Already Here, Not Yet Everywhere: Shaping the Economic Impact of Artificial Intelligence

Keynote speech at the International Economic Symposium

21.04.2026 | Rome | Joachim Nagel

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1 Introduction

Ladies and gentlemen,

The science fiction writer William Gibson once said: "The future is already here – it is just not very evenly distributed".[1] That remark quite aptly describes the current state of artificial intelligence. Its capabilities are already visible across many applications – from text generation and coding to research and forecasting. Or, in a more personal context, from designing invitation cards to making songs or even movies. Yet its broader economic impact is still far less apparent from the aggregate statistics.[2]

This is not without historical precedent. When electricity first spread throughout the advanced economies, the productivity gains were limited, to begin with. Firms adopted electric motors, but they did not reorganise their production straight away.[3] However, artificial intelligence could be spreading significantly more quickly than earlier general-purpose technologies.[4] This suggests that artificial intelligence is a transformation that will almost certainly have a massive impact on the global economy.

In my speech today, I will explore what AI may imply for growth, inflation and financial stability. Another key question I will address is this: How do we shape its impact? In this context, I would like to touch upon how well Europe is positioned in the global AI race. But before I do that, allow me to outline how I see AI and where I see its strengths and weaknesses.

2 What today's AI can and cannot do

AI is best understood not as a single product, but as a general-purpose technology. Such technologies are widely used across many sectors. They improve continuously over time. And they interact with other innovations.[5] As they evolve, they spread throughout the economy and generate broad productivity gains. Economic history offers several prominent examples. The steam engine, for instance, did not merely improve one industry; it fundamentally transformed transportation, manufacturing and mining, becoming a cornerstone of the Industrial Revolution. Electricity followed a similar trajectory: once widely adopted, it enabled entirely new production processes, reshaped factory organisation, and ultimately powered the mass production systems of the 20th century. With a delay of about 140 years, electricity is now finally marching to victory in individual transportation. More recently, digital computing and the internet have also been general-purpose technologies, driving innovations ranging from industrial automation to global financial systems.

Artificial intelligence shares these defining characteristics. It is not confined to a single use case. It can be used across almost all sectors – from healthcare and finance to manufacturing and public administration. Against this background, AI can be described as "the steam engine of the mind".[6] The steam engine amplified human physical labour. AI amplifies human cognitive abilities. Used properly, it will enhance human intelligence – with possibly far-reaching implications for productivity, innovation and economic growth.

In this context, the strengths of AI are becoming increasingly clear: It can process and summarise vast amounts of text; detect patterns in large datasets; support coding and scientific research; improve forecasting in some settings; and automate repetitive knowledge tasks at very high speed. At the same time, the weaknesses of AI are equally important for users, because generative AI can hallucinate; produce false or biased outputs; and reproduce errors hidden in training data. These limitations reflect the underlying nature of current AI systems. Large language models are based on statistical methods and generate responses probabilistically. They cannot reason in a human sense – rather, they predict likely sequences of words based on patterns in the data on which they have been trained.

The next important drawback of AI is the huge amount of electricity it consumes.[7] Just how much energy AI uses can be illustrated in terms of the heat generated by data centres. Recent estimates suggest that land surface temperatures in areas surrounding AI data centres can rise by about 2°C after operations begin.[8] This can create local microclimates, often referred to as the "data heat island effect". These temperature increases may have tangible effects on nearby communities. In total, more than 340 million people worldwide could be exposed to such local warming effects.

Overall, the AI boom is expected to unleash a dramatic increase in electricity demand in the years to come. Currently, data centres are consuming about 415 terawatt hours of electricity each year. That corresponds to roughly 1.5 % of global electricity consumption in 2024. The International Energy Agency projects that global electricity consumption for data centres will double by 2030, representing just under 3 % of total global electricity consumption at that time.[9] One may be tempted to say: As the "steam engine of the mind", AI comes with a very real electricity bill.

3 AI and the macroeconomy: growth, investment and emerging risks

These developments highlight that AI is not only a technological transformation, but also an economic one with far-reaching consequences. Those consequences include a restructuring of the labour market, the emergence of new industries, and changes in global trade patterns. While, of course, immensely important, I will not be covering these aspects in my remarks today. Instead, my key question is this: What does artificial intelligence imply for growth, inflation and financial stability?

Let me start with economic growth. Productivity growth is the key channel through which technological progress translates into economic growth. However, past technological innovations typically raised productivity only with a long delay because they required widespread diffusion, complementary investments, and fundamental organisational changes, all of which took time. Existing capital and practices persist, so new technologies are initially layered onto old systems rather than fully replacing them.[10] For example, in the case of electric power, it took several decades for its full impact on productivity to become visible.[11] Computers are another good example. We experienced the IT-driven productivity boom in the late 1990s, more than twenty years after the first personal computers came onto the market.[12]

In the case of AI, though, these diffusion lags could be considerably shorter. In fact, it seems we are currently observing the fastest adoption of a general-purpose technology in history. Within less than three years, more than 1.2 billion people worldwide have used AI tools – that's a rate of adoption that surpasses the internet, smartphones, and personal computers.[13] Moreover, artificial intelligence may be spreading faster than previous technologies not only because it builds on existing digital infrastructure, but also because it speeds up the innovation process itself.[14]

Recent estimates by the OECD suggest that in a scenario of rapid adoption, AI could elevate aggregate annual labour productivity growth over the next decade by somewhere between 0.8 and 1.3 percentage point in G7 economies.[15]This contrasts with recent experience: Over the past two decades, we have seen productivity growth in advanced economies slow noticeably to between just 0.8 and 1.8 percentage point.[16] Against this background, AI contributing more than 0.8 percentage point would represent a significant acceleration. By way of comparison, for the US, information technology accounted for 0.7 percentage point of additional labour productivity growth during the IT boom in the late 1990s.[17]

These estimates, however, are subject to high uncertainty, and some researchers are far more cautious.[18] The estimates depend on key assumptions, such as the pace and intensity of AI adoption among firms. For instance, according to the Bundesbank's own surveys, most German firms are expecting to see productivity gains from the use of generative AI.[19] At the same time, it is still uncertain how great these gains will be. In fact, the intensity of generative AI use is still increasing at a moderate pace, suggesting that many firms are continuing to experiment with the technology.

In the long run, AI-related productivity gains could help counter or at least dampen losses from the demographic decline in the working population.[20] Given potential productivity increases, AI could also significantly raise aggregate output, consumption and investment.[21] And I am in no doubt that the impact of AI will continue to increase. In the US, AI-related investment is already contributing noticeably to GDP growth.[22] In particular, at around 1 percentage point in 2025, AI investment recently surpassed the contribution that IT components made to real GDP growth during the dot-com boom.[23] In Germany, Bundesbank survey data show that firm expenditure on generative AI is already comparable to that on traditional digital investment.[24] Most of that spending, however, comes in the shape of recurring costs, such as subscriptions or permanent IT staff.

The potential effects of AI on inflation are still uncertain. On the one hand, higher productivity resulting from AI adoption expands aggregate supply, reducing firms' costs and potentially the labour force shortages caused by demographic factors as well. All this would tend to dampen inflationary pressures – at least initially.[25] On the other hand, over time, AI adoption may raise income, the need for additional investment and intermediate outputs, and – almost certainly – demand for electricity. This additional aggregate demand would increase inflation pressures.

And even in the shorter run, a disinflationary effect may not materialise if demand rises in anticipation of future productivity increases. In this scenario, the AI effect may become initially inflationary.[26] One particular development is that the use of algorithms may facilitate the setting of prices above competitive levels.[27] There is evidence that AI algorithms are able to consistently learn to charge excessive prices, without communicating with one another. From a central banking perspective, this uncertainty calls for particular vigilance.

At the same time, developments in artificial intelligence also warrant close attention from a financial stability perspective. Specifically, AI could result in a build-up of financial stability risks due to AI-supplier concentration, herding behaviour, increasing market correlation, and cyber and operational risks because similar models are being used in critical processes.[28]

Consider, for example, the provision of credit by banks to households and firms. Increasingly, lending decisions may be supported or even driven by AI-based models. If many banks rely on the same AI providers or use similar underlying models, their credit risk assessments may become more closely aligned. As a result, bank lending could be curtailed simultaneously across institutions in response to a deteriorating economic outlook and by more than would normally be observable. This could amplify procyclical dynamics, making credit availability homogenously more sensitive to the business cycle and potentially increasing financial stability risks. Moreover, a strong reliance on a limited number of AI providers could give rise to operational and data protection risks. Disruptions at a major provider or vulnerabilities in widely used systems could have broad repercussions across the financial sector.

Finally, the use of AI in the financial sector opens the door to new and sophisticated cyber risks, since autonomous AI agents could exhibit harmful behaviour. Early identification and mitigation of such risks are crucial for financial stability, as highlighted by the current discussion around Anthropic's Mythos. Mythos is an AI model that appears capable of quickly identifying and exploiting security vulnerabilities in financial institutions' software. However, this AI model seems to be a double-edged sword, since it could be used not only to improve digital security systems, but also to leverage their vulnerabilities for malicious purposes. We must prevent the misuse of this technology. At the same time, all relevant institutions should have access to such technology to avoid competitive distortions.

4 Europe in the global AI race

Taken together, these risks point to a broader structural issue: the development and deployment of AI is increasingly concentrated and globally interconnected. This makes it all the more important to consider where different regions stand in this evolving landscape. That brings me to Europe's position in the global AI race. Europe is entering the AI era with important strengths, but from a weaker position than the United States and, in several dimensions, China.

The United States remains the clear leader in terms of frontier-model development and private investment: US-based institutions produced 40 notable AI models in 2024, compared with 15 in China and only 3 in Europe, while US private AI investment reached USD 109.1 billion versus USD 9.3 billion in China and USD 19.4 billion in Europe.[29] At the same time, relatively low private AI investment in China is overcompensated by the government's investment in AI, estimated at USD 62 billion.[30] Government AI investment in the United States and the European Union, by contrast, is an order of magnitude lower: about USD 3.3 billion in the United States and about USD 1.2 billion in the European Union.[31] The European Union thus ranks a clear third in terms of AI investment. Europe's relative weakness is particularly visible in scale-up financing, computing infrastructure and the development of frontier models. These areas are dominated by American firms. At the same time, Chinese actors are benefiting, in addition to large-scale state support, from a vast domestic market.

Still, Europe has huge research potential that can be fed into entrepreneurial activity. We already have a roster of important and significant private suppliers of AI services in Europe, for example *Mistral AI*, *Black Forest Labs* or *Aleph Alpha*. And Europe boasts a multitude of hidden champions – small firms that are global leaders in their specific markets. As I have said in a previous speech: When it comes to using AI in industrial processes, I still see the race as open. This requires highly specialised AI models. Industry in Europe, and especially in Germany, is based on a wealth of data for training such models. This allows tailor-made AI solutions to be developed in many areas: for production, logistics, maintenance and so on.[32] I thus take it as a very positive sign that the uptake of AI technologies among European firms is on the increase as well.[33]

A collaboration among central banks, including the Bundesbank and Banca d'Italia, has proven very useful in this regard. In 2024 and 2025, firms in Italy and Germany were asked a harmonised set of questions on the use of generative AI.[34] The results show that AI adoption has increased markedly in both countries.

We as central banks are not merely observers of this transformation – we are also actively shaping it within our own institutions. At the Bundesbank, we recently approved a comprehensive strategy for artificial intelligence, including concrete measures for its implementation. Today, two out of three Bundesbank colleagues use AI regularly in their daily work – in a dedicated, safe and secure environment. The central objective of our strategy is to systematically integrate artificial intelligence into the Bundesbank's toolkit, where it can help us fulfil our tasks.

That said, individual efforts – whether by firms or public institutions – will not be sufficient on their own. Realising the full potential of AI requires progress at the European level as well. I am convinced that Europe can move faster in terms of financing, scaling, infrastructure, skills, energy and market integration. The European Union has already started some initiatives in this direction. In particular, the AI Act entered into force on 1 August 2024.[35] Moreover, the EU launched the InvestAI initiative in February 2025 with the aim of mobilising €200 billion for AI investment, including a new €20 billion fund for AI gigafactories.[36]

As I noted earlier, artificial intelligence is not only the "steam engine of the mind" – it also comes with a very real electricity bill. This brings us back to a critical enabling factor: the availability of reliable and affordable energy. Ensuring that enough power is available to run AI infrastructure may prove to be just as important as mobilising capital. To be fair, the problem is not confined to Europe. For example, according to some reports, around half of the data centre projects planned in the United States have been delayed or cancelled. Constraints in power infrastructure play a key role in these delays.[37]

In Europe, new data centre projects have been delayed or postponed due to insufficient grid capacity as well.[38] For instance, in Dublin and Frankfurt, the time required to supply power to new data centres can run to three to five years.[39] In extreme cases, this raises the risk that investments may not fully materialise or could even become stranded. In response to these challenges, the European Union has begun to develop a more comprehensive policy framework to ensure that the expansion of AI infrastructure remains compatible with its energy and climate objectives. A key element is the forthcoming Data Centre Energy Efficiency Package, expected in 2026.[40] This initiative aims to improve transparency on energy use and to introduce an EU-wide rating scheme for data centres. What these developments ultimately underline is that successfully deploying artificial intelligence depends not only on innovation and investment. It also relies on the right institutional frameworks and effective practical implementation.

5 Concluding remarks

Ladies and gentlemen,

Let me conclude. AI clearly has the potential to become a defining force for the world economy in the years ahead. However, the history of electricity reminds us that technological breakthroughs alone are not enough. Early adoption did not immediately translate into higher productivity, because firms had yet to reorganise production and adapt their structures. Similarly, AI's impact on growth will depend on how effectively it spreads across the economy – that is, how long it takes until "it is everywhere". And it depends on how well firms and institutions adapt to it.

This is precisely why it is essential to actively shape the AI revolution. As central banks, we are well-advised to scrutinise its effect on inflation and financial stability. Policymakers can provide the right policy mix to support more scale-up capital and more computing power. This way, our societies can ensure that the benefits of AI are brought to fruition – and distributed everywhere across the economy.

In Europe, we have everything we need to master the AI revolution: a small, but thriving AI sector; outstanding research capabilities; highly specialised and curious corporations; and a huge internal market.

Thank you.

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