The productivity potential of GenAI

EY Parthenon

Building a better working world

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Executive summary

The transformative capability of generative artificial intelligence (GenAI) to augment human work and unlock efficiency will likely have far-reaching implications for the macroeconomic and business landscape. Productivity growth is the main long-term propeller of economic growth and living standards, but growth has slowed in recent decades and remains on a subdued trend, even as GenAI adoption continues to quicken.

In this installment, we explore the economic impact of GenAI through a productivity lens and quantify the extent to which the productivity potential of GenAI could bolster overall economic prospects in the next decade.

GenAI systems are expected to permeate wide segments of business operations in coming years with significant implications for a wide range of activities, such as customer support, marketing and sales, business operations and software programming. All of these are areas that may see substantial productivity enhancement. As GenAI technologies gain traction, labor productivity will likely rise through direct labor efficiency gains but also through the enhancement of organizations and business processes. Any productivity increase that is not the result of changes in capital or labor inputs is measured as total factor productivity (TFP).

To assess the potential economic impact of a GenAI-driven productivity upswing, we examined the contribution of TFP – our proxy for technological innovation – to long-term growth. Based on the analysis we developed in the prior chapter on capital investment, we built three different productivity scenarios, drawing parallels with the acceleration in TFP growth during the information and communications technology (ICT) boom in the 1994-2006 period.

Our key findings are:

- **GenAI-driven productivity is set to provide a substantial lift to the economy, likely delivering a boost worth $650b over the next decade and lifting real GDP by nearly 2.5% by 2033.** Assuming that total factor productivity will grow 50% faster than the 2017-2022 trend pace over the next decade, the productivity boost powered by GenAI will contribute an additional 0.25 percentage points (ppt) annually to US GDP growth over the next 10 years.
- **The economic impact could be twice as large if productivity growth were to double relative to trend pace.** This more optimistic scenario with faster GenAI adoption and a significant acceleration in the pace of innovation would be akin to the acceleration in TFP growth in the late 1990s. In this context, the additional contribution to GDP growth would average 0.5ppt over the next 10 years. This strong productivity trajectory would represent a boost to real GDP worth $1.2t and lift real GDP by nearly 5% above the baseline by 2033.

Looking across major economies, a GenAI-driven productivity upswing could also make a substantial contribution to the global economy. We estimate that the lift to global GDP from stronger productivity could total $1.2t to $2.4t over the next decade.

Unlocking the productivity potential of GenAI will likely require the deployment of both tangible (infrastructure) and intangible (technology, software, skills, new business models and practices) investments. And, as we saw in the first installment of our article series, it could also take time for the productivity benefits of GenAI to materialize. There has generally been a delay between the inception of paradigm-shifting technologies and their diffusion across the economy. But the faster speed of GenAI diffusion could mean that the boost to economic activity could be felt more quickly – that is, in the next three to five years.

1. Productivity is 'almost everything'

Will GenAI jumpstart productivity growth and fire up the economy in the long term?

Productivity growth – the ability of an entity to produce more with the same labor and capital investment inputs – is the primary driver of long-term economic growth and improvements in living standards. As the economist Paul Krugman famously noted in 1994, "Productivity isn't everything, but, in the long run, it is almost everything."

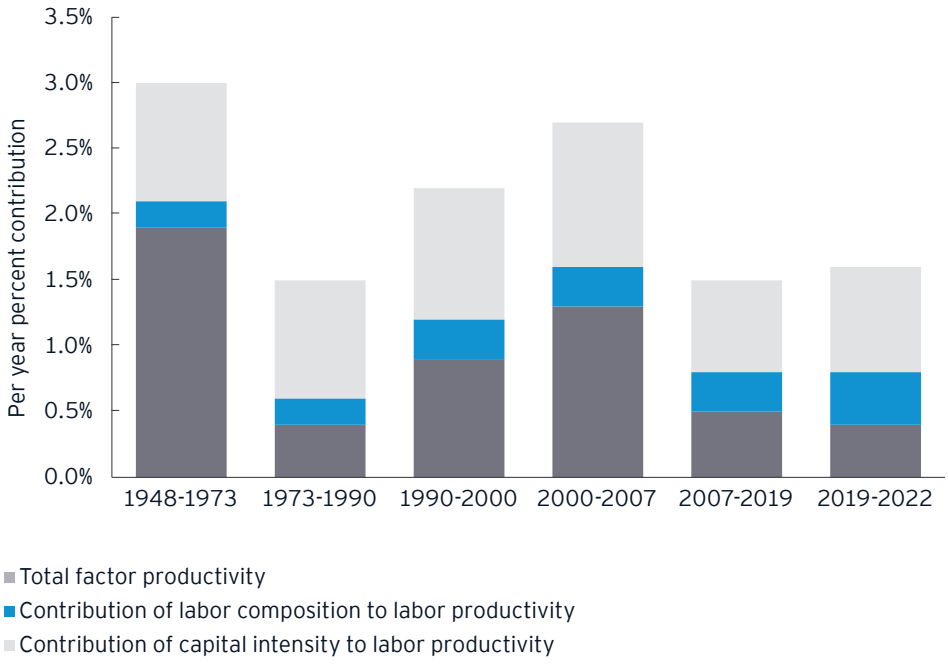
Disappointingly though, productivity growth has been sluggish in both advanced and developing countries over the past decade. In the US, labor productivity growth has averaged only 1.4% per year since 2013, less than half the rate of the previous decade.

Labor productivity can be decomposed into three distinct components (see figure 1): the labor composition, reflecting the quality of labor; capital deepening, reflecting the ability to use tangible and intangible capital more efficiently; and total factor productivity (TFP) or multifactor productivity (MFP), reflecting efficiency gains such as new management practices, changes to an organization, knowledge improvements or economies of scale.

The effect of technological innovation on the economy is typically measured indirectly as economic output growth that cannot be accounted for by changes in capital or labor inputs used in the production process. It's generally captured in TFP but is often measured as greater labor productivity growth.

Looking back at history, TFP was a driving force behind the acceleration in US labor productivity growth that took place during the ICT revolution of the late 1990s. Beginning in the mid-1990s, output per hour began to grow rapidly, reversing the productivity growth slowdown of the 1980s. After averaging 1.4% annually from 1973 to 1990, labor productivity growth accelerated to 2.2% between 1990 and 2000 and 2.7% between 2000 and 2007. Notably, TFP accounted for about half of the decade-long acceleration in labor productivity growth during the 1990s and early 2000s.

US contribution to labor productivity growth (% per year)



Source: Bureau of Labor Statistics, EY-Parthenon

2. Gauging the productivity potential of GenAI

History lessons and scenarios provide clues about the magnitude of GenAI's future impact.

By executing and automating complex cognitive tasks that previously only humans could perform, GenAI has the potential to enhance workers' efficiency, accelerate capital deepening and unlock substantial productivity gains across the economy.

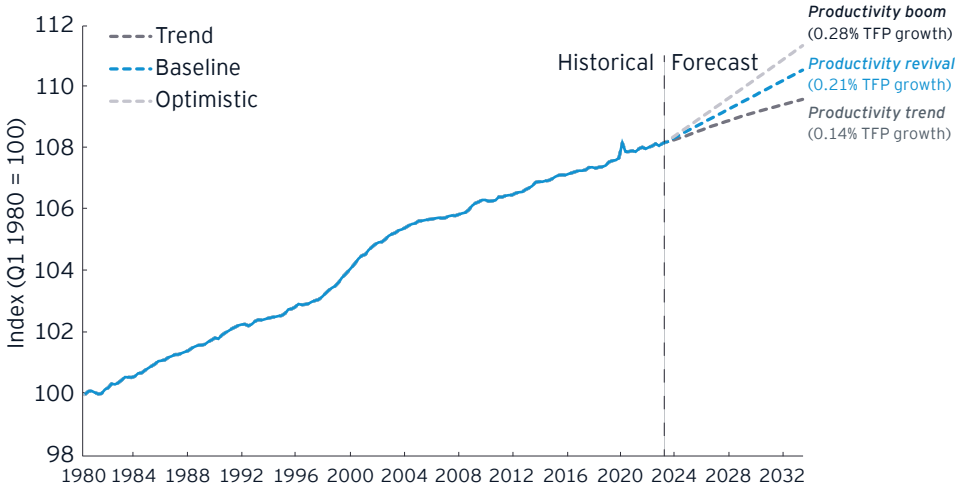
Scenario analysis

In assessing the potential economic impact of GenAI from a productivity perspective, it is worthwhile to consider the TFP dynamics observed during the ICT revolution. From the early 1970s through 1995, TFP rose about 0.7% per year. But that pace more than doubled to a rate of 1.3% between 1995 and 2003.

Using the ICT period as a reference, we created three scenarios – trend, revival (our baseline) and boom – that correspond to three different productivity outcomes for the next decade. Our analysis builds on the scenarios developed in the previous chapter on capital investment. We then estimated the growth effects of these productivity scenarios on long-run GDP growth using a growth accounting approach such as Fernald (2014).

In the trend scenario, investment in GenAI technology and productivity growth continue along their 2017-2022 trend. In the revival/baseline scenario – which represents our baseline view – TFP growth departs from its recent trend and grows 50% faster than during the 2017-2022 period amid a 25% acceleration in nominal capital investment in GenAI technology. In the boom scenario, TFP growth advances at twice the TFP growth pace recorded during the 2017-2022 period amid accelerating GenAI diffusion and innovation – in line with the productivity acceleration witnessed during the ICT boom of the late 1990s.

US total factor productivity



Source: EY-Parthenon

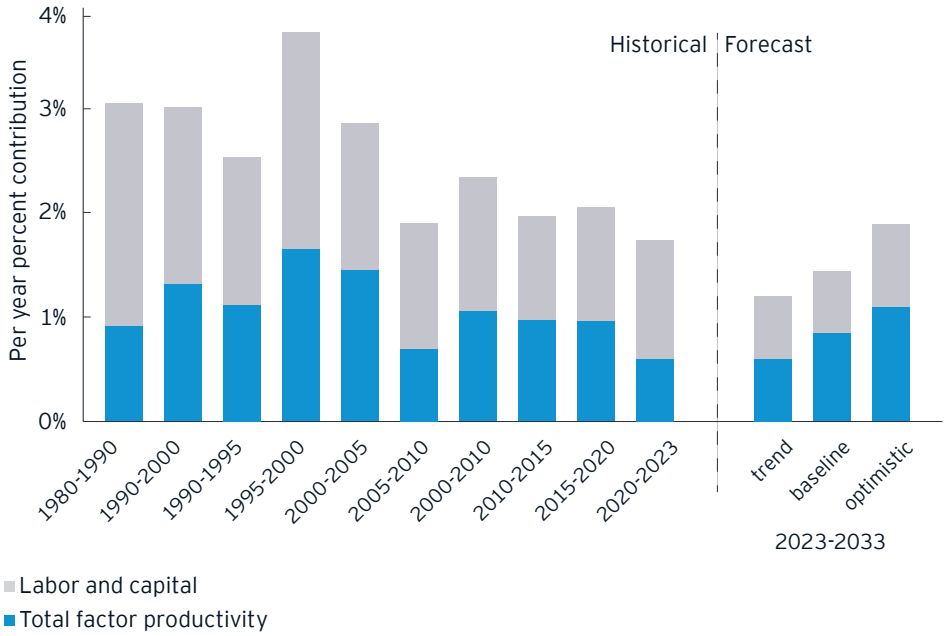
Trend scenario: productivity trend. Assuming productivity grows in line with the 2017-2022 pace, TFP would be expected to grow around 0.14% per year from 2023 to 2033. While this would mean that productivity growth would contribute about 0.6ppt to the potential growth rate of the economy over the next decade, it would not represent an increase in the contribution relative to the recent past.

Baseline scenario: productivity revival. If, instead, we assume that GenAI deployment leads TFP to grow 50% faster than the 2017-2022 trend pace over the next decade, real GDP growth would be boosted by 0.25 ppt per year. This revival in productivity growth would provide a boost to the economy worth $600b and lift real GDP by 2.5% over the baseline by the end of 2033.

Upside scenario: productivity boom. Assuming that GenAI leads to a doubling of the TFP growth pace relative to the 2017-2022 trend – which is akin to the acceleration in TFP growth in the late 1990s – real GDP growth would be boosted by 0.5ppt per year compared to the trend. This strong productivity trajectory would lift real GDP by nearly 5% over the baseline by 2033, or the equivalent of a $1.2t boost over a decade.

The potential benefits to the global economy from increased GenAI productivity could also be substantial. With the US market likely to remain at the forefront of GenAI investment, closely followed by Europe, Japan and China, global GDP could get a boost worth $1.2t (in our baseline scenario) and $2.4t (in the optimistic case) over the next decade.

US contribution to potential GDP growth (% per year)



Source: Bureau of Labor Statistics, EY-Parthenon

3. Broad productivity gains across sectors and occupations

Initial case studies provide evidence that GenAI will likely provide substantial productivity boosts in four major realms.

The latest EY 2023 Work Reimagined Survey indicates that 84% of employers say they expect to have implemented GenAI within 12 months. And a net 33% of employees and employers see potential benefits for productivity and new ways of working. As such, the ability of business leaders to reimagine business models and consider how best to augment workers' skills will be a key determinant of how powerful the productivity lift from GenAI is.

The magnitude of the productivity boost from GenAI will depend on the speed of its diffusion across organizations and industries. While GenAI has already spawned many innovations, it has yet to show a visible and meaningful boost in the aggregate productivity data. As we highlighted in our first article, the productivity boost from GenAI will likely occur with a lag as there has generally been a long delay between the inception of paradigm-shifting technologies and their diffusion across the economy and society.

While the majority of previous technological advancements have focused on automating manual labor, GenAI stands poised to revolutionize the automation or assistance in complex cognitive functions such as sophisticated predictive analytics, interactive 3D data modeling, advanced natural language processing for document summarization and the development of intricate algorithms for machine learning. Its usage is expected to span a wide range of sectors, occupations and tasks.

As such, information and knowledge workers across a diverse array of sectors are poised to experience significant impacts due to the diffusion and integration of AI tools. These sectors include, but are not limited to, technology, banking, life sciences and retail. In these fields, GenAI specifically offers substantial enhancements in productivity across four key domains by performing a wide range of skills:

- **Office and administrative support:** This includes roles such as customer service representatives who can leverage GenAI for handling complex queries, information clerks utilizing GenAI for efficient data retrieval, desktop publishers employing GenAI for advanced layout designs, inventory managers using GenAI for predictive stock management and research assistants harnessing GenAI for data collection and analysis.
- **Business and financial operations:** This covers roles such as financial analysts who can utilize GenAI for deeper market insights, human resource specialists applying GenAI in talent acquisition and management, logisticians leveraging GenAI for optimized supply chain solutions and credit analysts employing GenAI for more accurate credit risk assessments.
- **Life, physical and social sciences:** This encompasses roles like political scientists using GenAI for predictive modeling of political trends, medical scientists employing GenAI in drug discovery and personalized medicine, economists leveraging GenAI for complex economic forecasting, and biological technicians utilizing GenAI in experimental design and data interpretation.
- **Mathematics and computer programming:** This includes software developers integrating GenAI to create more sophisticated applications and data scientists using GenAI for advanced predictive analytics and machine learning model development.

In these major domains, GenAI stands not just as a tool but as a transformative force, reshaping the way tasks are approached and executed, which can lead to unprecedented levels of efficiency and innovation. In the next installment of this series, we will examine the labor-augmenting capabilities of GenAI across sectors and occupations in greater detail.

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Early evidence of GenAI productivity effects

There is only initial literature indicating the impact of GenAI technologies on workers' performance, but early research vividly illustrates the substantial productivity enhancement that GenAI technologies can provide to an organization. Three recent case studies have quantified the impact of the use of GenAI systems such as recently released large language models (LLMs) to complete certain tasks. They showed the following:

- Access to GenAI systems can meaningfully improve workers' efficiency.
- The use of GenAI tools can reduce the productivity gap between the most and least skilled workers.
- The quality of output can be enhanced using GenAI tools.

Case studies

- **Customer service:** With the help of a GenAI-based conversational assistant, customer service agents could resolve 13.8% more customer inquiries per hour than agents without the GenAI tool. The productivity boost reflected a decline in the time it takes an agent to handle an individual chat, the increased ability of an agent to handle multiple chats simultaneously and a small increase in the share of chats that are successfully resolved. The productivity impact was also highly uneven, with the largest productivity gains observed for the least-skilled workers.[1]
- **Documentation and content creation:** With the use of the assistive chatbot ChatGPT, experienced business professionals (e.g., marketers, HR professionals, consultants, data analysts) writing routine business documents (such as press releases) could complete a task 40% faster and see an increase in output quality of 18%. The productivity boost resulted from a substitution effect (decrease in the time spent on the task as ChatGPT could quickly produce output) and a complementary effect since humans and ChatGPT combined could produce more. The study also revealed that ChatGPT substantially increases workers' satisfaction.[2]
- **Software development:** An experiment with GitHub Copilot – a GenAI pair programmer that suggests code and entire functions in real time – showed that software developers who were asked to complete a standardized software project took almost three hours to perform without GenAI assistance. However, by using GenAI, they could complete the task 56% faster—that is, in slightly over an hour— than without the help of GenAI tools. Like the prior two studies, the results also indicated that the least-experienced programmers benefited more from Copilot than their experienced peers.[3]

References:

1. Generative AI at Work (Brynjolfsson, Li, Raymond, 2023)

2. Experimental Evidence on the Productivity Effects of Generative Artificial Intelligence (Noy, Zhang, 2023)

3. The Impact of AI on Developer Productivity: Evidence from GitHub Copilot (Peng, Kalliamvakou, Cihon, Demirer, 2023)

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