FORECAST

Finnish economy's long-term growth outlook squeezed by a shrinking working-age population and weak productivity

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AUTHORS

Meri Obstbaum
Adviser to the Board

Pirkka Jalasjoki
Economist

Arto Kokkinen

Population ageing and dwindling growth in labour productivity are straining the long-term growth outlook for Finland's economy. This article presents the Bank of Finland's scenarios for the growth outlook. Without additional investment in education, in attracting foreign talent and in fixed capital involving new technologies, the growth outlook for Finland's economy will be weak. The long-term forecasting scenarios for economic growth combine the projections for human capital and fixed capital. In the baseline scenario, the growth outlook turns out to be similar to that of the Bank of Finland's previous such scenario published in 2023. In the current baseline scenario, the highest growth rate for Finland's gross domestic product (GDP) will be in the 2030s, averaging 1.8% annually. To strengthen the factors driving economic growth, it will be necessary to have well-focused policy measures that extend over parliamentary terms.

Arto Kokkinen worked in the Bank of Finland's Forecasting Division in 2019–2020. His collaboration in the development of long-term forecasting methods is continuing in 2024–2025 on the basis of a part-time secondment.

This article presents the Bank of Finland's scenarios for the growth outlook concerning the Finnish economy and examines the role of human capital and fixed capital in economic growth.[1] Finland's GDP growth has been subdued in the years since the global financial crisis, and, according to the scenarios presented here, the long-term growth outlook for the economy will be weak without additional investment in education, in attracting foreign talent and in fixed capital involving new technologies.

Finland is one of the very few countries which in the twentieth century managed to close its standard of living gap with the leading Western countries, measured by GDP per capita. As the twenty-first century approached, Finland had become an industrialised and services-oriented economy, and the average income of its population was among the top 15 to 25 countries in the world. The strong growth figures in the 1990s were due particularly to the global success of Nokia mobile phones alongside the traditional wood and paper industry and mechanical engineering.

In the period since the global financial crisis, Finland's GDP per capita has not grown. This is also starting to show in international comparisons: a comparison by the World Bank shows that in 2023, Finland's ranking in GDP per capita fell to twenty-eighth, and according to the US Central Intelligence Agency, Finland ranked thirty-first.

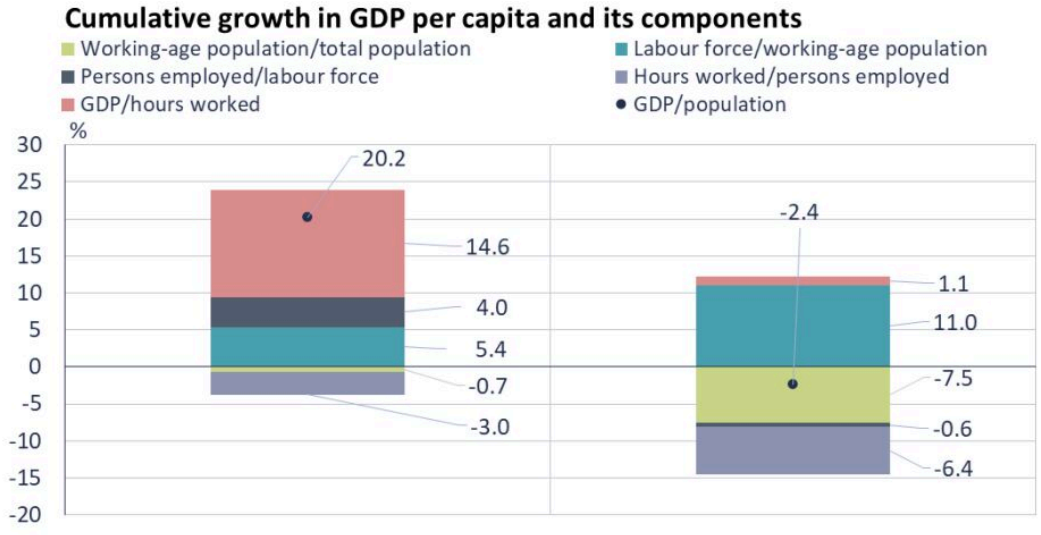
The weak GDP growth reflects the end of the Nokia mobile phone industry and its platform economy as well as the decline in the forest industry, and also the effects of population

ageing.[2] Finland's working-age population contracted in the 2010s. In the period between 2008 and 2023, the share of the working-age population in the total population shrank by 7.5% (Chart 1).[3] In 2023 and 2024, the share of the working-age population remained unchanged but the number of working-age people increased, due to the strong rise in net immigration.

It is uncertain whether this growth is permanent or temporary, however. This question will be discussed later in the article in connection with the forecast scenarios. The trend in population ageing, together with the diminishing size of new cohorts, is in any case creating immediate pressure on the sustainability of public finances, and is also adversely affecting the long-term growth outlook for the Finnish economy.

The largest contribution to the slowing of Finland's per capita GDP growth since the global financial crisis has come from the halt in labour productivity growth. In the period between 2000 and 2008, the golden era of Nokia, labour productivity grew by a total of 14.6%, but since the global financial crisis, labour productivity has grown by a total of only 1.1% (2009–2023).

Chart 1.



Based on a decomposition developed by Emeritus Professor Sakari Heikkinen: GDP per capita = (working-age population/total population) x (labour force/working-age population) x (persons employed/labour force) x (hours worked/persons employed) x (GDP/hours worked).
Sources: Statistics Finland, Sakari Heikkinen and calculations by Arto Kokkinen (National Audit Office of Finland) and Pirkka Jalasjoki (Bank of Finland).

On the upside, the labour force participation rate (labour force/working-age population) has risen significantly since 2008. At the same time, however, hours worked per person employed has decreased, in addition to the decline in the share of the working-age population. These offset the

positive contribution to GDP growth of the slight increase in labour force participation and labour productivity, with the result that GDP per capita declined by -2.4% between 2008 and 2023 (in Chart 1: the sum of components).

Countless studies show the importance of labour productivity for economic growth. The decline in the working-age population has a negative impact on GDP growth: it decreases the amount of knowledge and skills available for generating GDP, as knowledge and skills are acquired by people.

For a long time, the educational attainment of the young cohorts was higher than that of the retiring cohorts, and this compensated for the impact of the diminishing cohort sizes. However, the situation has changed, because in addition to the diminishing cohort sizes, the previously rising level of educational attainment of young people has stagnated in the period since the global financial crisis.

Long-term GDP growth is based on human capital and on fixed capital that involves new technologies

Human capital accumulated via investments in education plays an important role in the Bank of Finland's long-term forecasting framework. In the growth forecast, growth in labour productivity (GDP/L) depends on the development of the ratio of fixed capital and labour input (K/L) and the ratio of human capital and labour input (H/L) (Chart 2). Long-term GDP is calculated by multiplying labour productivity by labour input.[4]

Chart 2.

Labour productivity in Finland has developed in line with the ratios of fixed and human capital to labour input

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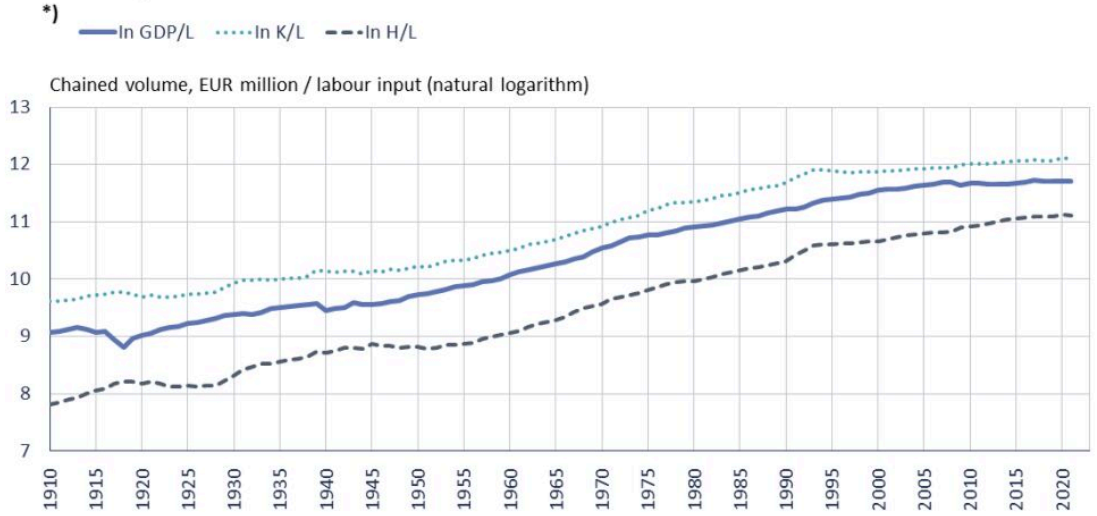


Sources: Statistics Finland; Kokkinen, A. (2012): On Finland's Economic Growth and Convergence with Sweden and the EU15 in the 20th Century, Research Reports 258, Statistics Finland; and calculations by Arto Kokkinen (National Audit Office of Finland) and Pirkka Jalasjoki (Bank of Finland).
*) ln is the abbreviation for 'natural logarithm'.

In the production of GDP, human capital includes a measure of labour input quality in terms of the average education level (H/L) and a measure of labour input quantity (L). In the Bank of Finland's long-term forecasting framework, human capital is measured in the same National Accounts framework as GDP, fixed capital and labour input. The stock of human capital is accumulated via investments in education, as is the case with the stock of fixed capital. Investment is in the form of the degree and other qualifications gained by the working-age population.[5]

When the education and training received earlier become outdated, their capacity to generate an income decreases. This is taken into account in the forecast for human capital by estimating a rate of depreciation for each level of education. In this respect too, the approach is similar to that for fixed capital. Calibration of the rates of depreciation takes into account the duration of the labour market participation of those who gained the qualifications, up to the time they retire.

Let us take as an example an 18-year-old who completed a secondary-level vocational qualification in 2000. Without work experience or further education and training, it would be very difficult for him or her to find a job in 2020. This is because, whether in working life or education, other people will adapt constantly to new technologies, such as new computer software.

Human capital forecast by level of education and age group

The forecast of human capital requires projections of demographic change, student numbers, degree and other qualifications among people of working age and the funding available for education services.

The number of students in each of the different levels of education over the years 2024–2075 is forecast for every age cohort among 16–74-year-olds using an assumption of one-year age groups adapted from Statistics Finland's population projection. For each cohort, the enrolment rate and the degree pass rate are assumed to remain unchanged from recent years.

At every level of education, the forecasts for the qualifications obtained by each cohort among the 16–74-year-olds are derived from the numbers of students. The qualification forecasts take into account the extension of compulsory education to the age of 18, the additional funding in 2024–2027 aimed at gaining a thousand new doctoral graduates, and the extra starting places created in higher education from 2021 onwards. The last of these will be visible via growth in student numbers in the most recent years for which statistics are available.

The investment in human capital is estimated by giving a value to the qualifications that corresponds to the amount of education services consumed per student. Growth in education services is depicted in the National Accounts as the volume of final consumption expenditure on education.

Trajectory of human capital assessed on basis of demographic change and investments in education

To take into account uncertainty over the future, the Bank of Finland's long-term forecast for 2024–2075 has three different scenarios for the paths taken by Finland's human capital, fixed capital and GDP.

The first, which is the no-policy-change scenario, envisages a situation where growth in human and fixed capital is not being supported through new economic policy measures. The scenario assumes that net immigration over the long term amounts to 18,000 people annually. This is a significantly smaller figure than in Statistics Finland's latest population projection, which shows net immigration in the coming decades remaining at the high levels of the past few years.[6]

The no-policy-change scenario considers that the recent immigration growth has been attributable to temporary factors, and that net immigration will return to the average of the last 15 years for which statistics are available, 2009–2023 (excl. the temporary protection for

Ukrainians). The level of education and employment rate for immigrants are assumed to be the same as for existing residents.

The working-age population will already start to shrink again in the 2030s, and there will be no upswing in educational attainment among young cohorts. Instead, the ratio of degrees and other qualifications per student and per inhabitant will develop at the same pace as in recent years. In this scenario, the stock of human capital will still be increasing in the 2030s but will start to decline as the 2050s are reached.

Assuming constant spending per student, the funding need of education services is decreasing due to the declining size of the age cohorts. However, the decline in student numbers does not mean that the cost of organising education is falling at the same pace. The shrinking size of the cohorts enables additional increases in per-student education spending without increasing overall costs.

In all three scenarios the volume of final consumption expenditure on education per student is assumed to rise towards the end of the forecast period to the level seen in the late 1980s and early 1990s. Due to the low birth rate, the size of the young cohorts will decrease to such an extent that the volume of final consumption expenditure on education overall will decline in the long term.

The no-policy-change scenario demonstrates that, with the changes currently under way in demographics and education, the growth in human capital within Finland's economy will come to a halt in the 2040s and contract after that. Since the erosion of human capital can scarcely be prevented by raising the birth rate, a considerable amount of investment will be needed to strengthen education, increase education-based immigration, attract more foreign talent, and raise the labour force participation rate and the employment rate.

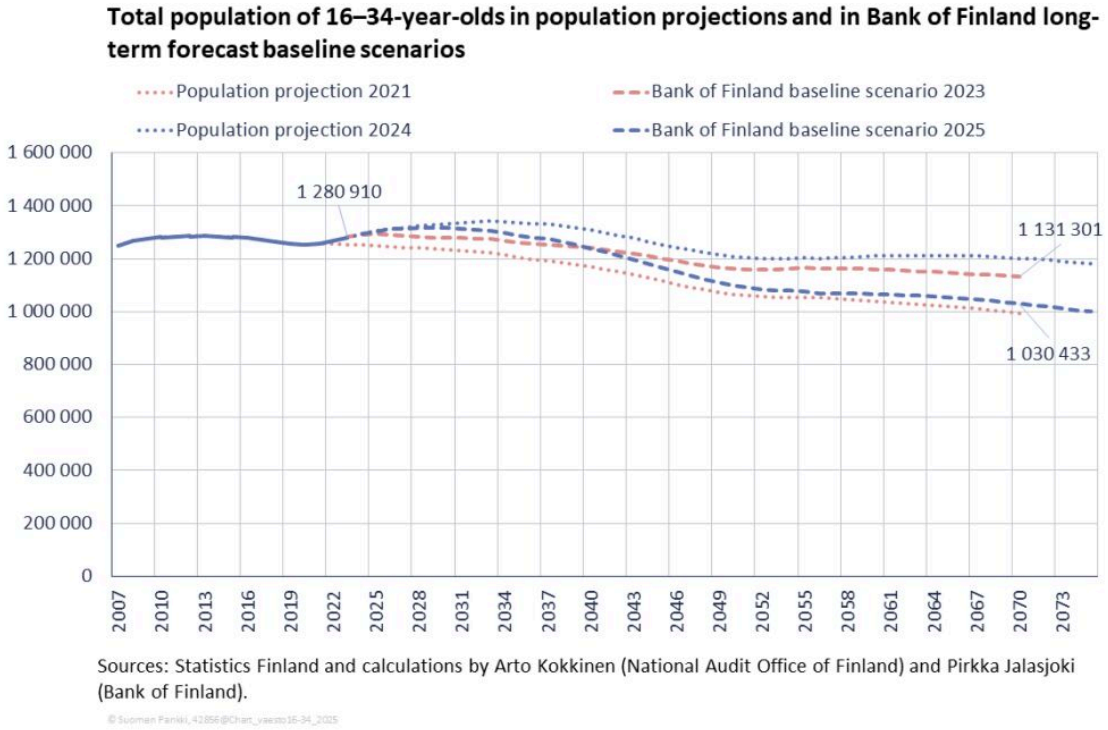
In the second scenario, which is the baseline scenario, the level of net immigration in the long term is assumed to be 27,000 people annually. This is based on the observed average for 2020–2023, excluding Ukrainians applying for temporary protection. This too is a lower assumption than in Statistics Finland's population projection but is similar to the assumption in the baseline scenario of the Bank of Finland's previous updated forecast in 2023,[7] in which annual net immigration was assumed to be 23,000 people.

In the new population projection, however, the total fertility rate has fallen to as low as 1.26 from its earlier level of 1.45 in the previous projection. This reduces the foreseeable size of the young cohorts educated in all three scenarios. The collapse of the total fertility rate will bring challenges for the Finnish economy in the latter part of the forecast period, despite even optimistic assumptions about net immigration.

Even high net immigration cannot fully compensate for the adverse demographic effects of a low

birth rate. This can be seen in the updated baseline scenario as a fall in the assumed number of 16–34-year-olds to a point close to that given in the 2021 population projection (Chart 3).

Chart 3.



Sources: Statistics Finland and calculations by Arto Kokkinen (National Audit Office of Finland) and Pirkka Jalasjoki (Bank of Finland).

The baseline scenario nevertheless assumes that the decrease in the working-age population and the weakening of educational attainment among the young cohorts can be successfully curbed to some extent through economic policy measures. Raising the proportion of 25–34-year-olds with a higher education degree to 50% by 2035 will slow the erosion of human capital.

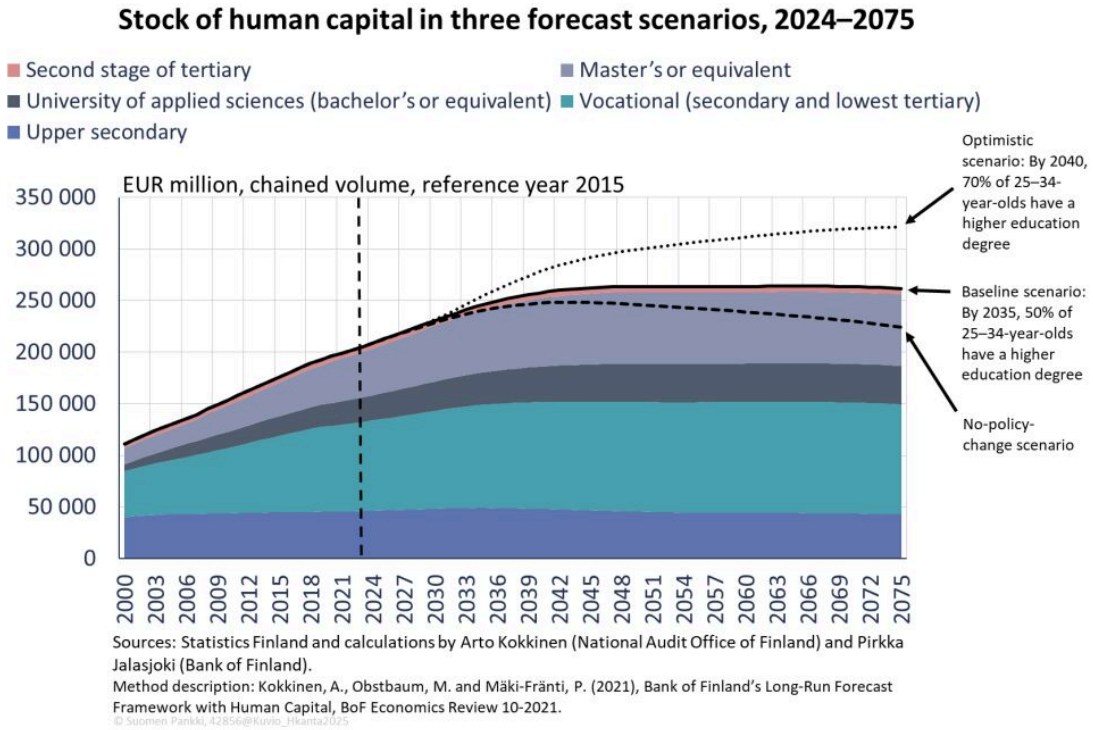
In the baseline scenario, human capital will continue to grow in the 2020s and 2030s, even at a slighter faster pace than previously under the 2023 baseline scenario, because the assumption for net immigration is marginally higher. The birth rate assumption, which is lower than in the 2023 projection, will nevertheless gradually reduce the size of the young cohorts to be educated. This will weaken the growth in human capital from the late 2040s onwards. In the new baseline scenario, there will be no growth in human capital at all from the 2050s onwards.

In the third scenario – the optimistic scenario – net immigration is assumed to follow the trajectory set out in Statistics Finland's population projection (40,000 people annually from 2026 onwards). This scenario also sees growth in the proportion of 25–34-year-olds with a higher education degree to 70% by 2040; this share accords with the target of the Finnish Parliament's

Education and Culture Committee and the example set by leading OECD countries. However, even under these more optimistic assumptions, the growth in human capital will, from the 2040s, show a significant slowdown from the preceding decade, due to the low birth rate. In this scenario too, the growth in human capital will diminish further in the subsequent decades of the forecast period.

The projections for human capital under the different scenarios are presented in Chart 4.

Chart 4.



Fixed capital now also includes research and development activities

The long-term economic growth forecasts are formulated using projections for human capital and estimates of the stock of fixed capital in the decades ahead. In the National Accounts, fixed capital roughly corresponds to fixed assets in the accounts of companies and includes the production equipment used for generating GDP. Besides traditional machinery and equipment and traditional transport equipment, fixed capital now also includes computer hardware and software and information and communication technology (ICT) equipment.

As a result of changes introduced in 2014, research and development (R&D) activity in Finland

(and other countries) is treated in the fixed capital data as capital formation. This applies to data for 1975 onwards. R&D and its outcomes are included in 'intellectual property products'. As the term suggests, intellectual property products are fixed capital goods that are produced using human capital.

The results of R&D and innovation can also be evident in other capital goods, such as machinery and equipment or transport and communication equipment, as all fixed capital goods and the technology contained in them are created by people.

Another key observation is that the fixed capital stock of the macro economy includes not only the results of domestic R&D but also new products developed abroad and imported into Finland, and new variants of old products containing new features.

The incorporation of R&D projects into fixed capital investment highlights a connection between human and fixed capital that is significant in terms of economic growth.

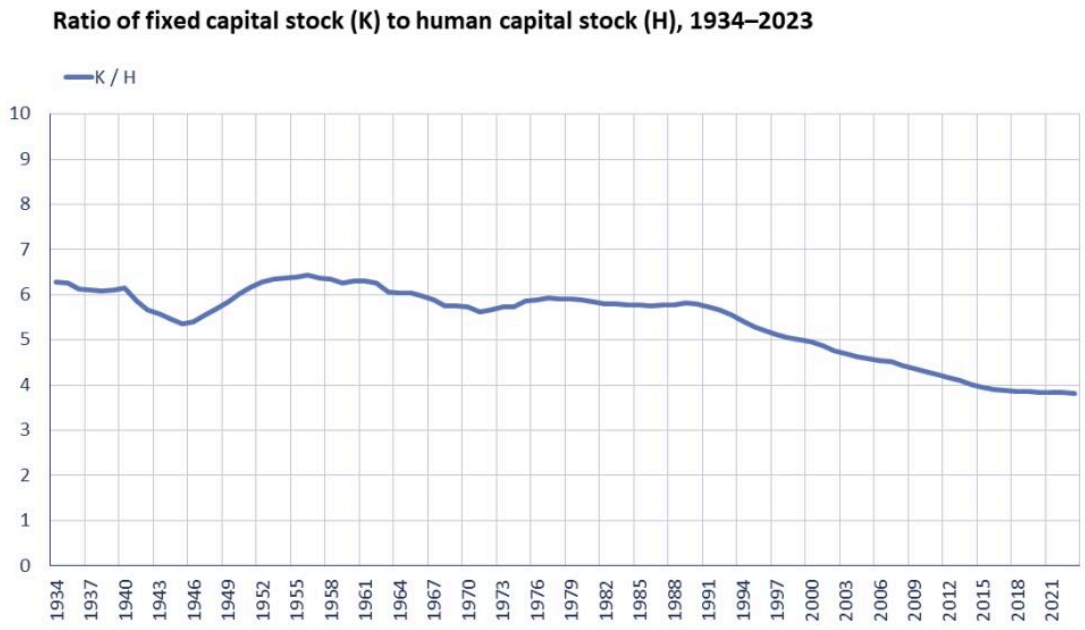
Increasing investment in fixed capital requires long-term incentives

According to theoretical models, the growth rates of fixed capital (K) and human capital (H) cannot diverge in the long term. An earlier study (Kokkinen, 2012)[8] showed that K and H have indeed increased roughly at the same pace since 1910. An examination of the ratio of fixed capital to human capital (K/H), as indicated in Chart 5, shows that it remained fairly stable in Finland until the end of the 1980s. Since the beginning of the 1990s, however, the growth rates of K and H have diverged. Human capital appears to have increased faster than fixed capital, and the K/H ratio has declined as a result. This suggests that a change occurred in the goods produced in the economy in the early 1990s.

This view is supported by data on the stock of fixed capital reported by Statistics Finland. The proportion of intellectual property products among the fixed capital investments of non-financial corporations increased from 11% in 1990 to 33% in 2010. Over the same period, the mobile phone industry and its platform economy were booming, and this significantly boosted investment in R&D in Finland as a whole.

The higher share of R&D investment in the corporate sector's overall investment appears to have increased the demand for human capital per unit of fixed capital produced. The proportion of intellectual property products in the corporate sector's fixed capital investment has since decreased by several percentage points, to 26% in 2023.

Chart 5.



Sources: Jalava and Pohjola (2007), Kokkinen (2012), Statistics Finland's National Accounts and calculations by Arto Kokkinen (National Audit Office of Finland) and Pirkka Jalasjoki (Bank of Finland).

This declining trend was reinforced by a shift in the educational structure of Finland's working-age population at the end of the 1980s. In contrast to the situation prevailing before that, the majority of the working-age population now held a vocational qualification or a university degree. The majority of the working-age population had previously entered the labour market with, at most, upper secondary qualifications (Kokkinen 2012, pp. 123–124).

The forecasts of fixed capital make use of the above-mentioned observed relationship between fixed and human capital. The stock of fixed capital goods excluding R&D is forecast separately from the stock of R&D. The no-policy-change scenario assumes that the ratio of fixed capital (excl. R&D) to human capital will remain at the level of 2023, the latest year for which data are available. Thus, in the no-policy-change scenario, fixed capital (excl. R&D) will grow at the same pace as human capital.

The baseline scenario assumes that by 2075 the ratio of fixed capital (excl. R&D) to human capital will return to the level seen in the late 1980s and early 1990s. This means that the annual growth rate of fixed capital (excl. R&D) will pick up to over 2% in the 2030s. In the subsequent decades – from the 2040s to the 2070s – it will return to around 1%. Moreover, in addition to government support for R&D investment, it is assumed that long-term incentives will also be developed for speeding up investment in imported fixed capital goods involving new technology.

The optimistic scenario assumes that the annual growth rate of fixed capital (excl. R&D) will pick up to 2%. This corresponds to the observed average annual growth of fixed capital over the period 1976–2019. The assumption that this growth will pick up is based on the empirical observation (referred to above) that K and H have historically grown at the same pace.

The trajectory of the R&D stock of fixed capital has been forecast in the different scenarios on the basis of the growth rate for the most recent year for which data is available and based on the objectives of the Act on Research and Development Funding in 2024–2030 (1092/2022). In the no-policy-change scenario, R&D investment as a share of GDP is assumed to remain in the forecast period at the 2023 level, around 3%. In the baseline scenario, the GDP share of R&D investment will increase linearly from 3% to 3.5% from 2035 onwards. In the optimistic scenario, R&D investment will grow linearly to 4% starting from 2040. It is assumed that the strengthening of human capital will allow faster growth in R&D investment.

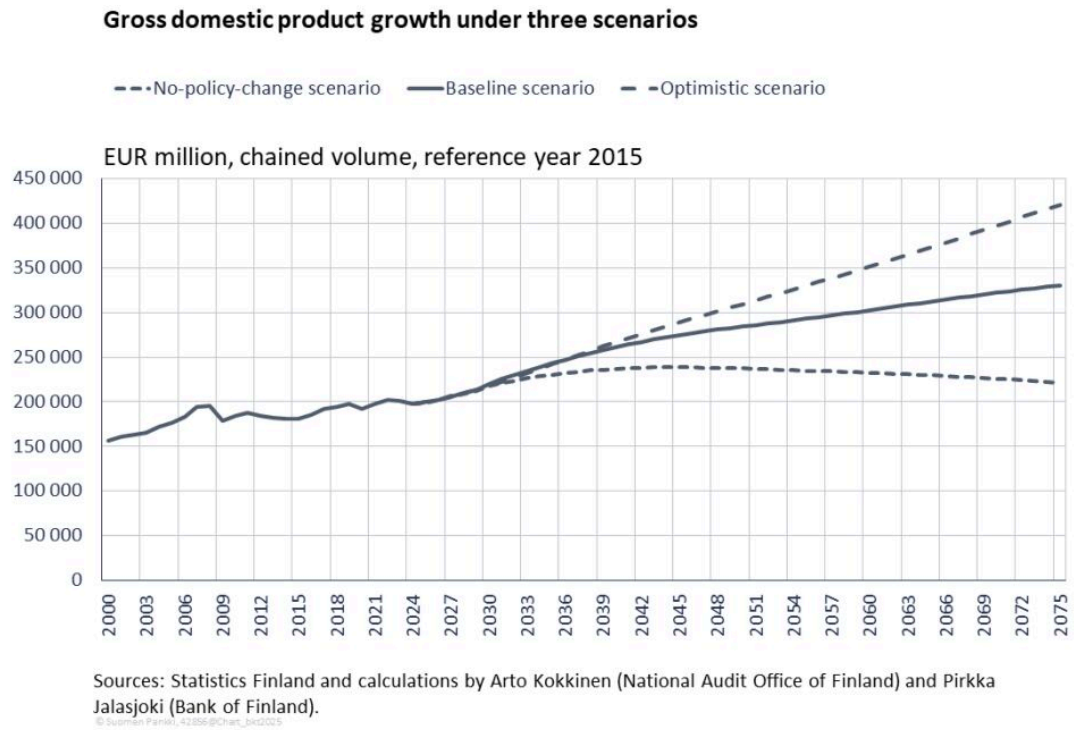
Three scenarios for Finland's long-term economic growth

The forecast scenarios for long-term growth combine the human capital and fixed capital projections described above. In the no-policy-change scenario, GDP will grow in the 2030s at an average annual rate of 1% (Chart 6 and Table 1). GDP growth will then come to a halt in the 2040s, as both human capital and fixed capital growth shrivel. From the 2050s onwards, GDP will start to decline in line with the trajectory of both types of capital.

In the baseline scenario, the growth outlook for the economy follows a similar path to the Bank of Finland's previous long-term baseline scenario from 2023. The highest GDP growth rate is in the 2030s, averaging 1.8% annually. This is due to growth in fixed capital, in particular. It is assumed that an increase in the proportion of 25–34-year-olds with a higher education degree will support innovation in new fixed capital goods in Finland as well as the demand for imports of such goods, although the theoretical model does not directly include such an interaction. The basis for the assumption is that a larger amount of human capital would most likely, in practice, facilitate an increase in fixed capital investments that involve new technologies.

In the baseline scenario, the growth in both human and fixed capital will slow down from the 2040s onwards, and from the 2050s GDP growth will mainly be driven by fixed capital growth. GDP growth will average just below 1% in the 2040s, slowing to a little over half a per cent in the following two decades. The slower growth is mainly due to dwindling growth in human capital, which may also limit fixed capital growth.

Chart 6.



Sources: Statistics Finland and calculations by Arto Kokkinen (National Audit Office of Finland) and Pirkka Jalasjoki (Bank of Finland).

In the optimistic scenario, GDP growth is stronger than in the baseline scenario throughout the forecast period. In this scenario, the average annual growth in the Finnish economy will remain just above 1% after the 2040s. The higher growth in the 2050s and 2060s compared to the baseline scenario is mainly due to stronger fixed capital growth.

From the perspective of growth in living standards, the main focus is often on labour productivity, i.e. GDP growth per labour input or per employee (GDP/L, Table 2). GDP per labour input increases even in the last decades of the no-policy-change scenario, although GDP growth turns negative. In both the baseline scenario and the optimistic scenario, labour productivity increases somewhat faster than GDP growth in the final decades.

The results show that in all three scenarios, the more significant driver of economic growth is clearly the growth in labour productivity and not the growth in labour input, i.e. growth in the number of hours worked. Labour input is already shrinking from the beginning of the 2040s in both the no-policy-change scenario and the baseline scenario. In the optimistic scenario, labour input starts to shrink from the 2060s onwards.

Economic wellbeing, as measured by GDP per capita, has historically increased roughly in line with labour productivity, but the two variables are again gradually diverging as the population

dependency ratio weakens. A similar divergence happened in 2008–2023.

Table 1. Long-term growth forecast in three scenarios

	GDP residual	H	K	GDP	GDP per capita	GDP at current prices
No-policy-change scenario						
2010-2019	-0.9%	2.5%	1.3%	1.0%	0.7%	2.7%
2020-2029	-0.4%	1.6%	0.7%	0.7%	0.4%	3.1%
2030-2039	0.0%	0.8%	1.1%	1.0%	1.1%	3.0%
2040-2049	0.0%	0.0%	0.1%	0.1%	0.2%	2.0%
2050-2059	0.0%	-0.3%	-0.2%	-0.2%	0.0%	1.8%
2060-2069	0.0%	-0.4%	-0.3%	-0.3%	-0.1%	1.7%
2070-2075	0.0%	-0.5%	-0.4%	-0.4%	-0.2%	1.6%
Baseline scenario						
2010-2019	-0.9%	2.5%	1.3%	1.0%	0.7%	2.7%
2020-2029	-0.3%	1.6%	0.7%	0.8%	0.4%	3.1%
2030-2039	0.0%	1.1%	2.4%	1.8%	1.7%	3.9%
2040-2049	0.0%	0.3%	1.4%	0.9%	0.9%	2.9%
2050-2059	0.0%	0.0%	1.1%	0.6%	0.6%	2.6%
2060-2069	0.0%	0.0%	1.2%	0.6%	0.6%	2.6%
2070-2075	0.0%	-0.1%	1.0%	0.5%	0.5%	2.5%
Optimistic scenario						
2010-2019	-0.9%	2.5%	1.3%	1.0%	0.7%	2.7%

Sources: Statistics Finland, calculations by Arto Kokkinen (National Audit Office of Finland) and Pirkka Jalasjoki (Bank of Finland).

	GDP residual	H	K	GDP	GDP per capita	GDP at current prices
2020-2029	-0.3%	1.7%	0.7%	0.8%	0.4%	3.1%
2030-2039	0.0%	1.8%	2.2%	2.0%	1.7%	4.0%
2040-2049	0.0%	0.9%	2.1%	1.5%	1.2%	3.5%
2050-2059	0.0%	0.4%	2.1%	1.3%	1.0%	3.3%
2060-2069	0.0%	0.3%	2.1%	1.2%	1.0%	3.2%
2070-2075	0.0%	0.1%	2.1%	1.2%	1.0%	3.1%

Sources: Statistics Finland, calculations by Arto Kokkinen (National Audit Office of Finland) and Pirkka Jalasjoki (Bank of Finland).

Table 2. Long-term growth forecast in three scenarios (continued from Table 1)

	GDP/L residual	K/L	L	H/L	GDP/L
No-policy-change scenario					
2010-2019	-0.9%	1.0%	0.3%	2.3%	0.7%
2020-2029	-0.4%	0.5%	0.2%	1.4%	0.6%
2030-2039	0.0%	1.0%	0.1%	0.7%	0.9%
2040-2049	0.0%	0.4%	-0.3%	0.3%	0.4%
2050-2059	0.0%	0.5%	-0.7%	0.4%	0.5%
2060-2069	0.0%	0.5%	-0.8%	0.4%	0.5%
2070-2075	0.0%	0.6%	-1.0%	0.5%	0.6%
Baseline scenario					
2010-2019	-0.9%	1.0%	0.3%	2.3%	0.7%
2020-2029	-0.3%	0.4%	0.3%	1.4%	0.5%

Sources: Statistics Finland, calculations by Arto Kokkinen (National Audit Office of Finland) and Pirkka Jalasjoki (Bank of Finland).

	GDP/L residual	K/L	L	H/L	GDP/L
2030-2039	0.0%	2.1%	0.3%	0.8%	1.5%
2040-2049	0.0%	1.5%	-0.1%	0.4%	1.0%
2050-2059	0.0%	1.5%	-0.4%	0.4%	1.0%
2060-2069	0.0%	1.6%	-0.5%	0.5%	1.1%
2070-2075	0.0%	1.7%	-0.6%	0.5%	1.2%
Optimistic scenario					
2010-2019	-0.9%	1.0%	0.3%	2.3%	0.7%
2020-2029	-0.3%	0.3%	0.4%	1.3%	0.4%
2030-2039	0.0%	1.5%	0.6%	1.2%	1.4%
2040-2049	0.0%	1.8%	0.3%	0.6%	1.3%
2050-2059	0.0%	2.1%	0.0%	0.4%	1.3%
2060-2069	0.0%	2.2%	-0.1%	0.4%	1.3%
2070-2075	0.0%	2.3%	-0.3%	0.4%	1.5%

Sources: Statistics Finland, calculations by Arto Kokkinen (National Audit Office of Finland) and Pirkka Jalasjoki (Bank of Finland).

Conclusions

The shrinking of the working-age population and the dwindling growth in the education level of young people are weighing on the long-term growth outlook. Raising the birth rate may prove difficult, but human capital growth can be strengthened by further investment in education and by increasing incentives for education, training and employment. Efforts should also be made to boost education-based and work-based immigration. The children of such migrants will, in future decades, also have an impact on the growth of human capital and the population dependency ratio.

R&D investments in fixed capital are supported through government R&D subsidies. Strengthening the long-term growth outlook and the public finances will also require additional incentives to invest in foreign fixed capital goods involving new technologies. Both the use of imported fixed capital goods involving new technologies and the promotion of innovation in such

technologies will require appropriately educated and trained employees in Finland.

Footnotes

1. The Bank of Finland's long-term forecasting framework is based on the doctoral thesis of Arto Kokkinen (2012), On Finland's Economic Growth and Convergence with Sweden and the EU15 in the 20th Century, Research Reports 258, Statistics Finland. ↑
2. The weakening of cost-competitiveness and losses in export market shares in the 2010s have also contributed to the negative impact. In addition, world trade has increased outside Europe and in services, i.e. in areas which are not Finland's key strengths. ↑
3. The chart is based on a decomposition developed by Emeritus Professor Sakari Heikkinen. Source: Sakari Heikkinen (2023), 'Is the national economy too small?' (in Finnish), blog post in Economics and History blog, University of Helsinki, 2 March 2023. ↑
4. The forecast method is described in the following publications: Kokkinen, A., Obstbaum, M., and Mäki-Fränti, P. (2021), 'Bank of Finland's Long-Run Forecast Framework with Human Capital', BoF Economics Review, 10-2021; Mäki-Fränti, P., Kokkinen, A. and Obstbaum, M. (2021), 'Finland's new long-term forecast suggests GDP growth will be more subdued' Bank of Finland Bulletin, 2 February 2022. ↑
5. Human capital has often been measured in terms of years of schooling or the average enrolment rate. In extensive international panel studies, it has not been possible to demonstrate using these factors an unequivocal statistical link between economic growth and educational attainment. ↑
6. Statistics Finland's population projections: https://stat.fi/en/statistics/vaenn. ↑
7. Mäki-Fränti, P., Kokkinen, A., Obstbaum, M. and Jalasjoki, P. (2023), 'Finland's economic growth threatens to dwindle without investment in human and fixed capital: The Bank of Finland's long-term forecast' (in Finnish), Kansantaloudellinen aikakauskirja/The Finnish Economic Journal 3/2023. Only in Finnish. ↑
8. Kokkinen, A. (2012), On Finland's Economic Growth and Convergence with Sweden and the EU15 in the 20th Century, Research Reports 258, Statistics Finland. ↑

Key words

education, Finnish economy, fixed capital, human capital, long-term projection