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Population Aging as a Driver of Technological Change

Martin Zeman

Summary

According to research by Daron Acemoglu and Pascual Restrepo, population aging can be a powerful driver of automation, technological innovation, and productivity growth. As the workforce shrinks, labour becomes more expensive, encouraging businesses to invest in robotics, digitalization, and new technologies. Successfully managing this transition will require support for innovation, investment in human capital, workforce reskilling, better access to investment capital, and social policies that help ease the impact of structural changes in the labour market.

Key Takeaways

- Labour shortages can create strong incentives for technological innovation and higher productivity.
- Automation is a natural response to demographic change. Countries with faster population aging tend to invest more heavily in robotics, digitalization, and artificial intelligence.
- The Czech Republic has strong potential to adapt thanks to its well-developed industrial base. Accelerating digitalization, supporting innovation, and making it easier to invest in new technologies will be essential.

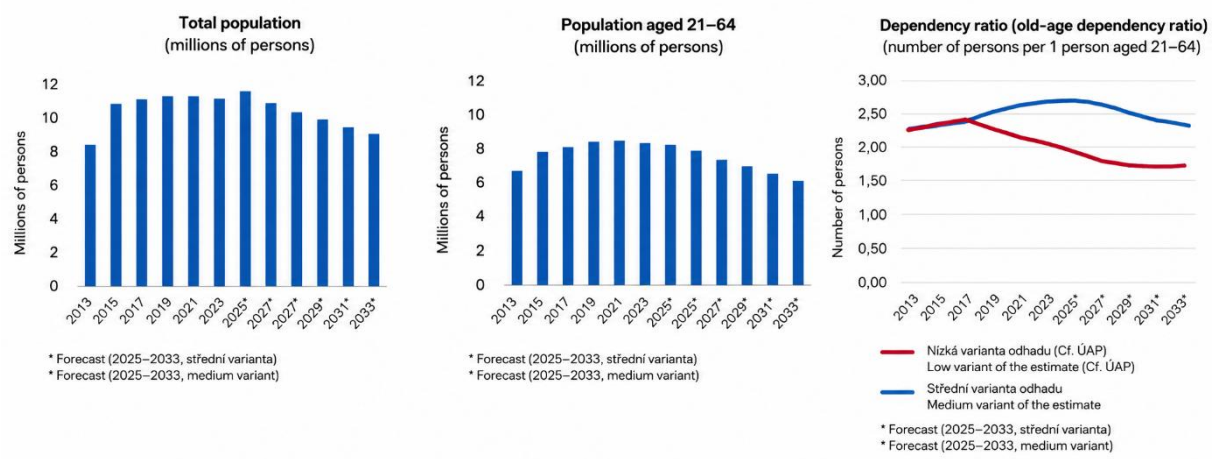
The Czech Republic is facing a sharp decline in fertility and the lowest number of births recorded in the past 240 years. In just a few years, the country has gone from having a slightly above-average fertility rate within the European Union to falling below the EU average. This trend will have a major impact on the country's age structure (CZSO, 2026). The number of older people will continue to rise, while the working-age population will steadily decline.

The Czech Republic is not alone in facing this challenge. Falling birth rates are affecting countries across Europe. As Mario Draghi (2024) points out in his report, Europe is entering the first period in modern history in which economic growth will no longer be supported by a steady increase in the labour force. By 2040, the number of people in the workforce is expected to decline by around two million each year. At the same time, the ratio of working-age people to retirees will continue to worsen. Today, there are roughly three workers for every retiree. By around 2040, that number is expected to fall to just two.

Demographic projections for the Czech Republic show that the number of people aged 65 and over is expected to peak around 2053. At the same time, the ratio of working-age people to older adults will continue to decline. Today, there are approximately 2.76 people aged 21–64 for every person aged 65 or older. By the 2060s, that figure could fall to 1.66 (National Budget Council, 2025). Only after that is a modest improvement expected.

Most discussions of these demographic trends focus on their negative consequences, particularly growing pressure on public finances, pension systems, and labour supply. The purpose of this paper is not to question the importance of supporting higher birth rates. In fact, the difference between the optimistic and pessimistic demographic scenarios for the Czech Republic exceeds four million people by 2100. However, population aging should not be viewed only as a challenge. Under the right conditions, it can also become a driver of technological innovation, higher productivity, and economic modernization.

Figure 1: The Demographic Situation in the Czech Republic



Source: ČSÚ, 2026; NRR, 2025.

Automation as a Response to Demographic Change

Nobel laureate Daron Acemoglu, together with Pascual Restrepo (2019, 2024), argues that population aging can itself accelerate automation, particularly in sectors facing shortages of workers performing routine and manual tasks. Their extensive research on labour markets shows that demographic aging can be a powerful driver of technological change, especially the adoption of automation.

Drawing on data from more than 160 countries over a 25-year period, they identify several important findings. The central mechanism is that population aging reduces the number of middle-aged workers, who form the backbone of the labour force. As labour supply declines, wages rise and employers face higher labour costs. In an environment where finding enough workers becomes increasingly difficult, businesses begin looking for alternative ways to maintain production and remain competitive. As labour becomes scarcer, its cost increases, making investments in technology, digitalization, and automation a natural response.

Their empirical research shows that countries experiencing faster population aging generally invest more in robotics and advanced manufacturing technologies. Labor shortages improve the economic return on these investments. Technologies that might be too costly when labour is abundant become increasingly attractive as wages rise. This applies not only to industrial robots but also to software solutions, artificial intelligence, automated logistics systems, and advanced manufacturing processes.

In some cases, this adjustment mechanism can be so strong that it not only offsets the negative effects of population aging but also increases labour productivity. In other words, a smaller workforce does not necessarily result in lower economic output. If firms adopt new technologies effectively, output per worker can grow faster than before. As a result, the economy becomes more productive and can sustain high levels of production with fewer employees.

It is important to distinguish between the impact on overall economic growth and the impact on labour productivity. A shrinking workforce slows the growth of the economy as a whole, but technological progress can still drive faster gains in labour productivity. Whether population aging becomes merely a challenge or also an opportunity for economic modernization depends on a country's ability to transform demographic pressure into innovation.

At the same time, not all sectors respond to population aging in the same way. The strongest effects are seen in manufacturing, where many tasks can be automated and replaced by machines. By contrast, automation is much more limited in service industries that depend on close human interaction, caregiving, or personalized support. Healthcare, social services, education, and many personal services are therefore likely to face different challenges than the manufacturing sector.

Acemoglu and Restrepo's conclusions are particularly relevant for public policy because they reject both simplistic pessimism and uncritical optimism. In their view, technology is not a neutral force that automatically raises employment and wages. What matters is whether it merely replaces workers in existing tasks or also creates new activities, occupations, and forms of work in which people retain a comparative advantage. At the same time, demand is increasing for labour-intensive services such as long-term care, healthcare, social services, rehabilitation, and home care. While many of these services can be supported by modern technologies—including digital care coordination, telemedicine, monitoring systems, and robotic assistance—they cannot be fully automated. They rely on human interaction, trust, empathy, professional judgment, and accountability.

Implications for the Czech Republic

Several important conclusions can be drawn for the Czech Republic. First, there is no reason for excessive alarm. Population aging does not automatically lead to economic stagnation or an inevitable decline in living standards. The real challenge arises when the economy fails to adapt to changing conditions through innovation, technological progress, and higher productivity. The key issue is therefore not simply the number of workers, but the economy's ability to generate greater value with a smaller workforce.

In the face of demographic decline, the response should not focus solely on increasing the number of workers. It should also create conditions that support the faster adoption and development of new technologies. This includes investing in research and development, accelerating business digitalization, expanding technical infrastructure, strengthening the education system, promoting workforce reskilling, and encouraging lifelong learning. Equally important is ensuring that businesses have access to investment capital and can effectively translate innovation into everyday economic activity.

One of the country's main priorities should be to accelerate the digitalization and automation of the Czech economy. The Czech Republic has a significant advantage thanks to its strong industrial base, particularly in the automotive, engineering, and manufacturing sectors. These industries offer substantial potential for automation and the adoption of advanced technologies. Support should therefore target not only large companies but also small and medium-sized enterprises, which often face limited access to capital, expertise, and information needed to implement technological investments. Artificial intelligence will also play an increasingly important role across both the private and public sectors. At the same time, it is important to recognize that the current development of AI is heavily supported by both public and private investment, making it more difficult to assess the long-term economic sustainability of today's business models.

Regional disparities also deserve close attention. The ability to adapt to technological change is not evenly distributed across the country. Large metropolitan areas, particularly Prague and Brno, benefit from a higher concentration of skilled workers, universities, research institutions, and technology companies, giving them a stronger foundation for rapid adaptation. By contrast, some structurally disadvantaged or peripheral regions may struggle to keep pace. Public policy should therefore ensure that technological transformation is not confined to major cities but that its benefits extend across the entire country. This could include support for regional innovation hubs, technology incubators, and targeted investment incentives.

Social policy must also be an integral part of this transformation. Automation and new technologies will not affect all workers equally. The government will need to strengthen active labour market policies, particularly reskilling programs, upskilling initiatives, and lifelong learning. The goal should be to help workers transition smoothly into new occupations and more promising industries. At the same time, the social protection system must be designed to cushion the short-term effects of technological change and frictional unemployment without creating barriers to re-entering the labour market. Striking the right balance between encouraging innovation and protecting individuals will be essential to ensure that technological progress reduces rather than deepens social inequality and supports inclusive, long-term economic growth.

Although investment activity in Europe has been increasing, European capital markets remain relatively fragmented and less efficient than those in the United States. As a result, innovative firms often face greater difficulties in securing financing for rapid growth and technological development. The Czech Republic should therefore foster an environment that encourages investment in productive capital, research, development, and technological innovation. This discussion should also include simplifying rules for corporate capital financing and expanding the use of employee stock ownership plans.

Looking ahead, a broader debate on the taxation of labour and capital is also likely to emerge. As technological progress increasingly replaces human labour, policymakers will need to design a tax system that encourages innovation and investment while ensuring sufficient public revenues and the long-term sustainability of social protection systems. If public incentives, tax policies, or investment support favour capital over labour, businesses may automate even where the broader social benefits

are relatively limited. Finding the right balance between promoting technological progress, maintaining an efficient tax system, and ensuring long-term fiscal sustainability will be one of the defining economic policy challenges of the coming decades.

Conclusion

Demographic change has the potential to accelerate the adoption of new technologies. Its ultimate impact, however, depends on whether these technologies simply replace workers in existing tasks or also create new activities and increase the value of human work. Public policy should therefore avoid treating people and technology as opposing forces. Instead, it should promote the development of technologies that enable people to work more productively, remain in the workforce longer, work more safely, and deliver higher-quality services.

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Author

MARTIN ZEMAN

Analyst

Martin Zeman graduated from the Faculty of Economics and the Faculty of Business Administration at the University of Economics in Prague. He also defended his dissertation at the University of Economics. He specializes in economic policy, fiscal policy and public finance. He is the author of several professional articles, speaks at international conferences and publishes commentaries in the media. For several years, he worked as an advisor to the Minister and in other institutions dealing with public finance.

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Martinská 2, 110 00 Prague 1

+420 602 502 674

www.politikaspolecnost.cz

office@politikaspolecnost.cz