Scientific Research Publishing

American Journal of Industrial and Business Management, 2025, 15(10), 1498-1528
https://www.scirp.org/journal/ajibm
ISSN Online: 2164-5175
ISSN Print: 2164-5167

AI's Economic Impact

David Crovato[1], Jose Rosania[2], Krish Phatak[3]

[1]Department of International Business Administration, Erasmus University Rotterdam, Rotterdam, Netherlands
[2]Department of Electrical Engineering, Florida State University, Panama City, Panama
[3]Department of Computer Science, University of Southern California, Los Angeles, USA
Email: joserosania@icloud.com

How to cite this paper: Crovato, D., Rosania, J., & Phatak, K. (2025). AI's Economic Impact. *American Journal of Industrial and Business Management*, *15*, 1498-1528.
https://doi.org/10.4236/ajibm.2025.1510080

Received: September 18, 2025
Accepted: October 25, 2025
Published: October 28, 2025

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Abstract

This paper explores how Artificial Intelligence (AI) and AI-based companies, such as NVIDIA, Google, and Microsoft, are making a huge impact on the global economy. It shows how AI, once just an idea, has now become a powerful tool for innovation, especially in the stock market, where these companies have seen rapid growth. The paper compares how AI-based companies outperform traditional companies in areas like revenue growth, market share, and spending on research and development. It highlights that AI companies are investing heavily in new technologies, which is helping them stay ahead in a competitive market. The study also looks at how AI is transforming different industries, such as healthcare, finance, and manufacturing. AI has improved productivity and efficiency in these sectors by automating tasks, speeding up processes, and helping businesses make better decisions using data. It also explores how AI is changing the job market, creating new opportunities while at the same time replacing some roles, and how it is reshaping the skills people need for work in the future. Additionally, the paper discusses the challenges governments face in regulating AI, such as ensuring ethical use and managing the rapid adoption of AI technologies. It suggests that governments need to develop better policies to handle these issues while also supporting AI innovation. Finally, the paper looks to the future, predicting that AI will continue to grow and further revolutionize industries and economies. The research emphasizes the importance of AI in the modern economy and provides recommendations for businesses and governments on how to fully leverage AI's potential for future growth and development.

Keywords

Artificial Intelligence, Economic Impact, Google, Microsoft, Nvidia, Productivity, Job Market, Innovation, Regulation, Global Economy, Technology Adoption

1. Introduction

Artificial Intelligence is the science of creating machines that can think like hu-

mans. Unlike us, AI powered technology can process vast amounts of data. The goal of AI is to recognize patterns, make decisions, and exercise judgment much like humans do.

Artificial Intelligence has evolved over the course of over two centuries. It all began in 1804 with the invention of the Jacquard loom by Joseph Marie Jacquard, in which instructions for fabric designs were contained on a series of punched cards. The first computer, developed by Charles Babbage in 1822, was based on the Jacquard loom on paper. Later, the first artificial intelligence system was developed by Claude Shannon in 1950. He developed a machine that could learn from telephone circuits. This system was known as Theseus, a robotic maze-solving mouse.

After that, the first artificial neural network was created. It was called the Perceptron Mark I, and it was developed in July 1958 by the U.S. Office of Naval Research. This network was developed by feeding a 5-ton computer a series of punch cards. After 50 trials, the computer taught itself to distinguish cards. Neural networks continued to develop, and in 1994, TD-Gammon was developed. This was software that learned to play backgammon, a two-player board game played with counters and dice on a board, at a high level. This neural network taught itself to play backgammon by playing repeatedly and learning from the results. This is an example of a reinforcement learning algorithm, which is an area of machine learning.

Moving on to the 21st century, in 2012, AlexNet was developed. AlexNet is a deep-learning neural network system that can recognize images at a near-human level. AlexNet uses a deep learning method in artificial intelligence that teaches computers to process data in a way that is inspired by the human brain—to recognize images in very large datasets. At first, people were skeptical about whether deep learning could be applied successfully to very large datasets, but the success of AlexNet removed the skepticism and sparked an explosion of interest in deep learning post-2012.

Finally, ChatGPT is the most modern AI development. It was launched on November 30, 2022, by OpenAI. ChatGPT is an AI chatbot built on foundational language models, a type of artificial intelligence designed to understand and generate human language. It also uses a type of deep learning known as a transformer. ChatGPT has had a significant influence on the evolution of AI, as it has paved the way for advancements in natural language understanding and generation. It has also encouraged other AI researchers to adopt and refine this architecture. ChatGPT can answer questions, solve math equations, translate between languages, debug and fix code, and write stories or poems, to name a few.

With all these developments, artificial intelligence has had a substantial impact on the economy, making it crucial to analyze these effects. This analysis covers the macroeconomic and microeconomic impacts of AI, AI's influence on industries, the socioeconomic implications regarding AI, the policies and regulatory considerations shaped by AI's impact, and the future economic trends related to AI.

2. Literature Overview

2.1. Overview of Existing Research on AI and Economic Impact

Artificial intelligence (AI) has significantly influenced stock market gains over the past year, impacting various sectors, including healthcare and finance. NVIDIA, a prominent semiconductor producer essential for AI technologies, demonstrates this transformation as it is the leader of this revolution. Currently, AI learns from specific data sources and automates decisions within narrow domains, also known as Artificial Narrow Intelligence (ANI). Given the exponential rate of technological advancement, AI is anticipated to soon reach human-level intelligence by learning from human-generated data. Consequently, as AI increasingly automates tasks, companies are likely to reduce human labor to minimize costs since AI systems essentially replicate human decision-making processes.

Existing theories:

- Theory of AI learning:

1) At a micro level, AI supports individual learning by offering personalized strategies, feedback, and simulations, enhancing knowledge through machine learning, and providing explainable insights using natural language processing (see Figure 1 below).

2) At a meso level, AI integrates social network theory to aid both individuals and teams, supporting self-regulated learning, problem-solving, and creativity while addressing privacy concerns (see Figure 1 below).

3) At a macro level, AI connects cross-disciplinary and international communities, fostering collaboration and exploring new research through Cultural Historical Activity Theory (CHAT) and deep learning. The interplay between these levels highlights AI's role in enhancing individual, team, and community learning across diverse contexts (see Figure 1 below).

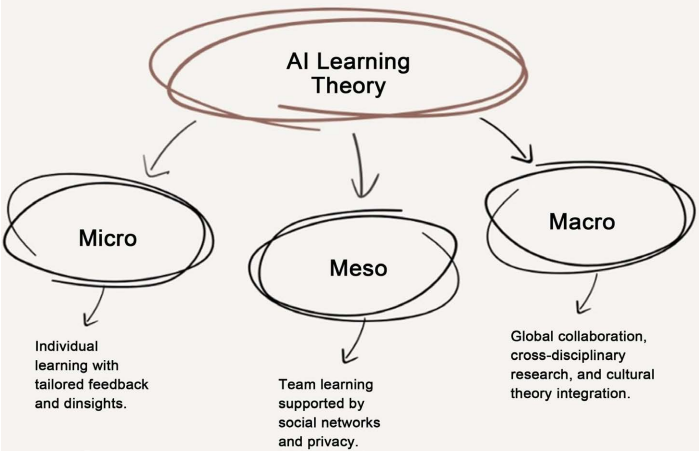

Figure 1. AI learning theory. Note: Gibson, D., Kovanović, V., Ifenthaler, D., Dexter, S., & Feng, S. (2023). Learning theories for artificial intelligence promoting learning processes. *British Journal of Educational Technology*, 54(5), 1125-1146. https://doi.org/10.1111/bjet.13341

- AI Economic Theory:
  - AI has the potential to accelerate economic growth dramatically, with researchers like Ajeya Cotra and Tom Davidson from Open Philanthropy predicting annual growth rates of 20% - 30% through task automation, leading to economies doubling in size every 2.5 years. This marks a significant shift from historical growth rates, which have followed a super-exponential trajectory since the Industrial Revolution, driven by population growth and innovation. By automating intellectual and physical labor, AI could exponentially boost productivity and innovation, resulting in rapid economic expansion.
  - A report from Tom Davidson in 2021 outlines three key arguments for this potential explosion in economic growth due to AI. First, historical data shows the world economy has followed a super-exponential growth pattern for millennia, suggesting future growth rates will continue to rise. Second, while population growth historically drove innovation and economic acceleration, declining birth rates in rich countries have slowed this loop. Advanced AI could reignite it by efficiently performing human tasks. Third, economic models like the Solow-Swan model predict super-exponential growth with AI, as it could increase capital investment and labor productivity, automating research and innovation (see Figure 2 below).

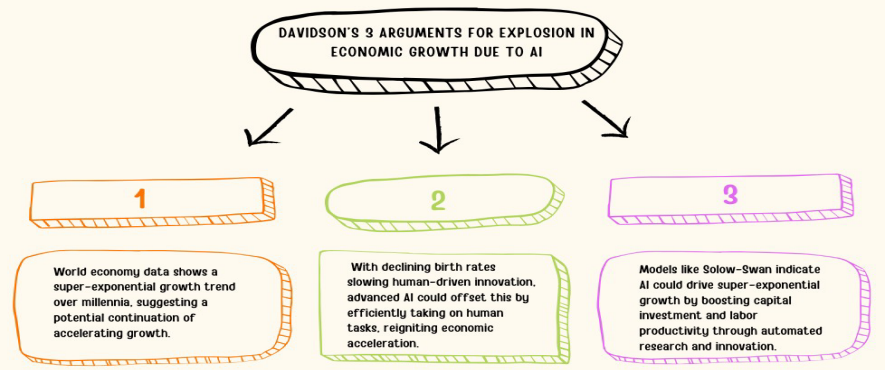

Figure 2. Davidson's 3 Arguments. Note: Adapted from Matthews, D. (2024, March 26). *How AI could explode the economy*. Vox. https://www.vox.com/future-perfect/24108787/ai-economic-growth-explosive-automation

2.2. Gaps in the Current Field

As for gaps in the field, there has been limited research on the extent to which the economy can grow at a micro/macro level, limited papers on the impact and roots of AI as well as its future, and few projections in the field of stocks, jobs, and industries.

3. Methodology

3.1. Research Design and Approach

The goal is to analyze the quantitative evidence of AI-based companies that lead

to the conclusion that there is an impact on the economy and the stock market. Primary and Secondary research will be employed to find evidence. Case studies focus on three major companies: Google, Microsoft, and Nvidia. The studies focus on how each of them plays a pivotal role in the global AI landscape.

3.2. Reasoning for Selected Companies

Market Influence: Google, Microsoft, and Nvidia are among the most significant players in the global AI market. Their contributions to AI development and economic transformation make them ideal subjects for this analysis. Each company leads in AI adoption, with significant market share and global influence.

Diversity of AI Applications: The three companies were chosen for their diverse roles within the AI ecosystem:

- Google: A leader in consumer-facing AI applications, including search engines, AI assistants (Google Assistant), and cloud-based AI services.
- Microsoft: A major player in the enterprise AI market, integrating AI in productivity tools such as Office 365, Azure, and its collaboration with OpenAI.
- Nvidia: The primary hardware provider for AI technologies, particularly GPUs, essential for machine learning and deep learning, making Nvidia the backbone of AI infrastructure.

Innovation and AI Integration: Google, Microsoft, and Nvidia have demonstrated a commitment to pushing the boundaries of AI through extensive research and development (R&D). Google has introduced innovations like Gemini and Project Starline, Microsoft is leading the integration of AI in enterprise solutions, and Nvidia's GPUs power some of the world's most advanced AI systems.

3.3. Analytical Tools and Techniques

Graphs, projections, the stock market, financial statements, comparative data, trend analysis, ratio analysis, funds flow analysis, and cash flow analysis will be the main analytical tools used to find the data.

3.4. Limitations

The analysis relies heavily on historical data and assumes that past trends will continue in the future, it also doesn't account for external factors that can significantly impact financial performance, and there isn't a definitive say in what we can expect to happen as the world can be unpredictable.

4. Macroeconomic Impacts

Artificial Intelligence has a diverse and widespread impact on the economy, especially in the field of macroeconomics. It ranges from GDP growth, productivity, economic performance, employment trends, and sector specific contributions, to name some.

4.1. Impact on GDP Growth

In terms of GDP growth, AI has driven significant increases in the GDP of many countries. For instance, AI is expected to contribute a 21% net increase in the United States' GDP by 2030, highlighting its profound impact on economic growth. In China, projections show a 26% GDP growth by 2030, with a 14.5% boost in North America (see **Figure 3** below). This equates to a total of $10.7 trillion, accounting for nearly 70% of the global economic impact. Additionally, AI investment in the U.S. could reach as high as 2.5% - 4% of the GDP. Goldman Sachs Research also expects that AI will have a measurable impact on U.S. GDP by 2027 and begin influencing growth in various economies in the years that follow. This upward trend in AI's influence on GDP and global economies is expected to continue, emphasizing its growing role in shaping economic performance worldwide.

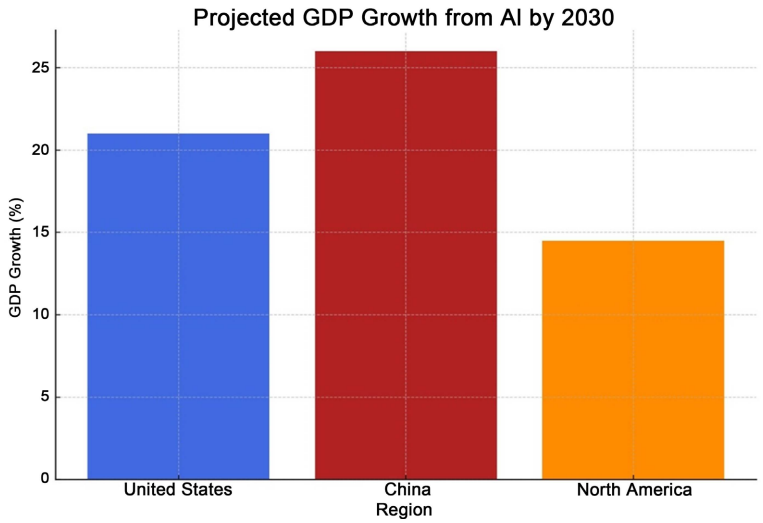

Figure 3. Projected GDP growth from AI by 2030. Note: Adapted from PwC. (2023). *Artificial intelligence study*. PwC. https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html

The economic potential of AI extends beyond the U.S. and China. Agrawal, Gans, & Goldfarb (2019) argue that AI technologies contribute to global GDP growth by enhancing productivity, particularly through automation. Their research suggests that the increase in AI-driven productivity could be a central driver of economic growth in both developed and developing countries. This aligns with Brynjolfsson & McAfee (2014), who note that AI's transformative power lies in its capacity to revolutionize industries, improve efficiency, and streamline business operations, contributing to sustained economic growth globally. Acemoglu & Restrepo (2019b) further support this by showing how AI adoption in sectors like manufacturing and healthcare has the potential to boost national GDP through both labor productivity increases and capital investment in AI infrastructure.

The ability of AI to learn from large data sets and improve its processes at various levels plays a critical role in this accelerated economic growth. At the macro level, AI's learning capabilities foster cross-disciplinary collaborations and innovations, driving significant advancements in productivity and economic output. As AI systems adapt and optimize their operations, they contribute to increased efficiency across industries, ultimately boosting GDP and economic performance. The continuous improvement of AI through learning and adaptation supports long-term, sustainable economic growth, making it a powerful driver of global economic progress.

Davidson's first argument for super-exponential growth suggests that innovations like AI drive economic growth at an accelerating pace. AI companies such as Google have already demonstrated this pattern of rapid, exponential growth, particularly with their increasing market share and revenue from AI-driven services like Google Search, Google Cloud, and Google Ads. As AI continues to enhance productivity and innovation, the global economy is set to experience sustained super-exponential growth.

4.2. Impact on Productivity

Regarding productivity, it is believed that AI will help increase it. A significant 64% of businesses believe that artificial intelligence will increase their overall productivity, and 60% of business owners, as revealed in a Forbes Advisor survey, agree.

This increase in productivity directly aligns with Davidson's second argument, where AI compensates for slowing population growth by driving significant improvements in efficiency. Microsoft exemplifies this as they integrate AI into their core enterprise solutions such as Azure and Office 365. Their AI-driven cloud services are enabling businesses worldwide to scale rapidly, contributing to higher productivity without depending on population growth.

4.3. Impact on Overall Economic Performance

With overall economic performance, AI is trending upwards. The AI market is projected to reach a staggering $407 billion by 2027, which is substantially more than its estimated $86.9 billion revenue in 2022. AI also has an expected annual growth rate of 37.3% between 2023 and 2030, as reported by

Grand View Research. By 2030, AI could contribute up to $15.7 trillion to the global economy (Bank of America, 2024), with $6.6 trillion likely to come from increased productivity and $9.1 trillion from consumption side effects (see **Figure 4** below). This current and projected growth highlights the increasing impact of AI technologies in the coming years.

Davidson's third argument, rooted in the Solow-Swan model, suggests that AI boosts both capital investment and labor productivity, fueling long-term economic growth. Nvidia, as a hardware provider for AI technologies, is a prime example. Nvidia's GPUs are essential for machine learning and AI applications across sec-

tors, driving capital investment in AI infrastructure. The company's focus on R&D and technological innovation exemplifies how AI drives both capital investment and productivity gains, aligning with the predictions of the Solow-Swan model.

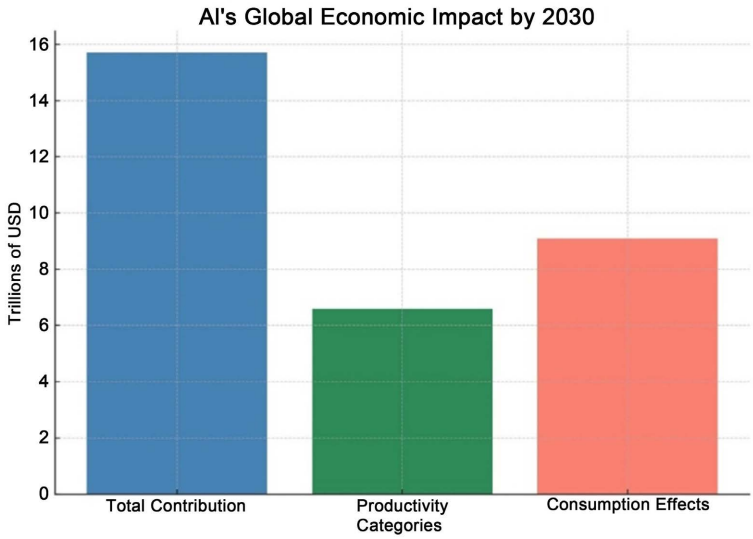

Figure 4. AI's global economic impact. Note: Adapted from PwC. (2023). *Artificial intelligence study*. PwC. https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html

4.4. Impact on Employment and Labor Market

AI is projected to create 97 million new jobs, according to World Economic Forum research. Additionally, there is a growing demand for AI support roles, with 39% of businesses reporting they hired software engineers and 35% hiring data engineers for AI-related positions in 2022, as noted in a McKinsey report. Despite these positive trends, a significant 77% of people remain apprehensive about potential job losses due to AI.

In terms of the labor market, a McKinsey report predicts that by 2030, AI-related advancements may impact approximately 15% of the global workforce. As labor shortages become more pressing, 25% of companies are turning to AI adoption to address this issue, according to an IBM report. On the contrary, 42% of business owners believe AI will streamline job processes.

Davidson's theory also relates to how AI transforms labor markets. While some jobs may be displaced, AI will also create new opportunities, particularly in AI-centric fields such as machine learning, data science, and AI ethics. This is consistent with Davidson's vision of AI-driven economic expansion, where new forms of work emerge even as traditional tasks are automated. As AI evolves, those willing to adapt and acquire new skills will be able to thrive in the new labor market created by AI technologies.

AI's influence extends to the hiring process, worker inclusion, and regulatory

frameworks as some companies are leveraging AI to retain talent, while regulators are focusing on worker inclusion practices.

For example, the US Equal Employment Opportunity Commission's recent Strategic Enforcement Plan (SEP) prioritizes addressing workplace discrimination in an increasingly AI-assisted environment. Similarly, the newly passed AI Act in the EU mandates that HR data and processes must comply with established standards for workers' rights or face corporate fines. Ultimately, it is anticipated that workers will evolve to coexist with AI, and those who are willing to learn and adapt will reap significant benefits.

5. Microeconomic Impacts

Artificial Intelligence has also had a significant impact on the microeconomic sector. While its macroeconomic influence includes factors like GDP growth, productivity, employment trends, and sector-specific contributions, the microeconomic impact is more focused on the performance of individual companies.

Some companies that focus on AI implementation or are centered around AI development include.

Google, Microsoft and Nvidia. AI has had a profound impact on their strategies, revenue growth, cost savings, and their market share while being the key to the growth and success of these companies.

Google and Microsoft use AI in many of their products, while Nvidia builds the hardware that powers AI. All three companies invest heavily in research and development and have strategies to save costs, helping them stay leaders in the tech industry.

5.1. Google Study

Google was founded in 1998 by Larry Page and Sergey Brin, Ph.D. students at Stanford University, who developed a search engine called "BackRub," which used links to determine page importance. After its initial public offering (IPO) in 2004, Google rapidly expanded its portfolio, launching Google Maps and acquiring YouTube in 2006. In 2008, the company introduced the Chrome browser, and in 2010, it initiated Google Fiber to provide high-speed internet access. More major innovations followed, such as the launch of the Android operating system in 2007, Google Assistant in 2016, and Google Duplex in 2018. To better manage its growing array of projects, Google restructured in 2015 under the parent company Alphabet Inc.

More recently, Google has focused on advancements in AI. It launched LaMDA, an AI-powered conversational program, in 2021 and unveiled Project Starline, a video communication method that would allow the user to see a 3D model of the person they're talking to, in 2022. Google implements AI in their search engine, Google Maps, their Pixel phones, Google Photos, YouTube, Google Assistant, Gmail, ads, and Google Cloud. AI helps optimize these features and applications. One of Google's latest AI innovations, Gemini, is a multimodal AI platform that

has significantly enhanced its search engine and boosted revenue (Google, 2024; Google AI, 2023).

Google dominates the search engine market, holding a 90.8% market share across desktops, tablets, and smartphones. In total, Google controls 81.95% of the global market share for search engines (Statista, 2023b). Economically, Google's ecosystem—comprising Google Search, Google Play, Google Cloud, YouTube, and advertising tools—generated $739 billion in economic activity for millions of American businesses, nonprofits, publishers, creators, and developers. Many of these businesses rely on Google's free tools to facilitate direct customer connections, whether through phone calls, bookings, reviews, or requests for directions (Google, 2024).

In terms of financial performance, in Q2 of 2024, Alphabet demonstrated continued financial strength, with total revenue reaching $84.7 billion, a 14% increase year-over-year (see **Figure 5** below). Google Services contributed $73.9 billion, supported by robust growth in Search and YouTube ads. Google Cloud achieved a milestone, surpassing $10 billion in quarterly revenue. The company reported an operating income of $27.4 billion, maintaining a 32% operating margin. Net income climbed to $23.6 billion, compared to $18.4 billion in Q2 2023. Additionally, Alphabet's workforce slightly decreased from the previous quarter's 181,798 employees to 179,582 employees.

Google has also focused on cost-saving measures as they recently commenced a selective round of employee layoffs as part of its strategy to reduce costs amidst economic uncertainties in the tech industry. However, the company is giving those affected opportunities to apply for other internal roles (Yahoo Finance, 2023).

In addition to revenue growth, Google continues to invest heavily in research and development (R&D). For the quarter ending June 30, 2024, Google's R&D spending was $11.86 billion, reflecting a 12.01% year-over-year increase. For the twelve months ending June 30, 2024, R&D spending totaled $47.13 billion, marking a 10.65% year-over-year increase. This demonstrates the company's sustained focus on innovation and research (MacroTrends, 2024b).

5.2. Microsoft Study

Microsoft, co-founded by Bill Gates and Paul Allen in 1975, had its breakthrough in 1980 when IBM chose Microsoft's operating system for its first personal computer. The 1985 launch of Windows revolutionized personal computing with its graphical user interface, setting the stage for decades of growth. Throughout the 1990s and 2000s, Microsoft expanded its software offerings with the introduction of Office Suite and entered the gaming industry in 2001 with the launch of the Xbox console. In 2010, the company made significant strides in cloud computing with the launch of Azure. Under CEO Satya Nadella, who took over in 2014, Microsoft has shifted its focus towards cloud services and AI. Key acquisitions like LinkedIn in 2016 and GitHub in 2018 enhanced its enterprise portfolio.

Microsoft has also concentrated on integrating AI into its products, developing advanced tools such as the AI-powered Copilot for Office 365 and enhancing its Azure platform. Microsoft's AI capabilities extend across various products, including Azure AI, a comprehensive suite of cloud-based AI services,

Microsoft 365 Copilot for productivity, AI Builder within Power Platform for AI model creation, Cognitive Services for API's that handle vision, speech, and decision-making, and machine learning tools for deploying AI models. Additionally, Microsoft has partnered with OpenAI to ensure access to the latest AI innovations and supports third-party developers by allowing them to create and integrate AI applications on its platform (Redress Compliance, 2024; SamExpert, 2024).

In terms of financial performance, In Q4 FY 2024, Microsoft reported strong financial performance with revenue of $64.7 billion (see **Figure 5** below), reflecting a 15% increase (16% in constant currency). Operating income rose by 15% to $27.9 billion (16% in constant currency), and net income increased by 10% to $22.0 billion (11% in constant currency). Diluted earnings per share grew by 10% to $2.95 (11% in constant currency). CEO Satya Nadella attributed this success to Microsoft's continued innovation and its leadership in the AI era.

The Productivity and Business Processes division saw revenue grow by 11% to $20.3 billion, with Office 365 Commercial revenue rising 13%. Microsoft 365 Consumer subscribers increased to 82.5 million, and LinkedIn revenue grew by 10%. Dynamics products and cloud services experienced a 16% growth, driven by a 19% rise in Dynamics 365 revenue. The Intelligent Cloud segment reported $28.5 billion in revenue, up 19%, with Azure and other cloud services revenue growing by 29%. The More Personal Computing division generated $15.9 billion in revenue, up 14%, driven by a 61% surge in Xbox content and services, while Windows OEM revenue grew by 4%. However, device revenue declined by 11% (SignHouse, 2024).

Microsoft also remains focused on cost-saving initiatives, including worker layoffs and reducing Azure costs through data-driven optimization techniques, good governance, and workload modernization (Microsoft, 2024c). Despite these cost-saving efforts, In Microsoft's FY 2024 Q4 report, research and development (R&D) expenses totaled $8.06 billion, a notable increase compared to the $6.74 billion in the same quarter the previous year. For the full fiscal year, R&D spending reached $29.51 billion, up from $27.20 billion in FY 2023, reflecting Microsoft's continued commitment to innovation, particularly in areas such as cloud services and AI-driven technologies (Microsoft, 2024a).

These strategic moves have solidified Microsoft's position as a top technology company, commanding a 21% market share globally.

5.3. Nvidia Study

Nvidia was founded in 1993 by Jensen Huang, Chris Malachowsky, and Curtis Priem, initially focusing on creating graphics processing units (GPUs) for gaming and professional markets. The release of GeForce 256 in 1999 marked a significant

breakthrough, establishing Nvidia as a leader in graphics technology (Investing.com, 2024).

Over the years, Nvidia expanded its GPU applications beyond gaming, targeting industries such as automotive, healthcare, and data centers. The company made significant strides in AI and deep learning with the introduction of the CUDA platform in 2006, enabling GPUs to be used for general-purpose computing. In recent years, Nvidia has become a major player in the AI and data center markets, with its GPUs being widely used for machine learning and AI research. Strategic acquisitions, like Mellanox Technologies in 2019 and ARM in 2020, have further solidified Nvidia's position in the tech industry.

Nvidia is a different type of technology company than Google and Microsoft. Instead of developing AI tools as part of their strategy, they create technology and devices that enable the use of AI. Nvidia's main strategy and revenue source comes from the development of their GPUs, which are used for gaming, cryptocurrency mining, and professional applications. They make most of their revenue from the Computer and Networking business segment, which includes AI, so it has been an increasingly shifted focus. Examples of this AI driven strategy is the successful launch of ChatGPT in late November 2022, powered by Nvidia's DGX™ AI supercomputer, which rapidly became the fastest-growing app in history, reaching 100 million users in just two months, and in November 2023 when Nvidia launched its NVIDIA HGX™ H200 platform, which features the H200 Tensor Core GPU with advanced memory, capable of handling vast amounts of data for generative AI and high-demand computing tasks.

Due to this strategy in a growing AI world, In Q2 Fiscal 2025, NVIDIA reported record revenue of $30.0 billion (see **Figure 5** below), reflecting a 15% increase from the previous quarter and a 122% growth year-over-year. Data center revenue reached $26.3 billion, marking a 16% rise from Q1 and 154% year-over-year. The company posted GAAP net income of $16.6 billion, up 12% from Q1, with earnings per share (GAAP) at $0.67. NVIDIA also returned $15.4 billion to shareholders and authorized an additional $50 billion in share repurchases. Adding to this, on June 7, 2024, Nvidia put forward a ten for one stock split.

NVIDIA implements cost-saving strategies through energy efficiency, operational efficiency, and research and development. By enhancing the energy efficiency of its products, especially in high performance computing, NVIDIA reduces power consumption while maintaining top performance. Streamlined operations and economies of scale help lower production costs by optimizing manufacturing and supply chain management. Additionally, NVIDIA's significant investments in research and development lead to innovations that contribute to more efficient designs and processes, resulting in long-term cost reductions across its operations. Still, In Q2 Fiscal 2025, NVIDIA reported R&D expenses of $3.09 billion, reflecting a 51.5% increase compared to $2.04 billion in Q2 Fiscal 2024. Over the first six months of Fiscal 2025, the company's total R&D spending reached $5.81 billion, up from $3.92 billion during the same period in the previous

fiscal year. This increase highlights NVIDIA's continued investment in innovation and technology development (MacroTrends, 2024a).

These strategies, spending, cost savings, and revenue have led to Nvidia having a dominant 88% market share in the GPU market (Nvidia, 2023a, 2023b; Nvidia, 2024a, 2024b).

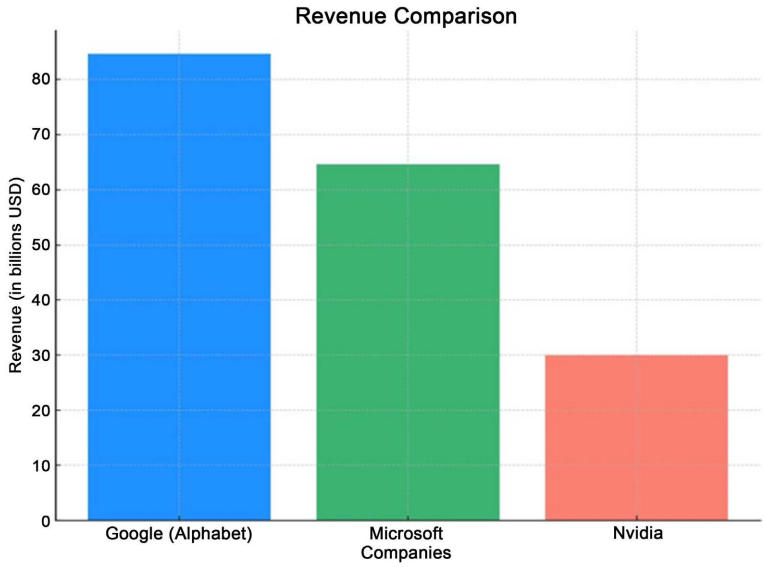

Figure 5. Revenue comparison. Note: Adapted from Statista (2023a). *Quarterly revenue of Google worldwide*. https://www.statista.com/statistics/267606/quarterly-revenue-of-google, Microsoft (2024b). *Q4 FY 2024 earnings release*. Microsoft Investor Relations. https://www.microsoft.com/en-us/investor/earnings/fy-2024-q4/press-release-webcast, NVIDIA (2024c). *NVIDIA announces financial results for second quarter fiscal 2025*. https://nvidianews.nvidia.com/news/nvidia-announces-financial-results-for-second-quarter-fiscal-2025

5.4. Comparison of AI Based Companies' vs Traditional Ones

Compared to AI-driven companies, businesses in other industries have less impact on the economy.

In the stock market, the "Magnificent 7"—which includes Apple, Amazon, Alphabet (Google), Meta, Microsoft, Nvidia, and Tesla—accounts for 31% of the S&P 500. Many of these companies are AI-based as their core business model is centered on developing or enabling AI technologies (CNBC, 2024). Several, like Microsoft, Google, and Nvidia, are heavily invested in AI, which underscores the significant economic impact these AI-focused companies have due to their rapid growth. In contrast, many traditional companies may adopt AI in various aspects of their operations, but AI is not the cornerstone of their business model.

Compared to non-AI-based companies, AI-based companies have experienced more growth as well. One example is Nvidia's growth compared to ExxonMobil's. ExxonMobil, a traditional company in the oil and gas sector, explores for, produces, and sells crude oil, natural gas, and petroleum products. ExxonMobil's key developments include advancements in deepwater drilling, hydraulic fracturing, and lique-

fied natural gas (LNG) technology. While ExxonMobil has made significant investments in renewable energy research, its primary focus is still on energy production. On the other hand, Nvidia, as an AI-driven company, has achieved a 122% growth year over year, demonstrating how companies whose core business is AI technology can experience more substantial growth compared to traditional firms.

Another example is Microsoft's growth compared to Coca-Cola's. Coca-Cola, a traditional company, is a global leader in the beverage industry, offering sodas, juices, teas, and energy drinks. Coca-Cola's developments include diversification into healthier beverage options, innovative packaging solutions, and extensive global marketing campaigns. Microsoft, an AI-focused company, experienced a 16% growth compared to the previous fiscal year, driven by its deep integration of AI into products like Azure and Microsoft 365. In contrast, Coca-Cola had a 3% year-over-year growth (see **Figure 6** below), highlighting how AI-based companies are generally experiencing higher growth due to their AI-centric business models, compared to traditional companies that are integrating AI into existing business models without making it the core focus.

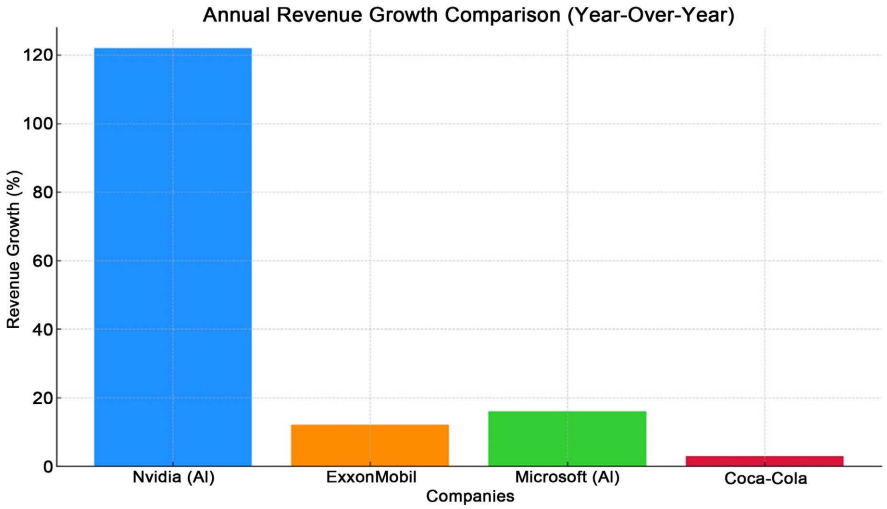

Figure 6. Annual revenue growth comparison. Note: Adapted from NVIDIA (2024c). *NVIDIA announces financial results for second quarter fiscal* 2025. https://nvidianews.nvidia.com/news/nvidia-announces-financial-results-for-second-quarter-fiscal-2025, ExxonMobil (2024, August 2). *ExxonMobil announces second quarter* 2024 *results*. https://corporate.exxonmobil.com/news/news-releases/2024/0802_exxonmobil-announces-second-quarter-2024-results, Microsoft (2024b). *Q4 FY* 2024 *earnings release*. Microsoft Investor Relations. https://www.microsoft.com/en-us/investor/earnings/fy-2024-q4/press-release-webcast, The Coca-Cola Company (2024, July 23). *Coca-Cola reports second quarter* 2024 *results*. https://www.coca-colacompany.com/media-center/coca-cola-reports-second-quarter-2024-results

6. Industry and Sector Analysis

6.1. Examination of How AI Adoption Varies across Different Industries

In the business sector, 35% of companies reported using AI, and 42% mentioned

exploring AI. More than half of these organizations have developed a corporate data strategy yielding results (see Figure 7 below).

Up to 26% of legal professionals use generative AI and were found more likely to use generative AI tools every month if they worked at larger law forms (32%) or academic institutions (33%). Moreover, 42% plan to incorporate AI in their legal work, such as redlining and document automation (see Figure 7 below).

40% of retailers have adopted AI to enhance in-person experience and implement real-time pricing and customer research as more customers shop online. This number is continuously growing and is expected to reach 80% by 2025 (see Figure 7 below).

In finance, AI achieved $9.45 billion in 2021 and is expected to grow at 16.5% by 2030.

AI in the healthcare industry has been evolving rapidly due to the urgency prompted by the COVID-19 pandemic. In 2022, AI in healthcare was valued at $15.4 billion; this value is expected to increase by a compound annual growth rate (CAGR) of 37.5% until 2030.

AI in telecommunications was valued at $1.45 billion in 2022 as it's a rapidly growing industry adopting AI. 52% of telecom enterprises have already deployed AI-powered chatbots to improve customer experience and network reliability (see Figure 7 below).

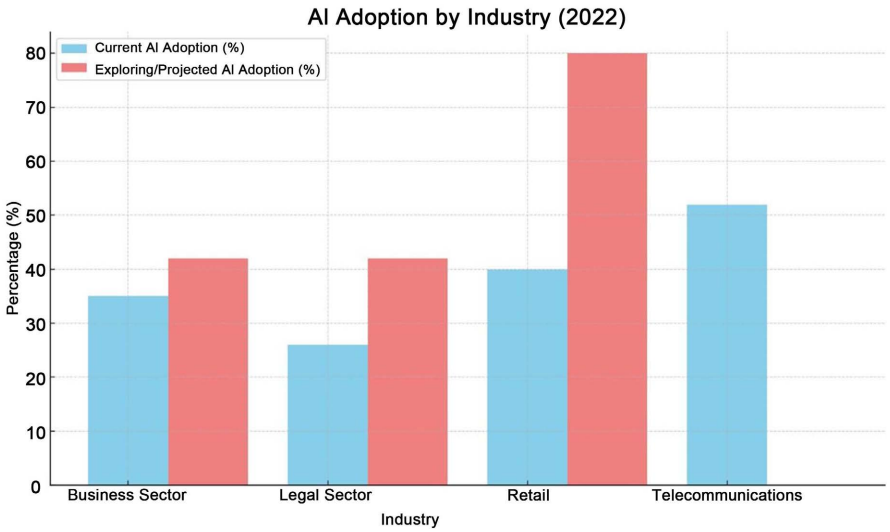

Figure 7. AI Adoption by Industry. Note: Adapted from EdgeDelta (2024). *AI adoption by companies*. https://edgedelta.com/company/blog/ai-adoption-by-companies, InData Labs (2024). *AI adoption by industry*. https://indatalabs.com/blog/ai-adoption-by-industry, Thomson Reuters (2024). *Navigating ethical and regulatory issues of using AI*. https://legal.thomsonreuters.com/blog/navigate-ethical-and-regulatory-issues-of-using-ai/

6.2. Impact on Different Sectors'

AI has made significant contributions across various sectors of the economy, notably in manufacturing, finance, healthcare, and beyond. According to a report by

Accenture, the manufacturing sector is projected to see the greatest financial benefit from AI, with a projected gain of $3.8 trillion by 2035. AI's impact on manufacturing ranges from automating production processes and managing warehouses to optimizing supply chains and tracking sales. This level of automation promises to revolutionize efficiency and productivity in the sector. Brynjolfsson & McAfee (2014) highlight that AI's role in manufacturing automation leads to substantial productivity gains, reducing costs, and increasing output in manufacturing facilities globally. The potential of AI to optimize supply chains and automate logistics operations directly aligns with Acemoglu & Restrepo's (2019a) research on the significant impact AI has on transforming production systems and job functions.

In healthcare, AI is poised to drive profound changes. It will enhance diagnostic capabilities and pave the way for innovations like eHealth, robotic process automation (RPA) assistants, and telemedicine solutions that promote interactive and collaborative care. The integration of AI into healthcare is expected to enhance the quality and accessibility of medical services worldwide. Acemoglu & Restrepo (2019a) emphasize that the adoption of AI in healthcare will likely lead to improvements in efficiency, particularly in diagnostic tools and administrative functions. Brynjolfsson & McAfee (2014) also discuss how AI-powered systems can help reduce the administrative burden in healthcare settings, enabling healthcare workers to focus more on direct patient care and decision-making. These advancements align with studies by Brynjolfsson & McAfee (2014) showing that AI can significantly impact service-based sectors like healthcare by improving efficiency and creating new opportunities for healthcare professionals.

The technology sector is also heavily investing in AI. In fact, 33% of companies in the technology and service provider industry plan to invest more than $1 million in AI technologies (EdgeDelta, 2023). In the financial sector, AI is transforming banking, finance, and fintech, with significant investments being made in AI-powered applications. These include tools for improving customer service, ensuring account legality, automating workflows, enhancing cybersecurity, and analyzing customer search patterns. Philippon (2019) discusses how AI has the potential to reshape financial markets by improving risk management and customer service while also facilitating fraud detection and cybersecurity solutions. Linn et al. (2021) show that AI is becoming a key tool in capital markets, with algorithms driving high-frequency trading, portfolio management, and automated trading systems.

AI is also reshaping marketing and e-commerce. Digital marketers are using AI to streamline their campaigns and automate brand promotion activities. Tools like ChatGPT assist with content creation, drafting email scripts, and generating web content that aligns with Google's indexing and ranking policies. In eCommerce, AI helps analyze customer search behavior to offer personalized product recommendations, enhancing the shopping experience. Additionally, retail is seeing AI automate store management processes while enriching the overall shopping expe-

rience for consumers. Acemoglu & Restrepo (2019a) discuss how AI is transforming industries such as retail and marketing, creating personalized experiences for consumers and automating many traditionally human-driven tasks. Brynjolfsson & McAfee (2014) argue that AI-powered marketing systems not only enhance customer experience but also allow companies to capture and analyze vast amounts of data, leading to more targeted and effective marketing campaigns.

6.3. Impact on Traditional Industries Vs Tech-Driven Sectors

- Traditional industries leverage AI to enhance operational efficiency, reduce costs, and improve quality and safety. The focus is often on incremental technological adoption and practical applications.
- Tech-driven industries use AI to drive innovation, create new business models, and utilize advanced data analytics for scalable and proactive management solutions. The impact of AI in these sectors leads to significant productivity gains and transformative changes.

6.4. Case Studies of Specific Industries

Healthcare:

AI is rapidly becoming a key component of modern healthcare, thanks to its adaptability, high diagnostic accuracy, and efficient data management. Since its introduction in the 1950s, AI has evolved considerably and is now essential in areas like medical imaging, drug design, and patient care. The FDA has increasingly approved AI and machine learning (ML) applications for medical use, recognizing their potential to improve work productivity and patient outcomes. AI contributes significantly by streamlining diagnostic processes, enhancing accuracy in medical imaging, assisting in drug discovery, and offering personalized treatment plans.

Notable AI systems, such as IBM Watson Health and DXplain, provide evidence-based solutions that improve diagnostic precision and treatment effectiveness. AI-powered clinical decision support (CDS) tools now integrate with electronic health records (EHRs), allowing providers to process large data sets and deliver personalized treatment recommendations. This has been particularly beneficial in managing chronic diseases and aiding surgical decisions, such as with the AI-based Rapid Aneurysm tool, which offers 3D models for more accurate aneurysm risk assessment.

AI's role in drug discovery has also accelerated development, reducing costs and timeframes, as seen with AI-designed molecules targeting SARS-CoV-2, the virus responsible for COVID-19. In addition to improving clinical outcomes, AI addresses operational challenges by automating tasks like EHR data extraction and reducing clinician workload and errors. Genomics and precision medicine benefit from AI's real-time genomic profiling, helping in surgical decisions, while hospital management systems leverage AI for optimizing resources, such as in AI-driven operating room scheduling. In medical imaging, it enhances diagnostics,

including using deep learning models to analyze lung ultrasound images for COVID-19. Beyond direct patient care, AI also streamlines revenue cycle management by automating claims processing and medical coding, as demonstrated by Mount Sinai's use of autonomous coding technology. Overall, AI's transformative impact on healthcare is evident, improving patient outcomes and operational efficiency across various domains (Rahman et al., 2024; TechTarget, 2024).

Finance and cryptocurrency:

AI is significantly transforming the finance industry by enhancing decision-making and optimizing operational processes. With the use of predictive analytics and machine learning, it helps financial institutions make more informed decisions, optimize trading strategies, and manage risks more effectively. AI automates routine tasks such as data entry, customer service, and transaction processing, reducing operational costs and improving efficiency. AI-powered chatbots and virtual assistants deliver personalized responses, enhancing customer service. In addition, AI improves security by detecting and preventing fraud in real-time, ensuring safer financial transactions. Financial institutions are also leveraging AI to analyze vast datasets, driving better investment decisions and higher returns, while minimizing risks. This data-driven approach is leading to the creation of more sophisticated financial products and services.

AI plays a pivotal role in several key areas of finance. In risk management, AI can process vast amounts of data quickly, offering precise forecasts and identifying potential credit risks to enhance lending decisions. In trading, algorithmic and high-frequency trading has become popular due to AI's ability to analyze large amounts of data, driving data-driven investments. AI also supports market sentiment analysis by quickly processing both structured and unstructured data from various sources. Personalized banking is another area where AI excels, offering tailored financial advice based on customer spending patterns. Additionally, AI enables robotic process automation (RPA), reducing the need for manual intervention in tasks like data verification and document review. Lastly, in terms of cybersecurity, AI enhances the safety of online transactions by detecting suspicious activities and preventing fraud before it occurs.

As for cryptocurrency, AI is already widely employed in the market, but many experts predict that this is only the beginning and that AI usage in the crypto market will skyrocket in the next few years. Some of the ways in which it's currently used are:

- Predictive Analytics: AI algorithms can analyze historical price data and market trends to provide predictions for future price movements in the crypto market, helping traders make informed decisions about when to buy or sell.
- Fraud Detection: As the crypto space is largely unregulated, it is vulnerable to fraud and other criminal activities. AI can be used to identify suspicious transactions and patterns that may indicate fraudulent behavior.
- Trading: AI algorithms can execute trades automatically based on pre-set parameters and market conditions, helping traders capitalize on opportunities in

the market while minimizing risks.

- Portfolio Management: AI-powered tools can help investors manage their crypto portfolios by analyzing market trends, assessing risk, and suggesting portfolio rebalancing strategies.
- Mining: AI can help improve the efficiency of cryptocurrency mining by optimizing energy usage, reducing hardware maintenance costs, and increasing the accuracy of mining algorithms.

7. Socioeconomic Implications

7.1. Impact on Job Creation and Displacement

A report by Goldman Sachs highlights that AI could potentially replace the equivalent of 300 million fulltime jobs (see **Figure 8** below). However, it may also catalyze new job creation and drive a productivity boom, ultimately increasing the total annual global production of goods and services by 7%. The report further states that two-thirds of jobs in the U.S. and Europe are "exposed to some degree of AI automation," with around a quarter of all work tasks in these regions potentially being fully automated by AI.

While AI's impact on the job market is often framed in terms of job displacement, Acemoglu and Restrepo (2019a) offer a more nuanced perspective. They argue that AI and automation technologies not only displace jobs but also reshape job functions, particularly by improving productivity. In their analysis, job displacement is often accompanied by job creation in new sectors, especially those driven by technology and healthcare advancements. Brynjolfsson & McAfee (2014) also discuss how AI's impact on job creation depends largely on how economies manage automation. They suggest that AI's ability to drive new industries and enhance productivity in existing sectors will create new opportunities, although some sectors will be slower to adapt than others.

Meanwhile, researchers from the University of Pennsylvania and OpenAI found that educated whitecollar workers, especially those earning up to $80,000 a year, are among the most likely to be impacted by workforce automation. The World Economic Forum adds to these findings, estimating that AI will replace 85 million jobs by 2025. Additionally, Freethink projects that 65% of retail jobs could be automated by 2025, primarily due to technological advancements, rising costs, tight labor markets, and reduced consumer spending (Freethink, 2024).

Autor et al. (2020) examine how automation and AI disproportionately affect low-skill jobs while creating new opportunities for higher-skilled roles. They note that white-collar workers, especially those with routine cognitive jobs such as in clerical work, are most vulnerable to automation, which mirrors findings from the University of Pennsylvania and OpenAI. However, AI technologies also create opportunities for these workers to transition to more complex, non-routine jobs, which AI cannot easily automate.

Looking further ahead, PwC projects that by the mid-2030s, up to 30% of jobs may be automatable. Although men are anticipated to be more affected in the long

term due to higher employment in manual labor roles, the initial waves of automation may impact women more due to their higher representation in clerical and administrative positions.

Autor et al. (2020) and Acemoglu & Restrepo (2019a) provide insights into the gendered impacts of automation. While men are more likely to be affected in the long term due to their higher representation in manual labor and manufacturing roles, women are expected to be more affected in the short term due to their higher representation in clerical and administrative positions, which are highly automatable.

Despite these potential job disruptions, not all outcomes are negative. A report from McKinsey & Company estimates that AI could create 20-50 million new or enhanced jobs by 2030 across industries such as healthcare and pharmaceuticals (see **Figure 8** below).

Acemoglu & Restrepo (2019a) also argue that AI's potential to increase productivity will expand the range of tasks humans can perform, generating new roles, particularly in technology, healthcare, and creative industries. As new AI-driven industries emerge, job creation is expected to offset some of the negative effects of automation.

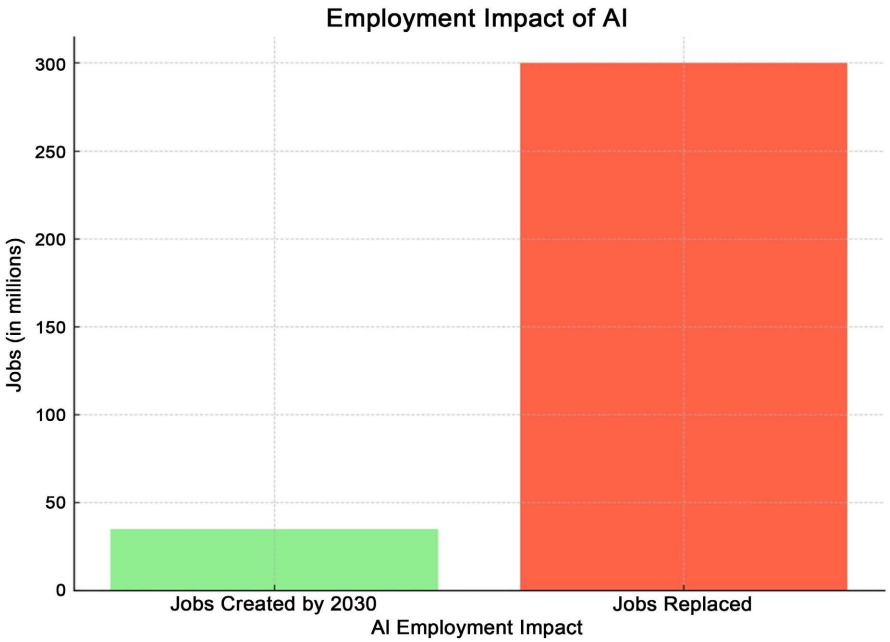

Figure 8. Employment Impact of AI. Note: Adapted from Nexford (2024). How AI will affect jobs. https://www.nexford.edu/insights/how-will-ai-affect-jobs, McKinsey Global Institute (2017, December). Jobs lost, jobs gained: What the future of work will mean for jobs, skills, and wages. McKinsey & Company. https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the-future-of-work-will-mean-for-jobs-skills-and-wages

Jobs likely to be Automated:

- Customer service representative

- Receptionists
- Accountants/Bookkeepers
- Salespeople
- Research and analysis
- Warehouse work
- Insurance underwriting
- Retail

New Jobs that AI can create:

- AI trainers and teachers
- Data analysts/scientists
- Human-machine teaming managers
- AI ethics and policy specialists

7.2. Market Concentration, Stifling Innovation, and Financial Instability

While job displacement is a significant concern associated with AI, the economic risks extend beyond labor market shifts. One potential negative impact is increased market concentration. As AI technologies continue to advance, a small number of AI-driven tech firms, such as Google, Microsoft, Nvidia, and Apple, are poised to dominate both the AI sector and broader industries. As these companies develop and deploy AI technologies, they are capturing increasing market share, with the "Magnificent Seven" tech giants—Apple, Amazon, Alphabet (Google), Meta, Microsoft, Nvidia, and Tesla—collectively accounting for 31% of the S&P 500's total market capitalization. Autor et al. (2020) discuss how market concentration in the tech sector increases barriers to entry for smaller firms, as established giants have increased resources and market dominance, effectively crowding out competitors and reducing the potential for new innovations. Philippon (2019) further explores how monopolistic power in industries like AI leads to reduced competition, preventing smaller firms from entering the market and potentially stifling the diversity of AI solutions. This growing concentration of power could also exacerbate inequality, as dominant firms capture large market shares and redistribute economic gains to their shareholders, rather than allowing for a more equitable spread of benefits.

As the "Magnificent Seven" continue to consolidate their influence over emerging AI technologies, the risk of stifling innovation increases. Autor et al. (2020) note that dominant firms often set industry standards and control the flow of resources, which limits the ability of smaller companies to compete or introduce disruptive innovations. This market power not only limits competition but also reduces the diversity of ideas, as large firms control much of the research and development efforts in AI. Philippon (2019) highlights the broader economic risk of such concentration: market dominance by a few firms could result in inefficiencies where innovation is driven by profits rather than consumer need or technological advancement, stifling overall progress.

Stifling Innovation is another key concern. With Nvidia controlling roughly 80% of the AI chip market, the dominant players in AI development are setting the direction for the entire industry, potentially limiting new ideas and alternative approaches. Smaller firms, without the same resources or access to cutting-edge AI infrastructure, face significant challenges in competing or innovating in the space. As Nvidia and other major companies lead AI research, innovation could become concentrated in their hands, leading to reduced diversity in solutions and stalling progress in areas not prioritized by these dominant firms.

Moreover, AI-driven financial market instability poses significant risks to economic stability. AI's ability to process vast amounts of data and execute trades at lightning speed can lead to accelerated market movements, as AI algorithms react instantly to new information. The IMF warns that these rapid responses could destabilize markets, particularly during moments of economic stress (International Monetary Fund, 2024a). AI-driven trading is already linked to increased market volatility, with higher trading volumes and quick price swings that can escalate financial crises. Linn, Dube and Edwards (2021) examine how AI's role in high-frequency trading can amplify price volatility, particularly in capital markets during periods of uncertainty. Additionally, the potential for cybersecurity threats and market manipulation via AI tools, such as deepfakes and fraudulent trading strategies, could undermine market integrity and investor confidence. Philippon (2019) discusses how AI-driven manipulation could pose new risks to market transparency, potentially eroding investor trust and affecting overall financial stability.

Regulators are increasingly aware of the potential risks posed by AI in the financial sector. The U.S. Financial Stability Oversight Council (FSOC) highlighted AI as a vulnerability in its 2023 annual report, stressing the importance of monitoring AI's impact on financial stability. As AI continues to evolve, regulatory frameworks will need to adapt to mitigate the risks associated with its widespread use in financial markets (CBS News, 2023). Linn, Dube and Edwards (2021) also note that regulatory bodies may need to implement more robust oversight mechanisms to account for AI's role in automated decision-making, market surveillance, and transactional risk. They suggest that these regulatory frameworks must balance the need for innovation with mitigating systemic risks to prevent the kind of market crashes that have previously been exacerbated by AI-driven trading.

The IMF's Global Financial Stability Report also indicates that while AI can improve risk management, it may introduce systemic risks. The widespread use of AI in capital markets could reshape market structures, creating new risks that are not yet fully understood. This could lead to large-scale changes in how financial markets function, heightening the likelihood of unforeseen disruptions (International Monetary Fund, 2024b). Philippon (2019) explores how market structures are likely to change in response to AI's growing influence, raising concerns about concentration of power and the potential monopolization of financial services by large firms with the most advanced AI technologies. These changes, while

improving efficiency, could also create new systemic risks, potentially increasing the likelihood of financial instability during times of economic stress.

7.3. Changes in Skill Requirements and Workforce Development

Traditional skill sets are being supplemented with AI-specific proficiencies. New jobs not only demand a deep understanding of AI algorithms and technologies but also require expertise in programming, data analysis, and domain-specific knowledge which will allow people to qualify for these new jobs.

AI in the workplace is transforming industries by enhancing efficiency, fostering innovation, and creating new job categories. Similarly, automation changing the workplace has streamlined operations, reduced errors, and freed employees to focus on more complex tasks.

According to the World Economic Forum, the skill sets for jobs have changed by around 25% since 2015 and by 2027 that number is expected to double. While human qualities such as empathy and critical thinking remain important, there is now an added emphasis on understanding AI systems to effectively collaborate with them. Traditional jobs have evolved into roles where employees collaborate with AI powered robots, necessitating skills in robotics and automation. Even creative fields, like graphic design, have seen the need for AI familiarity to work with AI-assisted design tools (FutureLearn, 2024).

In the coming years, the global workforce will require millions of workers with technical skills in data analysis, AI, and machine learning. This transformation can lead to significant gaps in the labor market, leaving workers without the required education or experience at a disadvantage. For instance, the rapid development of AI in industries such as IT and finance has escalated the need for professionals with expertise in data science, machine learning, and cybersecurity. However, not all workers have the means or opportunity to acquire these high-demand skills, potentially leading to increased unemployment rates among impacted workers and exacerbating economic inequalities. A well-designed career navigation system that allows these workers the resources and opportunities they need to thrive can be key to mitigating these challenges and fostering a more inclusive labor market (American Institutes for Research, 2024).

AI-driven platforms analyze labor market data to identify skills gaps and forecast future job trends, providing valuable insights for workers and employers. Personalized learning systems powered by AI tailor educational content to individual needs, making skills acquisition more efficient. AI also enhances career guidance and job placement by matching job seekers with suitable positions and identifying areas for upskilling. Additionally, AI creates adaptive learning environments that adjust to learner progress, ensuring they acquire the skills needed to thrive in an evolving job market (SHRM, 2024).

7.4. Income Inequality and Regional Economic Disparities

According to a survey, about half of Americans think that the increased use of AI

will lead to greater income disparity and a more polarized society. However, their concerns should be lessened as several studies have found that within certain occupation groups, the lowest skilled/least experienced workers derive much greater productivity gains from AI than their higher skilled/more experienced counterparts. Leading economists, such as MIT's David Autor, have praised these results as they suggest that AI could boost middle-class wages and help reduce inequality.

This would be a welcome course correction for technology's impact on wages in the U.S. over the last 40 years, during which about 50% - 70% of the increase in wage inequality has been attributed to the introduction of new automation technologies.

While this positive vision is a useful target for policymakers, this evidence within occupations can be misleading when attempting to predict the economy-wide impacts of AI on income inequality. By relying on it, we risk overlooking broader implications of AI on inequality both now—while AI is mainly used to boost worker productivity on tasks—and in the future, when new systems will become more reliable at fully automating more complex tasks.

There are at least two likely mechanisms through which AI could increase inequality in the U.S:

- In the near term, AI-driven productivity boosts could be skewed towards high-income workers, leaving lower-wage workers behind.
- In the slightly longer term, AI-driven labor automation could increase the share of income going to capital at the expense of the labor share (Brookings Institution, 2024; Technology Review, 2022).

An IMF article discusses how AI is likely to widen the economic gap between rich and poor nations where advanced economies, which already have significant investments in AI and automation, are poised to benefit more from increases in productivity due to AI. In contrast, developing countries, which rely heavily on unskilled labor, may struggle as AI technologies tend to replace such jobs rather than complement them. This could result in reduced investment in developing economies, declining terms of trade, and a potential fall in GDP, exacerbating global inequalities (International Monetary Fund, 2020).

Recent advances have been impressive, from driverless cars to human-like language models. Guiding the trajectory of technology is critical as new digital technologies have created vast wealth for those owning and inventing them, while too often destroying opportunities for those in jobs vulnerable to being replaced.

8. Policy and Regulatory Considerations

8.1. Government Policies Supporting AI Adoption

Governments have been cautious yet welcoming to the wave of AI. In the US, for example, President Biden signed an executive order on the development and use of AI in November 2023 emphasizing the importance of safe, secure, and trustworthy AI. The guidance also includes developing agency-specific AI strategies, improving infrastructure, and ensuring ethical AI usage with adequate safeguards

and transparency.

Crossing the Atlantic, the European Union's AI Act, formally known as the Regulation on Artificial.

Intelligence, is a comprehensive regulatory framework designed to govern AI technologies within the EU. The act also incorporates principles from the OECD to define AI systems clearly and categorize them by risk levels, imposing stringent requirements for high-risk applications.

8.2. Regulatory Challenges and Ethical Considerations

Regulatory compliance-related risks AI can bring to businesses:

- Risks of Bias and Discrimination
- AI can inherit human biases, leading to discriminatory outcomes, such as Amazon's AI favoring male resumes based on past hiring patterns. Biased AI can harm a company's compliance and reputation, so ethical and fair operation must be ensured before deployment.
- Data Privacy Risks
- AI requires large amounts of data, raising concerns about privacy and security. Companies must comply with data privacy regulations when using customer and employee data and invest in security awareness training to prevent breaches.
- Security Concerns
- While AI skyrockets the efficiency of processes, it also opens new opportunities for criminal activities and misappropriation. As the AI revolution continues to get stronger, companies must find a way to ensure AI is developed and used in a way that aligns with their internal policies and company values. This can be achieved through meaningful security training and constant monitoring of all existing systems.
- Antitrust Capabilities
- AI's power can be exploited to dominate markets and reduce competition, creating antitrust risks. Companies must ensure their AI usage complies with competition laws, focusing on improving efficiency without violating antitrust regulations (Ethico, 2024).

Ethics in AI involves the moral principles guiding the responsible development and use of AI systems.

This is closely linked to the regulation of AI, with a need for a shared legal framework. A report by Reuters shows that 93% of professionals acknowledge the need for regulation, citing concerns over trust and the accuracy of AI outputs, especially when used without human oversight. There is a growing call for organizations to implement policies around AI usage, privacy, and communication. Additionally, 53% of law firms and 43% of corporate legal departments agree that industry-level regulations on AI ethics are necessary (Thomson Reuters, 2024).

Some other key ethical issues include:

- Bias and discrimination: Can cause unfair outcomes in hiring, lending, and

law enforcement because of biased training data.

- Transparency and accountability: Many AI systems operate as "black boxes", making it difficult to understand how decisions are made. This lack of transparency can be problematic in high-stakes areas like healthcare and autonomous driving.
- Privacy and security: There are huge concerns due to the vast amounts of personal data AI systems require. Ensuring this data is handled securely and ethically is essential to protect individual privacy rights and prevent misuse.
- Job displacement: While AI can increase efficiency, it can also lead to unemployment as machines replace human workers. To mitigate this, policies focused on retraining and upskilling workers are necessary to help them transition to new roles created by AI advancements.

8.3. Recommendations for Policymakers

Policymakers should specifically include more robust protections against ineffective and unsafe systems, address algorithmic discrimination, require independent audits and human rights-based impact assessments, and mandate increased transparency regarding the design, testing, use, and effects of AI products.

Ultimately, the focus should be on the safety of the people, not maximizing profits, and making AI systems as friendly as possible.

9. Future Trends and Prospects

9.1. Trends in AI Technology and Applications

Emerging trends in AI technology are rapidly transforming industries.

These include:

- AI-Based Cybersecurity: Enhances threat detection, predicts attacks, and monitors data continuously.
- Embedded Machine Learning: Allows AI models to run on devices for applications like predictive maintenance and environmental monitoring.
- Multimodal Machine Learning: Processes multiple data types (text, images, audio) for enhanced accuracy.
- AI-Enabled Conceptual Design: Streamlines design processes, boosting innovation in industries like engineering and fashion.
- Deep Learning: Automates complex tasks by mimicking human brain processes, especially in data-intensive fields.
- AutoML: Automates machine learning processes, making AI accessible to non-experts.
- Ethical AI: Focuses on transparency, fairness, and privacy to address concerns around bias and decision-making.
- Multimodal AI Models: Includes advanced models like GPT-4V and Google's Gemini, processing diverse inputs.
- Smaller AI Models: Gain popularity due to lower resource requirements, eas-

ing cloud computing costs and addressing GPU shortages.

- Open-Source AI Tools: Lower the cost and complexity of AI optimization, making it more accessible.
- Custom Local AI Models: Enable data-sensitive applications by running AI locally to protect user privacy.
- Shadow AI: Refers to unsanctioned AI tool use by employees, raising security and compliance concerns.

9.2. Economic Trends

The AI market is projected to experience substantial growth, potentially contributing $15 trillion to the global economy by 2030 and significantly boosting the GDP of many countries. Companies like Microsoft, Google, and Nvidia, which are centered around AI, have already shown remarkable growth which highlights the trend of the growth of AI-based companies. AI could create 20 - 50 million new jobs, replacing up to 300 million existing ones, illuminating employment and job creation trends. Finally, there is a growing trend in AI adoption in industries and companies. One example of this is how 40% of retailers have adopted AI for enhancing in-person experiences and real-time pricing and how by 2025, this number is expected to reach 80%, illustrating AI's increasing role in transforming industries.

9.3. Future Predicted Scenarios

Some predictions for the future of AI and its impact include advancements, innovations, and implementations of AI in various fields. Autonomous systems and robotics could revolutionize industries with innovations in vehicles, drones, and smart assistants, improving productivity while reducing labor costs. Machine learning and deep learning will continue to be at the forefront, driving new applications like natural language generation and emotion analysis. Hybrid AI models, combining multiple AI techniques, will enhance learning and adaptability, with impacts on sectors such as healthcare and finance. As AI takes over routine tasks, workers will shift focus to creative and complex roles, but reskilling will be essential to meet the evolving job market demands. AI will also play a critical role in sustainability, optimizing energy use and managing resources to address global environmental challenges. Finally, AI-human collaboration will grow, with AI complementing human abilities in decision-making and problem-solving, leading to increased efficiency without fully replacing human labor. This decade promises transformative growth, with AI reshaping industries and everyday life through collaboration rather than replacement.

10. Conclusion

We have found that AI has a profound impact on the economy, whether positive or negative. This includes macroeconomic, microeconomic, industry, policies, fu-

ture, and socioeconomic impacts in the world.

The overall implications of AI's impact on businesses, policymakers, and society are positive; however, certain scenarios present challenges. In the business realm, those operating within the technology sector are likely to reap significant benefits, while those in manufacturing may experience less favorable outcomes. For policymakers, the implementation of ethical frameworks around AI can lead to substantial advantages; conversely, neglecting these considerations may yield adverse effects. Lastly, for society, the responsible use of AI has the potential to generate considerable benefits, but misuse or exploitation could lead to unforeseen consequences.

Davidson's economic theory aligns with the expected super-exponential growth driven by innovations like AI. As AI continues to automate both intellectual and physical labor, its rapid integration into industries is likely to foster sustained economic growth. AI-driven technologies enhance productivity, which, according to Davidson, compensates for slowing population growth, and fuels both capital investment and labor productivity in ways that transcend traditional economic models. AI's expanding role across sectors, from healthcare to finance, demonstrates this ongoing super-exponential economic acceleration, reinforcing Davidson's vision of AI as a transformative force in global economies.

The Theory of AI Learning also plays a central role in this evolution. As AI systems improve over time through continuous learning, they not only optimize their own processes but also drive innovation across industries. At the macro level, AI learning enables cross-disciplinary collaborations that accelerate technological advancements and economic growth. This learning, which adapts and evolves based on new data, underpins the productivity gains and efficiency that are contributing significantly to GDP growth worldwide. As AI learns from its environment, it fosters a dynamic, self-reinforcing cycle of growth that amplifies its impact on global economies.

Some key areas for future research include exploring methods to mitigate the negative impacts of AI in specific sectors and investigating how AI can be used ethically on a global scale. Additionally, research should focus on achieving a balance between integrating AI into our daily lives and maintaining economic stability.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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