MINISTRY
OF FINANCE

Productivity growth in a new environment

How will the green transition and geopolitics affect productivity?

Finnish Productivity Board

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Abstract

Slow productivity growth has been one of Finland's main economic challenges since the financial crisis. Though labour productivity growth has slowed in Western countries in general, the gap in productivity to leading countries has widened in recent years.

In step with productivity, wages have also grown more slowly than in reference countries over the past ten years. As a result, the problems in productivity growth have not developed into cost competitiveness problems.

The slowdown in productivity growth is the result of several factors that relate to changes in the global operating environment and to domestic structural issues. However, the Finnish economy is showing some promising signs. According to structural business statistics, investments in tangible capital made by Finnish businesses do not differ significantly from reference countries. Compared internationally, R&D investments by Finnish small and medium-sized enterprises are also at a high level. The availability of skilled labour poses a challenge to growth in R&D activities.

The Finnish economy is also facing rising global challenges relating to climate change and mitigation as well as to the shifting geopolitical environment. Unless effectively addressed, these challenges could undermine productivity growth. The green transition may also have a positive impact on labour productivity. Industrial policy measures may be needed to address the green transition and geopolitical issues.

Keywords Finnish Productivity Board, economic policy, productivity, economic growth, technological development, competitiveness, boards (organs), businesses, national economy, competence, education, research and development

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Tuottavuuden kasvu uudessa ympäristössä
Miten vihreä siirtymä ja geopolitiikka vaikuttavat tuottavuuteen?

Valtiovarainministeriön julkaisuja 2024:71		**Teema**	Lautakunnat
Julkaisija	Valtiovarainministeriö		
Yhteisötekijä	Tuottavuuslautakunta		
Kieli	englanti	**Sivumäärä**	42

Tiivistelmä

Tuottavuuskasvun hidastuminen on ollut yksi Suomen keskeisimmistä taloudellisista haasteista finanssikriisin jälkeen. Vaikka työn tuottavuuden kasvu on hidastunut länsimaissa yleisesti, ero tuottavuuden eturintamamaihin on viime vuosina kasvanut.

Tuottavuuden lisäksi palkat ovat nousseet viimeisen kymmenen vuoden ajan verrokkimaita hitaammin, joten tuottavuuskasvun ongelmat eivät ole muodostuneet kustannuskilpailukykyongelmiksi.

Tuottavuuskasvun hidastuminen on seurausta useista tekijöistä, jotka liittyvät globaalin toimintaympäristön muutoksiin ja kotimaisiin rakenteellisiin ongelmiin. Suomen taloudessa on kuitenkin lupaavia merkkejä. Yritysten investoinnit aineelliseen pääomaan eivät yritysten rakennetilastojen perusteella eroa merkittävästi verrokkimaiden tasosta. Lisäksi pienten ja keskisuurten yritysten panostukset T&K-toimintaan ovat kansainvälisesti korkealla tasolla. Haasteena T&K-toiminnan kasvulle on koulutetun työvoiman saatavuus.

Suomen talous kohtaa myös nousevia globaaleja haasteita, jotka liittyvät ilmastonmuutokseen ja sen torjuntaan sekä muuttuvaan geopoliittiseen ympäristöön. Näihin haasteisiin vastaaminen voi heikentää tuottavuuskehitystä, jos niihin ei vastata tehokkaasti. Vihreällä siirtymällä voi olla myös työn tuottavuutta parantavia vaikutuksia. Myös teollisuuspolitiikkaa voidaan tarvita vihreän siirtymän ja geopoliittisten ongelmien ratkaisemiseksi.

Asiasanat tuottavuuslautakunta, talouspolitiikka, tuottavuus, talouskasvu, teknologinen kehitys, kilpailukyky, lautakunnat, yritykset, kansantalous, osaaminen, koulutus, tutkimus- ja kehittämistoiminta

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Produktivitetstillväxt i en ny miljö
Hur påverkar den gröna omställningen och geopolitiken produktiviteten?

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Referat

En av Finlands största ekonomiska utmaningar efter finanskrisen har varit den avtagande produktivitetstillväxten. Även om tillväxten i produktiviteten i arbetet har avtagit i västländerna i allmänhet, har skillnaden jämfört med de länder som har högst produktivitet ökat under de senaste åren.

Utöver produktiviteten har lönerna under de senaste tio åren stigit långsammare än i jämförelseländerna, så problemen i produktivitetstillväxten har inte blivit ett problem för kostnadskonkurrenskraften.

Den avtagande produktivitetstillväxten beror på flera faktorer som hänför sig till förändringar i den globala verksamhetsmiljön och inhemska strukturella problem. Finlands ekonomi uppvisar emellertid lovande tecken. Enligt statistiken över företagens strukturer avviker företagens investeringar i materiellt kapital inte nämnvärt från nivån i jämförelseländerna. Dessutom ligger små och medelstora företags satsningar på FoU-verksamhet på en internationellt sett hög nivå. En utmaning för tillväxten i FoU-verksamheten är tillgången på utbildad arbetskraft.

Finlands ekonomi står också inför växande globala utmaningar i anslutning till klimatförändringen och bekämpningen av den samt den föränderliga geopolitiska miljön. Om dessa utmaningar inte hanteras effektivt kan det försvaga produktivitetsutvecklingen. Den gröna omställningen kan också förbättra produktiviteten i arbetet. Även industripolitik kan behövas för att lösa olika problem i anslutning till den gröna omställningen och geopolitiska problem.

Nyckelord produktivitetsnämnden, ekonomisk politik, produktivitet, ekonomisk tillväxt, teknisk utveckling, konkurrenskraft, nämnder, företag, samhällsekonomi, kompetens, utbildning, forsknings- och utvecklingsverksamhet

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Contents

FOR THE READER

In June 2018, the Government issued a decree establishing a productivity board in Finland. The establishment of the Board is based on the Council of Europe recommendation on the establishment of national productivity boards.

The Board is tasked with monitoring the development of productivity and competitiveness of the Finnish economy, and for regularly providing and publishing independent evaluations. The Board prepares financial reports and estimates concerning the developments in income and expenditure. In addition, the Board participates in discussion and exchange of information with Productivity Boards in other EU Member States and the EU Economic Policy Committee.

The members of the Finnish Productivity Board were appointed by the Government for a term running from 1 September 2021 to 30 August 2024. The Board is chaired by Janne Huovari, Senior Ministerial Adviser at the Ministry of Finance. The Board's secretary is Olli Palmén, Ministerial Adviser at the Ministry of Finance.

The following members of the Board have also participated in the preparation of this report:

- Natalia Kuosmanen, (PhD.), Chief Research Scientist, ETLA Economic Research
- Ilkka Kiema (PhD), Research Leader, Labour Institute for Economic Research LABORE
- Seppo Kangaspunta, (M.B.A.), Ministerial Adviser, Ministry of Economic Affairs and Employment
- Mika Maliranta (PhD), Director and Professor, Labour Institute for Economic Research LABORE and University of Jyväskylä
- Juuso Vanhala (PhD), Head of Forecasting, Bank of Finland.

1 Introduction

The Productivity Board is tasked with monitoring the development of productivity and competitiveness in the Finnish economy. In its previous reports (2019, 2020, 2021, 2022, 2023), the Finnish Productivity Board has examined the causes of sluggish productivity growth in the Finnish economy since 2007 from various perspectives. This report provides updated data on the development of labour productivity and cost competitiveness (Chapter 2), builds upon the analyses presented in previous reports and investigates new phenomena affecting productivity, such as the potential effects of the green transition, geopolitical competition and industrial policy on productivity.

Chapter 3 of this report and the accompanying background reports explore how investments in education, research and capital have evolved. The report focuses particular attention on education and the development of labour skills and demand (Kangaspunta 2024a), developments in research and product development funding and personnel (Kangaspunta 2024b), the structural transformation of corporate R&D activities (Huuskonen & Maliranta 2024) and the combined effects of increased public R&D funding and the supply of R&D personnel (Palmén 2024). The report also examines the development and measurement of tangible investments (Huovari & Maliranta 2024).

Chapter 4 examines the impact of emerging global challenges on economic productivity. It discusses how climate change, biodiversity loss, and the green transition needed to address them affect productivity (Kuosmanen et al. 2024). Furthermore, this chapter considers the implications of heightened geopolitical competition in recent years and the associated rise in industrial policy on productivity trends.

The concluding chapter (Chapter 5) synthesises the findings of the Finnish Productivity Board's previous reports and this report regarding the productivity trends of the Finnish economy and the key factors driving its decline.

2 Productivity and competitiveness

2.1 Development of productivity

After the Covid-19 crisis, productivity trends in the Euro area and the United States have diverged significantly (Figure 1). In the United States, production quickly returned to its pre-2020 trend and continued to grow along that trajectory. In contrast, production in the Euro area has not only failed to return to its previous trend but has also experienced a considerable slowdown in growth. In Finland, production growth has been even weaker, with output beginning to decline at the beginning of 2022. By the second quarter of 2024 GDP in the United States was more than 10% higher than in 2019, whereas it was only 4% higher in the Euro area and remained at the 2019 level in Finland.

During this period, the employment trends have shown less variation.

In fact, the number of hours worked evolved almost identically in the United States and the Euro area. In Finland, the number of working hours even increased until 2023. Since then, employment and the number of hours worked have declined, but the difference between the US and the Euro area is considerably smaller in employment than in production.

In a straightforward interpretation, the difference in labour productivity (GDP/working hours) between the economies has been fairly large and may largely explain the growth gap between the US and the Euro area after the Covid-19 crisis. Labour productivity growth in the United States has been faster since the Covid-19 crisis, consistent with its pre-crisis trend. However, the gap in productivity may not be as great as the GDP figures alone suggest.

This can be attributed to several factors. First, GDP encompasses the entire economy, including sectors where productivity measurement is challenging or omitted from national accounts. The public sector, for instance, represents a significant sector whose productivity growth is not measured in the national accounts (for more information, see Finnish Productivity Board 2019).

Second, methodological differences in how countries measure production prices in their national accounts contribute to discrepancies. Price measurement plays an important role in measuring production, particularly in the context of new

technologies, where rapidly changing products and services introduce significant challenges (IMF 2018). These measurement issues have likely intensified in recent years due to major price fluctuations. Beyond challenges with measurement of final product prices, the measurement of the volume of value added is further complicated by limited availability of intermediate product prices in general (Finnish Productivity Board 2023, Box 1).

Moreover, real GDP at market prices is not the best indicator for how consumption opportunities generated by economies evolve, as it fails to account for the changes in relative prices between countries and the fact that consumption comprises both domestic production and imports. Purchasing power-adjusted GDP offers a more accurate measure of economic development from a consumer's perspective across countries. When measured by purchasing power-adjusted GDP, the difference between Finland and Sweden appears much smaller (Jäntti 2024).

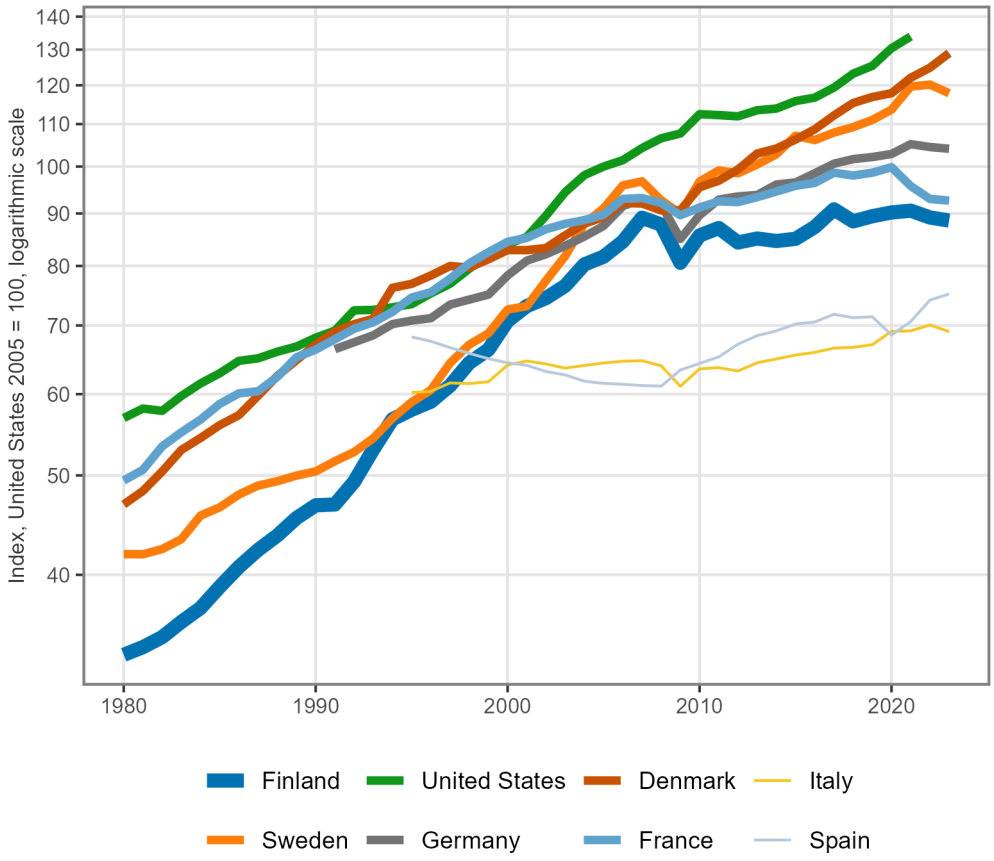
Figure 1. GDP and working hours in Finland, the Euro area and the United States. Reference: Statistics Finland, Eurostat, BEA, BLS, Finnish Productivity Board.

The Finnish Productivity Board has not used the GDP of the entire economy to measure labour productivity, but rather the value added in the market sector, which can be measured with a reasonable degree of reliability. This approach will not eliminate all the problems mentioned above, but helps mitigate them to some extent. In addition, annual accounts data are used, as the measurement issues in these are somewhat less pronounced than in more frequently published figures based on a smaller database. However, one drawback of this approach is that the productivity analysis only covers the market sector, not the entire economy.

Despite challenges in measuring and interpreting productivity, labour productivity growth in Finland and the Euro area has been weaker than in the United States. However, the gap may not be as large as GDP and employment figures suggest.

In Finland, productivity growth has been weak for nearly the entire period following the financial crisis. While labour productivity growth has generally slowed across Western countries, Finland's productivity growth has fallen even further behind, particularly during the first half of the 2010s (Figure 2). The slowdown in productivity growth following the financial crisis has proven more lasting in some countries, whereas in others, growth has either accelerated or the slowdown has been less severe overall. Notably, in the United States, Denmark and Sweden, labour productivity growth has accelerated, whereas in most European countries, including Finland, labour productivity growth has remained weak. As a result, the gap between Finland and its neighbouring countries Sweden and Denmark has widened significantly.

Figure 2. Level of labour productivity in the business sector, United States 2005 = 100, logarithmic scale Reference: Eurostat, OECD, BEA, Finnish Productivity Board.



In Finland, the prolonged period of weak labour productivity growth following the financial crisis can be attributed to several factors, or at least the sources of this sluggish growth have varied. A prominent example is the collapse of the electronics industry, which caused a substantial drop in productivity. Labour productivity in Finland's digital industry fell sharply from its peak in 2007, reaching its lowest point in 2013. Since then, however, productivity growth in the digital industry has rebounded significantly. The issue remain that the share of digital industry in the Finnish economy is considerably smaller than before the financial crisis, reducing its overall contribution to market-sector productivity.

Digital services have also posed challenges to Finland's productivity growth. Their productivity level has remained significantly lower than that of reference countries, and their productivity growth has similarly lagged behind, at least until around 2015. Since then, however, productivity growth has become more closely aligned with that of the reference countries.

In recent years, traditional industry has experienced the most severe challenges in productivity growth, with productivity declining sharply since 2017.

This is likely due to a combination of structural changes and cyclical factors. Productivity measurements are inherently affected by cyclicality. For instance, weak demand may manifest as lower productivity when firms are slow to adjust labour inputs (Finnish Productivity Board 2019, Chapter 6.2). This suggests that productivity in the traditional industry could recover as economic conditions improve. Nevertheless, productivity levels in the Finnish industry remain comparatively high relative to reference countries. The background report by Huovari and Kiema (2024) provides a more detailed analysis on Finland's productivity trends.

2.2 Cost-competitiveness

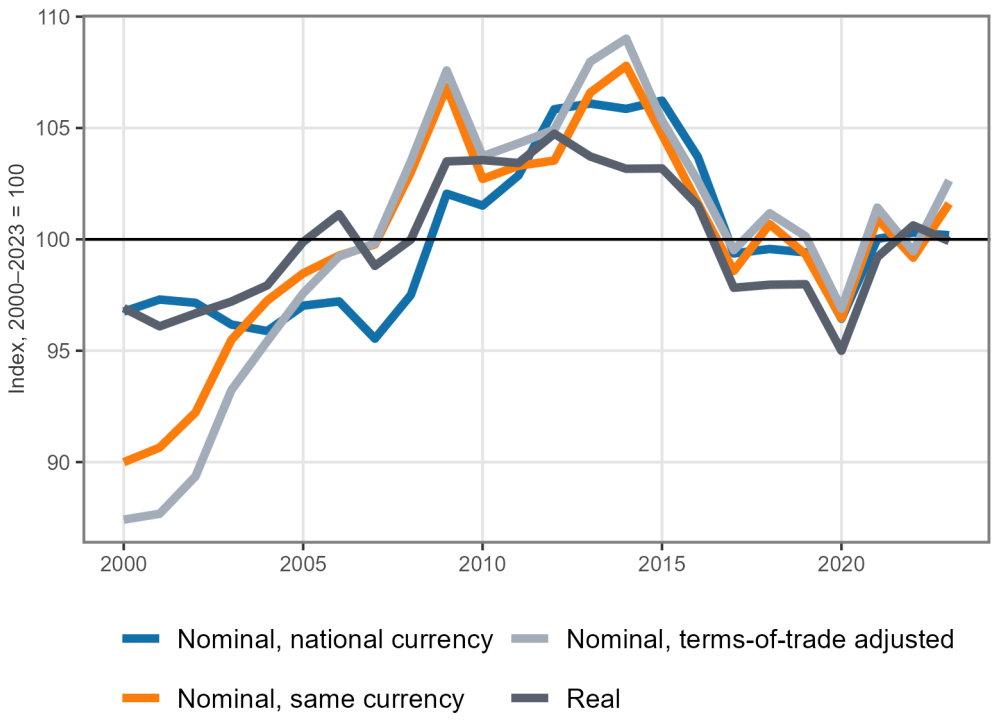
In recent years, the rise in earnings has accelerated in Finland. In 2022, the earnings index increased by 2.4%, but last year it accelerated to 4.2%, marking the fastest growth rate in more than ten years. Similarly, the growth of average hourly earnings according to national accounts increased to 3.7% last year. According to Statistics Finland's current estimate, the earnings index is expected to increase by about 3.1 per cent this year (Huovari & Kiema 2024).

However, the increase in earnings has been substantially slower than the increase in prices. Real average earnings began to decline already in 2022, as inflation accelerated primarily as a result of the energy crisis triggered by Russia's war of aggression in Ukraine. In 2022, inflation measured by the consumer price index was 7.1% and it was 6.2% in the previous year. During this same period, the growth rate of the harmonised index of consumer prices (HICP) was 7.2% and 4.3%, respectively.

Based on internationally comparable indicators (HICP and average hourly earnings according to national accounts), the decline in real earnings came to a halt last year. At the quarterly level (hourly wages as an indicator of earnings and private consumption deflator as an indicator of consumer price inflation), a reversal in real earnings already took place at the beginning of last year (Pönkä & Silvo 2024).

The rise in earnings and average wages has also been reflected in an increase in unit labour costs. However, the increase in unit labour costs in proportion to reference countries has remained relatively modest. In Finland, wage development has adapted to weakened productivity growth. Since 2013, employee compensation in Finland has grown more slowly than in reference countries.

Figure 3. Development of relative unit labour cost indices of the Finnish economy as a whole in 2000–2023. In relation to 16 key reference countries. Reference: Eurostat, OECD, BIS, Finnish Productivity Board.



After the Covid-19 crisis, Finland's cost competitiveness has remained at approximately the average level in the period 2000–2023. However, as shown in Figure 3, in 2023 nominal unit labour costs increased slightly faster in same-currency terms than in the reference countries. This increase is due to the strengthening of the exchange rate of the euro against the US dollar and the Swedish krona. Real unit labour costs and unit labour costs measured in the national currency did not increase compared to those of reference countries in 2023. Huovari et al. (2020) provide a more detailed examination of these cost competitiveness indicators.

3 Investment in education, research and capital

3.1 Education and human capital

Human capital is one of the key factors in labour productivity. Skills, abilities and knowledge are strongly linked to productivity, not only at the individual level but also at the level of companies, countries and even urban areas. In Finland, population's level of education appears to explain historical trends in productivity quite well (Finnish Productivity Board 2023). Human capital is also an important factor for technological development. The development and deployment of new technologies and innovations play a key role in improving corporate productivity. Achieving this requires research and development, which depend on the availability of a highly educated workforce (Cohen & Levinthal 1989, Griffith et al. 2003, 2004).

The outlook for human capital development in Finland is concerning, as the population's average educational attainment is expected to fall increasingly behind that of reference countries. Survey data indicate that there is already a shortage of skilled labour, which is limiting companies in their efforts to expand operations (Kangaspunta 2024a).

Furthermore, the limited availability of highly educated workers could hinder the expansion of research and development activities. Evidence of Finland's declining educational levels and the challenges in accessing skilled labour are concerning for the country's potential productivity growth.

Human capital beginning to decline

Finland's human capital has grown since the end of the 19th century, driven primarily by continuous improvements in the average educational attainment of the working-age population. However, this trend is now at risk of reversing in the coming decades due to an ageing population, shrinking age cohorts, and if the education attainment of younger generations does not significantly improve. A decline in human capital could significantly slow productivity growth.

While the overall educational level of the population continues to rise, a closer examination by age group reveals that the increase in the educational attainment in Finland stalled in turn of the 1980s. By international comparison, Finland's relative level of educational attainment now relies heavily on the working-age population aged 45 and above, who were born before the early 1980s. As the cohort currently aged 55–64 will leave the labour market by 2030, the average educational level among 25–64-year-olds is projected to drop below the OECD average (Kalenius 2023).

Since the 1990s, Finland's global educational standing has been shaped by the continued growth in tertiary education in other developed and developing countries, even as Finland's own growth stagnated. The future of educational attainment among working-age population will depend on how the education levels of younger generations develop. A key challenge is to significantly increase the proportion of higher education degrees among 25–34-year-olds.

Supply and demand of knowledge

Companies face intensifying (international) competition for employees capable of developing and deploying new technologies (Ali-Yrkkö et al. 2021). A shortage of experts needed for technological innovation could limit the effectiveness of Finland's target to increase R&D expenditure to 4% of GDP, potentially resulting in modest productivity gains. At the same time, a shortage of highly educated workforce could lead to higher wages for R&D employees, which might make Finland more attractive to foreign experts. The planned expansion of doctoral education between 2024 and 2027 could partially address the shortage of experts.

The demand for experts in companies is typically highest during the early stages of their life cycle, particularly when new technologies are being introduced (Bartel & Lichtenberg 1987). Increased productivity often follows substantial long-term investments in knowledge. Studies using Finnish data indicate that an increase in the number of experts employed by a company leads to productivity gains only after several years (Daveri & Maliranta 2007, Maliranta 2003).

The evolution of the technological environment and business environment is continually reshaping the demand for skills. As workers need to reskill and upskill to adapt to these changes, labour supply usually adjusts to demand with a lag. Consequently, a certain degree of skill mismatch is unavoidable. However, persistent imbalances can be a symptom that the labour market is not functioning optimally (OECD 2022).

In high-productivity countries, skills shortages seem are particularly acute in occupations requiring higher education (OECD 2022). According to the OECD's Skills for Jobs 2022 database, on average more than half of workers in occupations experiencing labour shortages across participating countries hold positions that require higher education. This share is highest in Belgium, Estonia and Finland, where it exceeds 80%

There are significant cross-country differences in how well workers' education levels align with the skills required for their jobs. In Finland, approximately one-third of employees lack the skills needed for their roles (OECD 2022). This proportion is less than the OECD or EU average. In Finland, most of the mismatch stems from employees being underqualified, while the prevalence of overqualified employees is significantly lower compared to other OECD and EU countries on average. Finland appears to have the lowest rate of over-qualification among all reference countries.

The OECD finds that the gap between the supply and demand of highly educated labour in Finland is wider than in most other OECD countries. These findings are supported by a study by Koske et al. (2023), which suggests that Finnish companies have not succeeded in recruiting enough, or sufficiently high-quality, experts to utilise new advanced technological knowledge and drive innovation.

Labour shortages can also be examined through wage trends in occupations. Rising wages indicate increasing competition among employers for skilled workers. Although higher wages theoretically increase the supply of labour, the long training periods required for high-skilled roles and other market frictions often cause supply to adjust with a lag. A recent wage study based on data on individuals shows that the salaries for highly educated workers have been rising faster than those of other groups (Fornaro & Maliranta 2023). Wage increased have been particularly pronounced for workers with advanced degrees in science, technology, engineering and mathematics (STEM) who have changed employers. This suggests growing competition among companies for workers needed for developing and deploying new technologies.

Improving education

The decline in human capital can be prevented by increasing education levels and work-related immigration. However, changes to the educational attainment and structure of the entire working-age population occur very slowly. Even significant improvements in educational participation lead to only gradual changes in the

educational structure of the working-age population. Nevertheless, raising the educational level of younger generations remains the most important way to increase future workforce's human capital.

Since the number of higher education graduates (e.g. those completing post-graduate studies) depends on secondary education, ensuring the functioning of education at all levels is essential. As age cohorts shrink in size, increasing attention should be paid to the orientation, content and quality of education, as well as to factors that motivate participation in education and enable access to it.

The number of workers capable of participating in R&D activities can be measured by the number of engineers and the natural scientists. In Finland, the proportion of engineers and natural scientists within the working-age population is among the highest in the EU (Eurostat 2024). This share is larger than the EU average but lower than in Sweden, the Netherlands, Switzerland, Norway and Ireland. In addition, since 2010 the growth in the number of engineers and natural scientists in Finland has been slower compared to the leading countries.

Overall, the share of higher education graduates working in science and technology in Finland is lower than in the top-performing countries, which may partly result from differences in educational systems and economic structures. Based on international comparisons, Finland has the potential to increase the share of engineers and natural scientists in its population by narrowing the gap with the leading countries. Raising the share of high-skilled labour to the level of top countries could significantly foster the creation of new innovations and thus also enhance labour productivity (Palmén 2024).

From the perspective of innovation and productivity, Finland could also benefit from attracting highly educated labour through immigration. Work-based immigration, particularly from non-EU countries, has grown significantly in recent years. Foreign students in Finland could also be a significant source for skills. However, it is more challenging for individuals with a foreign background to secure employment after completing the degree compared to those with a Finnish background in similar circumstances. It is estimated that one in five individuals with a foreign background leaves the country the same year they graduate (Loukkola 2020; see also Välimäki et al. 2023).

According to the OECD, Finland's attractiveness to international talent is approximately at or slightly above the OECD average but falls short compared to other Nordic countries. Furthermore, Finland's attractiveness has deteriorated in recent years, especially from the perspective of foreign students. The OECD

suggests that Finland could improve its attractiveness to international highly educated workers, entrepreneurs and students by adopting immigration policy practices from the most attractive countries and by creating a broader operating environment that draws foreign talent, drawing on the experiences of the leading countries (OECD 2023a, OECD, 2023b).

3.2 Research and development

Structural change in business research and development activities

The Finnish business sector experienced a deep and widespread negative productivity shock in the early 2010s. In a relatively short period of time, a significant number of high-productivity jobs were lost (Productivity Board 2022, Calligaris et al. 2023). At the same time, business investment in R&D fell sharply, particularly among large companies. In contrast, R&D investments in new and small enterprises, and later in young and medium-sized enterprises, began to grow. In recent years, small and medium-sized Finnish enterprises have ranked among the highest globally in R&D investments on a per capita basis (Fornaro & Maliranta 2024).

Analyses presented in the background report Huuskonen and Maliranta (2024) indicate that as recently as 2010, R&D activity in Finnish companies was still highly concentrated in a relatively small number of firms. Comparisons indicate that Finland's R&D concentration then resembled that of countries such as Sweden and Switzerland. In contrast, Spain and Italy are examples of countries where R&D investments are relatively evenly distributed across companies. Between 2010 and 2015, during the negative productivity shock, Finland saw a significant decrease in the concentration of R&D activities among firms. Since then, the distribution of investments across firms has remained relatively stable.

These comparisons also reflect the renewal of Finland's business R&D activities. Between 2011 and 2016, the R&D intensity (R&D expenditure relative to turnover) of both young (less than five years old) and old (at least five years old) small companies (10–49 employees) in Finland was lower than that of comparable firms in other OECD countries. However, between 2017 and 2022, the situation changed. At that time, among young companies in Finland R&D intensity had risen significantly higher than those in other OECD countries in previous years. Conversely, the R&D intensity of small, old firms in Finland was well below the average observed in other OECD countries.

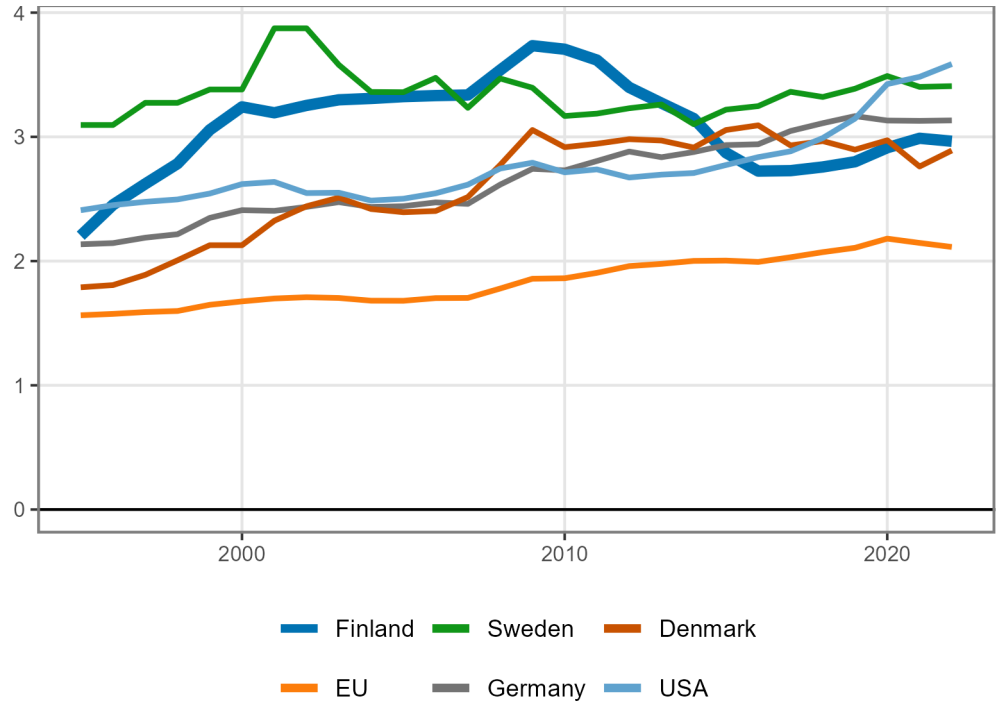
The share of R&D activity attributable to foreign-owned companies in Finland has been relatively low, less than 30 per cent. By comparison, in Sweden, the share exceeds 40 per cent. However, the share of foreign-owned companies in both R&D expenditure and their share of R&D personnel has been steadily increasing (Huuskonen & Maliranta 2024).

R&D activity levels

The background report, Kangaspunta (2024b) examines changes in the volume and financing of R&D activities, as well as the number, educational background and placement of R&D employees in 2004–2022. Finland's R&D intensity, measured as R&D expenditure relative to GDP, has fallen from its peak in the early 2010s, but remains high by international standards. Finland's R&D intensity fell from 3.7% in 2010 to 3.0% in 2023, dropping from 3rd to 11th place in global rankings. However, this figure was still above the OECD and the EU-27 averages (see Figure 4).

Since 2016, R&D funding in Finland has grown relatively favourably (+15%), albeit more slowly than the average growth in OECD and EU-27 countries. Despite the increase in R&D investments, firms' real R&D expenditure in Finland increased by only around 4 per cent between 2004 and 2022, compared to 40 per cent or more in countries like Sweden and Denmark.

Figure 4. R&D expenditure in relation to the GDP, 1995–2023. Source: OECD



In Finland, the total number of R&D employees, measured by person-years, in 2022 remained below the 2004 level, despite the increase since 2016. Following the Nokia crisis, the number of corporate R&D employees initially decreased but had surpassed 2008 levels by 2022. At the same time, the composition of R&D employees has also changed: the number and share of researchers and product development engineers within corporate R&D personnel have increased, while the number of other R&D employees has decreased. The educational level of corporate R&D employees has also increased, with highest relative growth in doctoral graduates. In absolute terms, the number of employees with university or polytechnic degrees grew the most. Compared to 2004, a larger share of Finnish R&D employees worked in the private sector in 2022, while the number of R&D employees in the public sector decreased sharply during the same period.

In 2021, the share of all R&D employee and researcher person-years in the private sector in Finland was slightly below the OECD average. Between 2015 and 2021, the growth in the private sector's share of total R&D employees lagged behind the average growth in EU-27 and OECD countries. However, the share of private sector researcher person-years increased more in Finland than the EU-27 and OECD averages during the same period.

Between 2011 to 2022, the focus of corporate R&D activities shifted toward basic research and applied research at the expense of development work. This trend has been the most pronounced in large and very small companies and is consistent with changes in the composition of R&D employees.

R&D growth requires more than funding

Cuts to Finland's R&D subsidies have been shown to have contributed to a reduction in R&D activities (Pohjola 2020). The R&D Funding Act, which entered into force at the beginning of 2023, aims to increase public R&D investments gradually from 0.8% to 1.2% of the GDP during between 2024 and 2030.

The background report, Palmén (2024) uses the European Commission's QUEST III general equilibrium model (Roeger et al. 2022) to examine the impact of increasing the supply of R&D workforce on the production of new innovations alongside the additional public R&D support introduced under the R&D Funding Act. The analysis suggests that increasing public R&D subsidies increases overall production and productivity in the longer term. However, it is notable that increased R&D spending may initially dampen productivity growth by diverting high-skilled labour from final production to the R&D sector. Higher R&D subsidies also raises the wages for high-skilled workers unless the labour supply increases. Based on the model

analysis, while increasing the supply of high-skilled labour enhances innovation and productivity, it does not significantly improve the productivity impact of R&D subsidies compared to a scenario where the supply of R&D-capable labour remains constant.

Ensuring productivity growth requires that R&D expenditure is allocated as efficiently as possible (Einiö et al. 2022). Targeting R&D investments towards activities with the greatest externalities and social returns is crucial to boosting productivity. However, supporting research involves a trade-off: broad-based subsidies (e.g., tax incentives) may be inefficient, while targeted support requires optimal allocation decisions, which can be highly challenging.

From the perspective of innovation activities, it is worrisome that the role of companies in funding the R&D funding for universities, research institutes and universities of applied sciences has decreased significantly in just over a decade (Kangaspunta 2024b).

3.3 Tangible investments

The weak growth of labour productivity in Finland has been attributed to insufficient investments by companies (e.g., Pohjola 2020). According to neoclassical growth theory, labour productivity growth originates predominantly from technological development, which is assumed to be determined outside the model, i.e. it is generated exogenously. Technological development is considered to be *disembodied*, meaning it is not tied to specific inputs or conditions. In this type of model, this assumption implies that technology can flow freely between companies, leading to an immediate and automatic increase in their productivity. In the long-term equilibrium, the capital stock grows at the same pace as technological developments. Therefore, in the long term, investments are driven by technological development, not the source of productivity growth (see e.g. Aghion & Howitt 2007; Hulten 2001, footnote 15). The situation becomes somewhat more complicated if part of the technological development is embedded (or embodied) to investment goods (Hulten 1992).

Empirical analyses have also found that past investments are a weak predictor of future labour productivity growth. This relationship may even be negative. On the other hand, labour productivity growth seems to correlate positively with future investments (Blomström 1996; Stundziene & Baliute 2022).

Theory and empirical data therefore do not support the view that investments are the fundamental source of labour productivity. Nevertheless, it is useful to examine whether the Finland's investment rates differ from those of reference countries and whether this may have contributed to Finland's weaker productivity growth.

According to the background report by Huovari and Maliranta (2024), there are significant uncertainties associated with comparing investments and interpreting results across countries. National accounts and business structure statistics portray a significantly different picture of corporate investments. Based on structural statistics, Finland does not invest less in tangible capital than others.

In recent years, investments have been relatively high in international comparisons, both across the market sector as a whole and within industry and private services. However, both sources of statistics consistently show that the investments of Finnish companies have been growing both in absolute terms and in relation to the reference countries.

The results indicate that a lack of investments is not the root cause of Finland's productivity problems. Investments were relatively low in the early 2010s, but this can be explained by the negative productivity shock and reduced cost competitiveness during that period, which reduced the companies' incentives to invest in tangible capital. Companies tend to increase investments in tangible capital when high-productivity investment projects are available and cost competitiveness is adequate.

If the growing investments in R&D by young Finnish companies yield results, that is, successful innovations, and cost competitiveness remains sufficient, these companies' incentives to invest in tangible capital will increase in the coming years.

4 Intensifying global challenges

In addition to the problems that hinder productivity growth highlighted in previous reports, Finland is also facing other significant and intensifying challenges that are likely to impact productivity as well. The threats posed by climate change and biodiversity loss to ecosystems and the economy require urgent action to reduce emissions, preserve biodiversity and mitigate major economic risks. In addition, increasing tensions in industrial policy and geopolitical competition are intensifying pressures on the Finnish economy and security as global power structures and trade relations change. Addressing these challenges requires innovative policies and strong international cooperation.

4.1 Climate change and biodiversity loss

Climate change and biodiversity loss weaken habitats and can cause significant economic losses. Addressing these issues is also justified from a purely economic perspective. Finland has made significant investments in renewable energy and undertaken efforts to enhance energy efficiency, aiming to meet climate targets and reduce greenhouse gas emissions.

Short-term and long-term impacts

The effects of climate action on economic growth and productivity are complex. In the short term, investments in renewable energy can lead to lower productivity as resources that might otherwise be allocated to areas, such as infrastructure or education investments, are redirected toward climate action. Additionally, R&D efforts directed at renewable energy production might generate higher short-term returns if redirected to other areas. Moreover, the capital used in polluting production may have to be decommissioned more quickly than would be economically optimal, and the cost of zero-emission energy may exceed that of polluting energy.

In the long term, the benefits of environmental investments, such as reduced air pollution, improved public health and the prevention of major economic losses due to climate change, are likely to far outweigh the short-term costs. Assessing

the opportunity costs of the green transition is challenging because the benefits of climate change mitigation are largely realised in the future, primarily benefiting future generations. Estimates of the opportunity costs of the green transition thus depend significantly on how the future benefits are weighted against current benefits. When seeking the right balance between short-term economic growth targets and environmental goals, discounting future benefits using conventional methods based on market interest rates is problematic, as this assigns very little weight to the wellbeing of future generations (Kiema 2024).

Economic perspectives and green productivity indicators

The background report (Kuosmanen et al. 2024) highlights that traditional productivity indicators, such as labour productivity and total factor productivity, may provide an incomplete picture of actual economic development and the impacts of policy measures supporting the green transition. These indicators fail to account for negative impacts on the environment as costs, and do not consider the combined greenhouse gas emissions produced by humans as a finite resource. Consequently traditional productivity indicators fail to account for long-term environmental objectives or measures aimed at reducing the carbon footprint, leaving productivity assessments incomplete. The report emphasises the use of green productivity indicators, such as carbon productivity and green total factor productivity for a more comprehensive assessment of productivity from the perspective of sustainable development.

Carbon productivity is an analogous productivity measure to labour productivity. While labour productivity refers to value added per hours worked, carbon productivity refers to value added per unit of greenhouse gas emissions. Similarly, green total productivity is comparable to standard total factor productivity, but incorporates greenhouse gas emissions alongside labour and capital. The estimation of green total productivity is more complex than that of carbon productivity (cf. Kuosmanen et al. 2023).

Green productivity indicators enable a better understanding of how environmentally friendly practices can promote both sustainability and economic efficiency, particularly in energy-intensive sectors. When carbon productivity and green total productivity are used as productivity indicators, greenhouse gas emissions are treated as a limited resource, much like available working hours. Even when labour productivity appears higher in a sector using fossil fuels instead of renewable energy, the transition to renewable energy generally improves carbon productivity. However, the concept of carbon productivity does not account for negative environmental impacts unrelated to greenhouse gases.

Recent empirical studies have shown a positive link between labour productivity and carbon productivity (Fornaro et al. 2023). In other words, labour productivity is higher in companies that produce added value with low CO2 emissions. In addition, carbon productivity has been observed to fluctuate procyclically, improving carbon productivity during economic booms. This may be partly due to the fact that the strongest companies invest in greener technology during upturns (Maczulskij & Fornaro 2024). These results indicate that increasing labour productivity and reducing carbon dioxide emissions are not contradictory objectives.

Supporting the transition and market disruptions

Regulations and subsidies that promote the green transition can, however, distort market dynamics. Kuosmanen et al. (2023) note that companies respond to regulation by altering their production, the location of their production facilities and investment strategies. Such decisions affect the allocation of resources both within companies and between them.

Restrictions for production that accelerate climate change may contribute to the green transition, but the diversity of regulations in different countries may lead to production being moved to countries with less stringent environmental standards. Levinson (2009) and Levinson & Taylor (2008) argue that the reduction in pollution emissions in the United States is explained more by technological changes than by the shift of production to less regulated areas.

The transition to renewable energy is inevitable in the future due to the limited resources available. However, the path dependence of R&D activities by companies may slow down the transition and longer-term productivity development. Companies may find it more profitable to focus their R&D activities on the production of non-renewable energy than on renewable energy because non-renewable energy is already cheaper due to previous R&D activities in its production. In this case, temporary public aid for renewable energy production may encourage companies to redirect their R&D activities toward ensuring that renewable energy becomes cheaper, which will gradually render public support redundant (Rouvinen & Deschryvere 2024).

Recently, zero-emission energy has seen rapid cost reductions, and Finland is well placed to produce it. This will provide Finland a competitive advantage in the green transition. However, national aid introduced by larger economies to support the green transition – such as those based on the Inflation Reduction Act of 2022 in the United States or subsidies approved by the European Commission and implemented by individual European Union countries for green energy and battery

production (European Commission 2024) – may pose challenges for Finland. On the other hand, European Union-wide investment programmes, such as the InvestEU initiative, can promote the green transition in ways that benefit the Finnish economy.

4.2 Industrial policy and geopolitical competition

There are signs of fragmentation in the global economy, and states have intervened in economic activities more extensively than in past decades. Recent major shocks to the global economy, such as the pandemic, disruptions in supply chains, Russia's war of aggression, the energy crisis and growing polarisation of blocks have heightened geopolitical tensions and increased scepticism towards the benefits of globalisation. The rise in trade barriers, protectionism, and industrial policy reflect this development.

This is a worrying trend for future productivity growth, as globalisation and functioning global markets supported productivity growth, particularly from the mid-1990s until the years leading up to the financial crisis. The benefits of globalisation are traditionally attributed to more efficient allocation of resources in the global economy. However, positive impacts also arise through other channels: innovations are driven by exposure to international competition and cooperation, and companies gain access to better or cheaper capital goods and intermediate products. Global value chains have delivered substantial productivity benefits through efficiency, economies of scale, and the diffusion of technology and knowledge (Goldin et al. 2024).

Globalisation facing strong headwinds

Geoeconomic fragmentation and the headwinds against globalisation threaten to erode these productivity benefits. Alongside traditional factors based on productivity and the relative prices of factors of production, such as specialisation, division of labour, selection and economies of scale, new political, trade policy and security considerations have emerged. These new factors inevitably weaken allocation efficiency and the conditions for productivity growth. For example, relocating production to politically stable countries (*friendshoring*) or nearby countries (*near-shoring)* to minimise political risks can be detrimental to productivity if the comparative advantages of these countries, including their unique characteristics and resources, are not fully utilised. So-called *reshoring*, in

which parts of production chains are shifted back to domestic production to ensure security of supply, may have a similar impact. Diversifying production domestically may reduce economies of scale derived from specialisation.

The wellbeing and productivity benefits of globalisation is fundamentally depend on the reallocation of resources between firms, even within sectors (e.g. Melitz 2003; Melitz & Redding 2014). Exporting firms are typically more productive than companies that sell to the domestic market. As trade barriers decrease and competition increases, the most productive firms expand, the least productive firms exit the market, and the productivity of surviving companies improves. These selection effects are a key factor behind the productivity premium (e.g. Wagner 2012). Conversely, when trade barriers rise, the effects are reversed: competition diminishes, the operating conditions for low-productivity firms improve, and the growth opportunities for high-productivity firms weaken.

In addition to these "classical" trade-related effects, fragmentation also weakens the international diffusion of technology. Through international markets, domestic actors gain access to new ideas and innovations that enhance productivity. A decline in trade and supply relationships thus leads not only to immediate losses in the form of reduced trade but also to a long-term decline in the diffusion of innovations (Eaton & Kortum 1999; Goes & Bekkers 2023). This particularly affects countries with lower productivity than their more innovative trading partners. Similarly, small countries that cannot innovate everything domestically and rely on importing a large share of the technology they use may face significant challenges. Finland and the other Nordic countries fall into this latter category, as estimates suggest that approximately 90% of innovations in the Nordic countries have been adopted from abroad (Lind & Ramondo 2024).

Fragmentation can reduce the international mobility of skilled labour. This channel is important for productivity, as foreign students, researchers and entrepreneurs contribute significantly to knowledge creation and growth, particularly in regions such as the United States and the EU (Maskus 2023). The temporary mobility of skilled workers to and from a country is an important mechanism for the dissemination and adoption of technologies, leading to major positive "spill-over effects".

New industrial policy

The new industrial policy and extensive corporate subsidies are reshaping nature of international competition. State aid to companies has increased significantly over the past five years, driven partly by major societal challenges, such as the Covid-19

pandemic and climate change. In addition, many countries strive to safeguard their strategic technologies or sectors, ensure economic growth and innovation capacity, and enhance national security.

However, the measures associated with the new industrial policy often focus on job creation and influencing international trade. Examples include the European Green Deal, Horizon 2020, and the Strategic Forum for Important Projects of Common European Interest (IPCEI), as well as the Infrastructure Investment and Jobs Act (IIJA), the Inflation Reduction Act (IRA), the CHIPS and Science Act in the United States. Similarly, China has pursued initiatives, such as Made in China 2025 and the Belt and Road Initiative, to expand its export trade ecosystem (Shih 2023).

Large-scale national subsidies for companies or sectors can lead to rapid changes in the operating environment for businesses. State aid places foreign companies at a disadvantage in the competition for future technologies. This issue is particularly acute for smaller economies, which lack the resources to compete in subsidy races. In addition to the direct impacts, there is evidence that state aid may affect the technology and product market strategies of firms in competing countries (Friesenbichler et al. 2024).

In an intensive competitive environment, companies may not be able to wait for new technological solutions to emerge through technological developments (innovations) but might instead be focus on defending their position by improving their existing technologies. In the long term, this will be an unsustainable competitive strategy if competitors also catch up with their core competencies (Morandi Stagni et al. 2021).

Geoeconomic fragmentation threatens to become yet another drag on Finland's productivity growth. Over the past decades, Finland has greatly benefited from globalisation and EU integration. As a small open economy, Finland has more to lose than larger countries from geoeconomic fragmentation, which may lead to a shift towards more regional forms of multilateralism and a slowdown in international trade based on multilateral rules.

Investment subsidies related to industrial policy and increased research funding can, of course, have beneficial effects on productivity growth. However, the problem with the resurgence of industrial policy stems from its frequent focus to steer technological development, direct investment in certain technologies, and to increase investments in some areas at the expense of others.

This is partly justified. Addressing geostrategic challenges, such as those posed by climate change, also requires solutions that may not be economically optimal. For example, geo-strategic challenges should be addressed as a united Western front rather than weakening internal competition, and instead focusing on genuinely strategic sectors. In addition, the objectives of industrial policy can often be achieved through other instruments than subsidies or restrictions on competition, such as education, research, infrastructure investments, and the development of the public sector (Juhász, Lane, and Rodrik 2024). These measures are often more effective and less detrimental to the economy.

5 Conclusions

The slowdown in productivity growth has been one of Finland's most significant economic challenges since the financial crisis. While labour productivity growth has generally slowed across Western countries, Finland has fallen behind even this decelerated pace since 2007. In recent years, the gap between Finland and the global productivity frontier has widened.

In addition to lagging productivity, wage growth in Finland has also been slower than in the reference countries over the past decade. This slower wage growth has prevented productivity growth problems from evolving into cost-competitiveness problems. Finland's labour market appears to have adapted to slow productivity growth.

However, the current slow pace of productivity growth implies sluggish real wage growth in the coming years as well. The large public-sector deficit is also rooted in weak productivity development, which complicates the financing of welfare services for the ageing population.

The slowdown in productivity growth is the result of several factors related to changes in the global operating environment and domestic structural issues. For example, Goldin et al. (2024) and the Finnish Productivity Board (2023) discuss the causes of the slowdown in productivity growth that has affected Western countries. Key reasons include the slowdown in total factor productivity growth, a reduced impact of capital deepening, a decline in capital per worker, smaller contributions from intangible capital growth, the slowdown in global trade, and diminished efficiency in resource allocation. Additionally, the observed slowdown in productivity growth is partly thought to stem from measurement errors.

In Finland, the financial and euro crises, coupled with the collapse of Nokia, delivered a severe blow to the economy, resulting in the loss of some of its most productive sectors. Beyond the immediate impacts, these events have had long-lasting effects, leading to a slow recovery. In addition, the 2020s have brought about new economic crises, with the direct and indirect impacts of Russia's war of aggression having a more pronounced effect on Finland's economy compared to many reference countries.

As a result of these crises, Finland lost large and significant companies in rapidly growing technology sectors, and no comparable new players have emerged since. This has been reflected in both tangible and intangible investments. The void has been partially filled by small and medium-sized enterprises, which have increased their R&D activities. However, it takes time for these companies to translate R&D efforts into higher productivity, and they need to grow significantly larger to have a meaningful impact on productivity at the economy-wide level. This can easily take several decades.

Finland has also not seen the emergence of new high-productivity companies in the service sector that are significant at the economy-wide level. As the economy becomes increasingly services-oriented, the relatively low productivity of Finland's service sector compared to reference countries hinders overall productivity growth. In countries at the productivity frontier, new technology-driven service companies have played a significant role in in driving productivity growth in recent years.

Investments in tangible, intangible and human capital

Improving labour productivity requires investments in tangible capital, enabling employees to utilise more or better equipment. Additionally, investing in research and product development (R&D) provides employees with access to better technology. In Finland, investments in machinery and equipment have long been at a lower level than those in reference countries, according to national accounts. Meanwhile, investments in intangible capital, as a share of GDP, have declined from world-leading levels to the euro area average.

However, tangible investments might be underestimated according to national accounts. When examined through structural business statistics, companies' investment rates in tangible capital in Finland are not significantly different from those of reference countries (Huovari & Maliranta 2024). Nevertheless, making reliable comparisons of investments between countries is quite challenging. Statistical sources, however, agree that productive investments in Finland have been growing more rapidly in recent years compared to the average in reference countries. It is also important to note that, based on theory and empirical research, tangible investments are not a source of long-term productivity growth but rather the consequence of technological development.

The decline in R&D investments as a share of GDP is largely related to the electronics industry crisis in the early 2010s and the lack of large, high-productivity companies in Finland's economy. Current R&D investments by large companies are low by international standards, and reductions to R&D subsidies have further

diminished R&D activities (Pohjola 2020). Nevertheless, R&D investments relative to GDP in Finland remain at a reasonable level internationally (Kangaspunta 2024b). However, this figure masks the fact that absolute R&D investments have not increased significantly, as GDP growth has been weak over the same period (Kangaspunta 2024b; Huovari & Maliranta 2023).

Signs of improvement in R&D investments are emerging. Small and medium-sized enterprises are investing in R&D at high levels compared to key competitors, and business R&D activities is undergoing renewal. The focus of the Finnish economy has increasingly shifted to services, with the share of private services in production growing while industry's share has decreased (Huuskonen & Maliranta 2024). The public sector is also increasing R&D investments.

The future growth of R&D activities, however, is challenged by the availability of educated labour. A critical issue for future economic growth is the shortage of highly educated workers. While the size of the working-age population has declined, the rise in educational attainment among young people has stagnated and lags significantly behind that of reference countries (Kangaspunta 2024a). Without an increase in education, particularly among young age groups, and the immigration of highly education individuals, Finland's human capital is set to decline (Finnish Productivity Board 2023). The shortage of highly educated labour is already evident in both surveys and wages.

To foster new innovations, a workforce capable of R&D activities is essential. If the supply of skilled labour is inelastic, increased public R&D spending might initially weaken productivity growth by crowding out other production and driving up wages for R&D professionals. Raising the share of a highly skilled workforce to levels in leading countries could quickly enhance labour productivity (Palmén 2024). Proposed solutions include raising the number of starting places in education and aligning education with fields that support R&D activities. However, due to the time required for education, this approach does not address the immediate labour shortage. A faster solution to ensuring the availability of skilled labour would be to attract specialists from abroad.

To promote productivity growth effectively, R&D subsidies must be carefully targeted. Basic research should be maintained at an adequate level, best supported through core funding. Targeting R&D subsidies is challenging: broad-based aid can be inefficient, while identifying the optimal targets for subsidies is difficult. In general, targeted aid should focus on projects that widely disseminate information and expertise, such as applied research through joint industry-university projects.

Market dynamics and labour mobility

The quantity of production inputs is not the only factor affecting productivity growth. Inefficient resource allocation along with resulting imbalances and distortions can significantly reduce productivity. Evidence from Finland suggests that the allocation of resources, such as labour and capital, is not optimal, weakening the efficiency of the economy (Profitability Board 2021, Kuosmanen 2022, Dai et al. 2023). This misallocation leads to excessive resources being directed to low-productivity companies, while high-productivity companies face resource shortages, thereby slowing down total factor productivity growth in the economy (Kuosmanen 2022, Dai et al. 2023).

Although market dynamics have been declining, Finland's relative position has improved (Biondi et al. 2023). Labour mobility functions reasonably well, and the wage flexibility, both at micro-level (high wage dispersion in Finland) and macro-level, appears to operate as expected. In recent years, wage-setting has also aligned closely with productivity growth.

Combating climate change and productivity

Finland's economy also faces emerging global challenges related to climate change and its mitigation, as well as a shifting geopolitical environment. Addressing these challenges could weaken productivity growth in the coming years if they are not addressed appropriately and efficiently.

Efforts to combat climate change and biodiversity loss may have short-term negative impacts on productivity growth. However, in the long term, these effects could be minor or even beneficial. The potential economic consequences of unmitigated climate change and biodiversity loss could be unpredictably severe.

The green transition also holds potential to enhance labour productivity. Empirical evidence suggests that improving carbon productivity (see section 4.1) is positively correlated with labour productivity. For example, more efficient energy solutions and innovations in green technologies can improve energy efficiency and reduce operational costs, thereby enhancing competitiveness and productivity. In addition, the recent fall in renewable energy prices has made the green energy transition more economically advantageous.

Geopolitical challenges

The fragmentation of the global economy and rising barriers to international trade may present significant threats to productivity growth. As a small open economy, Finland is particularly dependent on international trade. If the global economy is divided into different economic blocs, Finland could face challenges in its export markets and supply chains, leading to challenges that may undermine productivity growth and economic development.

In the field of green technologies, in particular, limits to global cooperation and trade can amplify these challenges. The development and deployment of green technologies require international cooperation and technology exchange. Trade barriers could slow progress and limit the spread of innovations, affecting Finland's ability to achieve the Sustainable Development Goals and enhance economic growth.

Industrial policy response and problems

The fight against climate change and geopolitical challenges has driven a global increase in industrial policy measures. Industrial policy will likely play an important role in addressing issues related to the green transition and geopolitical concerns. When implemented effectively, industrial policy can support environmental objectives, help resolve geopolitical challenges and foster productivity growth.

However, poorly designed industrial policies can slow down productivity growth. As trade barriers rise, business subsidies increase and the global economy becomes more fragmented, global resources may be allocated less efficiently. Reduced competition can impair selection, allowing operating conditions of low-productivity companies improve while restricting the growth potential of high-productivity companies. A decline in international competition reduces the incentives for businesses to improve efficiency and innovate, and limits the diffusion of technology.

To mitigate these risks, well-functioning markets and leveraging market-based solutions should be a priority. Healthy competition and effective incentives can accelerate the transition to a sustainable economy (Kuosmanen et al. 2023). Industrial policy should be purpose-driven and targeted at problems that markets cannot solve effectively. While targeted industrial policies can generate more investments and production in specific areas, they also reallocate resources, potentially undermining the efficient functioning of the economy as a whole. Moreover, industrial policy does not need to rely solely on subsidies. Instead, other instruments, which may be more efficient, cost-effective, and less problematic, could be also be employed. (Juhász et al. 2024).

Background Reports for the 2024 Annual Report of the Finnish Productivity Board

Productivity and cost competitiveness development in Finland. Huovari, Janne & Kiema, Ilkka. The annex is saved as its own file at https://urn.fi/URN:ISBN:978-952-367-836-1. (In Finnish)

Labor Productivity, Investments, and the Measurement of Investments from Data. Huovari, Janne & Maliranta, Mika. The annex is saved as its own file at https://urn.fi/URN:ISBN:978-952-367-836-1. (In Finnish)

R&D Activity in Finnish Companies in Comparison: Finland Analysis of the OECD Project. Huuskonen, Jussi & Maliranta, Mika. The annex is saved as its own file at https://urn.fi/URN:ISBN:978-952-367-275-8. (In Finnish)

On Education, Skills, and the Availability of Skilled Labor. Kangaspunta, Seppo. The annex is saved as its own file at https://urn.fi/URN:ISBN:978-952-367-836-1. (In Finnish)

Research and Development Activity, Its Funding, and Employees. Kangaspunta, Seppo. The annex is saved as its own file at https://urn.fi/URN:ISBN:978-952-367-836-1. (In Finnish)

Productivity and Green Transition in Finland. Kuosmanen, Natalia, Kiema, Ilkka & Maczulskij, Terhi. The annex is saved as its own file at https://www.etla.fi/en/publications/productivity-and-green-transition-in-finland/. (In Finnish)

Public R&D Expenditures and the Availability of Skilled Labor. Palmén, Olli. The annex is saved as its own file at https://urn.fi/URN:ISBN:978-952-367-836-1. (In Finnish)

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