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The Macroeconomic Effects of Artificial Intelligence

While various forms of artificial intelligence (AI) technologies have existed and been used for decades, the recent popularization of AI products such as ChatGPT have spurred further research and debate about how these technologies could impact the economy. AI potentially has wide-ranging uses in the production of goods and services, which could affect the macroeconomy through the labor market, productivity growth, and economic growth, to name a few. However, whether AI will prove to be as economically transformational as some suggest remains to be seen and will depend on a number of complex factors. Members of Congress are increasingly interested in AI, including its economic impacts. For example, the House announced a bipartisan task force on AI in February 2024.

What Is Artificial Intelligence?

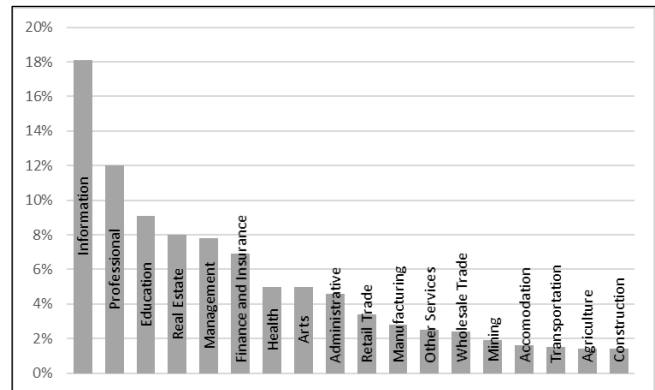
AI is a broad term referring to algorithms and techniques that aim to give computer systems the ability to learn new concepts or tasks and to reason and solve complex problems in a manner that mimics human intelligence. Machine learning (ML) is generally considered a subfield of AI focused on developing systems that can learn (i.e., optimize model parameters) from data without explicit programming. AI/ML is not one thing, such as a discrete computer application, nor is it one technology. Instead, it is a group of systems that is defined in part by the type of information used to train the model and the amount of involvement provided by human trainers.

The suite of AI products in the spotlight since late 2022 are “generative AI” tools. *Generative AI* refers to AI systems that can generate content—such as written material, art, or computer code—from prompts using advanced techniques that helps models better understand how data elements influence and depend on one another. While proponents of the technology believe it can transform delivery of services in industries that rely on both general and specialized knowledge alike, it has also raised concerns of misuse by bad actors and misrepresentation in the form of “deep fakes,” among others.

AI Adoption and Diffusion

The effects of AI on the economy largely depend on the extent of AI use. The overall adoption of AI by businesses to this point has been limited. According to the Census Business Trends and Outlook Survey (BTOS), the number of businesses using AI rose from 3.7% in September 2023 to 5.4% in February 2024. Further, as shown in **Figure 1**, adoption across sectors has varied widely. The information sector’s usage of AI (18.1%) far surpasses usage in other sectors, but it nonetheless still indicates that a majority of information sector businesses are not yet using AI.

Figure 1. Sector Usage of AI
Selected Two-Week Period from February 2024 Survey



Source: Census Business Trends and Outlook Survey (BTOS).

Notes: Sector names have been shortened for brevity.

That use of AI has been somewhat limited does not necessarily indicate that it will remain so. In February 2024, businesses indicated an expected rate of AI use at 6.6% by fall 2024, an increase from earlier in the year. Other estimates indicate that certain types of AI—such as large language models, which underpin many generative AI tools—could be adopted by a large swath of businesses. One projection of future private U.S. investment in AI also indicates growth to \$81.7 billion in 2025 from \$47.4 billion in 2022. How much usage would be necessary to create structural shifts in the economy is uncertain, although the effects to this point appear somewhat limited.

Further, just because a technology has the capacity for use does not necessarily indicate that it will be used quickly and broadly across economic activity or at all. The diffusion of past technologies has varied widely. According to the Federal Reserve Bank of St. Louis, the diffusion of AI appears to be following a pattern similar to personal computers or cloud computing, which were adopted slowly over multiple decades. The extent to which AI use becomes ubiquitous in the workplace is uncertain, but current evidence suggests that workplace use of roughly 40% or more could take over a decade. As such, the effects of AI on the economy may be relatively small for the time being but may grow over time.

AI and the Labor Market

Questions around how technologies may cause structural labor market shifts are long-standing. In the past, some economists voiced concerns about the extent to which automation could replace jobs, such as in manufacturing. Today, similar questions are being asked with regards to AI. As shown in **Table 1**, BTOS data indicate that while businesses that use AI report it replacing some number of

tasks, employment effects in either direction are relatively small. This indicates that, as used currently, AI is not replacing workers on average. However, businesses report expectations that AI will have a growing impact on firm employment. Nonetheless, as has happened in past episodes of technological change, AI may result in a changing mix of available jobs, including the creation of new ones but not fewer total jobs in the long run.

Table I. AI Effects in the Workplace
Responses from February 2024 Survey

	Six Months Prior to Survey	Six Months After Survey
Responses to “Number of Tasks Replaced by AI?”		
“Small Number”	84.6%	79.2%
“Moderate Number”	13.0%	17.7%
“Large Number”	2.4%	3.1%
Responses to “Effects of AI on Firm Employment?”		
“Increase”	2.8%	6.5%
“Decrease”	2.6%	6.1%
“No Change”	94.6%	87.4%

Source: BTOS.

Notes: Questions asked only to firms that responded affirmatively to using AI.

Potential Effects on Productivity

Economists generally agree that the main avenue by which AI is likely to affect the economy is labor productivity. Many estimates suggest that AI can affect task productivity notably, although these effects may differ across skill levels. In general, studies tend to conclude that the use of AI increases task productivity and performance, although some studies have found that errors made by AI can be counterproductive. How total labor productivity may be affected by AI is harder to estimate, because it depends, in part, on how many and what types of tasks use AI. Goldman Sachs estimates that if 25% of total work tasks are automated by generative AI, labor productivity would increase 15%.

AI also has the potential to impact total factor productivity (TFP), which accounts for the impact of technological growth. If the adoption of AI results in an increased pace of research and development, this would increase the growth rate of TFP and long-run economic growth. One study suggests that in the short run (10 years), the effects of AI on TFP would be a roughly 0.53% cumulative increase.

AI and Economic Growth

Productivity growth is an important determinant of long-term economic growth and income. Gains in productivity allow for the more efficient production of goods and services, thereby increasing the productive capacity of the economy. Estimates of the effects of AI on U.S. gross domestic product (GDP) in the short and long run vary but are typically positive. The Goldman Sachs study estimates

that this productivity increase could result in an up to 0.9% cumulative increase in GDP over the same time frame.

When considering the longer run, more questions arise: How many and what types of new tasks will AI create in addition to automating existing ones? Will AI-based tasks become more advanced and therefore harder to learn? Will AI adoption be even across sectors or types of tasks? How will short-run effects of AI and policy decisions in the coming years affect future economic and policy responses? One study suggests that the effects of AI on GDP in the long run could vary substantially based on a number of factors, including which industries AI adoption is concentrated in and whether or not productivity gains from AI adoption are expected. The study suggests that GDP could rise to about 35% above baseline in the long run but could be much smaller depending on the scenario.

AI and Inequality

Owing to the expected effects on productivity growth, AI has the potential to increase total income in the economy. However, this does not mean that all economic actors will benefit. For example, in recent decades, productivity gains from technological innovation have largely been concentrated among high-income, skilled workers. It is not clear whether AI use would have a similar effect.

On the one hand, evidence has suggested that within certain types of work, lower-skilled workers may benefit more from AI. For example, in a recent study the authors conducted an experiment in which customer support agents of varying experience and skill level used an AI-based conversational assistant. On average, this use of AI increased productivity significantly more for those with less experience or lower skill levels than for more experienced, higher-skilled workers. Thus, AI could potentially normalize outcomes across workers within businesses, in theory resulting in equalizing productivity and wages.

On the other hand, AI is expected to generally produce higher productivity gains for higher income and skilled workers. For example, some research suggests that productivity gains from large language models could be significantly larger for higher-income workers.

Policy Considerations

A plethora of policy questions arises from the adoption and use of AI in the production process. Many of the most frequently asked questions involve labor market outcomes, as evidenced by recent House Oversight and Accountability Committee and Joint Economic Committee hearings on AI and the labor market. Questions often consider whether AI could structurally change the nature of work and, if so, how the costs and benefits of such a change might be distributed. Congress may wish to consider policies that would either prevent or mitigate changes to the labor market or otherwise provide assistance to those workers who are fully or partially displaced once any changes do take effect.

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