87	60140.04	61847.30	64057.92	67061.13	71329.11
Animal Health:						
Livestock	3538.87	3618.50	3699.91	3783.16	3868.28	3955.32
Companion Animals	2488.48	2563.13	2640.03	2719.23	2800.81	2884.83
Total Animal Health segment sales	**6027.35**	**6181.63**	**6339.94**	**6502.39**	**6669.09**	**6840.15**
Total segment sales	64786.22	66321.67	68187.25	70560.31	73730.22	78169.26
Other	928.87	968.34	1009.50	1052.40	1097.13	1143.76
Total Revenue	**65715.09**	**67290.02**	**69196.74**	**71612.71**	**74827.35**	**79313.02**

Forecasting Assumption - Revenues

Based on Merck's third-quarter forecast, the company expects its full-year 2024 revenue to be between $63.3 billion and $64.1 billion. Our projection of $636.7 billion appears to be an oversight as it significantly exceeds Merck's provided range.

Statista projects Keytruda sales to reach $31 billion by 2028, while our estimate stands at $35 billion. Given Keytruda's historical annual growth rate of approximately 19.45% to 21.8% over the past three years, we believe Statista's projected five-year growth rate of merely 4.38% is substantially underestimated. Consequently, we have adjusted the annual growth rate for Keytruda from 2025 to 2029 to half of the 2024 growth rate, rounded to the nearest integer.

Welireg and Vaxneuvance exhibited exceptional quarterly growth rates of 102% and 106% in 2024, translating to annual growth rates of 25.5% and 27%, respectively. However, such a high growth trajectory is unlikely to be sustainable in the long term. Therefore, we have moderated their annual growth rates from 2025 to 2029 to 5.1%, aligning with Merck's projected average revenue growth rate of 5.1% from 2023 to 2024.

The growth rate for other drugs is assumed to be 25% of their respective quarterly growth rates. Analysts point out that Winrevair will reach 4.9 billion US dollars in 2029 and may become a new revenue driver

Appendix 8: Forecasting Assumptions-Income Statement

Cost of sales	Cost of goods sold includes amortization, royalty payments and other parts. Keytruda, Gardasil/Gardasil 9 and Vaxneuvance pay 6.5%, 14% and 7.25% royalty rates before 2023. The royalty rate of Gardasil/Gardasil 9 drops to 7% in 2024F-2029F. The royalty rates of Keytruda and Vaxneuvance drop to 2.5% and 7.25% in 2024F-2026F and continue to drop to 2% and 2.5% in 2027F-2029F. Other sales-related COGS will be calculated based on the historical average of 20.5% of revenue (after deducting amortization and royalty rates)
Selling, general and administrative	Follow the annual growth rate of Revenue
Research and development	R&D costs include depreciation, acquisitions and cooperation, and pharmaceutical R&D costs. 2025F-2030F is the cost of the previous year after removing depreciation multiplied by the revenue growth rate of the current year
Restructuring costs	Calculated as the average growth rate over the past five years.
Interest expense	Calculated based on the amount of future debt due and the corresponding interest rate and term
Exchange losses (Gains)	Multiply the exposure based on the changes in the forward exchange rates of EUR, CNY, JPY, AUD and NZD against USD.
Taxes on Income from continuing operations	The Operating Tax Rate is calculated based on the average of the past five years, which is 21%. The Non-Operating Tax Rate is calculated based on the average of 2019-2022. Since 2023 involves special major events, it is not considered.
Depreciation	According to Merck's 2023 financial report, the useful lives of Buildings and Machinery, Equipment and Office Furnishings are 25-40 years and 3-15 years respectively. We take the average value of 32.5 years and 9 years for depreciation calculation. Land and Construction in Progress do not require depreciation.
Amortization	Merck's 2023 financial report gives the specific amount of amortization and applies it, plus the amortization of additional growth from

	new intangible assets and acquisitions.

Appendix 9: Forecasting Assumptions-Asset

Accounts Receivable	Historical average
Inventories	Follow the growth rate of revenue
Other Current Assets	Follow the growth rate of revenue
Investments	The difference between the investment amount and the investment securities income in the previous year
PP&E (at cost)	Calculated based on the average of the historical share of Revenue
Goodwill	This item has been assigned a 54% weighting, primarily allocated to: Merck's 2025 acquisition of MoonLake and the WuXi Vaccines manufacturing facility,A $1 billion investment in the North Carolina vaccine plant,The remaining $8 billion of Merck's long-term U.S. investment plan through 2028, Acquisition reserves for 2029–2030.
Other intangibles，Net	After the distribution of Goodwill, the remaining 46% was allocated to intangible assets.
Other Non-current Asset	Based on historical data, the proportion of Revenue is 25%. For 2025-2030, it is 25% multiplied by the Revenue of that year.

Appendix 10: Forecasting Assumptions-Liabilities

Loans payable and current portion of long-term debt	The historical average of revenue is 7%, multiply it by the revenue of the corresponding year
Trade accounts payable	Based on the historical average of 25% of COGS, multiply by the COGS of the corresponding year
Accrued and other current liabilities	Follow the growth rate of revenue
Income taxes Payable	The proportion of tax calculated based on historical data is 123.6%. For 2025-2030, it is 123.6% multiplied by the tax amount of that year.
Dividends Payable	Maintain the level in 2023
Long-Term Debt	Based on the long-term debt table given in Merck's financial report, the matured debts are written off and compared with the total debts.
Deferred Income Taxes	Based on the historical average of -32.7% of EBIT, we calculated the operating deferred tax. Based on the sliding average, we calculated the change in non-operating deferred tax and calculated the non-operating deferred tax. Finally, we calculated the valuation allowance and other assets based on the sliding average distribution and finally got the Deferred Income Taxes.
Other Non-current Liabilities	Follow the growth rate of Revenue

Appendix 11: Forecasting Assumptions-Equity

Common Stock Par Value	Keep the 2023 level unchanged
Share-based compensation plans and other	Calculated based on the number of unexercised options combined with the weighted average exercise price and taking into account a 21% tax rate
Cash dividends declared on common stock	According to Merck’s Q1 2024 report, total outstanding shares are 2,554 million. The dividend per share has consistently increased by $0.16 annually over the past four years, and we assume this fixed annual growth will continue.
Treasury stock shares purchased	Based on the increase from 2,531,63Mn shares in 2023 to 2,554Mn in 2024, and Merck’s consistent buybacks over the past decade, we assume annual net repurchases of 22.37Mn shares will continue.
Non-controlling Interests	According to the financial report, this item is the tax of the subsidiary. The proportion of Non-controlling Interest to Net Income in the past ten years multiplied by the effective tax rate multiplied by the Net Income and tax rate of the year

Appendix 12: Estimating Risk Free Rate

Merck is headquartered in the United States, with its main revenue coming from the North American market, and most of its costs and revenues are denominated in US dollars. Therefore, we choose to use the 5-year and 10-year US Treasury yields when calculating the risk-free rate. Instead of the 30-year Treasury yield. Due to the high volatility of the US fiscal policy, the 30-year long-term Treasury bond is deeply affected, and the low trading volume may lead to valuation bias. When determining the risk-free rate, we evaluated the following four methods:

Use the current yield. Use the 5-year average. Refer to the 10-year average yield of the 10-year Treasury. Survey Market Risk Premium and Risk-Free Rate used in 54 countries in 2025 (Pablo Fernandez)

We ultimately adopted the risk-free rate of 4.1% as referenced in the survey conducted by Pablo Fernández et al., which was based on responses from 1,547 emails collected from university professors, analysts, and corporate executives.

Risk Free Rate			
Treasury Yield 10 Years		Spot Price	4.31%
Treasury Yield 10 Years		5 Years Average	2.69%
Treasury Yield 10 Years		10 Year Average	2.48%

Appendix 13: Market Risk Premium

Our MRP uses the average US market risk premium from Statista. The mode, mean, and median over the past thirteen years are all 5.5%. The fluctuation range is 5.3%-5.7%. Therefore, we use 5.5% as the MRP.

Appendix 14: Cost of Equity

We averaged the betas of seven peers and found Unlevered Beta = 0.8, and calculated Beta Levered = 0.87 using the following formula. We applied it to the formula and got Cost of Equity = 8.84%

$$\boldsymbol{Cost\ of\ Equity = Risk\ Free\ Rate + Beta * (Market\ Risk\ Premium - Risk\ Free\ Rate)}$$

$$\boldsymbol{Beta\ levered = Beta\ Unlevered * (1 + (1 - Corporate\ Tax) * \left(Total \frac{Debt}{Market\ Capitalization}\right))}$$

Appendix 15: Computing the Long-Term Growth Rate

Calculating Terminal Growth Rate	2023	2024	2025	2026	2027	2028	2029	2030 Terminal	
Reinvestment Rate	**9.3%**	**5.3%**	**16.1%**	**14.3%**	**15.2%**	**16.4%**	**18.5%**	**19.3%**	**15.0%**
Net Capex	3863	3372	5219.3931	5559.146296	5921.527	6308.087015	6720.487202	7160.508576	
Change in NWC	666.92	-1164.82	1131.1414	194.3167715	137.0152	288.3842634	342.0409822	433.7611092	
1-Debt Ratio	0.352800562	0.395983126	0.428343	0.458399455	0.487175	0.516871256	0.54517227	0.573003274	
Net Income	365.00	17117.00	16530.11	16934.31	18456.43	19405.28	20762.50	22489.28	
ROC	**2.6%**	**18.8%**	**16.9%**	**16.2%**	**16.7%**	**16.4%**	**16.3%**	**16.4%**	**16.8%**
EBIT*(1-t)	1860.45	15730.48	15070.01	15329.26227	16623.79	17446.65601	18618.42563	20202.8593	
Book value of Equity	37635	46372	53168.207	59960.54221	66868.48	75317.96608	84717.92051	95438.42675	
Book Value of Debt	35055	37111	36247.663	34845.58412	32909.5	31313.1139	29520.86073	27802.21316	
ROE	**0.97%**	**36.91%**	**31.09%**	**28.24%**	**27.60%**	**25.76%**	**24.51%**	**23.56%**	**28.2%**
NPM	0.006071696	0.266752899	0.251542	0.251661559	0.266724	0.270975393	0.277472065	0.283550884	
Asset Turnover	0.563534099	0.547948013	0.5294253	0.514433414	0.504137	0.491443856	0.481524974	0.47618785	
Financial Leverage	2.834462601	2.525360131	2.3345779	2.181503468	2.052652	1.934717764	1.834282584	1.745190728	
g(ROC)								**0**	**2.524%**
g(ROE)								**0**	**4.243%**
Weighted Average Long-Term GDP Growth								**0%**	**2.12%**
Long-Term Average Global GDP Growth								0	2.90%
Long-Term Average GDP Growth in the OECD area								72.00%	1.50%
Long-Term Average GDP Growth in Emerging Countries								28.00%	3.70%
Long-Term Annual Average Headline CPI								**0%**	**2.30%**
Long-Term Growth USA								68%	1.80%
Long-Term Growth EU								32%	1.50%
Long-Term Growth China								0%	2.98%
Weighted Average Long Term GDP Gwoth of US,EU and China									**1.70%**
Weighted Average LT Growth Rate								**100%**	**1.70%**

To estimate terminal value, we assumed an 8-year average and perpetual cash flow growth at a constant rate, evaluating five methods: (1) ROE,

(2) ROC, (3) weighted long-term GDP growth, (4) global CPI inflation, and (5) US–EU weighted growth.

The **ROE** and **ROC** methods yielded growth rates of **4.243%** and **2.524%**, respectively. However, both exceeded the **global average GDP growth of 2.42%**, rendering them overly optimistic. A **weighted GDP growth approach**, applying **72% to OECD** and **28% to emerging markets**, produced a more sustainable estimate of **2.12%**. We also considered the **global CPI inflation rate of 2.3%**.

Additionally, a regional approach using **US (68%)** and **EU (32%)** revenue weights gave a growth rate of **1.705%**. While Merck's revenue is currently concentrated in developed markets, emerging market expansion suggests a shifting revenue base. Thus, we selected **2.12%** as the terminal growth rate, balancing conservatism with Merck's evolving global footprint.

Appendix 16: Calculating Beta

We calculated the average beta based on Merck's own beta data and the six peers' beta data, and we used it as the unlevered beta for the relevant calculations

Beta	Ticker	Market Cap (Equity Value)	Net Debt	Levered Beta	D/E	Unlevered Beta
Merck	MRK	259,362.00	29,348.30	0.58	0.11	0.53
AstraZeneca PLC	AZN	222,389.00	21,129.00	1.13	0.10	1.05
Bristol-Myers Squibb Co.,	BMY	113,068.00	12,360.00	1.07	0.11	0.98
Eli Lilly and Co	LLY	494,310.00	22,389.40	0.68	0.05	0.66
Pfizer Inc	PFE	158,933.00	17,552.00	0.44	0.11	0.40
Sanofi	SAN	112,261.00				
Novo Nordisk	NVO	3,452,603.00		1.18		1.18
Novartis	NOVN	211,804.00				
Union Chimique Belge	UCB	19,923.00				
Johnson & Johnson		384,945.00	16,000.00	0.80	0.04	0.77
Corporate Tax	**21%**				Average	**0.80**
					Median	**0.77**

Appendix 17: Estimating Cost of Debt

We calculated the Cost of Debt to be 3.28% based on the Spread data and Risk-Free Rate from Damodaran. At the same time, Damodaran gave the average level of the pharmaceutical industry 7.58e average of the above two is 4.68%. However, considering that the two values are quite different, and the data given by Damodran covers a wide range of companies, including immature small and medium-sized pharmaceutical companies, we decided to use 4.45%

Cost of Debt			
Interest Rate	1.98%		
Credit Spread	**4.45%**		
Interest Coverage	15.68528718		
Spread	0.35%	Damodaran	
Risk Free Rate	4.10%		
Industry Cost of Debt	7.58%	Damodaran	
Average of Credit Spread and Industry Rd	6.02%		

Appendix 18: Discounted Cash Flow Model

Under the DCF model, the value of a company can be written as the value of the company's future cash flows discounted based on the Cost of Capital

The company's free cash flow is calculated as follows: $FCFF = NOPAT + D\&A - CAPEX - \Delta Net\ WC$, we discount it at a weighted average cost of capital of 8.38% and adjust it based on net debt, Operating Lease, Non-core Investment and Non-Controlling Interest to arrive at the equity value.

The terminal value assumes that the company will grow permanently at a long-term growth rate of 2.116%

Calculating FCFF								
	2024	2025	2026	2027	2028	2029	2030	Terminal
FCFF	**18,299.56**	**10,870.39**	**13,444.92**	**14,300.77**	**14,277.95**	**14,886.77**	**15,356.32**	**250,381.96**
NOPAT	16,007.74	13,469.94	15,458.24	16,724.03	17,437.63	18,704.19	19,739.89	
+ D&A	4,499.00	3,750.99	3,740.15	3,635.28	3,436.79	3,245.11	3,210.69	
- NWC.change	-1,164.82	1,131.14	194.32	137.02	288.38	342.04	433.76	
- CAPEX	3,372.00	5,219.39	5,559.15	5,921.53	6,308.09	6,720.49	7,160.51	

DCF Model								
	2024	2025	**2026**	2027	2028	2029	2030	Terminal
FCFF	18,299.56	10,870.39	**13,444.92**	14,300.77	14,277.95	14,886.77	15,356.32	250,381.96
WACC	8.38%	8.38%	**8.38%**	8.38%	8.38%	8.38%	8.38%	8.38%
Present Value	18,299.56	10,029.99	**11,446.39**	11,233.75	10,348.71	9,955.80	9,475.84	154,501.89
PV(FCF)-VL	216,992.37	224,303.63	**229,652.95**	234,594.65	239,973.23	245,193.66	250,381.96	
(-)Net Debt	25,076.36	24,778.40	**22,250.40**	20,102.75	17,212.70	14,791.40	12,284.09	
(-) Operating Lease	2,160.89	1,721.57	**1,322.41**	995.74	695.26	205.29	205.29	
(-) Non core Investment	5,268.00	5,653.54	**6,066.48**	6,384.52	6,751.68	7,107.74	7,548.59	
(-) Non-Controlling Interests	16.00	23.11	**23.67**	25.80	27.13	29.02	31.44	
Equity Value	184,471.12	192,127.01	**212,122.96**					
Target Price (DCF Model)			**83.06**					

Appendix 19: Adjusted Present Value Model

The APV model is more flexible than the DCF model because it does not require the company to have a stable debt structure, as the valuation of the tax shield is done separately.

Under this model, the terminal value of FCFF and Value of Tax Shield is calculated by using the terminal growth rate and Ru. The cash flow of FCFF is then discounted using Ru, given by $r_u = \frac{E}{V} * r_e + \frac{D}{V} * r_d$, to derive the unlevered value (VU) of the company.

The present value of the interest tax shield is then added to VU to derive the value of the levered company.

The terminal Ru is calculated as the average of all Ru from 2024-2030F.

Finally, the Equity Value is derived by adjusting Net debt, Operating Lease, Non-Core Invested Capital, and Non-Controlling Interests. The model yields a target price of $83.34per share

APV Model								
	2024	2025	**2026**	2027	2028	2029	2030	Terminal
FCFF	18,299.56	10,870.39	**13,444.92**	14,300.77	14,277.95	14,886.77	15,356.32	247,197.57
Ru	8.46%	8.46%	**8.46%**	8.46%	8.46%	8.46%	8.46%	8.46%
g								2.12%
Present Value u	18,299.56	10,022.53	**11,429.37**	11,208.70	10,317.96	10,757.92	10,231.68	164,703.93
Vu	214,188.39	221,437.50	**226,725.33**	231,604.65	236,919.55	242,075.26	247,197.57	
Tax Shield	270.72	276.07	**271.54**	256.98	245.72	236.87	230.29	
V Tax Shield	3,562.76	3,588.08	**3,620.08**	3,669.35	3,734.04	3,813.05	3,707.12	
(-) Net Debt	25,076.36	24,778.40	**22,250.40**	20,102.75	17,212.70	14,791.40	12,284.09	
(-) Operating Lease	2,160.89	1,721.57	**1,322.41**	995.74	695.26	205.29	205.29	
(-) Non-Core Invested Capital	5,268.00	5,653.54	**6,066.48**	6,384.52	6,751.68	7,107.74	7,548.59	
(-) Non-Controlling Interests	16.00	23.11	**23.67**	25.80	27.13	29.02	31.44	
Equity Value	185,245.89	192,848.97	**212,839.09**	207,790.99	215,993.95	223,783.89	230,866.73	
Share Outstanding	2,554.00	2,554.00	**2,554.00**	2,554.00	2,554.00	2,554.00	2,554.00	
Target Price (APV Model)			**83.34**					

Appendix 20: Flow to Equity Model

Based on the equity flow model, we need to calculate FCFE (free cash flow to equity)

The calculation is as follows: $FCFE = NI + D\&A + \Delta NWC + Capex + Net\ borrowing$,

Equity cash flow needs to be discounted by Cost of Equity

The terminal value is calculated using the Gordon growth model (assuming perpetual growth).

The target price of this model is $93.12 per share.

Calculating FCFE							
FCFE	**15,023.18**	**13,067.22**	**13,518.92**	**14,097.09**	**14,649.21**	**15,152.83**	**16,387.05**
NI	17,117.00	16,530.11	16,934.31	18,456.43	19,405.28	20,762.50	22,489.28
(+) D&A	4,499.00	3,750.99	3,740.15	3,635.28	3,436.79	3,245.11	3,210.69
(-) NWC,change	-1,164.82	1,131.14	194.32	137.02	288.38	342.04	433.76
(-) Capex	3,372.00	5,219.39	5,559.15	5,921.53	6,308.09	6,720.49	7,160.51
(+) Net Borrowing	2,056.00	-863.34	-1,402.08	-1,936.08	-1,596.39	-1,792.25	-1,718.65

FTE Model								
	2024	2025	**2026**	2027	2028	2029	2030	Terminal
FCFE	15,023.18	13,067.22	**13,518.92**	14,097.09	14,649.21	15,152.83	16,387.05	265,309.83
Re	8.84%	8.84%	**8.84%**	8.84%	8.84%	8.84%	8.84%	
g								2.1%
Present Value	15,023.18	12,006.07	11,412.40	10,934.07	10,439.61	9,921.59	9,858.39	
EV	224,181.49	230,928.52	**237,820.19**	244,742.81	251,725.15	258,821.02	265,309.83	
Share Outstanding	2,554.00	2,554.00	**2,554.00**	2,554.00	2,554.00	2,554.00	2,554.00	
Target Price (FTE Model)			**93.12**					

Appendix 21: Dividend Discount Model

We employed a two-stage dividend discount model (DDM). Given that the current dividend growth rate of 5.91% appears unsustainable, we applied this rate exclusively to the initial stage (2025–2030), followed by a more conservative terminal growth assumption in the second stage.

In the first stage, we projected dividends per share (DPS) for 2026F–2030F using the 5.91% growth rate, discounted each cash flow to present value using the cost of equity, and aggregated these values. For the second stage, we calculated the terminal value by growing the 2030F dividend at the sustainable long-term rate and discounting it to present value using the equity cost minus growth rate differential.

The sum of the discounted cash flows from both stages yielded a target price of $82.8 per share.

Dividend Discount Model								
	Stage 1	Stage 2	Stage2 (Adjusted)					
Dividend Growth Rate	5.91%	4.46%	4.46%					
	0	1	**2**	3	4	5	6	
Stage 1	2024	2025	**2026**	2027	2028	2029	2030	Terminal
Dividend Per share	3.12	3.304306482	**3.499500425**	3.70622498	3.92516129	4.157030735	4.402597309	
Cost of Equity	8.84%	8.84%	**8.84%**	8.84%	8.84%	8.84%	8.84%	
PV of Dividend	3.12	3.04	**2.95**	2.87	2.80	2.72	2.65	
PV of Sum of stage 1 Dividend	17.50	14.38	**14.00**					
Year 6 Divident*(1+stage 2 r)	4.60	4.60	**4.60**					
Stage 2 Terminal Value	105.08	105.08	**105.08**					
PV of stage 2 Terminal Value	63.21	68.80	**68.80**					
Tartget Price (DDM)			**82.80**					

Appendix 22: Relative Valuation

Based on the EV/EBITDA, P/E and P/S ratios of nine peers (Excluding Eli Lilly, as its three key metrics exhibit significant disparities compared to the other nine companies.), the target price is calculated by substituting the corresponding values of Merck each year into the formula. The prices given by the model are $81.99, $86.86 and $92.33 respectively. The final average price implied is $87.06

	EV/EBITDA LTM	EV/EBITDA NTM	P/E LTM	P/E NTM	P/Sales LTM	P/Sales NTM
Eli Lilly and Co	30.9	**21.9**	59	**29.1**	13.9	**10.9**
Bristol-Myers Squibb Co.	7.3	**8.3**	18.99	**7.8**	2.2	**2.15**
Pfizer Inc	7.6	**7.3**	17.1	**8.4**	2.8	**2.8**
Sanofi	13.2	**8.6**	18.6	**11.2**	2.7	**2.46**
Novo Nordisk	13.3	**12.6**	19.8	**17.5**	6.9	**6.1**
Novartis	11	**10.9**	17.8	**13.4**	4.6	**4.6**
Union Chimique Belge	17.4	**15.8**	29.8	**22**	3.8	**3.6**
Johnson & Johnson	12.7	**11.5**	17.1	**14.5**	4.3	**4.1**
Roche	10.1	**9.1**	25.3	**13.1**	3.7	**3.7**
GlaxoSmithKline plc	8.1	**6.5**	19	**8.5**	2.3	**2.03**
Average	13.2	**10.1**	24.2	**12.9**	4.7	**3.5**
Median	11.85	**9.1**	18.995	**13.1**	3.75	**3.6**

Relative Valuation							
	2024	2025	2026	2027	2028	2029	2030
EV	245,737.40	229,791.28	232,985.75	248,425.74	256,913.09	269,914.87	289,758.24
Total Debt	27,237.25	26,499.96	23,572.81	21,098.48	17,907.97	14,996.69	12,489.38
Non-Controlling interests	16.00	23.11	23.67	25.80	27.13	29.02	31.44
Market Value of Equity	218,484.15	203,268.21	209,389.27	227,301.46	238,978.00	254,889.16	277,237.43
Share Price calculate by EV/EBITD	**85.55**	**79.59**	**81.98**	**89.00**	**93.57**	**99.80**	**108.55**
	221,379.87	213,789.39	221,839.46	238,703.16	250,974.99	268,528.31	290,861.31
Share Price calculate by P/E	**87.24**	**83.71**	**86.86**	**93.46**	**98.27**	**105.14**	**113.88**
Market Value of Equity	224,873.19	230,294.88	235,814.12	242,496.15	250,962.77	262,228.28	277,948.07
Share Price calculate by P/Sales	**88.05**	**90.17**	**92.33**	**94.95**	**98.26**	**102.67**	**108.83**

	EV/EBITDA	P/E	P/Sales
MERCK	7.00	8.52	3.30
Peer Average	10.07	12.93	3.50
Peer Median	9.10	13.10	3.60
Implied Price	81.98	86.86	92.33
Average Implied Price of EV/EBITDA & P/E	**87.06**		

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Level of Risk	SELL	REDUCE	HOLD/NEUTRAL	BUY	STRONG BUY
High Risk	0%≤	>0% & ≤10%	>10% & ≤20%	>20% & ≤45%	>45%
Medium Risk	-5%≤	>-5% & ≤5%	>5% & ≤15%	>15% & ≤30%	>30%
Low Risk	-10%≤	>-10% & ≤0%	>0% & ≤10%	>10% & ≤20%	>20%

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Ziyao Jin

23-06-2025