MINISTRY OF FINANCE
FINLAND

Productivity board

Productivity and competitiveness in Finland

Which factors affect competitiveness?
Why do we need it?

Board

Publications of the Ministry of Finance – 2021:20

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Markku Stenborg, Janne Huovari, Ilkka Kiema, Mika Maliranta

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Abstract

The report sets out a wide-ranging examination of the factors affecting Finland's competitiveness and productivity. When debating the competitiveness of the economy, or of businesses generally or in a particular sector, it is important to be aware of what we actually mean by competitiveness. Above all, we need to distinguish between short-term and long-term competitiveness. In the short term, the variables are prices and costs, and so the focus is on cost-competitiveness. In the long term, other variables can also come into play, including various structural aspects of the economy. The decisive factor in long-term competitiveness is labour productivity. Structural competitiveness is primarily about the ability of the economy to raise productivity. Short-term cost competitiveness is all about bringing costs into line with the long-term potential. This means looking at whether the labor costs are in the right proportion to labour productivity.

Competitiveness will affect the export performance, in particular. In the short term, i.e., in a few years, it is cost-competitiveness that will affect exports. Structural competitiveness will help boost the productivity of businesses and their ability to export successfully.

In Finland, productivity grew very rapidly during the period between the early 1990s recession and the 2008 financial crisis, but in the years following the crisis it declined more than in peer countries. In 2015–2019, productivity growth in Finland was higher than in the other 'old' euro-area countries. A similar trend was evident in Finland's export success, too. Besides the trend in competitiveness, there is another notable factor that has affected Finland's export success and productivity: the fortunes of the electronics industry. First, the industry saw rapid productivity growth, but this was later followed by a powerful negative shock.

Keywords	productivity board, economic policy, board, productivity, economic growth, competitive strength		
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Kuvailulehti

3.5.2021

Tuottavuus ja kilpailukyky Suomessa
Mistä kilpailukyky koostuu ja mihin sitä tarvitaan?

Valtiovarainministeriön julkaisuja 2021:20		**Teema**	Lautakunnat
Julkaisija	Valtiovarainministeriö		
Tekijä/t	Markku Stenborg, Janne Huovari, Ilkka Kiema, Mika Maliranta		
Kieli	englanti	**Sivumäärä**	111

Tiivistelmä

Raportti tarkastelee Suomen kilpailukyvyn ja tuottavuuden tekijöitä monipuolisesti. Kun puhutaan kansantalouden, yrityssektorin tai toimialan kilpailukyvystä, pitää olla tarkka mitä tarkoitetaan. Tärkein erottelu koskee lyhyen ja pitkän aikavälin kilpailukykyä. Lyhyellä aikavälillä muuttuvia ovat hinnat ja kustannukset, ja silloin keskeisintä on kustannuskilpailukyky. Pitkällä aikavälillä paitsi hinnat, myös monet kansantalouden rakenteelliset seikat voivat muuttua. Pitkän aikavälin kilpailukyvylle ratkaisevaa on työn tuottavuus. Rakenteellinen kilpailukyky onkin ensisijaisesti kansantalouden kykyä kohentaa tuottavuutta. Lyhyen aikavälin kustannuskilpailukyvyssä on kyse kustannusten sopeutumisprosessista suhteessa pitkän aikavälin potentiaaliin eli ovatko työn kustannukset oikeassa suhteessa työn tuottavuuteen.

Kilpailukyky vaikuttaa ennen kaikkea viennin menestykseen. Kustannuskilpailukyky vaikuttaa vientiin lyhyellä, muutamien vuosien tähtäimellä. Rakenteellinen kilpailukyky edistää yritysten tuottavuutta ja kyvykkyyttä menestykselliseen vientiin.

Suomessa tuottavuus kasvoi hyvin nopeasti 1990-laman ja 2008 finanssikriisin välisenä aikana, mutta kriisin jälkeen tuottavuus supistui Suomessa enemmän kuin vertailukelpoisissa maissa. Vuosina 2015-2019 tuottavuuskasvu oli Suomessa muita vanhoja euromaita nopeampaa. Myös Suomen vientimenestys on noudattanut samantapaista kehitystä. Suomessa sekä vientimenestyksen että tuottavuuden kehityksen eräänä osasyynä oli kilpailukyvyn muutosten lisäksi ensin elektroniikkateollisuuden nopea tuottavuuskasvu ja myö-hemmin sitä kohdannut voimakas negatiivinen shokki.

Asiasanat	tuottavuuslautakunta, talouspolitiikka, lautakunnat, tuottavuus, talouskasvu, kilpailukyky, lautakunnat		
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Presentationsblad

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Produktivitet och konkurrenskraft i Finland
Vad består konkurrenskraften av och varför behövs den?

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Rapporten undersöker på ett mångsidigt sätt olika faktorer i Finlands konkurrenskraft och produktivitet. När man pratar om samhällsekonomi, företagssektorn eller en branschs konkurrenskraft ska man vara noga med vad man menar. Den viktigaste skillnaden är mellan kortsiktig konkurrenskraft och långsiktig konkurrenskraft. Faktorer som förändras på kort sikt är priser och kostnader, och det viktigaste då är priskonkurrenskraften. På lång sikt kan förutom priser även många strukturella faktorer i samhällsekonomin förändras. Det avgörande för den långsiktiga konkurrenskraften är arbetsproduktiviteten. Strukturell konkurrenskraft innebär i första hand samhällsekonomins förmåga att höja produktiviteten. På kort sikt handlar priskonkurrenskraft om en kostnadsanpassningsprocess i förhållande till den långsiktiga potentialen, dvs. om kostnaderna för arbetet står i rätt förhållande till arbetsproduktiviteten.

Konkurrenskraften påverkar framförallt hur det går för exporten. Priskonkurrenskraften påverkar exporten kortsiktigt, på några års sikt. Den strukturella konkurrenskraften främjar företagens produktivitet och förmåga att exportera framgångsrikt.

Det skedde en snabb produktivitetstillväxt i Finland mellan depressionen på 1990-talet och finanskrisen 2008, men efter krisen sjönk produktiviteten mer i Finland än i de jämförbara länderna. Produktivitetstillväxten var snabbare i Finland än i de andra gamla euroländerna 2015–2019. Även den finländska exporten har utvecklats enligt samma mönster. En särskild delorsak till de finländska exportframgångarna och produktivitetsutvecklingen var, utöver förändringar i konkurrenskraften, en stor produktivitetsökning inom elektronikindustrin och den negativa chock som denna industri senare drabbades av.

Nyckelord	produktivitetsnämnden, finanspolitiken, nämder, produktivitet, ekonomisk tillväxt, konkurrenskraft		
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TO THE READER

Motivated by the Council of the European Union Recommendation on the establishment of National Productivity Boards, a Productivity Board was also appointed in Finland. This recommendation was justified by poor potential for economic growth in Europe, poor competitiveness, the downward trend in potential output growth which underlies it, and the need to coordinate productivity measures.

The Finnish Productivity Board is an independent and autonomous expert body that operates in conjunction with the Ministry of Finance, however without being part of its organisation. The task of the Productivity Board is to monitor the development of productivity and competitiveness in the Finnish economy, produce independent assessments of it, and publish an annual productivity and competitiveness report.

The members of the Finnish Productivity Board were appointed by the Government for a term running from 1 September 2018 till 30 August 2021. The Board is chaired by Senior Financial Adviser Markku Stenborg, Docent, PhD, from the Ministry of Finance. Its other members are Mika Maliranta, PhD, Research Professor, Finnish Competition and Consumer Authority; Ilkka Kiema, PhD, DSocSc, Research Coordinator and Chief of Forecasting, Labour Institute for Economic Research; and Janne Huovari, MSSc, Head of Forecasting, Pellervo Economic Research PTT.

The Board's first report, which discussed the state and outlook of productivity in Finland from a number of perspectives, was published in spring 2019. This second report focuses on Finland's competitiveness.)

1 Introduction

The first report of the Finnish Productivity Board (Productivity Board, 2019) examined productivity across a broad front. This report concentrates on the Finnish national economy's competitiveness. It also gives a concise overview of recent productivity development and discusses sources of productivity and policy actions that promote it.

1.1 What is competitiveness of the national economy?

At the level of a firm, the concept of competitiveness is relatively clear. For example, it may mean a firm's ability to profitably take over a market share from its less competitive rivals. While competitive firms survive in the market, the market position of uncompetitive firms is unsustainable, and they are forced to exit the market as their expenses exceed their revenue.

At the national economy level, competitiveness is a vaguer concept. Firstly, national economies do not compete against each other; according to economic theory, each economy specialises in producing and exporting those goods which the country can produce the most efficiently, following the principle of comparative advantage. Secondly, a national economy with poor competitiveness will not cease to exist. Thirdly, no single definition exists for competitiveness at the level of national economies, and finally, the number of indicators used to measure competitiveness exceeds even the number of different interpretations given to the concept. To avoid confusion, it is important to clearly define what competitiveness means in each context.

The main distinction concerns short-term and long-term competitiveness. Prices and costs are particular factors than can be changed in the short term, whereas many others, including the volume and quality of capital as well as labour force skills and management competence, are unalterable constants. In the long term not only prices but also capital and employment, among others things, have found their balance, and institutions and other structural factors become important as they determine such things as the capital stock, export market share and employment in the balance of the national economy.

Simply put, short-term competitiveness is about optimising the external and internal balance. For a more detailed discussion of short-term competitiveness, see Chapter 5. The debate on competitiveness mostly concerns short-term price competitiveness, as in Mankinen et al. (2012) and Kajanoja (2012), (2015), (2016) and (2017). Examining and measuring price competitiveness is more straightforward than analysing structural competitiveness, which plays out over the long term, and thus the analysis and measurement of the former have been developed further.

Long-term structural growth competitiveness should be thought of as maximising the citizens' standard of living and wellbeing: rather than competing with each other, countries can be seen as trying to outdo each other in the standard of wellbeing they can produce for their citizens. For a more detailed discussion of longer-term competitiveness, see Chapter 4.

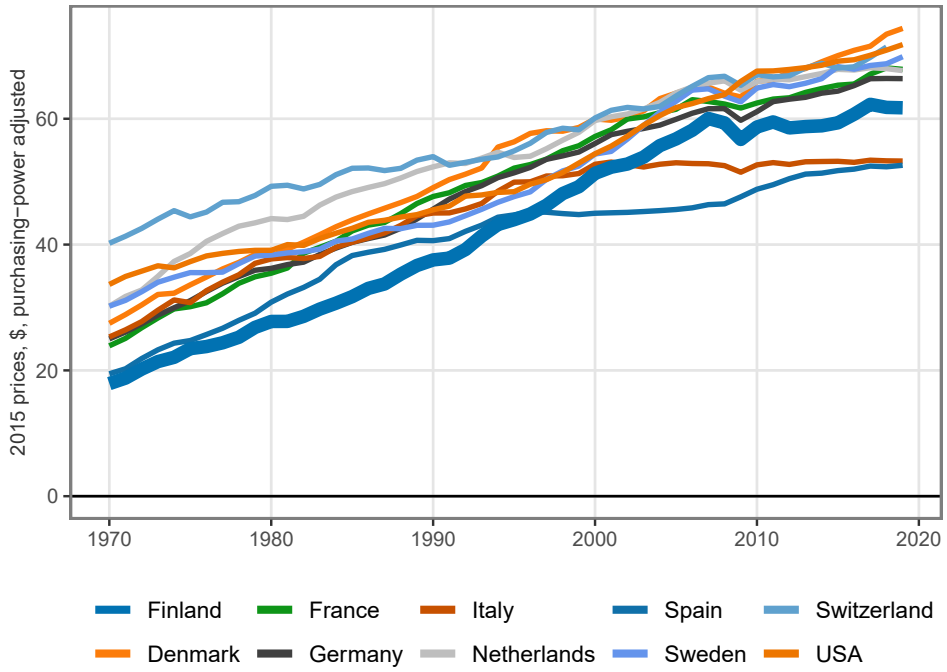
Long-term structural competitiveness can be thought of as the economy's ability to generate productivity. A competitive economy can attract new investments and skilled labour force, competently apply technologies developed by others, develop innovations itself and create a platform for successful firms. In other words, long-term structural growth competitiveness promotes those factors that bolster the growth of *total factor productivity* (*TFP*). To analyse and measure structural competitiveness, more complex examinations are required than to compare the prices, wages and productivity of economies which, in simplified terms, is what the assessment of price competitiveness comprises.

1.2 Finland's productivity growth slowed down significantly

In this section we take a closer look at productivity development and competitiveness at the level of national accounts. For a more detailed discussion of productivity, see Chapter 2, and the sources of productivity are examined in Chapter 3.

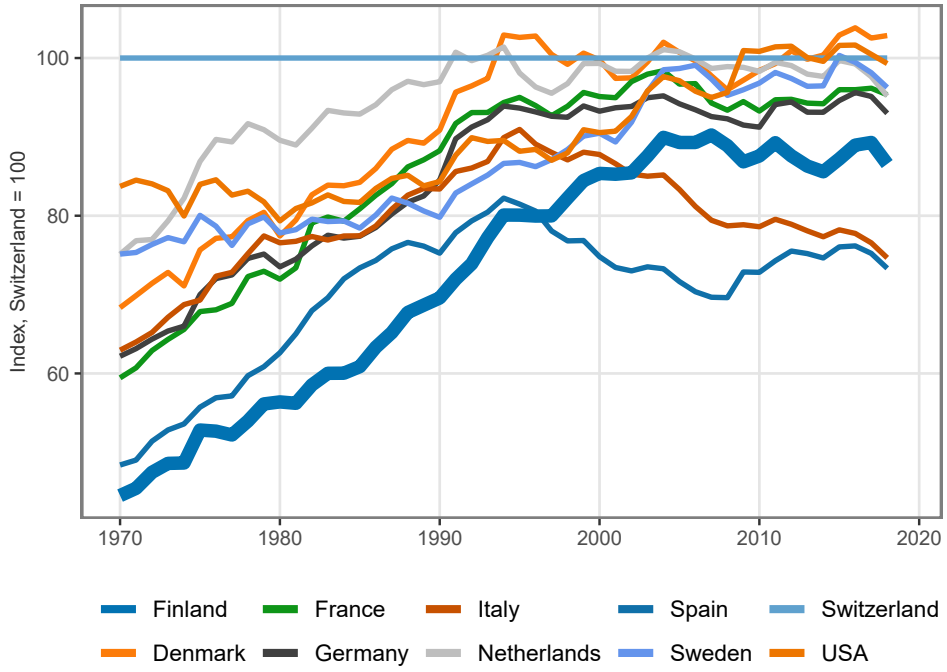
Figures 1.1 and 1.2 compare labour productivity in Finland and its key reference countries. These Figures are based on the OECD Labour Market and Productivity Statistics Database, in which each country's GDP figure is purchasing-power adjusted (USD in 2010), ensuring that exchange rates or purchasing power do not confuse the comparison.

Figure 1.1. Volume of GDP per working hour, USD 2010, purchasing power parity (PPP).



Source: OECD LAMA, Macrobond

Figure 1.2. Labour productivity compared to Switzerland.



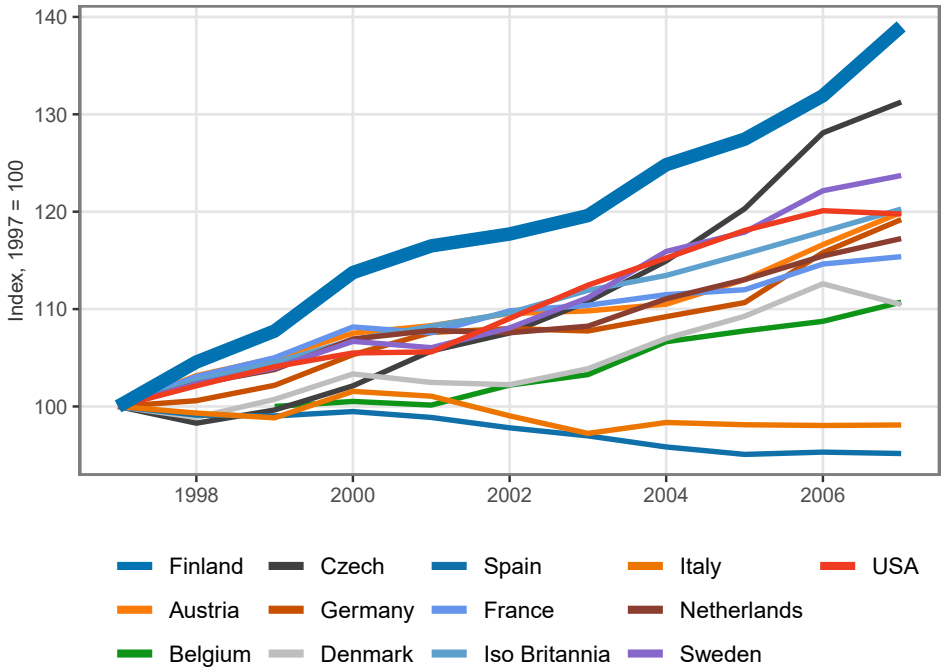
Source: Macrobond, OECD

Figure 1.1 shows that labour productivity in Finland (GDP/working hour) is lower than in the top-ranking countries. The Figure also shows that the average productivity growth in Finland was faster than in the reference countries between 1970 and 2007, however starting to decline around the time of the financial crisis. Since then, the average productivity growth has been negligible.

Figure 1.2 compares Finland and its reference countries to Switzerland. It shows that while Finland was closing the gap to the leading countries in terms of productivity, this development stalled before the financial crisis. For further details, we refer to Chapter 2 and the previous report (Productivity Board, 2019), which contains an extensive debate on productivity growth and, among other things, the way it has come to a halt. In this report, it should suffice to say that the financial crisis was not the reason for the stagnating productivity growth and the fact that Finland could no longer catch up. Most of Finland's exceptionally rapid productivity development in the 1990s and 2000s, and the exceptionally poor development of productivity after 2007, are explained by difficulties faced by the electronics industry, differences between countries in branch structure development, and Finland's slow adaptation to the permanent shock that hit the electronics industry.

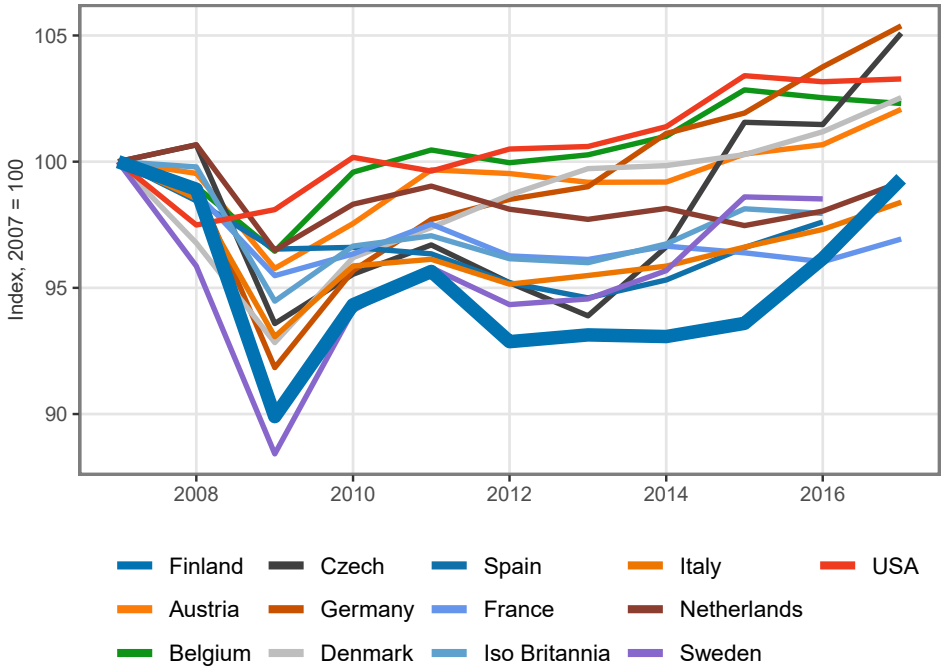
Usually, the most important factor affecting productivity growth is the total factor productivity mentioned above: the share of productivity growth that cannot be explained by the development of capital or the labour force. Total factor productivity is often interpreted as technological development, but in that case, technology must be understood in a very broad sense. Figures 1.3 and 1.4 compare the development of total factor productivity in the market sector in 1997–2007 and 2007–2017. They show that the growth of total factor productivity in Finland was very strong in 1997–2007 and exceptionally poor in 2007–2017. In 2017, total factor productivity still remained below its 2007 level. There was no deterioration in technology in the narrow sense during that period, however.

Figure 1.3. Growth in total factor productivity in 1997–2007, market sector, 1997 = 100.



Source: EU KLEMS, Macrobond

Figure 1.4. Growth in total factor productivity 2007–2017, market sector, 2007 = 100.



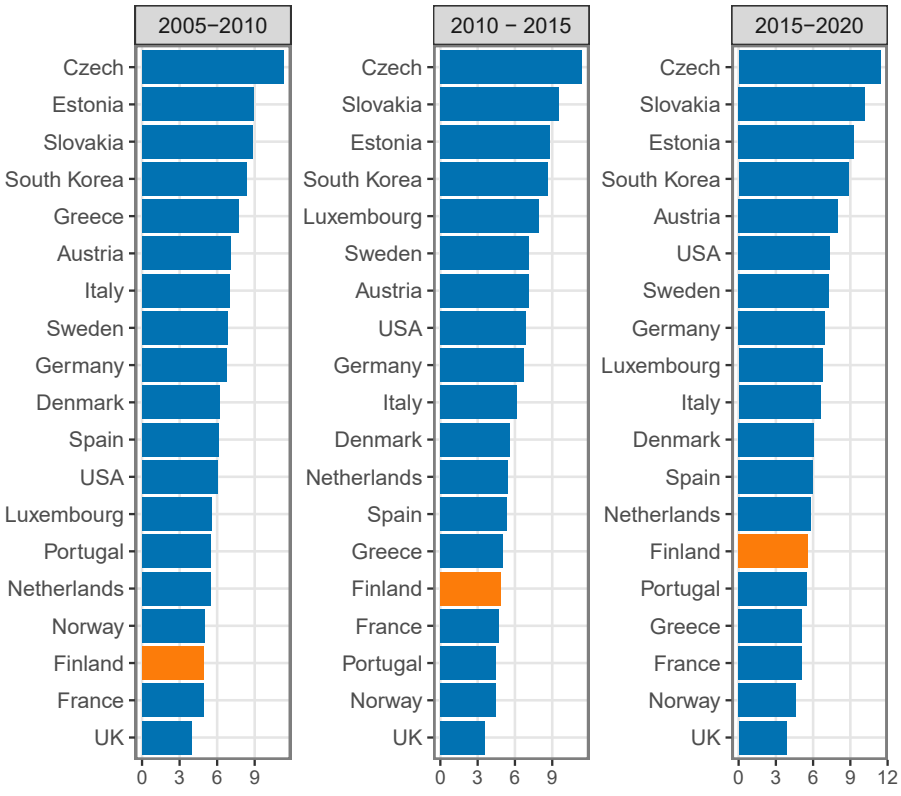
Source: EU KLEMS, Macrobond

We could say that in relation to the leading countries, each economy has a certain level which it cannot exceed. This is the so-called convergence club theory (Aghion and Howitt, 2009, Chapter 7). In Spain and Italy, for example, productivity growth had lost momentum even earlier. The distance at which convergence stops may depend on such factors as the country's ability to deploy innovations (Aghion and Jaravel, 2015). Chapter 4 examines long-term structural competitiveness, which could provide a partial answer to the question of why Finland stopped catching up.

1.3 Finland has not attracted productive investments

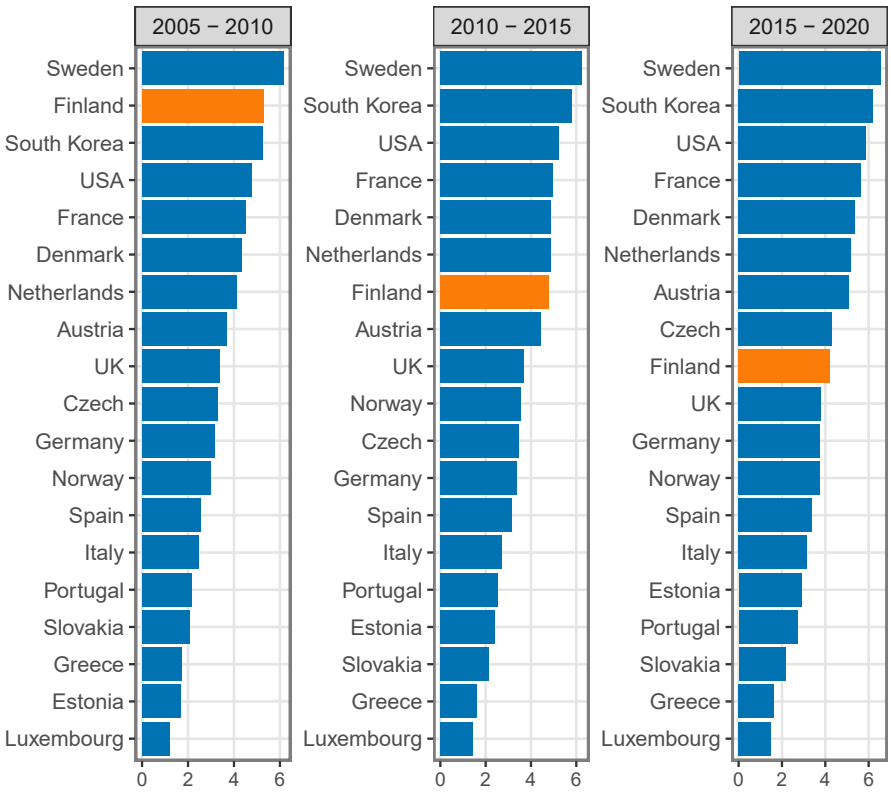
Figures 1.5 and 1.6 compare the development of productive investments in Finland and certain reference countries as a percentage of GDP. Figure 1.5 examines investments in machinery and equipment, while Figure 1.6 describes immaterial investments. The examination focuses on five-year averages over the last 15 years.

Figure 1.5. Machinery and equipment investments as a percentage of GDP, averages in 2005–2010, 2010–2015 and 2015–2020.



Source: Eurostat, Macrobond

Figure 1.6. Immaterial investments as a percentage of GDP, averages in 2005–2010, 2010–2015 and 2015–2020.



Source: Eurostat, Macrobond

Certain Eastern European countries, which have been catching up, are the leaders in the area of machinery and equipment investments. But even if we only focus our attention on the more mature economies similar to Finland, Finland falls far behind our key reference countries when it comes to attracting investments in machinery and equipment. While we do better in relative terms in the area of immaterial investments, even here Finland lags behind the key reference countries.

Pohjola (2020) argues that unlike our competitor countries, Finland has not benefited from technological development and ICT investments. Reduced R&D investments and stagnant growth in ICT investments have undermined labour productivity growth in Finland. These observations indicate that Finland still has scope for improvement in attracting investments and new technologies. Excessively low investments undermine the potential for future economic growth and slow down transfers of the best technology and expertise to Finland.

The transition to a carbon neutral and green economy would also require investments in clean technology to replace the old, polluting capital stock. Low investments weaken Finland's chances of a successful green transition.

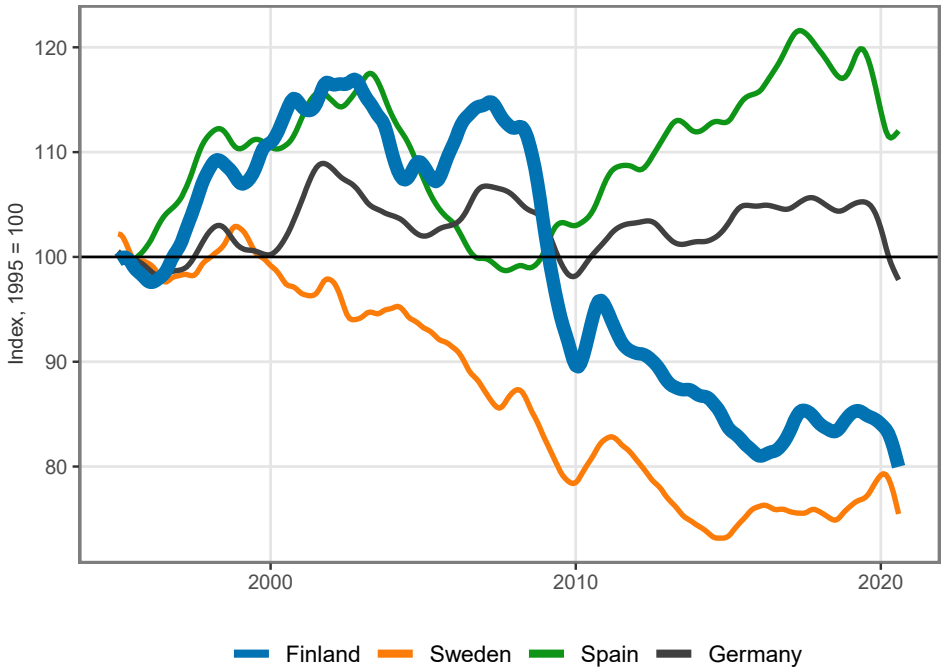
This phenomenon appears to be persistent. Is Finland's structural competitiveness fraught with problems that hinder investments?

1.4 Finland's success in the export sector is a reflection of competitiveness

Long-term structural growth competitiveness and short-term price competitiveness are important factors for a successful export sector. Let us first look at the exports of goods. Figure 1.7 compares development in the volume of exports of goods in Finland and certain other countries to the trend in world imports. The proportion of world imports has been scaled to 100 in 1995 in the Figure. The Figure shows that Finland increased its market share from the 1990s until 2008, after which year the market share has shrunk. A number of developed economies have experienced a similar development as Sweden: exports of goods are developing at a slower pace than world imports, as vertical integration of production has been dismantled and parts of production have been relocated to China and other emerging economies. Germany and such countries as Spain demonstrate that this development is not inevitable; however, Germany's market share had already fallen previously.

At this point, we should recall that it is the domestic added value that counts, not production or exports. The share of assembly, for example, may only represent a few percent of the product's final price. The comparative advantage of a high-competence economy may lie in other activities rather than assembly.

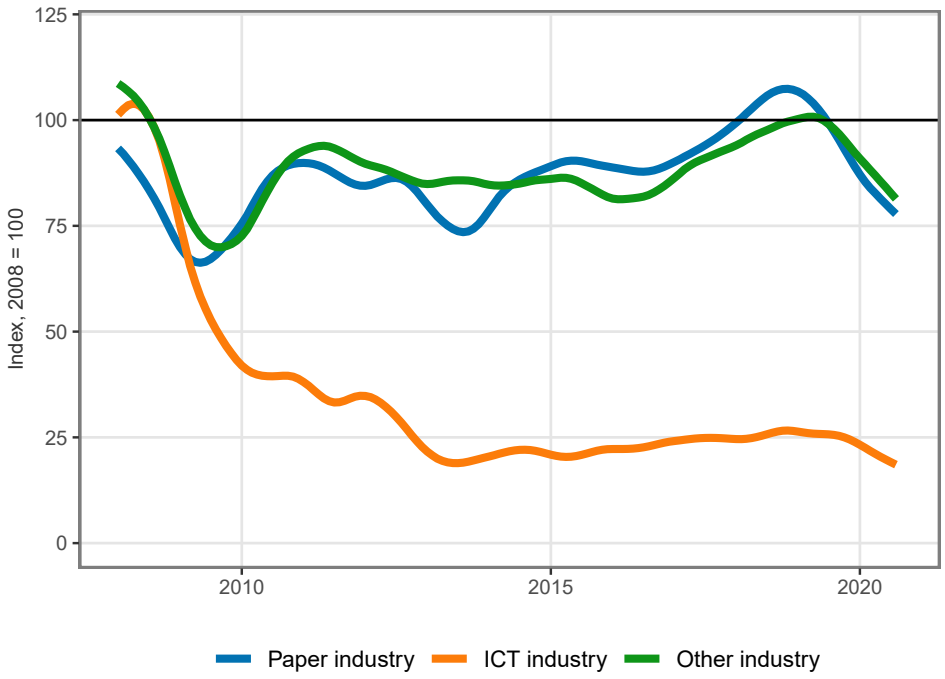
Figure 1.7. Development in the market share of exports of goods, 1995 = 100, HP-filtered trend.



Source: CPB World Trade Monitor, Macrobond

Figure 1.8 examines the exports of Finnish industry by branch. The electronics industry's exports of goods never recovered from the global shock that hit the Finnish supply. The paper industry also suffers from a decline in global newspaper and fine paper consumption, which the increased demand for paperboard and pulp has struggled to compensate for. Neither have other branches of manufacturing managed to exceed the peak year of 2008 in their exports.

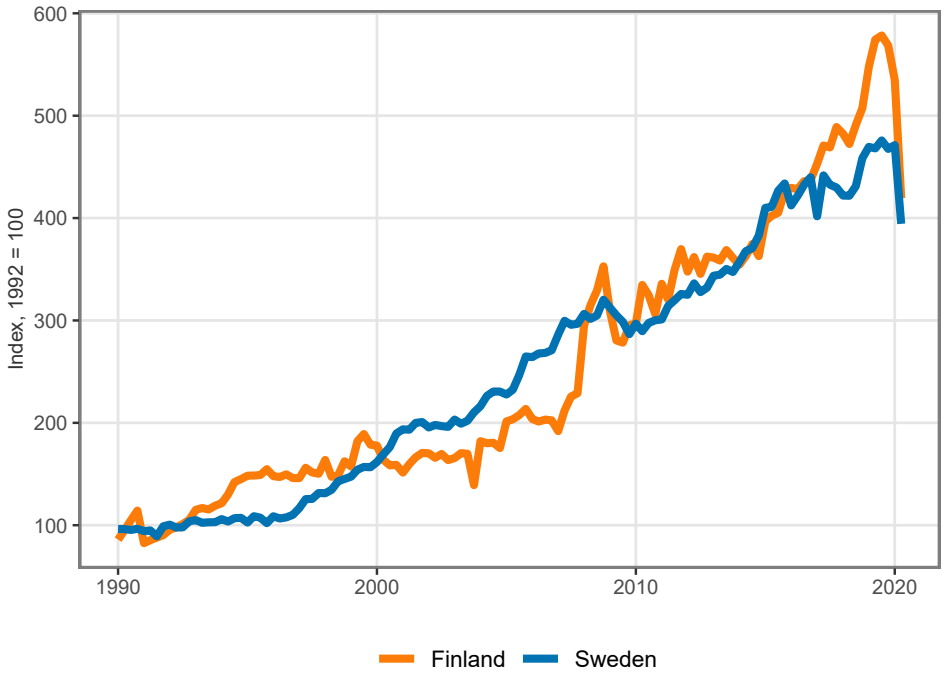
Figure 1.8. Volume of exports of goods by branch, HP-filtered trend



Source: Statistics Finland, Macrobond

Figure 1.9 compares development in the exports of services in Finland and Sweden using the 1990s recession as the baseline. We can see that Finnish exports of services have done relatively well, and particularly well in recent years before the Covid-19 pandemic. Service exports have not suffered from competitiveness problems to the same extent as the exports of goods. In recent years, the largest single item in exports of services has been ICT services, which accounted for over 36% of the service exports in 2019. Some of the positive development in service exports and the negative trend in exports of goods are also explained by changes in statistical practices, as part of ICT production has been transferred from the category of goods to services. However, the exports of services are only worth about one half of the value of goods exports.

Figure 1.9. Volume of service exports in Finland and Sweden in 1990–2020.

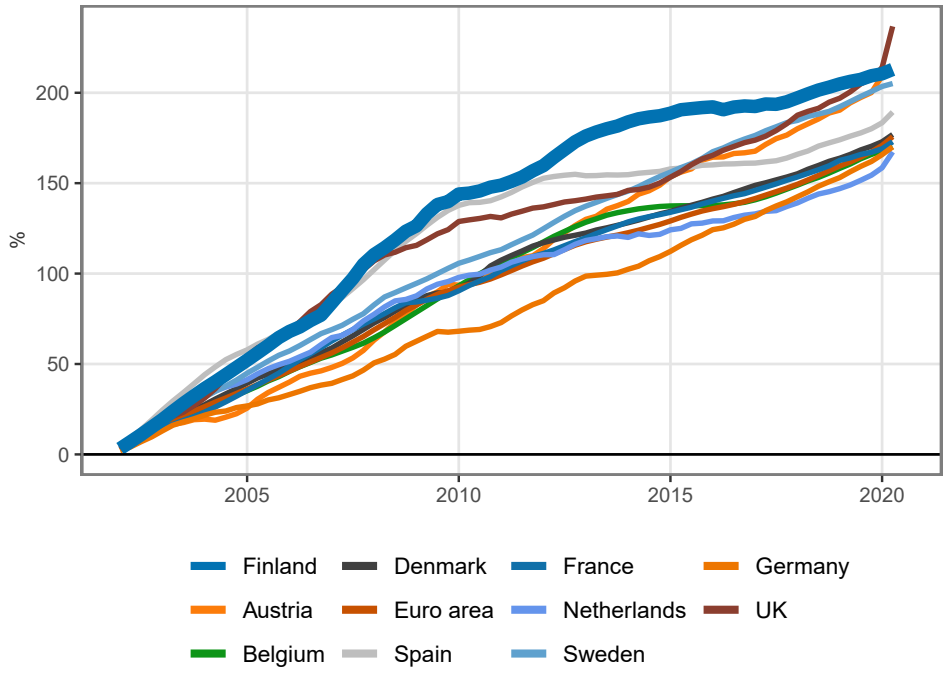


Source: Statistics Finland, Macrobond

1.5 The challenges of measuring price competitiveness

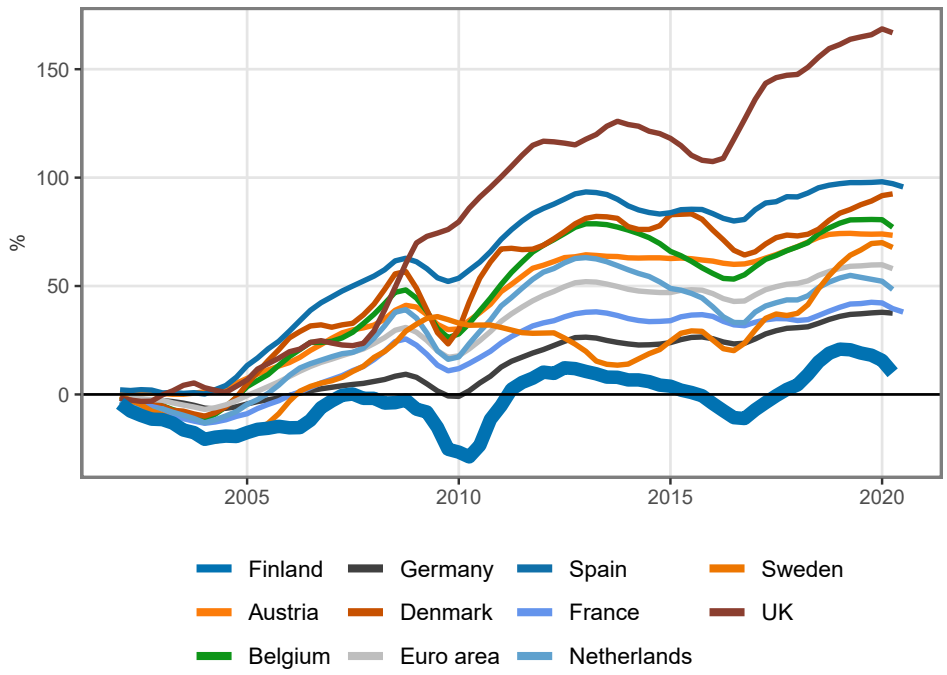
Figures 1.10-12 compare the development of wages in the corporate sector and export prices in the EU since 2002 (the first year for which data are available). The challenge to Finnish price competitiveness lies in the fact that we specialise in products and services whose prices have developed rather weakly. Whereas corporate sector wages have increased cumulatively by 50% more than export prices in such countries as the United Kingdom, this difference in Finland is almost 200%.

Figure 1.10. Wages in the corporate sector, change from 2002.



Source: Eurostat, Macrobond

Figure 1.11. Export prices, change from 2002.



Source: Eurostat, Macrobond

However, price competitiveness cannot be compared simply by subtracting labour costs from export prices. The output obtained for the price of the working hour, or the productivity of labour (Figure 1.1), and the prices of intermediate products are also essential. Rapid productivity growth in Finland, especially in the electronics industry, enabled wages to increase faster than export prices.

A metric well suited for measuring price competitiveness in the open sector is labour costs divided by the value of production, or the so-called *relative real unit labour costs*. As the price development of the Finnish industry differs from this development in reference countries (prices in the electronics industry and paper industry are decreasing, if anything), the *nominal* relative unit labour costs are not a good metric (e.g. Kajanoja, 2012, 2017).

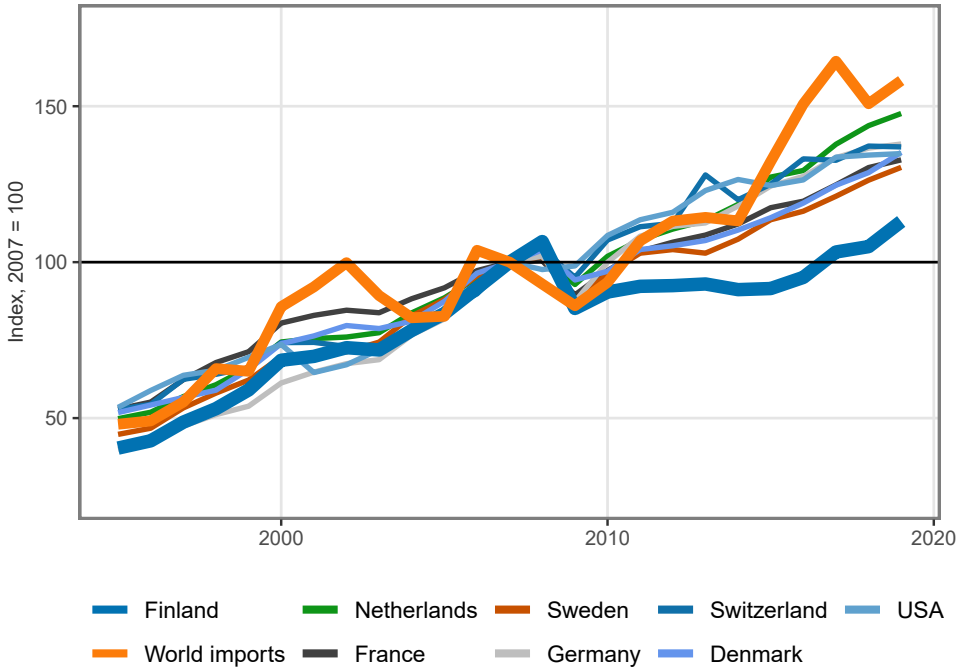
A specific set of countries, or individual countries, can be used as a reference point for this indicator. The real unit labour costs increase if labour productivity declines in relation to a competitor country, the price of labour goes up, or the price of production goes down; in other words, the terms of trade deteriorate. An increase in unit labour costs means that the relative profitability of production has deteriorated. Consequently, it is an inverse indicator of profitability.

In Chapter 5, we take a closer look at price competitiveness and discuss the details and challenges of indicators and comparisons. Several indicators have been proposed for price competitiveness, and the results they produce are not always identical. The links between price competitiveness and economic success are additionally complex, and a simultaneous improvement in price competitiveness and export success, for example, is not a direct indication of a causal relationship between these two trends. It may also be possible that the same changes in external circumstances, including increased export demand, drive the increase in both exports and labour productivity, and the increase in labour productivity is manifested as improved price competitiveness.

Despite these difficulties related to measurement, the essential point is that better price competitiveness promotes exports when the other factors remain unchanged. After all, the economy works in a so-called general balance in which everything affects everything else, making the measuring of this link more difficult. What is more, the other factors do not remain unchanged. The demand and supply sides of the economy are hit by different shocks at varying frequencies, which may affect cost competitiveness and export success simultaneously. Additionally, delays between improved competitiveness and export success may vary in different circumstances. These factors complicate the measurement of competitiveness.

Figure 1.12 sums up Finland's export success in comparison to world imports and reference countries. Until 2007, Finland's overall export performance was excellent, and the exports grew on average faster than world imports. Since that year, Finland has been lagging behind due to difficulties affecting the exports of goods; in recent years before the Covid-19 pandemic, however, exports of services enabled Finland to catch up with world imports.

Figure 1.12. Volume of world imports of goods and services and the exports of certain countries, 2007 = 100.



Source: World Bank, Eurostat, BEA, Macrobond

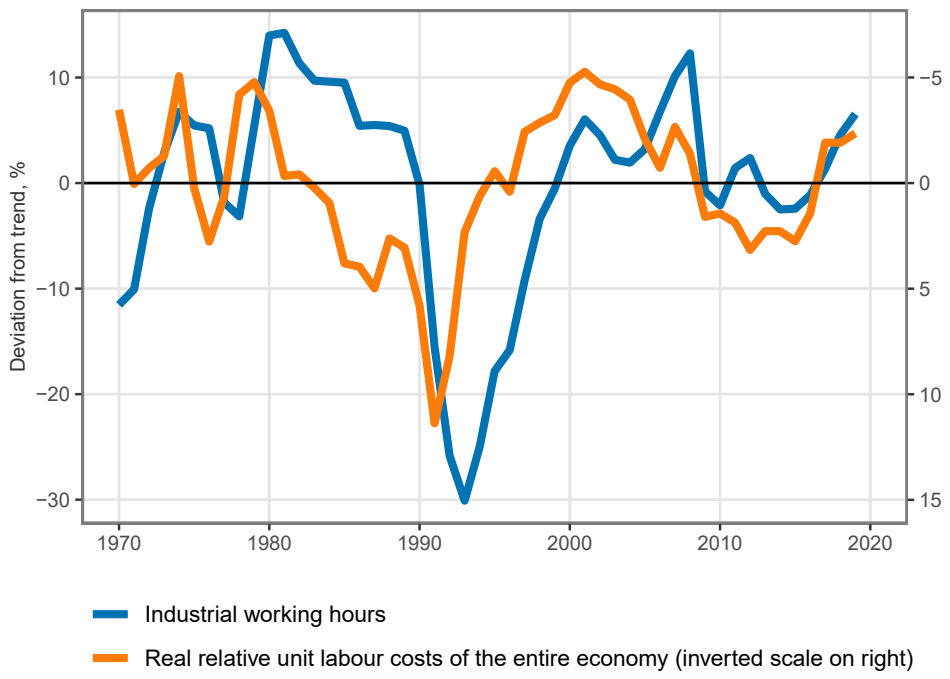
Below in Chapter 4 we argue that long-term growth competitiveness depends, among other things, on the institutions of the national economy and their details. Long-term growth competitiveness is also partly determined by short-term price competitiveness, for example because the longer time period consists of short periods.

1.6 Economic logic links short and long term competitiveness

Figure 1.13 compares relative real unit labour costs, which are a good indicator of price competitiveness in the national economy, and industrial working hours; both are measured as trend deviations in the Figure. We see that industrial working hours react with a delay to changes in price competitiveness. Improved price competitiveness increases industrial working hours, and declining price competitiveness reduces them with a delay. These delays are understandable, among other reasons because industrial orders are placed before price competitiveness has been realised. The orders are fulfilled even if price competitiveness has deteriorated. Similarly, expansion of production made possible by improved price competitiveness takes place with a delay, as attracting new orders takes time.

We also see that the delays would appear to vary. This is a challenge we face when applying econometric measurement to time series, and it partly explains why examining the connection between cost competitiveness and export success is not easy. Competitiveness has less of an impact at the level of the entire national economy (see Figures 1.14 and 1.15). This is partly due to the fact that industry accounts for less than 20% of Finland 's GDP, and a large share of primary production and services is significantly less dependent on the competitiveness of exports.

Figure 1.13. Relative real unit labour costs of the national economy and industrial working hours.

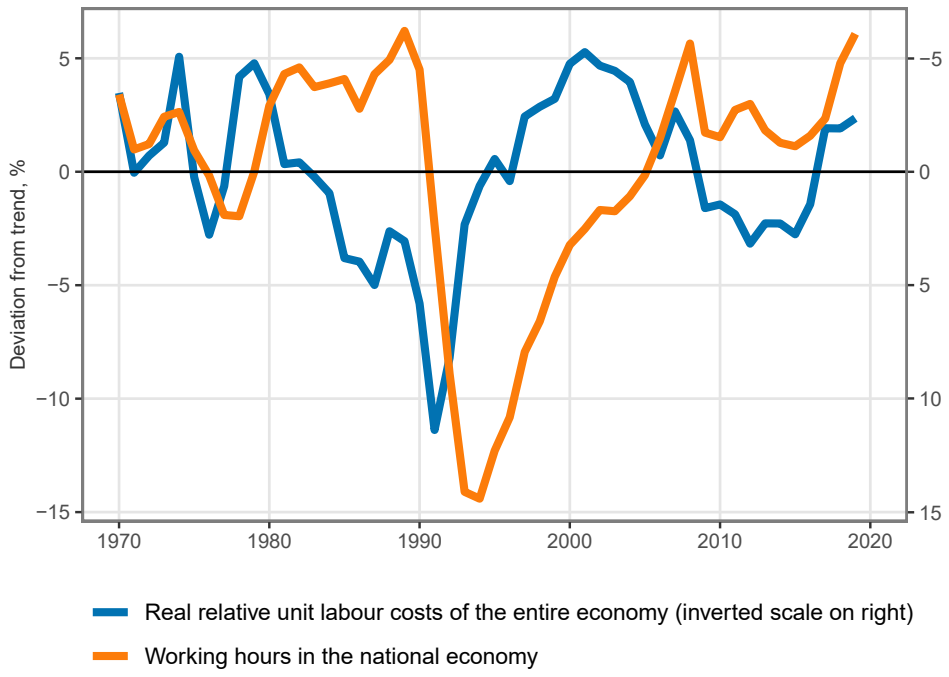


Source: Statistics Finland, Ameco

Figure 1.14. Relative real unit labour costs of the national economy and working hours in private services.

Source: Statistics Finland, Ameco

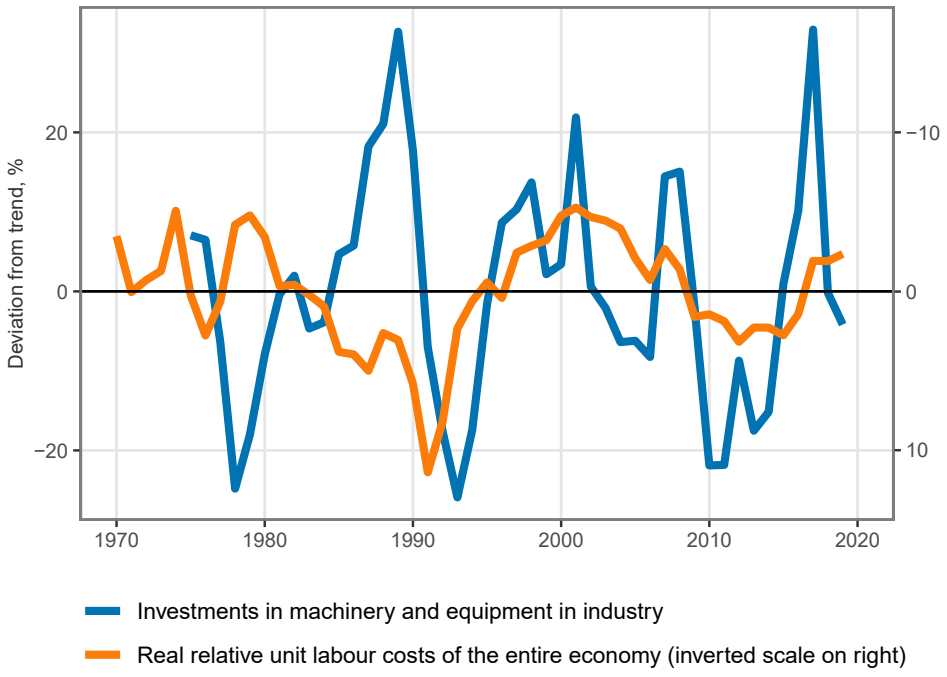
Figure 1.15. Relative real unit labour costs and working hours in the national economy.



Source: Statistics Finland, Ameco

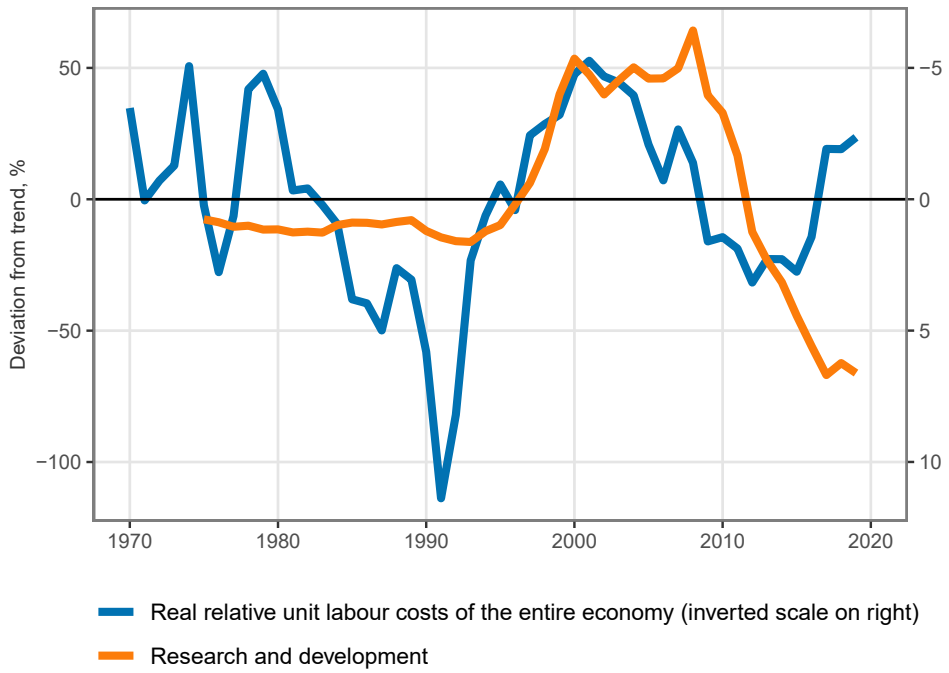
Figures 1.16 and 1.17 compare price competitiveness and industrial investments. They show that industrial investments, too, react to changes in price competitiveness with a delay. Improved price competitiveness contributes to increasing investments, while declining price competitiveness reduces them with a delay. However, investments are influenced by many other factors besides competitiveness, including estimates of the risks and changes in taxation. For example, investments increased in conditions of declining competitiveness in the 1980s, partly due to the overheating of the economy and a different tax regime; after 2015, industrial R&D investments continued to decline due to the large role of the electronics sector, even if competitiveness had improved.

Figure 1.16. Relative real unit labour costs of the national economy and industrial investments in machinery and equipment.



Source: Statistics Finland, Ameco

Figure 1.17. Relative real unit labour costs of the national economy and investments in research and development.



Source: Statistics Finland, Ameco

In other words, good price competitiveness makes it possible to expand exports and production in the open sector, which means more working hours and higher employment. At the same time, it motivates investments in larger and newer production capacity. New investments and new technology improve the potential for productivity growth. This way, price competitiveness contributes to productivity growth. Short and long-term competitiveness are linked by economic logic and international competition.

2 Labour productivity in the corporate sector

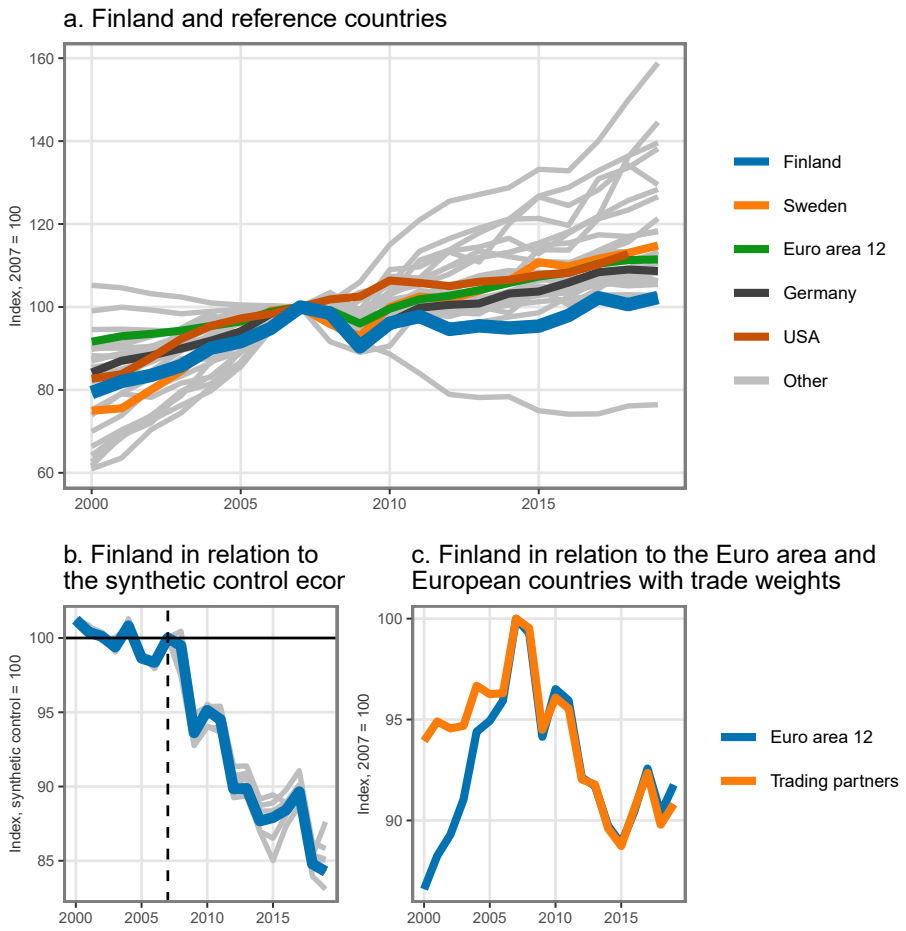
2.1 Entire corporate sector

Labour productivity in the Finnish corporate sector (excluding sectors difficult to measure) has fallen well behind the trend in reference countries since the financial crisis. The decline during the financial crisis was sharper than in most reference countries. In addition, recovery from the financial crisis was interrupted by the euro crisis, in the aftermath of which labour productivity did not increase for many years. The difference to the weighted average of European reference countries obtained by using Finland's trade weights was 10%, and to an estimated 'synthetic Finland' formed on the basis of reference countries was over 10%, by 2015 compared to the 2007 level.

After 2015, Finland's economic growth accelerated and labour productivity in the private sector also improved for two years. In 2017, labour productivity in the Finnish corporate sector reached the level preceding the financial crisis. Productivity growth was also faster than in reference countries for two years.

After 2017, however, the growth in labour productivity stalled once more. Similar stagnation in the growth of labour productivity has not been registered more extensively in reference countries. This difference is especially great in relation to the estimated 'synthetic Finland', whose productivity growth accelerated. Labour productivity also deteriorated in relation to the weighted average of European countries, especially in 2018.

Figure 2.1. Real aggregate labour productivity in the corporate sector. a) Finland, the European reference countries, the United States and Japan. b) Finland in relation to a synthetic control estimated on the basis of the reference countries and alternative estimates (in grey). c) Finland in relation to the euro area aggregate and European trading partners using double trade weights.



Source: Eurostat, OECD, ECFIN, Finnish Productivity Board

The decline in labour productivity in 2018 is not surprising, as the growth in employment and number of working hours was extremely rapid at the time. Employment went up faster than production, which meant that labour productivity declined. In the year before, a trend in the opposite direction was registered: while production increased sharply, the number of working hours continued to decrease slightly. In fact, years 2017 and 2018 are examples of the difficulty associated with interpreting short-term productivity. The rapid growth in employment in 2018 was largely due to a rapid growth in production in the previous year, as employment usually follows production with a delay. As a result of the time lag, the growth in labour productivity appears too good in 2017 and too weak in 2018.

The overall trend in labour productivity in 2015–2019 appears to be that of moderate growth. The average growth rate was 1.3% per year, which exceeds the rate of 0.9% in the old eurozone countries, of which Ireland and Denmark were the only ones experiencing faster growth in labour productivity than Finland. Labour productivity also grew faster in Finland than in Sweden and the United States.

In 2015–2017, the growth in labour productivity was only slightly faster in Finland than in the old eurozone countries. Compared to European trade partners to which Finland's trade weights are applied, the growth in productivity was slightly slower, and clearly slower compared to the synthetic control economy.

Synthetic control method

A national economy's development is often examined by comparing it to similar developments in other countries or regions. Comparisons to development in other countries also help determine how, for example, the national economy would have grown without certain political decisions, or economic shocks only affecting the national economy in question. Finland is typically compared to Sweden. Using individual countries as a benchmark is always highly problematic, as no two national economies are fully identical, and a national economy used as a reference point can only face shocks specific to it, which reduces the meaningfulness of the comparison.

As a solution to this problem, Abadie and Gardeazabal (2003) proposed a statistical approach based on a weighted combination of other countries, known as a linear combination, instead of a single country. The combination produced using their method is called a synthetic control. A synthetic control is selected ensuring that its economic development has, until a certain moment, resembled the examined national economy as closely as possible.

In this Chapter, we examine labour productivity in the entire Finnish national economy or in some parts of it, and the synthetic control has been selected to resemble Finland in 1996–2007 as closely as possible in its development. As an illustration, we can think of the synthetic control as an imaginary country in which the trend of labour productivity in 1996–2007 was almost similar to the development in Finland.

In the calculations we report, the reliability of the synthetic control was examined by removing one country at a time. This helps to identify the synthetic control's potential sensitivity to the individual economies used to estimate it. If the synthetic control turns out to be significantly different after an individual country has been removed, the difference between the synthetic control and the Finnish economy is more likely to reflect changes in the national economy of the removed country than in the Finnish economy. Consequently, this country should be eliminated from the group used for the estimation, and the sensitivity analysis repeated using the new, reduced set of countries.

The country weights used for the synthetic control do not necessarily have any economic interpretation, and far-reaching conclusions on similarities between the national economies of the country under review and countries with a large country weight should not be made on their basis. In fact, a linear combination consisting of widely different economies can be more similar in its dynamics to the national economy under review than a neighbouring economy considered to be very similar. Neither should the synthetic control in this report be regarded as a real alternative in the sense that labour productivity in Finland would have reached the level of synthetic control without the events that occurred after the period under review (such as Nokia's difficulties).

As the weights of other countries are selected to maximise the similarity of Finland's productivity development during the period under review (1996–2007) with the control group when fixing the synthetic control in this report, we should not conclude that Finland's productivity trend during this period was at an average level. Neither is the fact that productivity development in Finland remains below that of the synthetic control economy following the period under review sufficient to indicate that Finland has lagged behind the average development of other countries in terms of productivity growth. However, we can note that productivity growth in Finland has been weak compared to those countries in which previous trends have been the most similar to Finland.

In this case, the synthetic control is above all a statistically justified description of the development in Finland and the rest of the world in terms of labour productivity, and it helps to determine when Finland's development began to diverge from what could be expected in the light of the country's previous history. In addition, the sectoral analysis illustrates the extent to which each factor could be a driver of this exceptional development.

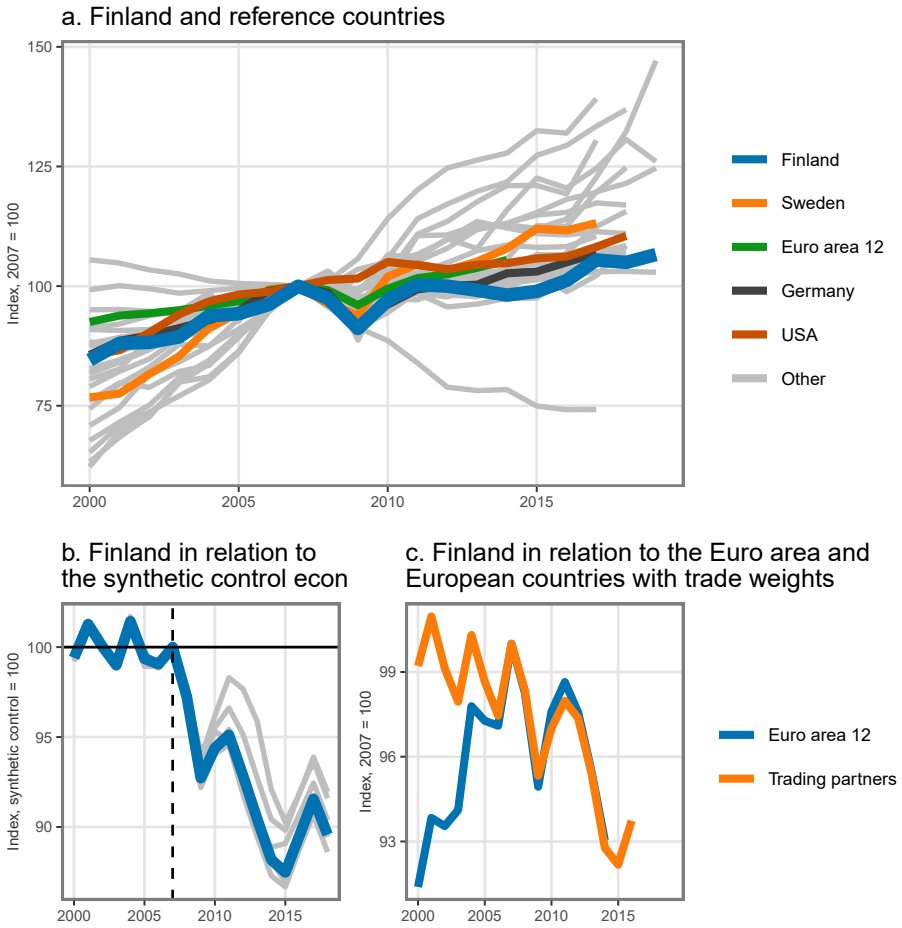
2.2 Corporate sector without the electronics industry

Part of the lower productivity growth after the financial crisis is explained by a decline in the production of the Finnish electronics industry. However, Finland's productivity growth was also slower than in the reference countries in 2008–2015 when this industry is excluded. The difference to the weighted average of the European reference countries when using Finland's trade weights was around 7%, and to the 'synthetic Finland' estimated on the basis of the reference countries almost 10% by 2015 compared to the 2007 level.

Compared to the reference countries, recovery in the corporate sector excluding the electronics industry has been slightly faster since 2015 than in the private sector as a whole. The difference in this trend is particularly noticeable when we compare Finland to the synthetic control economy. While productivity in the entire private sector has been left further behind the development in the synthetic Finland, development in the corporate sector excluding the electronics industry has been faster than in the synthetic Finland. However, this is mainly due to the fact that the synthetic control economy is made up from a different set of countries when the private sector is examined including and excluding the electronics industry.

What complicates the examination without the electronics industry is that data on the development of labour productivity in the electronics industry in recent years are still lacking in many countries.

Figure 2.2. Real aggregate labour productivity in the corporate sector excluding the electronics industry. a) Finland, European reference countries, the United States and Japan; b) Finland in relation to the synthetic control economy estimated using the reference countries and alternative estimates (in grey); c) Finland in relation to the eurozone aggregate and European trading partners using double trade weights.



Source: Eurostat, OECD, ECFIN, Finnish Productivity Board.

2.3 Manufacturing

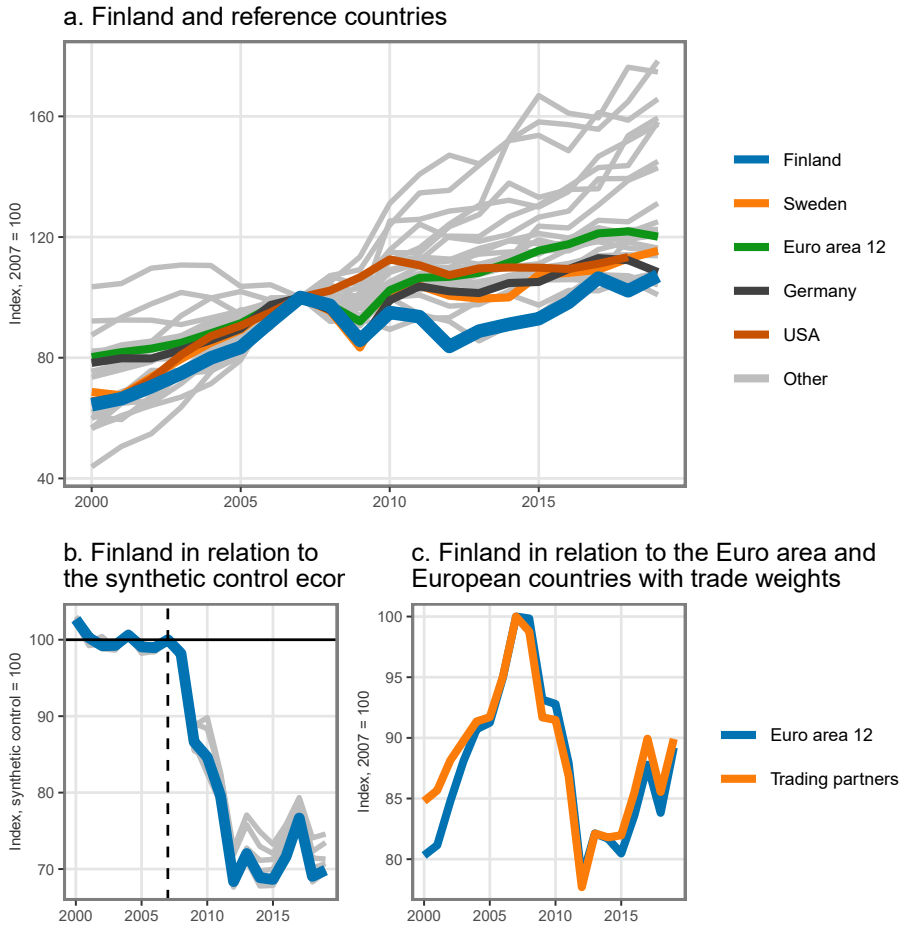
Following the financial crisis, the productivity of industrial labour in Finland clearly lagged further behind the reference countries than labour productivity in the entire economy. At worst, the synthetic Finland's difference to the eurozone was about 30%, and to European trading partners about 20%.

The widening of the labour productivity gap stopped even earlier in manufacturing than in the entire economy. The poorest year in relation to the eurozone and European trading partners was 2012 for manufacturing, whereas it was 2015 for the entire economy. The earlier turn in the trend in manufacturing does not apply to production, however. The volume of added value in Finnish manufacturing, and also in the entire economy, compared to the reference countries only started to grow in 2015.

After 2012, the productivity of industrial labour increased faster in Finland than in most reference countries. Having increased after the financial crisis, the difference to the eurozone and European trading partners was almost halved by 2017. Since then, however, growth in the productivity of industrial labour has stalled, and the difference to the reference countries has again grown somewhat.

The difference to the synthetic Finland, in which the emerging Eastern European economies are emphasised, narrowed slightly in 2016 and 2017, but as growth in labour productivity stagnated, the gap has grown again and was equal to its 2012 level in 2019.

Figure 2.3. Real aggregate labour productivity in manufacturing. a) Finland, the European reference countries, the United States and Japan. b) Finland in relation to the synthetic control economy estimated on the basis of the reference countries and alternative estimates (in grey). c) Finland in relation to the eurozone aggregate and the European trading partners with double trade weights.



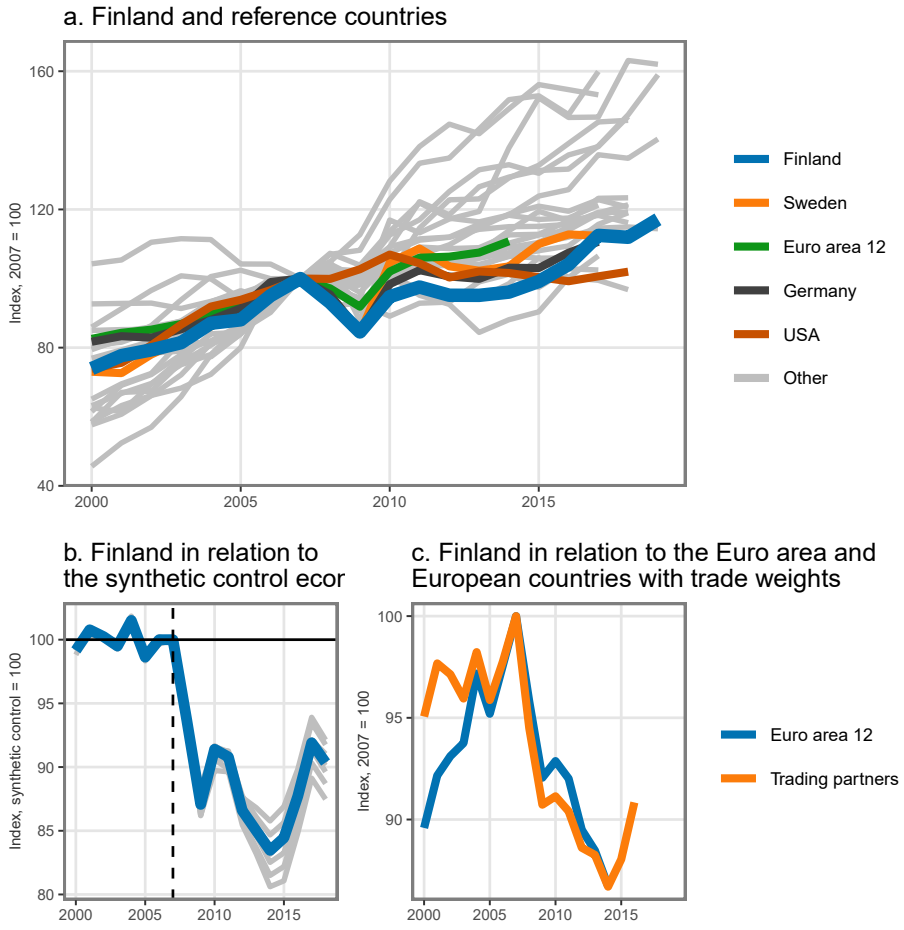
Source: Eurostat, OECD, ECFIN, Finnish Productivity Board.

2.4 Manufacturing excluding the electronics industry

To a great extent, the much weaker development of manufacturing in Finland than in the reference countries is explained by the electronics industry. Excluding the electronics industry, the difference to the reference countries was less than 15% at worst after the financial crisis. In manufacturing excluding the electronics industry, the relative lowest point of labour productivity was recorded in 2014.

Compared to the reference countries, growth in labour productivity in manufacturing without the electronics industry has been rather rapid since 2014, and most of the gap that increased following the financial crisis had been closed by 2017. Since 2017, however, the growth has slowed down, and Finland is no longer catching up. Nevertheless, labour productivity in manufacturing without the electronics industry also increased in 2018–2019, unlike labour productivity in manufacturing as a whole. However, the data for 2019 cannot be compared with other countries, as data concerning the electronics industry are not available in most countries.

Figure 2.4. Real aggregate labour productivity in manufacturing excluding the electronics industry. a) Finland, European reference countries, the United States and Japan. b) Finland in relation to the synthetic control economy estimated on the basis of the reference countries and alternative estimates (in grey). c) Finland in relation to the eurozone aggregate and European trading partners with double trade weights.



Source: Eurostat, OECD, ECFIN, Finnish Productivity Board.

2.5 Private services

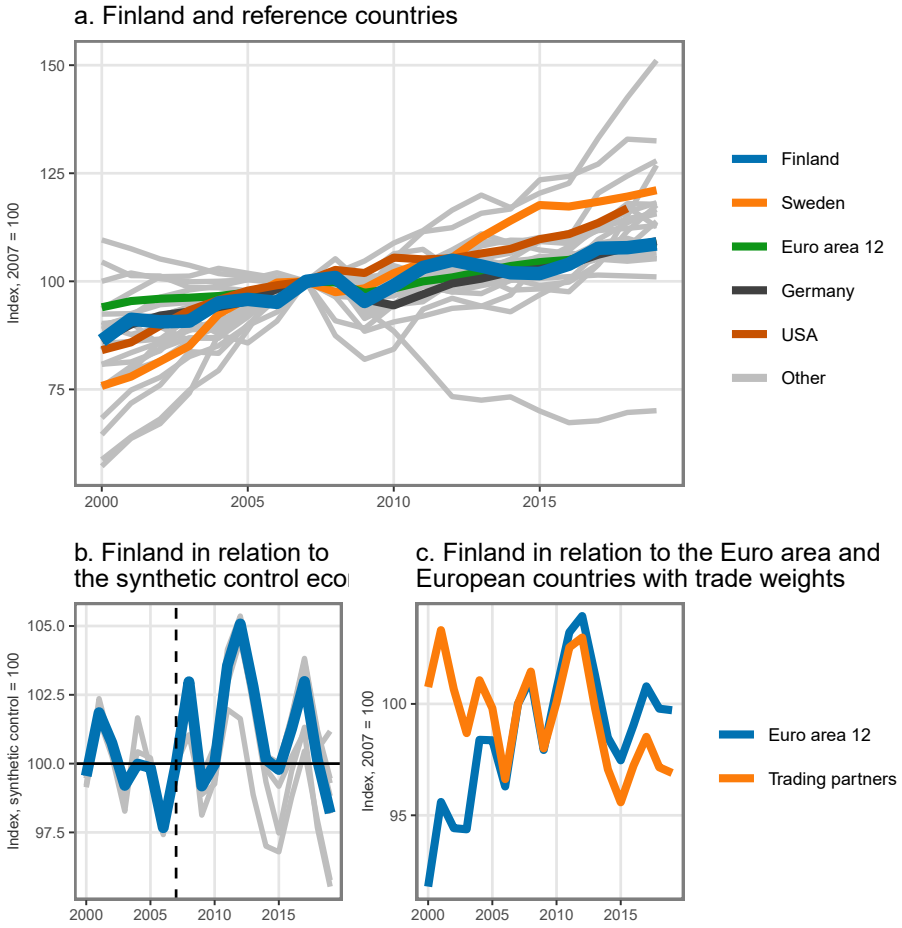
The development of labour productivity in Finland has clearly kept pace with the reference countries better in the services than in industrial labour. The impact of the financial crisis on the productivity of services was similar to that experienced in the reference countries, and the recovery of productivity following the crisis was even stronger in Finland.

However, the growth of labour productivity in services lagged behind the reference countries after 2012, while the productivity of industrial labour had begun to recover. After 2015, the productivity of labour in Finnish services has grown slightly faster than in the old eurozone countries, whereas it has been slightly slower than in the European trading partner countries and the synthetic Finland.

In general, differences in the growth of labour productivity are clearly smaller in services than in manufacturing. Labour productivity has grown at roughly the same rate in Finland as in the old eurozone countries since the financial crisis. The difference to the synthetic Finland is also small.

However, the difference in the development is greater in comparison to the European trading partners. This is mainly due to the faster growth of labour productivity in services in Sweden. The gap was already there before the financial crisis, and following the crisis, the growth in labour productivity in Finnish services has fallen behind the trend in European trading partners by about 5% in total.

Figure 2.5. Real aggregate labour productivity in services. a) Finland, the European reference countries, the United States and Japan. b) Finland in relation to the synthetic control estimated from the reference countries and alternative estimates (in grey). c) Finland in relation to the eurozone aggregate and the European trading partners weighted with double commercial weights.



Source: Eurostat, OECD, ECFIN, Finnish Productivity Board.

3 Competitiveness and its factors – short and long term perspective

3.1 Introduction

Competitiveness is a widely used concept in economic policy discussions. The problem is that people mean different things by it, which hampers the discussion. To improve the situation, we need to specify whether we are talking about the competitiveness of an individual firm or the national economy.

Firms compete in the market. A firm's high level of competitiveness is reflected as having a strong market position and better profitability than its competitors. The competitiveness of the national economy, on the other hand, is a less clear-cut concept. Paul Krugman (1994b) even calls this idea a dangerous obsession. There is no reason to think that national economies are competing against each other as firms do in the market. The interests of national economies do not clash in the same way as those of firms operating in the same market. This is why the competitiveness of a firm on the one hand and a national economy on the other should be assessed from different starting points. The interests of firms do not necessarily coincide with the interests of the national economy – and vice versa.

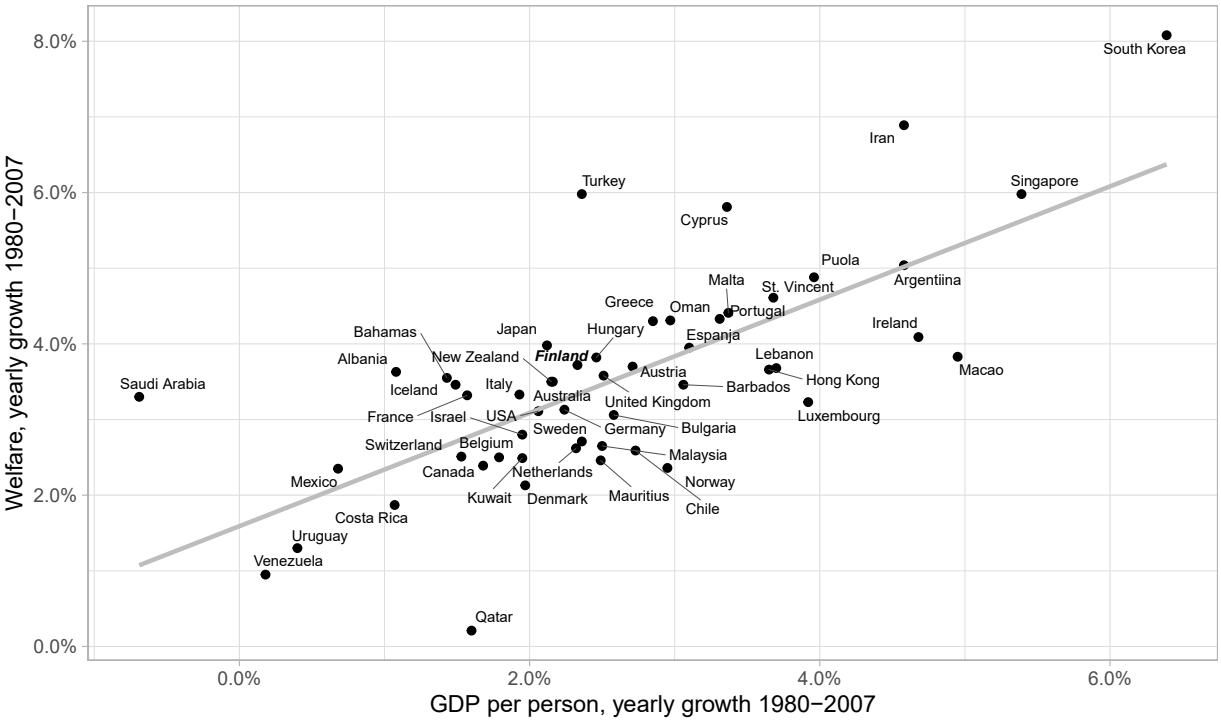
A natural ultimate economic policy objective is a national economy that creates wellbeing for the citizens in the short and, above all, in the long term. It is natural to think that countries strive to outdo each other in the level of wellbeing they can offer to their populations. One indication of success is that the citizens wish to live in the country in question, and many are willing to immigrate to it. A high proportion of citizens who are satisfied with their lives is another indicator.

A wide range of policy actions, such as social, educational, defence and environmental policies, is required to ensure citizens' wellbeing. However, policies that promote economic growth remain important also for wealthy countries. There is a strong link between economic growth and wellbeing, whether wellbeing is measured by subjective or objective indicators. Subjective indicators show that the more prosperous a country is, the greater the average satisfaction of its citizens with their lives, and prosperity is achieved through economic growth (Stevenson and Wolfers 2013).

Assessing wellbeing with subjective indicators is highly problematic, however. Quantifying life satisfaction requires scales based on which it is difficult to calculate meaningful averages, for example to make comparisons between countries. The results may be random or even arbitrary (Bond and Lang 2019). In addition, the correlation between objective indicators of health (including life expectancy or HIV morbidity) and subjective indicators has often been found weak (Deaton 2008). At worst, systematically implemented analyses based on subjective indicators of wellbeing can lead to economic policy recommendations fraught with moral dilemmas. In other words, subjective indicators do not necessarily justify major inputs in improving health. Studies of happiness have also sometimes found that families with small children have lower levels of happiness than families with no children. Children's allowances may, nevertheless, be a policy measure worthy of support (Blanchflower and Oswald 2011).

Drawing on the theory of wellbeing, Jones and Klenow (2016) have produced an objective wellbeing indicator that measures the wellbeing impacts of consumption, leisure time, income distribution and life expectancy. There is a strong statistical link between this indicator and per capita economic growth (see Figure 3.1). On the other hand, analyses produced by researchers also indicate that wellbeing can be improved not only through policies promoting economic growth but also by other policy actions. Wellbeing improves if policy actions are successful in reducing inequalities, improving public health or promoting families' possibilities to combine work and leisure time without significantly slowing down economic growth. In the light of an empirical analysis, it appears that such policy options do exist.

Figure 3.1. Link between the objective wellbeing indicator and per capita economic growth



Source: Jones and Klenow (2016)

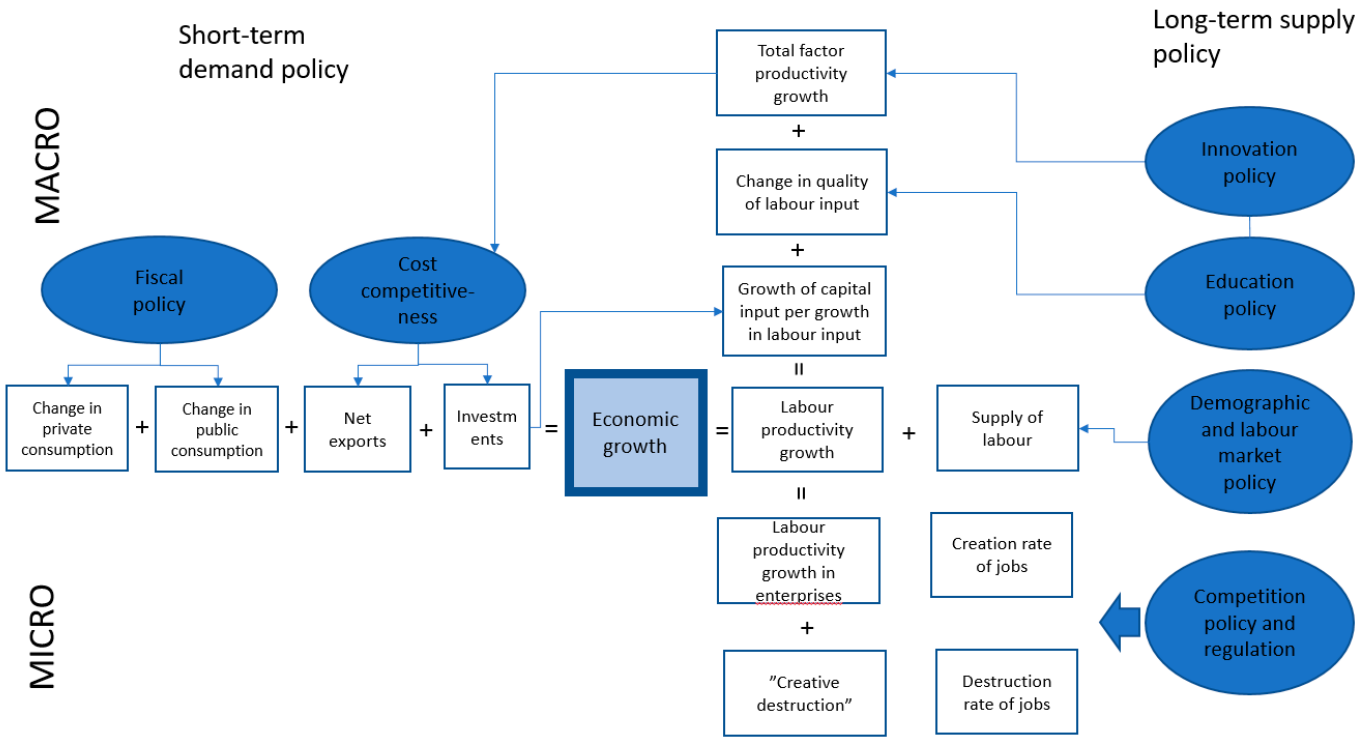
The empirical analyses described above indicate that policies that promote economic growth can improve the wellbeing of citizens. According to the New Keynesian economic theory, a distinction should be made between the short and long term when looking at economic growth. In the short term, the emphasis is on demand side policy, whereas in the long term it is on supply side policy. A similar distinction between the short and long term is also useful when examining competitiveness.

This is illustrated in Figure 3.2. Economic growth is presented in the middle. As the Figure shows, economic growth can be approached from three perspectives:

1. From a short-term perspective, in terms of total demand items (left)
2. From a long-term perspective by looking at the 'macro factors' of labour productivity (top right)
3. From a long-term perspective by examining the 'micro factors' of labour productivity (bottom right).

The figure also describes the components of economic growth that various economic policy measures mainly affect.

Figure 3.2. Examination of the factors of economic growth from three perspectives



Source: Maliranta (2019), edited

3.2 Short-term perspective on competitiveness – cost competitiveness

Examined from the short-term perspective, economic growth is the sum of changes in four demand items. These items are:

1. change in investments
2. change in net exports
3. change in private consumption, and
4. change in public consumption.

Based on this equation, we may argue that economic growth can be promoted by increasing investments, net exports, private consumption or public consumption. The assumption is that an increase in one demand item will not result in other demand items

being reduced by at least the corresponding amount. According to New Keynesian economic theory, economic growth can be accelerated by increasing total demand when the national economy has underused production capacity. In this case, unemployment is higher than in conditions of the normal balance, for example.

Overall demand can be increased through economic policy actions, which include lowering taxes or increasing social benefits, both of which increase the purchasing power and private consumption of households. Economic policy can also be used to increase public consumption or encourage investments, thus driving overall demand.

In a small open economy like Finland, a significant part of production is exported. On the other hand, a significant proportion of consumption demand is satisfied with imported goods. This is why the impacts of global economic development are significant. Net exports refer to the difference between exports and imports. They can be raised by increasing exports or reducing imports. Net exports depend on how successful Finnish production is in the export market or in competition with imports. This is about *the prerequisites for the economy's external balance*, or cost competitiveness (Kajanoja 2012). Cost competitiveness is determined by unit costs in comparison to competitor countries. The unit costs go down -- and cost competitiveness improves -- if input prices are reduced or input productivity is increased. On the other hand, the impacts may work in two ways. For example, stronger exports may improve productivity because the utilisation ratio of production increases, thus also improving cost competitiveness.

The measurement of cost competitiveness often focuses on labour input, which is the most important input at the national economy level. In this examination, relative unit labour costs are used as a metric for cost competition (Maliranta 2014).

When Finland had its own currency, cost competitiveness was adjusted by means of a devaluation, or lowering the external value of the currency, when necessary. After a devaluation, Finnish firms' export revenues received for the same volume of exports in Finnish marks were higher. Export firms became more profitable, and they were more competitive compared to foreign firms. They were able to lower the foreign currency price of their commodities, thereby increasing their market shares. A devaluation also makes imported products more expensive, improving the competitiveness of domestic production compared to imports. Improved cost competitiveness can also give export firms more incentives to increase their production capacity by investing, which also drives overall demand.

However, a devaluation is not an option for countries using a common currency, as Finland is today. From the perspective of stable economic development, it is still necessary to keep cost competitiveness at a sufficiently high level. If it deteriorates significantly, net exports

may decrease and economic growth will slow down as shown in Figure 2. This means fewer jobs in the export sector and increased unemployment. Consequently, maintaining the prerequisites for the external balance also makes it easier to maintain the internal economic balance (employment). An internal devaluation is one option for achieving this goal. This means that the price of labour is reduced by lowering wages or by cutting the non-wage labour costs of the employer.

A devaluation carried out by lowering the exchange rate and an internal devaluation may not necessarily have the same effect. Among other things, an internal devaluation increases the real value of domestic households' debts, which reduces private consumption. This does not apply to a devaluation based on lowering the exchange rate.

3.3 Long-term perspective on competitiveness – productivity

In the long term, economic growth depends on changes in productivity and working hours, as Figure 3.2 shows. From the perspective of economic growth and particularly the development of wellbeing, growth in labour productivity is the more important factor. Increasing labour productivity enables citizens simultaneously to both consume more and have more leisure time.[1] Labour productivity, or the ratio of production to working hours, is thus a valid indicator of the national economy's long-term competitiveness.[2] Paul Krugman's famous statement aptly sums this up:

"Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker."[3]

Ultimately, research in economic growth is primarily about examining the long-term factors of labour productivity. The sources or mechanisms of long-term growth in labour productivity can be sought in two directions: 1) in neoclassical growth theory, in which

1 The part of economic growth which is based on productivity growth is also favourable for the environment. Higher productivity means that the same volume of output can be achieved with smaller inputs, and less natural resources are thus needed.

2 In principle total factor productivity, or the ratio of production to the total volume of labour and capital inputs, is a more ideal indicator for a country's prosperity and thus long-term competitiveness. This is because labour productivity can be increased by saving and investing, in other words by reducing consumption.

3 Krugman (1994a)

technological development is assumed to be exogenous (having an external cause), and 2) in the theory of innovation-based growth, in which technological development is assumed to be endogenous (having an internal cause).

In an analysis based on the neoclassical growth theory, growth in labour productivity is examined empirically using the so-called growth accounting. Suitable data for these calculations include macro statistics, which are obtained from such sources as national accounts data prepared by national statistical offices, whereas detailed business statistics data sets are typically used in empirical applications of innovation-based growth theory.

3.3.1 Neoclassical growth theory and macro factors of labour productivity

The exogenous growth theory and empirical growth accounting underpinned by it have long traditions. Their roots can be traced at least as far back as the works of Robert Solow, who was awarded the Nobel Prize in Economic Sciences (1956), and Trevor Swan (1956). Olavi Niitamo (1958) also did ground-breaking work in this field of research. The factors of labour productivity are sought at the 'macro level'. According to this theory, growth in labour productivity is caused by three main factors:

1. **Growth in capital intensity (capital/working hours).** The idea is that the more machines, equipment and other capital an employee has available for them, the more output they will achieve per hour.
2. **Change in the quality of labour input.** The more skilled the employee is, the more output they will achieve in an hour.
3. **Total factor productivity (output/total labour and capital inputs).** This is a residual term of the growth accounting. It concerns the part of growth in labour productivity that cannot be explained by changes in capital intensity and the quality of labour input. As total factor productivity increases, more output can be achieved with the same quantity and quality of labour and capital inputs. The change in total productivity is often also used as an indicator of technological change. Since total factor productivity is measured as a residual term, technology should be understood in a very broad sense in this context. Among other things, it includes the organisation of labour and production, which further depend on such factors as the quality of management (Bloom et al. 2017).

Growth accounting is a useful tool for measuring some interesting features of labour productivity trends. The underpinning neoclassical theory and empirical calculations indicate that in the long term, roughly two thirds of the growth in labour productivity

can be explained by growth in total factor productivity (Aghion and Howitt 2007). This theoretical framework suggests that in economic policy, attention should be paid to factors that affect the growth of technological development, in other words total factor productivity.

On the other hand, the limitations of the method should be kept in mind when making interpretations. Its basic assumption is that technological development is determined by external factors, competition is perfect, all firms are the same, firms never have extra profits, and firms do not innovate. We can consequently say that this approach is not very productive when the aim is to consider such interesting economic policy issues as innovation, competition and entrepreneurship policies.

The growth accounting approach also assigns a narrower role to education policy than what it deserves. According to this theoretical framework, education policy can affect the productivity of labour by improving the quality of working hours, whereas empirical growth calculations indicate that this impact is relatively minor. However, this line of thinking does not factor in the possibility that the skills of the labour force could also affect the productivity of innovation activities in firms and thus growth in total factor productivity and labour productivity in the national economy (Benhabib and Spiegel 1994). This question is important when we consider the volume and significance of education inputs, for example from the perspective of innovation policy and long-term economic growth.

To examine how competition, entrepreneurship, innovation and education affect the long-term competitiveness of the national economy, a different theoretical framework and empirical tool for measuring labour productivity would be needed. These tools are offered by the theory of endogenous innovation-based growth as well as micro decompositions of labour productivity based on corporation-level data sets linked to this theory.

3.3.2 Theory of innovation-based growth and macro factors of labour productivity

The theory of innovation-based growth draws attention to the fact that the development of labour productivity in a national economy is largely based on research and development carried out by firms, through which firms strive to increase the efficiency of their processes and improve the quality of their products, thus increasing their productivity. A firm also needs to innovate in order to exploit productively technologies developed by others (Aghion and Jaravel 2015).

The basic idea of the models is simple. Firms are striving to innovate. When successful, they have exclusive rights to the new technology they have developed for a while and thus achieve better productivity and higher profits than their competitors. It was the potential of making a profit that provided them with the incentive to launch innovation activities to begin with.

Only some firms are striving to innovate. As innovation activities are uncertain, only some of these innovation inputs are productive. The result is an increase in the productivity distribution between firms in the national economy. However, competition in the product market also leads to selectivity and reallocation of resources between firms. In the meantime, jobs are created in some companies and lost in others within the branches (see Figure 3.2, bottom left corner). As firms survive or go under and resources are reallocated, this leads to a reduction in the productivity distribution between firms. It also leads to changes in company and job structures in the national economy, or creative destruction (Foster et al. 2019).[4]

Consequently, the theory of innovation-based growth advocates paying attention to the prerequisites of and incentives for firms' innovation activities. In an empirical analysis of productivity growth, it is useful to note the extent to which productivity growth observed at the level of the national economy or a branch is due to increased productivity within firms operating in the market.

The theory explains why attention should be paid to competition policy when the objective of economic policy is to improve the long-term competitiveness of the national economy, in other words productivity. Competition can encourage firms to innovate as well as speed up changes in corporation and workplace structures that increase productivity in the national economy and branches. To analyse this question empirically, firm level data and micro decomposition methods of productivity are needed (Bartelsman and Doms 2000; Balk 2016).

In addition to incentives, firms need prerequisites for successful innovation activities. As Figure 3.2 shows, by investing in education and innovation policy, the government can promote innovation activities and productivity growth in firms, in other words the long-term competitiveness of the national economy.

4 Maliranta (2005) proposes an empirical analysis of the links that connect R&D, productivity differences between companies and creative destruction as well as the delays associated with them in the export sectors of Finnish industry.

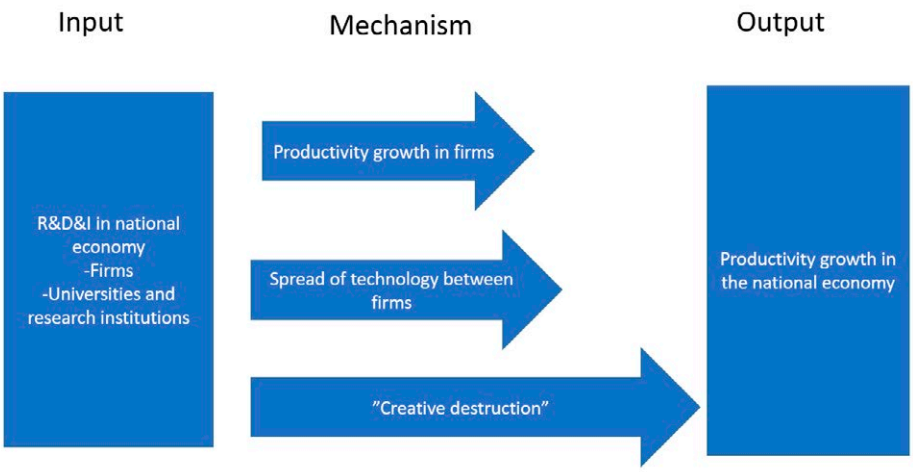
3.4 Factors, mechanisms and delays of productivity growth and economic policy

3.4.1 Productivity growth mechanisms

Productivity is not without significance in the short term, as it is one of the components of cost competitiveness. It is, however, the crucial factor in the long term, as improvement in the standard of living is based on productivity growth, which in turn is underpinned by technological development. In order to develop technologies, investments in research, development and innovation (R&D) are made by firms as well as universities and research institutes. Together they add up to an 'innovation ecosystem' (Arora et al. 2020).

R&D inputs and the operation of the innovation ecosystem influence productivity growth in the national economy through the mechanisms shown in Figure 3.3. Identifying these mechanisms is useful for two reasons. It helps to assess the significance of *complementary policy actions* and *delays in policy actions*. When assessing the status of productivity development and making economic policy recommendations, these aspects warrant attention.

Figure 3.3. Investments in productivity and the mechanism of their impacts.



The clearest mechanism, which is also the easiest to identify and examine, is the impact of a firm's internal R&D investments on its productivity growth. Transfers of technological knowledge from firm to firm are an interesting mechanism from the perspective of innovation policy. The social returns on an individual firm's R&D investments, or

benefits for the national economy, may be higher than the profits the firm reaps from this input, for example because the new technological knowledge generated through the input may spread to other firms and also increase their productivity. The third mechanism which improves the productivity of the national economy is the reallocation of resources betweenfirms, or 'creative destruction'. R&D inputs lead to improvement in the productivity of some firms and, consequently, increase the productivity distribution between firms. Some of the productivity growth in the national economy stems from the fact that labour and other resources move from firms with lower profitability to corporations whose productivity has been improved by innovations (Maliranta 2005; Maliranta and Määttänen 2014; Foster et al. 2019).

3.4.2 Productivity growth mechanisms and policy measures that complement innovation policy

When aiming for strong productivity growth, it is important to assess which policy measures can be used to strengthen the productivity impacts of R&D inputs. The following sections take a closer look at education, funding and well-functioning markets.

3.4.2.1 Education policy

A firm's R&D inputs produce new technological knowledge for it. This offers the firm opportunities to increase its output in proportion to the amount of inputs it uses, in other words to improve its productivity. Fundamentally, this is less about money than the real resources allocated to research, development and innovation. The most crucial one of them often is labour. The demand for educated labour force increases when a firm develops or deploys new technologies (Bartel and Lichtenberg 1987). An analysis based on Finnish corporation and establishment (local unit of a corporation) data shows that increasing the labour force's level of education accelerates the productivity growth of the firm or firm's establishment.

However, the direct effect is weak or even negative. The most obvious example is that of a firm recruiting employees with a high level of education in the technical or natural sciences field (Maliranta 2003; Daveri and Maliranta 2007). The results indicate that recruiting employees for R&D roles is an investment the firm makes for the years to come, and when successful, its results are seen as accelerated growth in productivity in later years.

In other words, education policy does affect productivity. This is not merely a question of upskilling the labour force in order to improve the quality of the labour input, thus increasing the output volume in relation to the hours worked. It is likely that technological

advancement is a more important channel through which the impacts of education policy are realised (see Figure 3.2). Public authorities' research and development inputs do not necessarily increase the real R&D inputs of the national economy if there is a shortage of skilled labour, in which case the government's inputs may mainly improve the wages of these highly skilled employees. Consequently, education policy can play an important role in complementing government R&D inputs. It is possible that the highest productivity impact is achieved when both types of inputs are increased.

Technological knowledge does typically not take the form of formulas that can be easily adopted. In order for low-productivity firms to successfully deploy technologies developed elsewhere, skilled labour is needed (Berlingieri et al. 2020), and as we noted above, often also a firm's internal innovations (Aghion and Jaravel 2015). Education policy can thus promote transfers of technological knowledge between firms, also strengthening productivity growth in the national economy through this mechanism.

3.4.2.2 Funding of R&D inputs

In addition to skilled labour, firms need funding for their R&D inputs. A well-functioning financial market has been found an important precondition for innovations (Aghion et al. 2013). As capital markets do not function perfectly in all situations, projects may have to be carried out on a smaller scale than what would be optimal for the firm concerned and the national economy as a whole (Einiö et al. 2013). The most direct and often the most effective way to improve the situation would be boosting the efficiency of the financial market. Supporting firms' R&D activities by means of grants, interest subsidies, loans, equity funding, tax exemptions or other arrangements involving financial assistance can be used as complementary measures (Ministry of Economic Affairs and Employment 2017).

The situation of SMEs in Finland has been at least reasonably good regarding the availability of funding. In 2011–2013, 87% of SMEs reported in an ECB survey that they had been able to access the funding they needed either fully or almost fully (Hyytinen 2013). The latest ECB statistics confirm the view that even today, access to finance is a key obstacle to growth for few Finnish SMEs. In the light of statistics, Finland is one of the best eurozone countries in terms of access to funding. It is interesting to note that based on these survey findings, the availability of skilled personnel and managers is perceived as a more substantial obstacle to growth by Finnish SMEs (European Central Bank 2019). The finding suggests that from the perspective of economic growth and increased productivity, investing in the availability of skilled personnel has more potential than improving the availability of funding.

3.4.2.3 Competition in the product market

Access to funding and skilled labour are important prerequisites for successful innovation activities in firms, but firms also need *innovation incentives*. While increasing competition and opening up markets may force firms to innovate, they also open up opportunities for financially profitable business for firms that are successful innovators (Aghion et al. 2018). Expansion of markets offers preconditions for firm level changes in corporation structures that improve the citizens' wellbeing in the national economy (Baqaee and Farhi 2020). When successful, competition and regulation policies accelerate productivity growth in the national economy through the first and third mechanism; in other words, they accelerate productivity growth within firms and promote creative destruction among them. The second mechanism, or transfer of knowledge between firms, often reduces firms' incentives for investing in their internal R&D activities.

3.4.3 Mechanisms and delays of productivity growth

We have seen how R&D inputs affect productivity through various mechanisms. These mechanisms are associated with a wide range of delays that should be taken into account in economic policy. Impatience may lead to hasty decisions and erroneous conclusions about the nature of the economy's problems, the effectiveness of the actions taken and the need for new actions. By reducing unnecessary delays in productivity impacts, the productivity of the national economy can be increased. The shorter the delays affecting productivity impacts, the more firms will use the latest technological knowledge productively, and the higher the level of productivity in the national economy will be.

3.4.3.1 Productivity growth in firms

All of the impact mechanisms of productivity discussed above have their delays. Firstly, it inevitably takes time for a firm to generate new technological knowledge, especially in case of a major breakthrough. For example, an analysis of French corporate data by Aghion et al. (2018) indicates that when innovation incentives offered to firms improve, it takes three to five years before this is reflected in patent numbers. Secondly, it may also take time before the impacts of new technological know-how can be seen not only in patent registers but also in a firm's productivity. In order for the productivity impact to be realised, the new technology must be deployed in the firm's production, which may require investments in machinery and equipment, recruitment of new employees, reorganisation of work and production, marketing, etc.

It is, of course, likely that these delays depend on the situation. An econometric analysis conducted by Ali-Yrkkö and Maliranta (2006) with Finnish corporate data indicates that it often takes four years before the long-term impacts of R&D inputs can be seen fully in

a firm's productivity. As we noted above, a firm's R&D inputs or the deployment of new technologies are strongly linked to the volume of highly educated labour force. This is consistent with such findings as the observation based on Finnish industrial establishment data sets, according to which an increase in the volume of highly educated labour force is still clearly reflected as accelerated growth in the establishment's productivity five years later (Maliranta 2003).

We can conclude that R&D inputs are a long-term investment for a firm. However, its impacts on enhancing productivity can only be seen with a delay which may well amount to half a decade. To make these investments, firms need highly educated and skilled labour force.

3.4.3.2 Spread of knowledge between firms

The delay in productivity impacts achieved through spread of knowledge between firms can be expected to be even longer than the one discussed above: in addition to the time required to generate technological knowledge in the original source, it also takes time to transfer it to other firms and for these firms to adopt it in a way that enhances productivity. The possibility that the delays in productivity impacts created by knowledge transfers can be significant and make it difficult to assess the social returns on public R&D investments is not a new idea. This viewpoint was already emphasised by Professor Zvi Griliches (1957, 1958). Knowledge that improves productivity is transferred from firm to firm through employee turnover, among other things (Moen 2000; Maliranta et al. 2009; Stoyanov and Zubanov 2012), but such mobility takes time even when no institutional rigidities are present in the labour market (Mortensen and Pissarides 1994).

The spread of new technologies indeed takes place slowly. Comin and Hobijn (2010) analysed the spread of 15 technologies in 166 countries over two centuries. Their findings indicate that on average, it takes 45 years before a new technology has been deployed in a national economy. There are significant variations, however, not only between different technologies but also between countries. According to their calculations, the differences in the deployment of technologies between countries account for 25% of the differences in their standards of living. The factors affecting the speed at which a technology is deployed have an extremely large impact on the productivity and standard of living of a national economy.

3.4.3.3 Creative destruction

The productivity impacts of R&D inputs which materialise through the mechanism of creative destruction may be a series of events with a particularly long time span. Not all firms manage to increase their productivity with the help of larger R&D inputs, as a result

of which the productivity distribution between firms grows (Maliranta 2005). Foster et al. (2019) even use the distribution in productivity growth between firms as an indirect indicator for the proliferation of innovation activity. There obviously is a significant delay between innovation inputs and the increase in productivity distribution, however. As noted above, it takes a few years before increased R&D inputs generate new technological knowledge. And even after that, it probably takes a significant amount of time before the new technological knowledge can be productively deployed in firms. Based on an analysis of Finnish data produced by Ali-Yrkkö and Maliranta (2006), the time it takes before increased R&D inputs can be seen as greater productivity distribution between firms is several years.

It then takes even more time before the growth in the productivity distribution driven by innovation activities can be seen as accelerating productivity growth in different branches. In addition to innovation and increased productivity distribution, technological renewal is also associated with accelerating dynamics at corporate and workplace levels, especially in the form of market entry of new firms and the exit of old ones (Bartelsman et al. 2016). An analysis of US data conducted by Foster et al. (2019) shows that following the market entry of new firms and increase in the productivity distribution, it may take almost a decade before the dynamics accelerated by innovation activities can be seen as productivity growth in the branches. As expected, the analysis highlights this dynamics particularly in high-tech branches with the most intensive innovation activities.

Finnish corporate and establishment data sets offer better opportunities than American data to study in detail the dynamics of productivity at corporation level, the mechanisms associated with it as well as the delays. Hyytinen and Maliranta (2013) argue that it takes at minimum 10 to 15 years before new firms start having any impact on productivity at the level of an individual branch.

Firstly, the *selection phase* takes time. New firms are on average less productive than those already operating in the market. Typically, these are the least productive firms which have not managed to improve their productivity through *learning*. Following an initial drop, the branch's productivity begins to increase as new low-productivity firms start to leave the market: low-productivity jobs are lost in young firms. This selection process takes place gradually and progresses strongly for the first five years.

This mechanism also includes the *reallocation* of resources (labour) to successful young firms. Those new firms that survive in the market hire new labour, in other words create new high-productivity jobs, thus increasing the productivity of their branch.

The results indicate that the mechanism of creative destruction is the strongest, and the delay is the longest, in high-tech industry. While the mechanism is weaker in private services, the delay associated with it is also shorter in these branches.

3.4.4 Mechanisms of productivity growth and economic crises

3.4.4.1 Productivity growth in firms

As the analysis contained in the Finnish Productivity Board's 2019 report shows, the immediate short-term impact of a recession on productivity growth in firms is strongly negative (see Table 6.1). It is even more negative than at the level of branches or the national economy as, at the start of the recession, low-productivity firms reduce their staff numbers more than high-productivity corporations, thus mitigating the decline in average productivity. The measured productivity of firms drops because, when demand declines, they do not reduce their labour force in the same proportion. The reason for this may be labour market rigidity or the employer's reluctance to dismiss their employees, as the firm incurs costs from recruiting new employees once recovery is underway.

In an economic crisis, the recession becomes prolonged and firms begin to adjust their operations. They start laying off their underused labour force, and their measured productivity begins to increase. A more constrained economic situation can force firms to reorganise their operations and improve their efficiency, which may even bring their productivity up to a level higher than the trend line. Firms are forced to operate at a lower output level, on the other hand, which means that some economies of scale may be lost.

During a recession, firms reduce their labour force, which is why more capital is available per working hour, at least in principle. This does not necessarily increase productivity per working hour, however. Investments are reduced during a recession, too. Investments are also needed to deploy new technologies, which means that lower investments can have a negative impact on labour productivity. Redundancies increase unemployment, which erodes the skills of the labour force. This may have long-lasting negative effects on labour productivity in firms. The decline in firms' organisational capital during a recession has similar effects. Especially in times of deep and prolonged recessions, value chains between firms may sustain damage that has long-term negative impacts on firms' productivity.

Firms also often reduce their R&D inputs during a recession (Barlevy 2007). This can be expected to have negative long-term effects on productivity growth in firms, as the volume of new technological know-how they create is reduced, and their ability to adopt technological know-how generated elsewhere for their own use declines.

While a recession consequently has a negative impact on the productivity of firms in the short term, it is not quite clear how a prolonged recession or economic crisis affects productivity in the long term. These impacts are likely to depend on the situation. Once the 1990s recession had started, productivity development in Finnish industrial firms returned to its earlier trend line relatively soon, and in this case the economic crisis did thus not appear to have either positive or negative long-term effects on productivity growth in firms (Maliranta et al. 2010). In this respect, the development since the financial crisis of 2008 appears to be different.

3.4.4.2 Spread of knowledge between firms

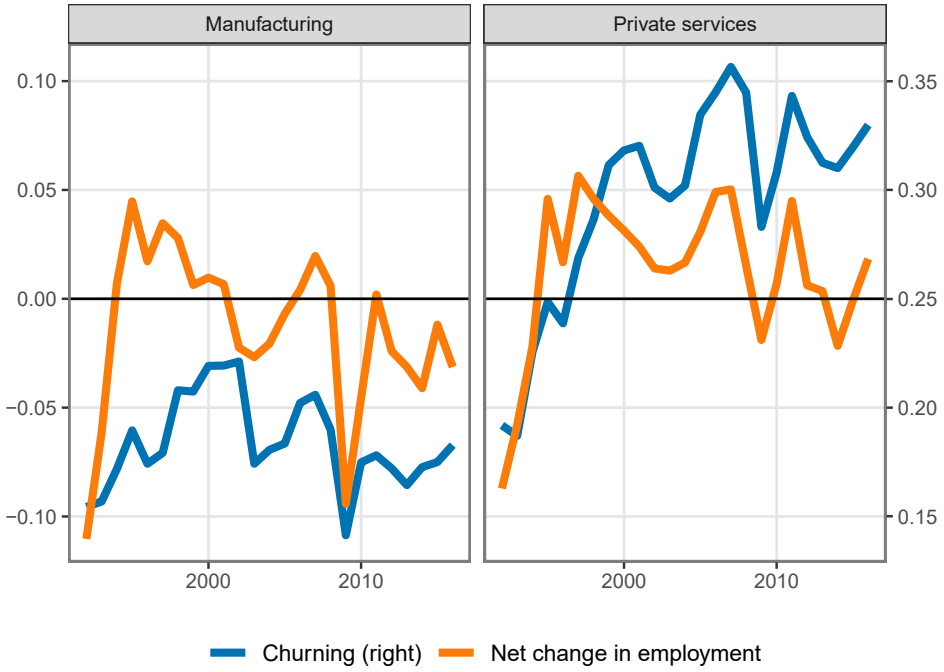
As R&D inputs are reduced during recessions and as they are also used to deploy new technologies (Cohen and Levinthal 1989; Griffith et al. 2003), the spread of technologies in an economy can also be expected to slow down during downturns. Anzoategui et al. (2019) provide empirical evidence of this using data from both the United States and the United Kingdom.

Labour force mobility between firms or establishments is one of the mechanisms through which technological knowledge and productivity impacts spread in the economy. The mobility of the labour force can be measured by an indicator of labour turnover, which describes the simultaneous influx and outflux of employees in firms or establishments.5

Figure 3.4 shows the influx and outflux rates in manufacturing and private services calculated by combining workplace and employee data from 1992–2016 (scale on the right). The figure also shows the rate of net change in jobs. We see that the variations in these rates follow each other quite closely; in other words, the effect is strongly pro-cyclical. This means that employee turnover in establishments decreases during a recession. The finding suggests that the spread of technological knowledge with employees slows down during a recession. This can be expected to have a negative effect on the development of productivity in the national economy (Moen 2000; Maliranta et al. 2009; Stoyanov and Zubanov 2012). The figure shows that while staff turnover in industrial establishments has decreased in the long term, the opposite is true for private services. This may have a positive impact on the growth of productivity in private services in the longer term.

5 More specifically, this indicator is calculated by adding the employees' influx and outflux rates together and subtracting from this figure the sum of job creation and loss rates (Ilmakunnas and Maliranta 2008).

Figure 3.4. Net change in employment (left scale) and employee turnover in establishments (right scale)



Source: Authors' calculations based on Statistics Finland's combined employee and employer data

3.4.4.3 Creative destruction

It is often mistakenly thought that recessions or crises have a positive impact on changes in corporation and workplace structures that strengthen productivity in the economy. It is true that in times of a recession or economic crisis, low-productivity firms and establishments reduce their staff more than their more profitable counterparts, thus decreasing the share of such firms and increasing average productivity. However, this is not about creative destruction from the viewpoint of prosperity. As part of creative destruction, labour is reallocated from low-productivity to high-productivity firms (Baqaee and Farhi 2020). Analyses indicate that recessions have a negative cumulative effect on the reallocation of labour (Caballero and Hammour 2005).

The crisis caused by the coronavirus pandemic treats different branches and firms asymmetrically. Profitable firms with strong balance sheets and firms whose purchasing, production and distribution practices are not greatly affected by the virus or the measures put in place to contain it are the best placed to cope with the recession. Young firms, firms with weak balance sheets (such as small firms specialising in immaterial operations) and firms that are strongly affected by the virus or the measures taken to contain it are the worst hit by the recession. It seems that the most productive, dynamic and innovative

firms are no more likely to survive the crisis than the others (Arrighetti et al., 2015). Young, growth-oriented firms play a key role in terms of productivity development. They also create the greatest numbers of new jobs (Adelino et al., 2017; Haltiwanger et al., 2013).

3.5 Trends in factors of productivity growth in Finland and other developed countries

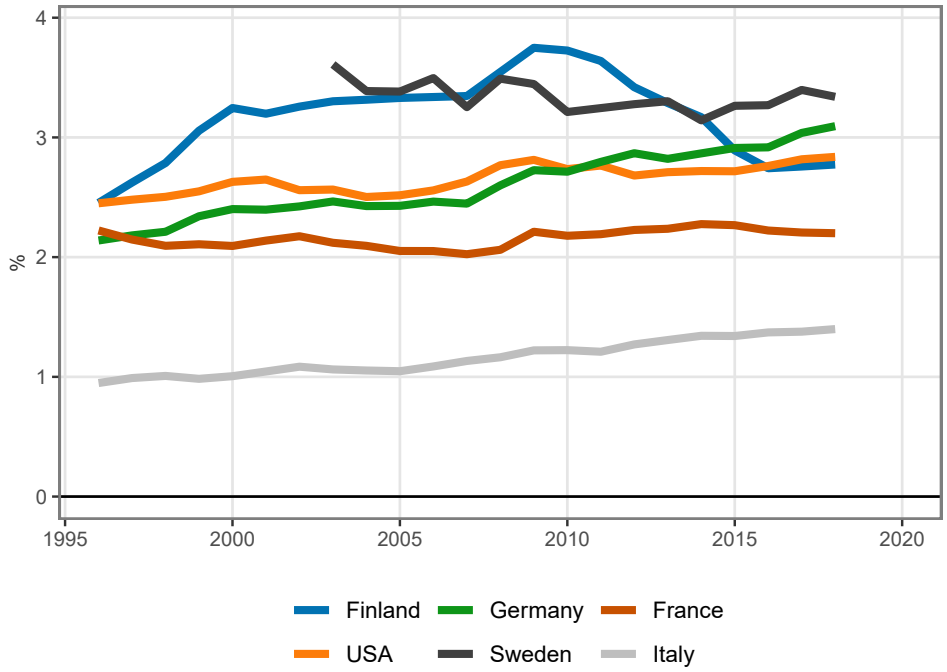
As the analyses produced by the Finnish Productivity Board in 2019 and 2020 show, productivity growth has been slowing down significantly for more than a decade in Finland and most other developed countries. Before making economic policy conclusions, it would be important to understand the key factors behind the stagnant productivity growth, not only in Finland but also in other developed countries, as Finland's productivity development is strongly linked to technological advancement in these countries. In the United States, the trend of slower productivity was seen several years before the 2008 financial crisis; consequently, at least in the US, the financial crisis does not appear to explain the stagnant productivity growth (Fernald 2015). Neither does it seem that biases or shortcomings related to measuring production could explain the lower productivity growth figures. (Byrne et al. 2016; Syverson 2017).

As Fernald (2015) notes, the stagnating productivity growth seen in the United States in the early 2000s has mainly affected those sectors in which ICT is either produced or used intensively. These are the very areas in which productivity growth had accelerated in the mid-1990s. This observation indicates the direction in which the reasons for the slower productivity growth should be sought.

3.5.1 Development of R&D inputs

As Figure 3.5 shows, research and development inputs (R&D) in relation to GDP have grown in most developed countries. Both the volume of inputs and the trend vary significantly between countries, however. The development in Finland has been remarkably weak since 2009. While Finland's R&D expenditure as a percentage of GDP was one of the best in the world as lately as 2009, by 2018 Finland had fallen behind Sweden and Germany to roughly the same level as the United States, however still staying above the OECD average.

Figure 3.5. R&D inputs as a percentage of GDP

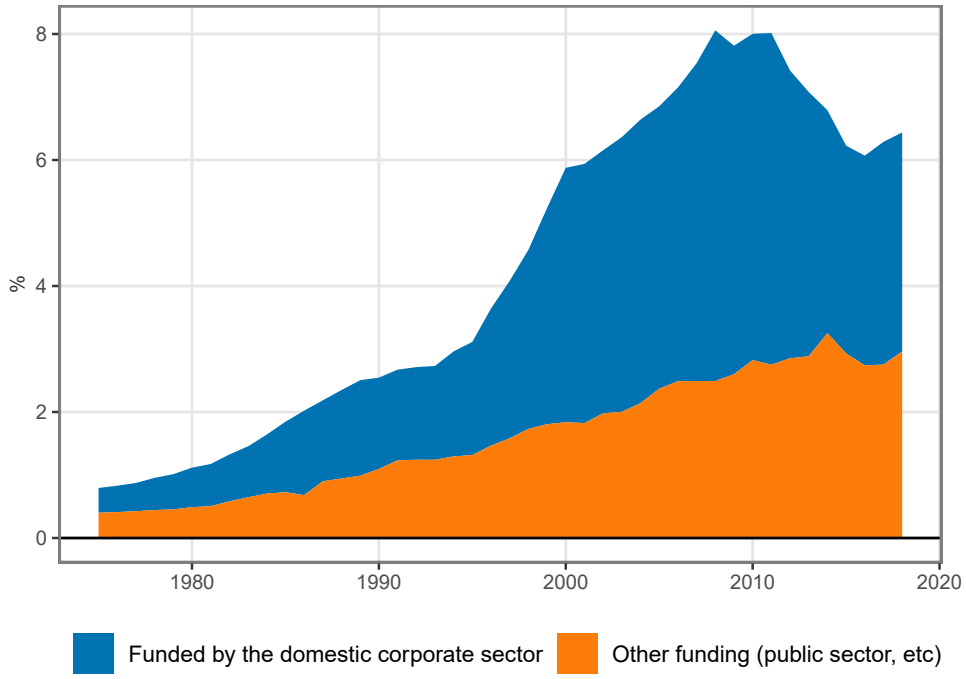


Source: World Bank

As Figure 3.6 shows, especially domestic firms in Finland have strongly reduced their R&D inputs in real terms. In 2008–2018 the real, or inflation-adjusted6, R&D funding of Finnish firms dropped by 38%, whereas the real R&D inputs of other funding providers increased by 19% in the same period. The R&D inputs in the Finnish corporate sector are primarily based on domestic firms' internal financing. While the internal R&D financing of domestic firms accounted for 90% of the R&D inputs in the corporate sector in 2008, this ratio had fallen to 80% by 2018.

6 Here, the GDP price index was used as the deflator.

Figure 3.6. Funding of research and development expenditure, EUR billion, at 2018 prices

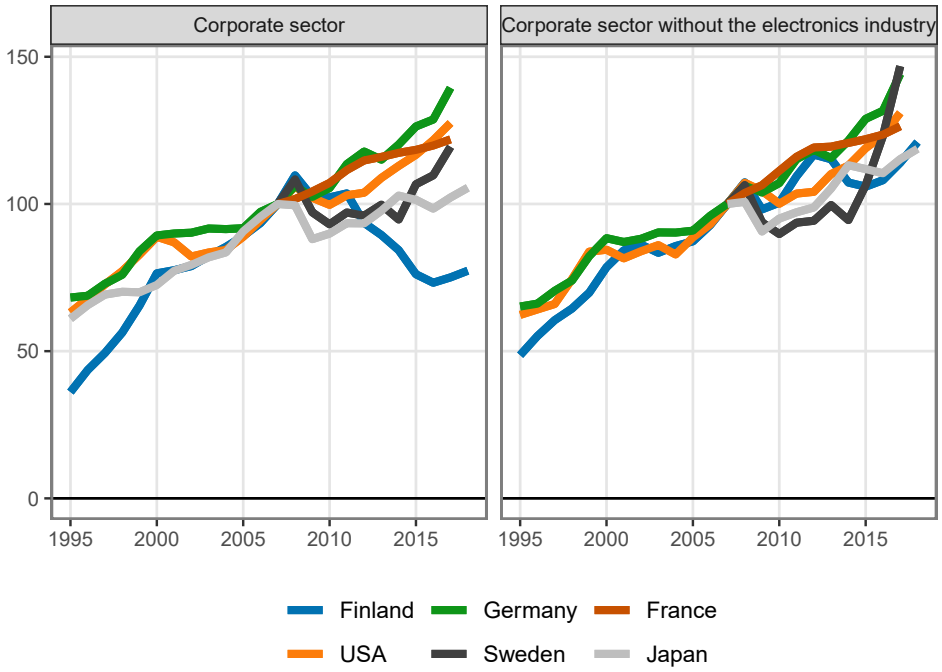


Source: Statistics Finland

Whereas the other funding providers (public sector, the EU, etc.) have increased their real inputs in the Finnish corporate sector's R&D activities by 37% between 2008 and 2018, the real R&D inputs of the Finnish corporate sector have gone down by 23% in the same period. On the other hand, public and private funding are not necessarily independent of each other. It is possible that an increase in public funding at least partly takes the place of private funding. As we can see in the left-hand side of Figure 3.7, the reduction in real R&D expenditure has been extremely large, especially when compared to many other major developed countries.

The strong reduction in real R&D inputs in the Finnish corporate sector is thus explained by the collapse in the electronics industry, which in turn reflects Nokia's difficulties. This can be clearly seen when the entire corporate sector (left side of Figure 3.7) is compared to the corporate sector excluding the electronics industry (right side of Figure 3.7). The latter shows a 21% increase in R&D inputs between 2008 and 2018. Even in this case, however, the development was considerably weaker than in such countries as Sweden or Germany, somewhat weaker than in the United States and France, and within the same range as in Japan.

Figure 3.7. Real R&D expenditure, 2007 = 100.



Source: OECD (Anberd database) and Statistics Finland (Finnish data from 2018)

Consequently, there has been an exceptionally drastic drop in the research and development inputs in Finland. This drop is mainly explained by a negative shock which affected a single sector (the electronics industry), however, rather than by a significant cut in public funding or a sharp reduction in the R&D inputs of firms in other branches. When we look at the other branches as a whole, R&D inputs have increased significantly in real terms from their 2008 level, especially in recent years. This, however, has also been the case in many other developed countries.

It is understandable that after a significant negative shock, it takes time before the reduced R&D inputs start growing strongly again. As the Finnish Productivity Board noted in its 2019 report, a drastic structural change has taken place in the R&D activities of the Finnish corporate sector. Stronger growth has been delayed because R&D resources must be reallocated between firms and branches. R&D is an activity with a long time span. A gradual growth in inputs in new branches appears logical. What may have slowed down the increase in R&D inputs in Finland is the recession of 2012–2015, as firms' R&D inputs typically vary pro-cyclically (Basu 1996; Anzoategui et al. 2019).

As we noted above, it is useful from the perspective of productivity growth in the national economy that new technological knowledge generated through R&D inputs is spread effectively between firms. There is no evidence, or at least no clear evidence, however, to indicate that the spread of technological knowledge in such countries as the United States has slowed down; the opposite may perhaps be true (Lucking et al. 2019; Arora et al. 2020), albeit research evidence regarding the trend in knowledge transfers is partly contradictory (ks. Andrews et al. 2015). As such, the spread of knowledge to other firms reduces the firm's incentives to invest in its R&D activities. As we noted before, however, research and development inputs have grown in several major developed countries in this millennium. This has also happened in Finland if we exclude the electronics industry, which encountered a strong negative shock. Consequently, the stagnating productivity growth in developed countries or in Finland cannot be explained by reduced R&D inputs when we factor in the shock that hit the electronics industry.

Bloom et al. (2020) suggest as the reason for the slower productivity growth the fact that coming up with innovations is increasingly difficult. More R&D inputs are constantly needed to maintain the same rate of productivity growth.7 While the inputs have grown in many industrialised countries, this increase has not been sufficient to maintain the previous rate of productivity growth. At least to some extent, this is consistent with the previous observation of productivity growth in the United States having slowed down above all in those sectors that produce or use ICT intensively, and of productivity growth in these sectors having accelerated in the 1990s. This suggests that the productivity potential within easy reach associated with this general-purpose technology has been used up, at least for the time being. In other words, the productivity of R&D activities has declined. This phenomenon applies to all developed countries across the globe.

3.5.2 Business dynamics

As we noted above, the change in business and job structures is an important mechanism through which R&D inputs in a national economy turn into productivity growth – possibly with a significant delay. There is evidence to indicate that in the United States, for example, the dynamics of business and job structures, which are important for productivity growth, have been stagnant throughout this century (Decker et al. 2018). Young firms play a particularly important role in this dynamics. They create more jobs than small, new or old firms (Haltiwanger et al. 2013; Haltiwanger et al. 2017). Young firms and their dynamics are important from the perspective of cyclical development, as they have a significant impact on how quickly the national economy recovers from a recession

7 See e.g. https://www.stat.fi/artikkelit/2012/art_2012-09-12_003.html?s=0.

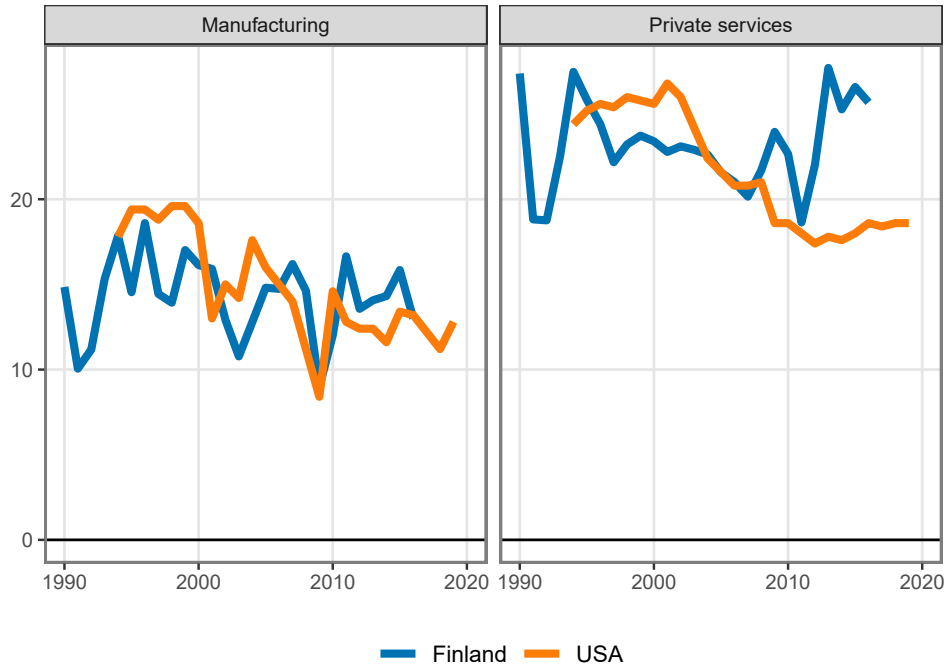
caused by a macroeconomic shock (Clementi and Palazzo 2016). From the viewpoint of long-term productivity growth, on the other hand, young firms are important because they have a significant impact on changes in businessand job structures that strengthen the productivity of the national economy, or creative destruction (Hyytinen and Maliranta 2013).

The weakening position of young firms could explain the downwards trend in productivity growth. Signs of this can be seen in the United States, at least. In the US, however, the relative market position of young firms has been deteriorating for years. Young firms are particularly dependent on external funding. Davis and Haltiwanger (2019) provide evidence of young firms having experienced increasing difficulties in accessing external funding in the US, particularly following the housing market collapse in 2006 and the post-2008 financial crisis. Whereas banks are important providers of financing for young firms, the firms' lack of collateral for bank loans has been a growing problem.

In Figure 3.8, the renewal of job structures has been measured by the 'excess job reallocation rate', which has often been used in labour market literature as a metric for micro level job renewal.8 Based on establishment level data, separate calculations were produced for manufacturing and private services. The figure supports the observation of declining renewal in the United States discussed earlier. This appears to be true for both manufacturing and private services.

8 The excess job reallocation rate is calculated as the sum of the job creation and loss rates, from which the absolute value of net rate of change in job numbers is subtracted (Ilmakunnas and Maliranta 2008). The figures for establishments both in Finland and the United States were calculated as annual changes.

Figure 3.8. Additional job turnover as the excess job reallocation rate (%)



Source: the authors' calculations based on Statistics Finland's establishment data (Finland) and BLS (USA)

Finnish manufacturing, on the other hand, shows no obvious signs of stagnating dynamics, and in private services a significant acceleration of dynamics has even been observed in recent years. This would seem to be consistent with the fact that creative destruction appears to have even gathered momentum in Finnish private services (Finnish Productivity Board 2019, see Figure 5.4). As Figure 3.8 shows, the dynamics remained weaker in both sectors in Finland than the United States in the late 1990s. In the 2010s, on the other hand, the situation has been reversed, especially in private services.

The observation made above of Finnish SMEs having at least a reasonably good situation in terms of access to funding is also consistent with these observations. From the perspective of corporate innovation and renewal, young firms are a more interesting group than SMEs, but we can assume that roughly similar assessments would also apply to young firms.

3.5.3 Competition and regulation policy

Competition between firms and the functioning of the markets are important for productivity growth in the national economy, as they affect both the innovation incentives of firms and business dynamics. Promoting the consumers' wellbeing is the starting point of competition policy. Effective competition lowers prices, improves product quality and widens consumer choice. It can also accelerate innovation, improving citizens' and consumers' standard of living in the long term.

Philippon (2019) suggests that in the United States, competition policy has deteriorated in recent decades and argues that in the meantime, the European Union has strengthened its competition policy. The EU's competition rules and policies also lay the foundation for Finland's national competition policy.

The effectiveness of competition and functioning of markets have often been assessed on the basis of business profitability (Berry et al. 2019). High profitability may indicate a lack of competition, which pushes prices up. In this situation the consumers are the losers, whereas firms with high margins and high profitability are the winners. Business profitability has improved in Finland and in many other developed countries (De Loecker and Eeckhout 2018). In the national accounts data, this is seen as a reduced labour income share, and thus increased capital income share, in the national income.

From the perspectives of the functioning of the markets, competition, citizens' wellbeing and economic policy conclusions, however, it is important to determine to what extent the growth in business profitability at national economy or branch level is explained by a reallocation of the national economy's resources from inefficient low-profitability firms to efficient high-profitability firms.

Detailed analyses of Finnish (Kyyrä and Maliranta 2008; Böckerman and Maliranta 2012; Maliranta and Määttänen 2018) and US (Kehrig and Vincent 2018; Autor et al. 2020; De Loecker et al. 2020) business and establishment data sets indicate that reallocation due to changes in business and workplace structures have had a highly significant impact. In Finland, firm dynamics began to boost the profitability of manufacturing in the early 2000s. This applied to medium and, in particular, high technology sectors. Little or no acceleration can be discerned in low-technology industries (ks. Maliranta and Määttänen 2018, kuvio 3). When we eliminate the impact of change in business structures, we observe that it is quite typical for firms to experience a loss of profitability during their life cycle. In Finland, this has happened not only in low-technology industries but also especially in high-tech branches.

Rough firm-level profitability figures can thus give a misleading idea of how competition and the functioning of the markets have evolved. To the extent that the increase in

business profitability is due to a change in business and workplace structures, this is an indication of the creative destruction that improves productivity in the national economy. This is the third mechanism of productivity growth described in section 3.4.1. Higher productivity increases the standard of living, which can benefit consumers, employees and business owners simultaneously. When we exclude the impact of change in business structures, we note that the firm's real wages (measured in product prices) typically increase faster than labour productivity, and the firm's profitability is thus reduced (Böckerman and Maliranta 2012).

These observations indicate that competition and the market are functioning well in the dynamic sense. On the other hand, business dynamics means that some firms are constantly running into difficulty. They are forced to reduce their labour force or cease to operate altogether. Jobs are lost, and workers must find new employment elsewhere. Consequently, competition policy can increase productivity while also causing continuous turbulence in the labour market.

Profitability is thus an inadequate metric for effective competition and the functioning of the markets as it ignores business dynamics. Different indicators describing market concentration have traditionally been used to assess the level of competition in the market, the best-known one of which is likely to be the Herfindahl-Hirchman Index (HHI) (Berry et al. 2019). The problem with these indicators, too, is that their perspective is static. Indicators of concentration do not take into account the fact that while a large part of the market is concentrated to one or a few firms operating in it, these firms may face potential competitive pressure exerted by new firms, or ones that have not yet had time to grow. The definition of the market is another problem. In global competition, the boundaries of markets do not follow official branch boundaries, let alone national borders (Rossi-Hansberg et al. 2020).

When assessing the impacts on competition, however, a case-by-case examination is often needed. There are no simple answers or formulas for promoting the functioning of the market and improving consumers' position. A merger, for example, may provide a firm with opportunities to improve the efficiency of its operations in a way that can benefit not only its owners but also consumers. On the other hand, a merger may increase the firm's market power to the extent that prices go up. It is also possible that large firms that have gained a dominant position in the market can use their power to close down their competitors (Shapiro 2019).

By using detailed (product and firm level) data and econometric methods, it is possible to assess the likely consequences of each situation on a case-by-case basis (ks. esim. Ribeiro and Golovanova 2020). Depending on the situation, mergers may also increase or discourage innovations (Bourreau and de Streel 2020). It is vital for competition

authorities to have sufficient powers and resources to investigate situations that may cause competition problems. This may also help prevent activities that are harmful to competition.

3.6 Conclusions and policy recommendations

Competitiveness is a multidimensional and to some extent unclear concept, which hampers economic policy debate on this topic. It is useful to distinguish between the perspectives of short-term cost competitiveness and the preconditions for long-term productivity growth. On the other hand, these two are interconnected. Looking after short-term cost competitiveness can support long-term productivity development. On the other hand, the development of a firm's productivity affects its cost competitiveness. Productivity development is the key to improving wellbeing and the standard of living, however.

Most developed countries have experienced stalling productivity growth for over a decade. In Finland, this decline has been somewhat stronger than usual. This is largely explained by the fact that Finland has experienced stronger negative shocks than other countries, most importantly the difficulties faced by Nokia and the electronics industry.

Decreasing R&D inputs are not the key to explaining the slow productivity growth in Finland. The reduced R&D inputs in the electronics industry and the decline in its productivity are both consequences of the same negative shock. When we look at the corporate sector excluding the electronics industry, R&D inputs have increased significantly between 2008 and 2018. However, this increase does not appear to be reflected as increased productivity in the same way as before. This observation is global. It seems that the productivity of R&D inputs has deteriorated, which means that the same real R&D inputs generate fewer innovations (Bloom et al. 2020). More and more R&D inputs would be needed to maintain the previous level of productivity growth.

Possible economic policy instruments include increased public R&D funding or actions that provide better R&D incentives for firms. Firms do not need R&D inputs only to generate new technological knowledge, or 'new recipes', but also to deploy technology created elsewhere in a way that improves their productivity. In a manner of speaking, R&D inputs thus have two faces (Cohen and Levinthal 1989). Consequently, R&D inputs help firms exploit the spread of technology between firms better (Aghion and Jaravel 2015).

What has been said above means that globalisation does not reduce the importance of R&D inputs; the opposite may be true. Opening up the market to international competition may increase R&D incentives for the most profitable firms but also reduce

incentives for low-productivity firms (Aghion and Howitt 2009; Aghion et al. 2018). While the national economy benefits, this results in turbulence in firms and in the labour market. To manage this turbulence, complementary policy actions are also needed, including labour and social policies.

If there is scarcity of skilled labour, increasing innovation incentives or public R&D funding will not lead to the desired increase in real R&D inputs and productivity growth (Bloom et al. 2019). This is why education policy, which can increase the number of workers skilled in R&D, is needed as a complementary factor to produce the optimal productivity impacts (Toivanen and Väänänen 2016). These impacts only materialise with a significant delay, however. As an additional measure, actions for attracting global talents to the country may be needed. They can be vital for both innovation and corporation dynamics (Kerr 2018; Bernstein et al. 2019). Consequently, immigration can help strengthen the national innovation ecosystem, which is a key prerequisite for successful innovation activities.

The attributes of a well-functioning innovation ecosystem also include effective division of labour and cooperation between firms and universities. Direct public support for large-scale technology projects, for example, in which both universities and large and small firms participate can be promoted not only by stepping up cooperation and producing new technologies but also by spreading technological knowledge in the national economy (Veugelers et al. 2009). In this sense, direct public R&D grants to universities and firms can be a more effective way of bolstering the Finnish innovation ecosystem and productive exploitation of technological knowledge than, for example, tax incentives (Bloom et al. 2019; Berlingieri et al. 2020). This impact is weakened, however, if public funding partially replaces firms' internal R&D funding. This risk is likely to be smaller when the aid is targeted at young firms.

One of the challenges associated with direct subsidies, however, is the question of how the subsidies could be allocated without influencing the direction of technological development and corporation dynamics in a way that is detrimental to productivity growth (Acemoglu et al. 2018).

Weak or weakened business dynamics also fails to explain the stagnating productivity growth in Finland. Analyses and indicators that draw on business and establishment data indicate that corporation and workplace dynamics have remained fairly strong in Finland and are not necessarily weaker than in such countries as the United States, where the dynamics has been deteriorating throughout the 2000s and appears to be linked to weaker productivity development (Decker et al. 2018).

In the United States, the explanation for the weakened dynamics has been sought in reduced access to finance for young firms. (Davis and Haltiwanger 2019). Surveys indicate,

however, that access to funding is not a major problem for SMEs in Finland (European Cental Bank 2019). On the other hand, the availability of skilled personnel and competent managers has been seen as a more significant obstacle to growth by Finnish SMEs. This observation highlights the need to pay attention to education policy and the immigration of skilled labour.

In the United States, an explanation for the weaker dynamics has also been sought in less effective competition policy (Philippon 2019). Finnish competition policy is underpinned by EU policies which, according to Philippon (2019), have developed more favourably than in the US. However, vigilant supervision of cartels, mergers and public procurement is needed, and regulation should be developed to improve the functioning of the market in different branches. Finland is a small and sparsely populated country. In the local domestic market, in particular, there is a risk of some firms gaining a dominant position. In addition to pushing up prices, this can reduce innovations vital for productivity growth and put the brakes on firm dynamics. Lack of competition may also have a negative effect on employment (Nicoletti and Scarpetta 2005).

Consequently, the basic preconditions for productivity development in Finland appear to be better than what a superficial examination would indicate. R&D inputs as a percentage of GDP remain at a high level by international standards. If we exclude the electronics industry, the real R&D inputs in the corporate sector have been clearly growing. A structural change of R&D inputs is underway in Finland, and this process can be expected to be gradual and have a long time span.

But if the basic preconditions are there, why has Finland's productivity developed so weakly? As we have noted, this problem also affects other developed countries. It appears that the most significant potential of the ICT transformation of the 1990s has been used up for now (Fernald 2015).9 To achieve the same volume of innovation and productivity development, more R&D inputs are needed. The productivity impacts of these inputs materialise through different mechanisms, and significant delays are associated with all of them. As discussed, they can take up to over a decade to materialise.

Consequently, it may be premature to say whether the 'Finnish innovation and productivity machine' is somehow out of order. While productivity development has been weak for a long time, it is likely that public inputs in universities' and firms' R&D activities should be increased. Rather than being reduced by the economic crisis caused by the coronavirus pandemic, the need for these investments is made more urgent by it. In times of a recession or economic crisis, the alternative costs of R&D go down, which means that

9 See e.g. https://www.stat.fi/artikkelit/2007/art_2007-12-21_005.html?s=0

increasing such investments would be justified. In addition, when the crisis strikes deep into economic structures, there may be a particularly great need for investments aimed at renewal. However, firms' R&D expenditure typically varies pro-cyclically, which is why it falls during a recession (Archibugi et al. 2013; Anzoategui et al. 2019).

Barlevy (2007) suggests that during a recession, incentives for firms' R&D investments are reduced more than what would be beneficial for the national economy, which is a justification for increasing public R&D inputs in such times. During and after an economic crisis, the economy has a particular need for young firms, as they are vital for renewal (Adelino et al. 2017; Davis and Haltiwanger 2019). Because they lack collateral, however, they may experience particular difficulties during a crisis in obtaining funding in the private financial markets for R&D inputs, or even surviving in the market. This means that the mechanism of creative destruction, which is important for long-term productivity development, may be disrupted during a crisis (Landini 2019).

In crisis conditions, particular attention should consequently be paid to young firms' possibilities to access funding for their R&D projects. Various complementary policy actions aiming to promote the dynamics of firms and the functioning of markets are additionally needed, thus strengthening and accelerating the productivity impacts of R&D inputs in the national economy.

4 Structural long-term competitiveness in Finland

4.1 What is structural competitiveness in a national economy?

At the level of a firm, the concept of competitiveness is relatively clear. It may mean such things as a firm's ability to profitably take over a market share from its less competitive rivals. While competitive firms survive in the market, the market position of uncompetitive firms is unsustainable, and they are forced to exit the market as their expenses exceed their revenue.

At the national economy level, competitiveness is a vaguer concept. Firstly, national economies do not compete against each other. Secondly, a national economy with poor competitiveness will not cease to exist. Thirdly, there is no single definition of competitiveness. It can mean the preconditions for the national economy's external balance (export market shares, current account balance), the capacity of firms to create and maintain jobs under pressure from international competition (job creation, investments and direct investments), citizens' wellbeing (real income and happiness) or something else. Finally, the number of indicators used to measure competitiveness exceeds even the number of different interpretations given to the concept. To avoid confusion, it is important to define what competitiveness means in each context.

The main distinction concerns short-term and long-term competitiveness. Simply put, short-term competitiveness is about optimising the external and internal balance. For a more detailed discussion of short-term competitiveness, see Chapter 5. For the purposes of this report, long-term competitiveness should be thought of as maximising the citizens' standard of living and wellbeing. We could say that rather than competing with each other, countries try and outdo each other in the standard of wellbeing they can produce for their citizens.

Perhaps the earliest attempt to define the concept of structural competitiveness in more specific terms dates back to Chesnais (1986): "the strength and efficiency of a national economy's productive structure... the global efficiency of the national economy, proficient and flexible structure of its industries, the rate and pattern of capital investment, its technical infrastructure and other factors determining the "externalities", i.e. the economic,

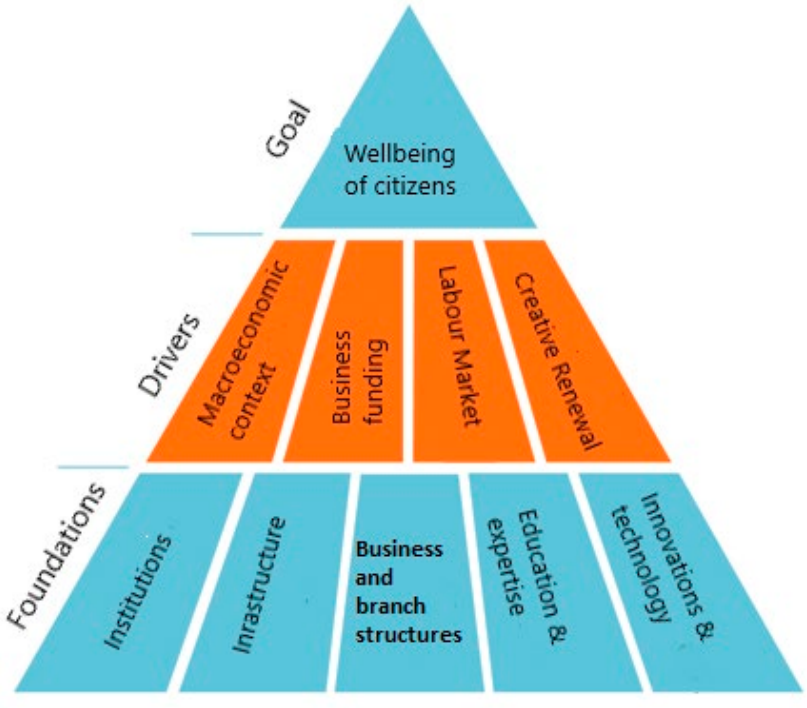
social and institutional frameworks and phenomena which can substantially stimulate or hamper both the productive and competitive thrust of domestic firms".

The externalities are the key concept here. The concept of structural competitiveness starts from the fact that firms' ability to compete effectively depends on not only their internal factors but also factors that are external to a firm operating in the economy in question. They include institutions, structures and phenomena that have a significant impact on firms' chances of success. The challenge lies in describing how this broad diversity of external forces affects domestic firms and alters their relative productivity and competitiveness. Structural competitiveness has an asymmetric impact on efficiency at domestic and sectoral levels. The problem lies in identifying the different channels through which the firms' capabilities can be improved or impaired, the interdependencies between a firm and its stakeholders can be improved, and efficient knowledge generation and value creation can either be catalysed or paralysed.

4.2 Competitiveness pyramid

As a useful way of making sense of long-term structural competitiveness in a national economy, Pajarinen et al. (2017) and Ylhäinen et al. (2020) propose a version of the competitiveness pyramid drawn up by the Irish Competitiveness Council (Ketels, 2016; National Competitiveness Council, 2018).

Figure 4.1. The competitiveness pyramid.



Source: Pajarinen et al. (2017) and Ylhäinen et al.(2020)

The highest goal at the top of the pyramid is the wellbeing of current and future citizens. The foundations of the pyramid consist of the underlying factors of competitiveness – long-term and slow-moving factors which are its essential preconditions. The drivers, which are found in the middle of the pyramid, are the most interesting category in terms of measurement and policy actions. Policy actions focusing on the drivers of competitiveness may affect the outcomes of competitiveness as quickly as within a few years. On the other hand, the ultimate impacts of interventions targeting the drivers may only be realised in the longer term.

Per capita gross domestic product (GDP) is often used as a metric of wellbeing in practice, even if we know that GDP is not a valid indicator of wellbeing. It is justified, however, as research has shown that economic growth increases the happiness of citizens. This is also true of prosperous countries (Stevenson and Wolfers, 2008; Sacks, Stevenson and Wolfers, 2011).

Extensive literature is available on wellbeing indicators that complement or replace GDP. Wellbeing is a complex phenomenon in practice and its details may be contradictory, which is why summing it up in a single indicator is difficult or, in fact, impossible. The problem is somewhat like trying to come up with a composite indicator for chalk and cheese. Choices must be made about which of the many dimensions or phenomena should be part of the indicator and how they should be weighted. Selecting the metrics and weights to be included is not easy, but these choices are inevitable when devising such indicators.

The higher the number of different phenomena included in the indicator, the more difficult it will be to interpret. This is why in indicators, too, a selection must be made of which phenomena should be included and which left out. For example, the Genuine Progress Indicator (GPI) has a strong focus on a clean environment and biodiversity, whereas it does not include a single metric describing such aspects as health. If we decided to use GPI alone as the indicator of wellbeing, we would also choose to regard sustainable development as valuable and measurable, while citizens' health would be considered unimportant in terms of wellbeing or genuine progress.

GPI also highlights another problem of measuring wellbeing, which is well known to those attempting to measure the quality of public services. As most of the phenomena included in the GPI do not have a market price, it is necessary to compose a price based on metrics describing either the use of inputs or resources or the volume of output, the market value of which must also be determined. Defining a market value for an output which does not have a market is difficult. Additionally, the inputs or resources used to produce something do not reflect its actual value or take into account changes in output quality. For example, increasing the resources used on education do not inevitably lead to an improvement in education quality.

A good example of operationalising a more extensive concept of wellbeing is given by Jones and Klenow (2016): in addition to GDP, they also look at the wellbeing impacts of consumption, leisure time, health and inequality at the level of individuals and the national economy.

When planning a policy action, there is no need to rely on such indicators; instead, policy-makers can and should strive to examine the impacts of the action on price competitiveness and productivity on the one hand, and on the environment and other factors of wellbeing on the other.

In the long term, GDP growth is essentially based on increased labour productivity. According to Krugman (1994b), competitiveness is mainly a 'poetic' expression for productivity. What about wellbeing that goes beyond the GDP? Even in a broader

examination of this type, productivity growth remains a crucial, albeit not the only, factor for promoting wellbeing.

The first report of the Finnish Productivity Board (Finnish Productivity Board, 2019) extensively examines productivity over the short and long term, in terms of demand and supply, and at micro and macro level. Rather than repeating such an examination, this Chapter discusses an alternative way of looking at long-term competitiveness, in other words the ability or potential of the national economy to increase its citizens' wellbeing.

4.3 Indicators of structural competitiveness

One line of research examines the importance of institutions, human capital and other more permanent factors for the success of the national economy (e.g. Acemoglu et al. 2003, 2005, 2019; Fagerberg et al., 2007; Hall & Jones, 1999; Jones and Romer, 2010), on which the pyramid discussed above is based. Differences in these factors, which are some of the most permanent ones, are part of the answer to the question of why, over a longer period of time, one economy has become prosperous quickly while others have remained poorer. This has sparked the idea of also comparing the competitiveness of developed countries by putting together indexes, such as those used by the International Institute for Management Development (IMD 2019) and the World Economic Forum (WEF 2019). These comparisons rank countries according to the points they score on the relevant indexes. Before we discuss the results of these comparisons, we should take a brief look at what structural competitiveness indices and comparisons measure and how.

In Finland, such comparisons have been examined by Rouvinen and Vartia (2002), Vartia and Nikinmaa (2004), Maliranta and Vihriälä (2013), Pajarinen and Rouvinen (2014), Pajarinen et al. (2017) and Ylhäinen et al. (2020). Globally, these indicators have been scrutinised critically by Lall (2001), Ochel and Röhn (2006), Berger and Bristow (2009), Delgado et al. (2012), Amaral and Salerno (2019), and Pošta and Nečadová (2019), among others. Over time, WEF and IMD have made a number of adjustments to their indexes. This is why the analyses of different years are not fully comparable and do not give a completely correct picture of the characteristics of the most recent indexes. The following concise analysis is mainly based on Ylhäinen et al. (2020).

The IMD indicator examines countries' ability to create and maintain an environment that supports the competitiveness of firms. A key idea is that the national level operating environment can either promote or hamper firms' ability to compete in the market. The index lists four main factors of the national operating environment: 1) economic performance, 2) government efficiency, 3) business efficiency, and 4) infrastructure. These main elements are each divided into five sub-factors, and the overall index thus

consists of 20 sub-factors. Each sub-factor is given the same weight of 5%, independently of the number of criteria they contain. The 'hard' variables obtained from statistical sources represent a weight of approximately two-thirds in the overall ranking, while the 'soft' variables from surveys directed at firm executives account for one third in the determination of the overall ranking.

The main problem with the IMD index is that it confuses the outcomes and sub-factors of competitiveness. Above all, this criticism concerns economic performance, which is one of the main factors of the IMD index. It should be seen as the outcome of competitiveness, rather than a sub-factor. In addition, the set of variables contains a mixture of variables indicating levels and those describing changes, both as such and measured in relative terms. The same variable may also be included several times in different forms. The problems also include 'size biased' variables, which favour large countries.

WEF links its index to the literature on growth accounting. The objective of the index is to measure the drivers of total factor productivity (TFP). Total factor productivity refers to those drivers of economic growth which cannot be explained by growth in the factors of production, or labour and capital. The index consists of four main categories: 1) enabling environment, 2) human capital, 3) markets, and 4) innovation ecosystem. Pillar 1 consists of four parts: institutions, infrastructure, ICT adoption and macroeconomic stability. Pillar 2 has two parts: health and skills. Pillar 3 includes four factors: product market, labour market, financial system and market size. Pillar 4 has two components: business dynamism and innovation capacity. The index outcomes are expressed on a scale of 0 to 100, in which the maximum value represents the ideal state. The final overall index value is the average of these 12 factors, giving each factor the weight of 1/12. The weight of survey-based 'soft' variables is 30% in the overall index.

When examining the country rankings, we should note that the confidence intervals related to the rankings in the case of each indicator may be unexpectedly large – possibly in the range of 5 to 10 places – and the results may be surprisingly sensitive to changes in the implementation or the group of respondents (Rouvinen, 2001). In addition, the disparity between the 'hard' statistical variables and 'soft' survey variables is quite apparent in places (Rouvinen, 2001; Rouvinen & Vartia, 2002); Finland came on top of the WEF ranking in the early 2000s when its development measured by GDP was modest. On the other hand, this observation can be interpreted to mean that Finland had growth potential in terms of its economic structure which, for one reason or another, was underused.

What about how well competitiveness indexes predict the future and how their correlate to current and past development? Pajarinen and Rouvinen (2014) and Ylhäinen et al. (2020) examine how the competitiveness indexes are linked to the actual level of

economic development on the one hand, and to growth on the other. They found a positive and statistically significant link between the competitiveness indexes and the current GDP per capita level. In terms of future development, the predictive power of competitiveness indicators is poor. A country's high ranking in competitiveness indexes tends to predict weak rather than good future development. When we look at growth, predictions of future development based on changes in the IMD index go in the right direction and are statistically significant, whereas no statistically significant link can be found in the case of the WEF index. There is a positive and statistically significant link between change in the indexes and current development.

The findings suggest that while a change in the competitiveness index ranking may anticipate future development, no predictive power can be observed at the level of the index value or ranking. This indicates that a major drop in the competence ranking could anticipate modest development in the next few years – and vice versa. The ability of competitiveness indexes to predict future GDP development has also been examined in other previous reports, and the consensus is that competitiveness indexes do not predict growth.

4.4 Finland's position in the competitiveness pyramid

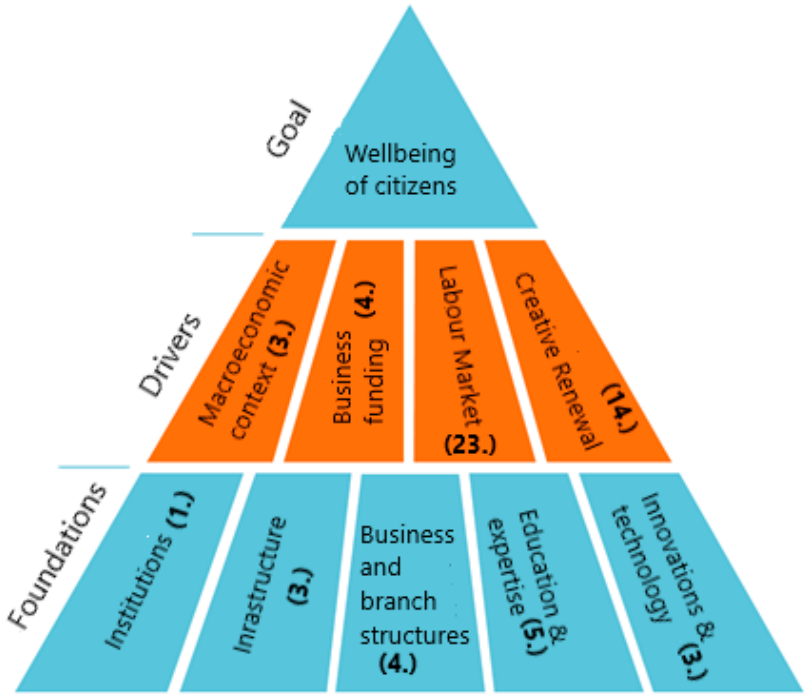
Using IMD and WEF data, Ylhäinen et al. (2020) put together a set of variables for each section of the pyramid in Figure 4.1 and shape these into a new indicator of structural competitiveness. The new competitiveness indicator streamlines the complicated index structures of the IMD and the WEF and seeks to avoid their weaknesses, such as size biased variables and confusion between sub-factors of competitiveness and outcomes. The new overall competitiveness index and its sub-indexes make it possible to compare Finland's structural competitiveness and its sub-factors to key reference countries, focusing on the dimensions of competitiveness that are relevant for Finland. In addition to describing the current state, this frame of reference allows us to examine the historical development of structural competitiveness with a consistent approach. Rather than discussing the details of the index in this report, we refer the reader to Ylhäinen et al. (2020). The leader in the overall index is Switzerland, followed by Denmark and the Netherlands. Finland ranks fourth among 38 reference countries. Sweden is in fifth place, almost even with Finland. The United States is in sixth place, Norway in seventh and Germany in 14th.

In addition to the composite competitiveness indicator, it is useful to look at indicators of the pyramid's sub-factors. Individual variables do not provide the policy-maker with a clear 'adjustment knob' which could be turned to correct any competitiveness problems. However, this frame of reference gives an indication of where the problem areas lie and what the identified strengths are, both through upper level concepts and a comparison of

variable level data. In addition, historical data sets provide comparative data concerning how the competitiveness index and its elements have developed over time.

Rather than examining the overall index, it is more interesting to look at the indexes of individual sections in Figure 6.2. In the index for institutions, Finland comes first before the Netherlands and Denmark. In the infrastructure index, Finland ranks third after Denmark and the Netherlands. In the index describing corporation and branch structures, Finland comes fourth after the Netherlands, Denmark and Switzerland. In the education and skills index, Finland ranks fifth after Switzerland, Sweden, the Netherlands and Denmark. In the innovation & technology index, Finland is in third place, bested by Switzerland and Israel. In the index measuring macroeconomic context, Finland also comes third after Ireland and Denmark. In the index on corporate finance, Finland ranks fourth. In this section, the United States makes it to the top three, along with the Netherlands and Switzerland.

Figure 4.2. Finland's rankings in the different sections of the competitiveness pyramid.



Source: Ylhäinen et al. (2020).

In the sub-index focusing on creative renewal, Finland only ranks 14th. The leading countries in this section are Denmark, Ireland and the Netherlands. In the sub-factors of this index, Finland ranks relatively highly when we examine legislation that supports the market entry of new firms. Finland's ranking is no better than average, however, when we look at understanding the need for economic and social reforms and adapting to them, the efficiency of SMEs on the international scale, the proportion of start-ups and the entrepreneurship of managers. Regarding administrative delays in setting up new firms, Finland is one of the last among the reference countries.

In the index describing the labour market, Finland ranks no higher than 23rd – with Switzerland, the United States and Denmark in the top three. Consequently, Finland falls far behind the leaders and finds itself near the bottom of the ranking when it comes to the labour market. When examining the elements of structural competitiveness, we can thus see that the labour market is Finland's most obvious weakness. Our weaknesses include a low labour market participation rate, a high share of long-term and youth unemployed, and inflexible recruitment and dismissal practices. Finland ranks particularly low when we look at flexibility in wage formation – or second last among all reference countries. If we examine the availability of skilled labour, correspondence between wages and employee productivity and the costs of dismissal, Finland does less badly but still finds itself outside the top ten.

It should be noted that the labour market index is largely based on 'soft' survey data regarding recruitment and dismissal practices, flexibility of wage formation and the availability of skilled labour. Similarly, the indicator of creative renewal is based on 'soft' survey data on entrepreneurship, flexibility and adaptability, need for reforms, adaptability of public policy, legislation that supports starting firms and the efficiency of SMEs. On the other hand, if we look exclusively at 'hard' statistical data on the labour market (including unemployment and its persistence, labour productivity, the ability of the labour market to employ workers with different levels of education), the labour market in such countries as Switzerland and Denmark appears to be performing better than its Finnish counterpart.

One lesson learned from literature on competitiveness indexes is that those seeking the highest rankings as competitive countries cannot afford to perform poorly in any area (Pajarinen & Rouvinen, 2014; IMD, 2019; WEF, 2018; Ylhäinen et al., 2020). A precondition for achieving the full growth potential would be actions focusing on Finland's bottlenecks – the labour market and creative renewal. In these areas, the highest-ranking countries perform clearly better than Finland. Reliance on 'soft' survey data reduces the interpretative power of indexes. On the other hand, Finland ranks very highly in many other dimensions of producing wellbeing but still lags behind in the productivity of labour. This suggests that in these dimensions, there are no low-hanging fruit to pick, and that the most important development targets can be found in the areas of the labour market and creative renewal.

5 Short-term cost competitiveness in Finland

5.1 Cost competitiveness and success of the national economy

While the impact of the national economy's cost competitiveness on its success is undeniable, measuring this impact is difficult. Perhaps the best way of illustrating the importance of cost competitiveness is by examining a time when the Finnish mark still was Finland's currency and devaluations caused sudden and dramatic changes in cost competitiveness. For example, once the 'period of strong mark' ended and a devaluation was carried out, the volume of exports increased by 10.4% in 1992 and 16.7% in 1993, and the strong growth of exports (on average 11.7%) continued until 2000. The only way of explaining such strong growth figures is by assuming that the growth was largely due to the devaluation of the mark in November 1991 and its floating in the following years, which increased Finland's cost competitiveness in the export market.

However, the economy's success measured by growth in exports or gross domestic product depends not only on cost competitiveness but also on export demand, the business skills of export firms' management, changes in branch structures in the destination countries of the exports and multiple other factors. Today, such sudden changes in cost competitiveness as those brought about by a devaluation no longer take place; other factors also change along with cost competitiveness, and distinguishing its impacts from the impacts of other factors is impossible in practice.

This assessment is hampered by the complexity of the links between metrics of economic success and cost competitiveness indicators. While competitiveness makes an economy more successful, a good export performance or strong GDP growth also influence labour productivity, which is reflected as changes in the most common indicators of cost competitiveness, in other words real and nominal unit labour costs. This is why the same external shocks, including changes in export demand, may affect both exports and unit labour costs. Unlike in the situation following the 1990s recession, it is not always clear today if a change in export performance, for example, is due to changes in cost competitiveness or vice versa, and their observed trends may also have a common cause.

5.2 Indicators of labour costs

Many types of cost competitiveness indicators have been proposed, and there are no clear criteria for ranking them. Table 5.1 structures the decisions that must be made when selecting an indicator. They can be divided into two types, the first one of which is the selection of a national indicator. As meaningful assessments of cost competitiveness cannot be made without comparisons between countries, choices must also be made between different comparison methods.

Table 5.1. Classification of cost competitiveness indicators

SELECTION	Options	Comment
TYPE OF (NATIONAL) INDICATOR		
Price or cost variable	Labour cost Unit labour cost General price level Export price (Nominal or real) effective exchange rate	Labour costs and unit labour costs can be calculated per employee or per working hour
Sector of the economy	Entire economy Open sector Manufacturing	
Frequency	Annual Quarterly	
Baseline year		Selecting a baseline year is necessary for comparing the levels of index figures
COMPARISON METHOD		
Reference countries	Countries at the same level of development Trading partners	Data availability restricts the choice of reference countries
Consideration of exchange rates	National currencies Common currency (e.g. euro or dollar)	

SELECTION	Options	Comment
Weights of the reference countries	Bilateral trade weights	
	Global trade weights	
	Double trade weights	
	Model-based weights	
Weighting type	Fixed	
	Variable	
Calculation of weighted average	Arithmetic average	
	Geometric average	

The most frequently used indicators of cost competitiveness in Finland are based on *labour* costs, but competitiveness could also be assessed by comparing general price levels, price levels of export products or effective exchange rates. The scrutiny could focus on the value of the indicator in the entire economy, in the open sector of the economy, in the private sector, or exclusively in manufacturing. The calculation of indicators may be based on either annual or quarterly data.

Many commonly used indicators of competitiveness – including nominal unit labour costs – are index figures by their nature. In this case, talking about the level of the indicators is not meaningful, as the results of comparisons between levels may also depend on the *baseline year* selected for the index. Nevertheless, indicators can be used to compare diverging development of competitiveness in different countries. For some indicators, including real unit labour costs, a baseline year may not be necessary, and the comparison can in principle focus equally well on the relative change in the indicator or its level. For example, real unit labour costs also depend on countries' different branch structures, however, and it is also questionable if comparing their levels is meaningful.

The simplest indicators of labour costs are compensation of employees per working hour or per head. In addition to wages, the compensation of employees includes the employer's social security contributions, and they consequently represent the actual costs incurred by the employer from the employee.

The results of cost comparisons based on working hours and employee numbers may differ, as the annual number of working hours varies between different countries and branches. While it makes more sense in principle to examine the cost per working hour than per head, international comparisons nevertheless often use the cost of labour per employee due to better availability of data.

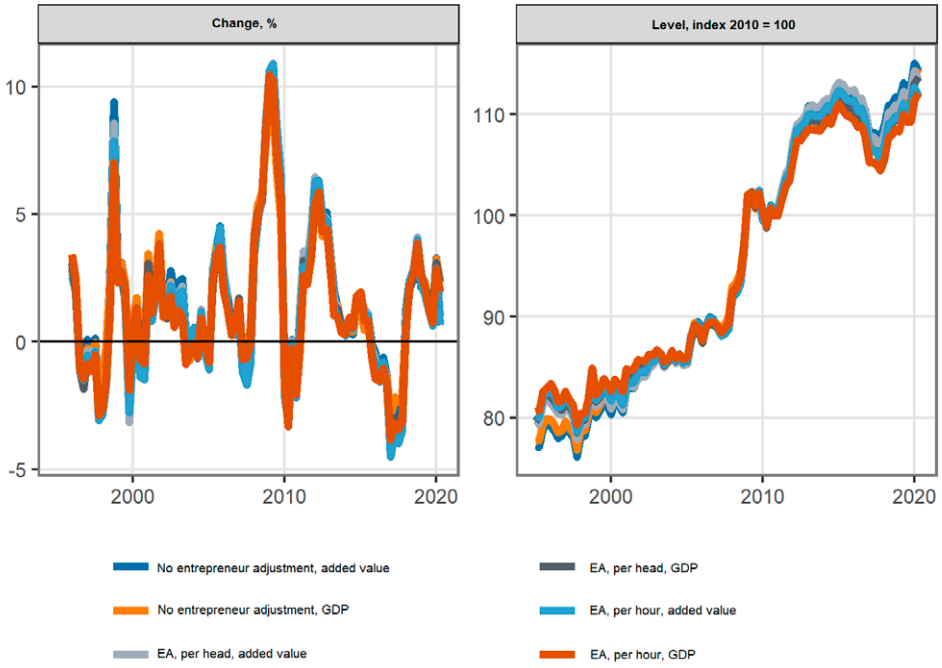
The cost of labour per hour or per head is an inadequate indicator of competitiveness, as the productivity of labour varies between countries: various countries can achieve very different output volumes in one working hour. This is why competitiveness is usually measured by unit labour costs, in which labour costs are examined in proportion to the added value or GDP produced. If the total labour costs of a branch or an entire national economy are *W* and the added value at current prices created by it is *Q* , *real unit labour costs* can be determined as the ratio *W*/*Q*.

It also indicates the *labour income share*, which means the share received by employees of the added value of the output. This is clearly linked to the *profitability* of firms, as the share of the added value that the entrepreneur keeps is reduced as the real unit labour costs go up. This is why differences in real unit labour costs between countries affect firms' investment decisions, for example. A so-called entrepreneur adjustment is usually made to the real unit labour costs (see text box) in an attempt to account for the fact that some of the working hours are completed by entrepreneurs rather than by employees, whereas labour costs are measured solely by the compensation of employees, as no data on the labour costs of entrepreneurs are available.

The real unit labour costs are affected not only by the trend in wages and output volumes but also the price development of the output. *Nominal unit labour costs* focus on the volume of added value, which is not affected by price changes, rather than the increase in added value at current prices. When the entrepreneur adjustment is made in the nominal unit labour costs (see text box), they can be interpreted differently: they can also be defined as the ratio of labour costs per hour and labour productivity. As an illustration, labour productivity describes the average number of added value units that can be 'achieved' per hour of labour; consequently, the nominal unit labour cost is the average labour cost needed to produce one unit of added value.

Figure 5.1 compares the development of nominal unit labour costs in the entire Finnish economy based on different definitions. As the Figure shows, the results of the entrepreneur adjustment depend on whether the labour costs are calculated per hour or per head. The Figure also distinguishes between unit labour costs calculated based on the *gross domestic product* and *added value*. When looking at the entire economy, gross domestic product and added value are basically the same quantity, but they differ from each other in terms of the price concepts used: gross domestic product is based on market prices and added value (excluding commodity taxes and product subsidies) on basic prices.

Figure 5.1. Nominal unit labour cost index for Finland calculated in different ways



Source: Eurostat

Figure 5.1 shows that the nominal unit labour cost indexes calculated with different methods have developed almost in the same way in Finland. The differences between annual changes are very small, and the pictures painted by the different indexes are also not very different in Finland in the longer term; however, the differences are not this small in all countries.

Kajanoja (2017) has proposed *terms-of-trade adjusted unit labour costs of the entire economy* as a competitiveness indicator that could be used for Finland. This indicator is discussed in section 5.4. The development of the terms-of-trade adjusted unit labour costs differed essentially from other indicators at the turn of the millennium, above all because Nokia's strong productivity growth and the decrease in its production prices have a different impact on the terms-of-trade adjusted indicator than others.

Nominal and real unit labour costs

Labour costs calculated per head or per hour describe the unit price of labour from the employer's point of view. Labour productivity is the ratio between the output and labour (measured per head or per hour). The unit labour costs are obtained by dividing labour costs by labour productivity. In its simplest form, nominal unit labour costs can be determined using the formula:

(1) $$ULC = \frac{W/H}{Q_v/H} = \frac{W}{Q_v}$$

In this formula, W is the total compensation of employees, Qv is the production volume, and H is the number of hours worked. To illustrate this, we can imagine that in formula (1), the numerator W/H describes the average price of one hour of labour, and the denominator shows the average volume of production 'achieved' in one hour.

The weakness of this definition (1) is that it does not distinguish between the hours worked by entrepreneurs and employees. When calculating labour productivity, working hours (H) should include the hours worked by both entrepreneurs and employees, but when calculating the average labour costs, only the hours worked by employees should be included. To take entrepreneurs' working hours into account, an entrepreneur adjustment can be made, and the average labour cost can be calculated per employee working hour and the productivity of work per working hours completed by the employed:

(2) $$ULC = \frac{W/H_{wage\ earners}}{Q_v/H_{Employed\ persons}}$$

Production volume Qv in equations (1) and (2) quantifies the amount of production, and an effort has been made to eliminate the effects of price changes in it. The production volume and the value of production in current prices, QC, are linked by the formula

(3) $$Q_v = \frac{Qc}{p}$$

in which P is the price index describing the price of the output.

The nominal unit labour costs do not reflect the impact that the price development of products has on the profitability of firms, as changes in prices do not affect the volume. The competitiveness indicator, which uses the value rather than the volume of production, is referred to as the real unit labour costs. Versions of formulas (1) and (2) can be given for this indicator, too. When using the simpler option (1) with no entrepreneur adjustment, the definition of the real unit labour cost can be written out as

(4) $$RULC = \frac{W/H}{Q_c/H} = \frac{W}{Q_c} = \frac{ULC}{p}$$

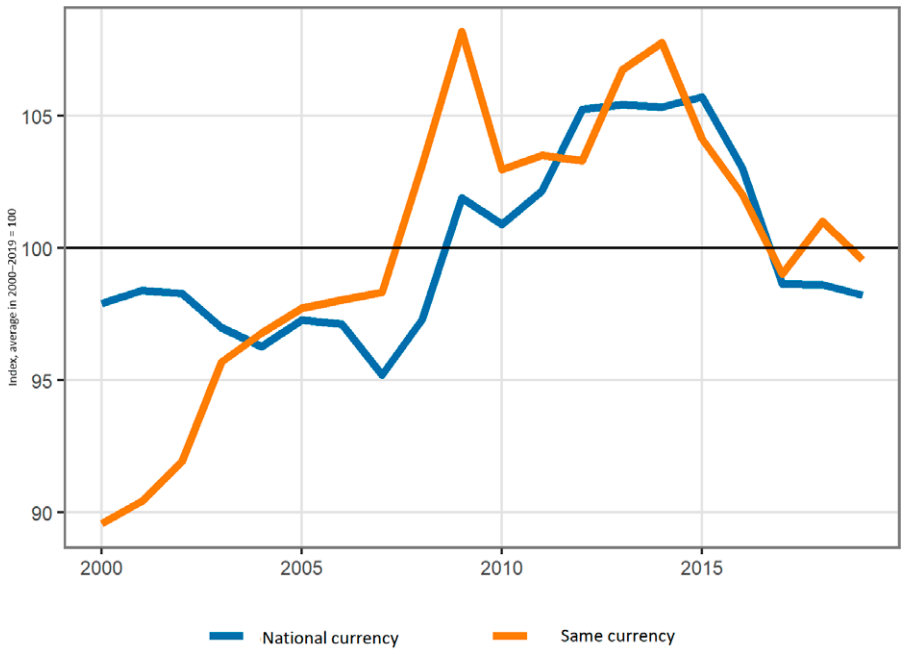
Interpreted in this way, the real unit labour costs consequently are the same as the labour income share, in other words the compensation paid to employees as a share of the value of production.

The definitions of nominal and real unit labour costs can be applied to individual branches or to the entire national economy. In these cases, the number of employees is often used instead of working hours (H), even if it would make more sense to determine labour productivity as the ratio of production volume and working hours, rather than the ratio of volume and number of employees. Nonetheless, definitions based on the number of employees are used in international comparisons, as data concerning the number of hours worked are incomplete in many countries.

5.3 Comparison of labour costs

The only meaningful way of talking about competitiveness is in comparison with other countries. This is why several further choices remain to be made after one of the above- mentioned cost indicators has been selected. First of all, the reference countries must be chosen. A weighted average of the reference countries must be formed, and the indicator describing Finland must be put in proportion to this average. Instead of a normal arithmetic average, a *geometric average* is usually used, as its mathematical properties are more workable. Costs may be examined in national currencies, or changes in exchange rates can be taken into account by presenting the costs in the same currency. While comparing them in the same currency is more justified in principle, short-term fluctuations in exchange rates result in variations in the same-currency indicator, which may not be relevant to price competitiveness over a slightly longer term. Several different methods can also be used to select weights.

Figure 5.2. Relative nominal unit labour costs per employee in national currencies and in the same currency. Calculated in relation to 19 key reference countries.



Source: Eurostat, OECD, ECFIN, Finnish Productivity Board.

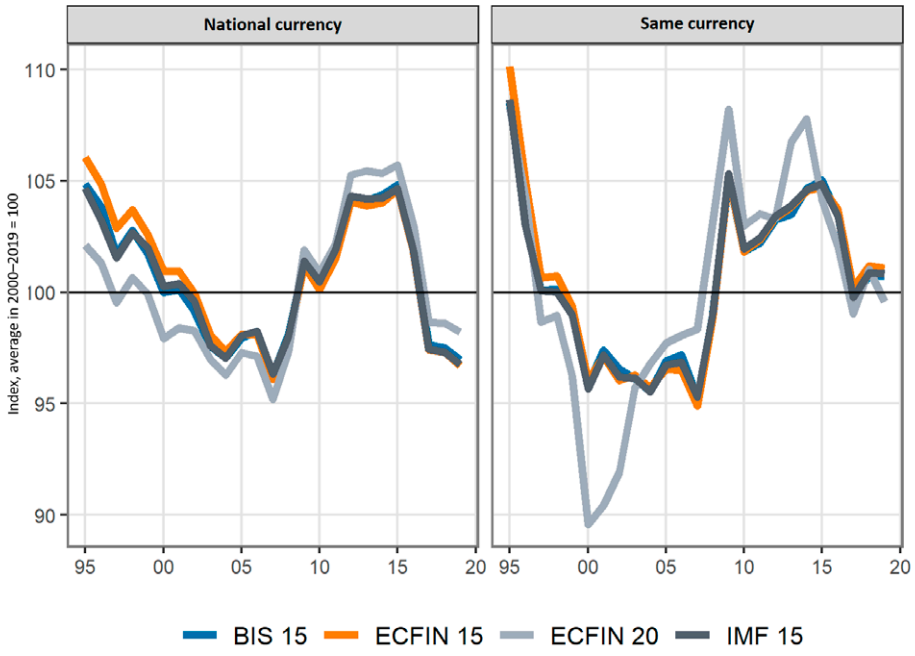
The reference countries generally are the trading partners of the country under review, and countries with a similar level of development are usually chosen. The choice of reference countries is also influenced by the availability of data, as generally the long-term statistical data required for the comparison are comprehensively available from developed countries only. Kajanoja (2017) argues that the most useful reference point for Finland is the group of developed countries which are Finland's most important trading partners. For example, the eurozone average can also be used as the basis of the comparison or, in order to avoid the problems of comparing countries at substantially different levels of development, to a group of the first 12 Member States of the eurozone.

The most mathematically sophisticated method of selecting weights consists of *double trade weights*. Their purpose is to account for competition between countries both in the domestic markets of competing countries (for example, Finnish products competing with German products in Germany) and elsewhere (such as products imported from Finland and Germany competing with each other in other countries). The Bank for International Settlements (BIS), the International Monetary Fund (IMF) and the European Commission publish time series of double trade weights. They differ slightly from each other in terms

of their scope, updating frequency and, among other things, the fact that rather than calculating the weights of individual eurozone countries for non-eurozone countries, the Bank for International Settlements examines the eurozone as a whole. The weights published by the European Commission appear to be the most comprehensive ones, and they are updated the most frequently at present.

Figure 5.3 shows Finland's relative nominal unit labour costs using different double trade weights. The differences between relative unit labour costs calculated with weights obtained from different sources are relatively small in Finland's case. However, the number of countries included in the weights is important, especially when the index is calculated in the same currency. The indexes calculated for a group of 15 European countries mainly differ from the indexes calculated for 20 countries because of the exchange rate effect.

Figure 5.3. Relative nominal unit cost index with different weights.



5.4 Cost competitiveness indicators used in Finland

The *Information Committee on Cost and Income Developments* (Tukuseto) publishes data on the development of certain key cost competitiveness indicators in Finland in its annual report. In recent years, cost competitiveness assessments of the *Bank of Finland* have also been prominent in public debate.

The Tukuseto Committee's report (Information Committee on Cost and Income Developments, 2020) contains information on how compensation of employees and labour productivity have developed in the eurozone and in Finland, as well as on the nominal unit labour costs of the entire economy calculated on their basis. The report also examines the *cost competitiveness indicator of the manufacturing industry* and the *cost competitiveness indicator of the entire economy*.

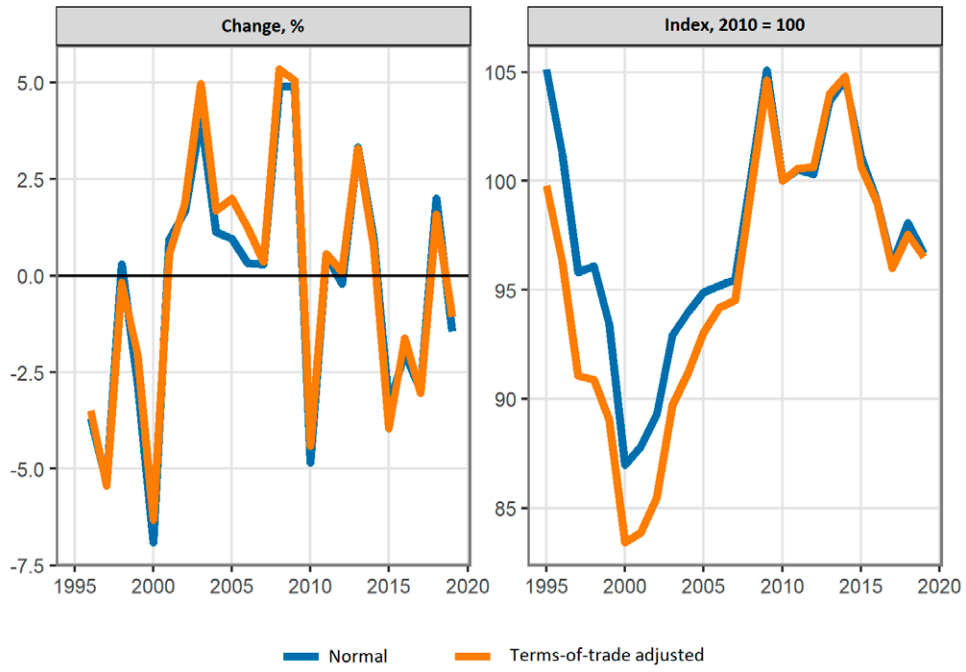
As the cost competitiveness indicator of the manufacturing industry is used its nominal unit labour costs in proportion to fifteen competitor countries. The cost competitiveness indicator for the entire economy is one of the indicators used by the European Commission, and it is based on the relative nominal unit labour cost of the entire economy expressed in the same currency. It is influenced by trends in compensation of employees and productivity development in Finland and in competitor countries as well as exchange rates. The report also examines a number of other indicators, including effective exchange rates deflated in different ways and the real unit labour costs of the manufacturing industry.

According to Kajanoja (2017), the cost competitiveness indicators used by the Bank of Finland include the *real unit labour costs of the manufacturing industry, the nominal unit labour costs of the branches producing intermediate products for the manufacturing industry*, and the *terms-of-trade adjusted nominal unit labour costs of the entire economy*. In practice, the nominal unit labour costs of the branches producing intermediate products for the manufacturing industry are calculated as a weighted average, in which the weight of each domestic sector is its share in the Finnish manufacturing industry's domestic intermediate consumption (cf. Kivistö, 2013).

According to Kajanoja (2017), the *nominal unit labour costs of the manufacturing industry* are not a useful indicator of cost competitiveness due to the deviant price trends of Finnish export products. The nominal unit labour costs depend on the compensation of employees and the productivity of labour, and the productivity of labour describes the *volume* of output per unit of time. Conversely, nominal unit labour costs do not reflect the *price* of the output. If an increase or decrease in product prices without a corresponding change in the compensation of employees alters the profitability of firms, this change in profitability does consequently not have any bearing on the development of nominal unit labour costs.

However, price development affects the real unit labour costs and terms-of-trade adjusted nominal unit labour costs. The terms-of-trade adjustment has no effect when export prices and import prices develop in exactly the same way, and the faster the increase in export prices compared to import prices, the lower the terms-of-trade adjusted unit labour costs will be.

Figure 5.4. Normal and terms-of-trade adjusted unit labour cost index in relation to 19 reference countries.



Source: Eurostat, OECD, ECFIN, Finnish Productivity Board.

Figure 5.4 compares the terms-of-trade adjusted and 'normal' nominal unit labour costs in Finland. As we can see in this Figure, the development of terms-of-trade adjusted unit labour costs only differed significantly from the development of normal unit labour costs in the 2000s when Nokia's influence on the Finnish economy was at its peak. When we look at development following the financial crisis in 2008, the adjustment is of minor importance.

The difference to the development before the financial crisis shown in figure 5.4 is largely explained by the development of the electronics industry and the statistical practices applied to its outputs. For example, an improvement in the quality of Nokia's mobile phones was dealt with in the statistics as a quantitative increase in production, which meant that it was shown as a dramatic increase in labour productivity on the one hand, and a decrease in export prices on the other (as there was no price increase to match the improvement in quality).

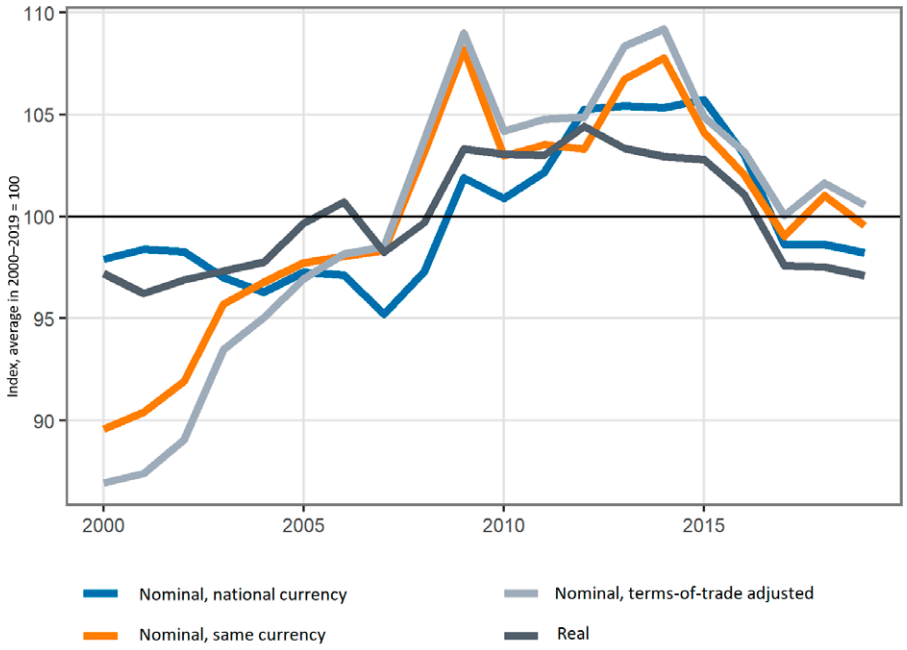
The terms-of-trade adjustment corrects the fact that productivity growth does not necessarily improve the payroll capacity and competitiveness of firms if this growth 'leaks' abroad as decreased export prices. This is what happened in the period of Nokia's rapid

growth, which was marked by an extremely strong growth in productivity. The prices also fell sharply at the same time, resulting in a major decline in the terms of trade.

5.5 Development of Finland's cost competitiveness

The unit labour costs in Finland, which describe the price competitiveness of the entire national economy, increased strongly in relation to the reference countries after the financial crisis. The variables which describe different unit labour costs indicate this fairly consistently. On the other hand, relative unit labour costs have fallen considerably since 2015 at the latest and been close to the longer-term average since 2017.

Figure 5.5. Relative unit labour costs of the entire Finnish economy. Calculated in relation to 19 key reference countries.

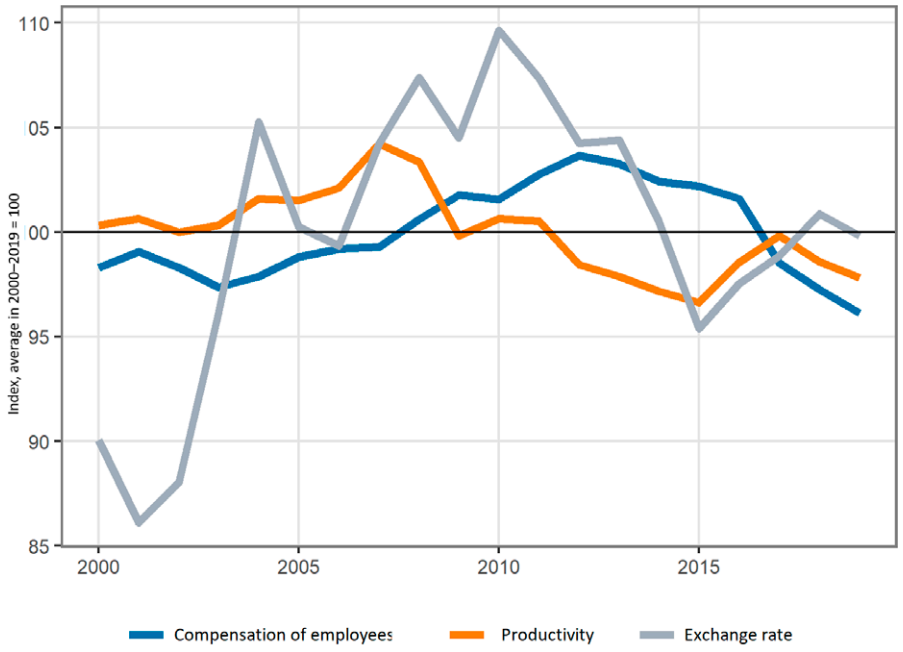


Source: Eurostat, OECD, ECFIN, Finnish Productivity Board.

Unit labour costs are affected by changes in productivity and the average compensation of employees per hour. Unit labour costs decrease if productivity increases faster and wage costs grow more slowly than in reference countries. Unit labour costs expressed in the same currency are also affected by changes in the exchange rate, with price competitiveness improving as the exchange rate deteriorates.

A weak euro boosted the price competitiveness of the Finnish economy, too, in the early 2000s. The euro rapidly grew stronger, however, and the price competitiveness deteriorated. Nevertheless, relative labour productivity increased faster than relative unit labour costs until the financial crisis. During the financial crisis Finland's relative labour productivity fell considerably, and the growth in labour productivity was also slower in Finland than in the reference countries after the crisis until 2015. As the average compensation of employees increased faster than in the competitor countries at this time, the unit labour costs went up and price competitiveness deteriorated considerably.

Figure 5.6. Components of the same-currency relative nominal unit labour cost index: average relative compensation of employees, relative labour productivity and nominal effective exchange rate. Calculated in relation to 19 key reference countries.



Source: Eurostat, OECD, ECFIN, Finnish Productivity Board.

The growth in relative average compensation of employees has been slightly slower than in the reference countries since 2013. This alone was not enough to reduce unit labour costs, however, as the relative increase in labour productivity slowed down at the same rate. The nominal unit labour costs in the national currency only decreased after 2015.

The decline in the nominal exchange rate of the euro in 2014 and 2015 clearly improved Finland's price competitiveness. From 2015 onwards, stronger productivity growth than in the reference countries also improved price competitiveness. The average compensation of employees had already increased less than in the reference countries since 2012, but this difference was not great. In 2017–2019, on the other hand, the average compensation of employees increased considerably more slowly than in competitor countries.

The simultaneous impact of three factors, or labour productivity, compensation of employees and the exchange rate, which all worked in the same direction, significantly decreased the relative unit labour costs in 2015–2017. In other words, Finland's price competitiveness improved. Not even relative indexes make direct interpretations of the level of price competitiveness possible. However, all relative indicators measuring competitiveness have been close to the longer-term average in 2017–2019.

The currency is again stronger, and growth in labour productivity has slowed down slightly in relation to reference countries. The relative compensation of employees has, however, declined so much that the unit labour costs have changed little in 2017–2019.

6 Impacts of the Covid-19 pandemic on productivity

6.1 The short-term effects are difficult to interpret

The Covid-19 pandemic and the policy actions introduced to contain it caused a rapid and sharp contraction of economic activity in Finland and globally. We do not know yet how long this recession will last, but most forecasts expect it to be short. It is predicted to lower incomes in almost all economies, however (World Bank, 2020).

Production declined by about 6% in Finland and about 15% on average in the eurozone from the previous year. Major changes in production, working hours and pay capacity also have a major impact on indicators measuring short-term productivity and cost competitiveness. Care should be taken when interpreting these changes, however, as economic adaption, adaptation measures and statistical practices differ from one country to another. In these circumstances, short-term variation in key figures is not guaranteed to give a completely correct picture of how the situation is developing. In addition, these figures are not necessarily very important in terms of long-term development.

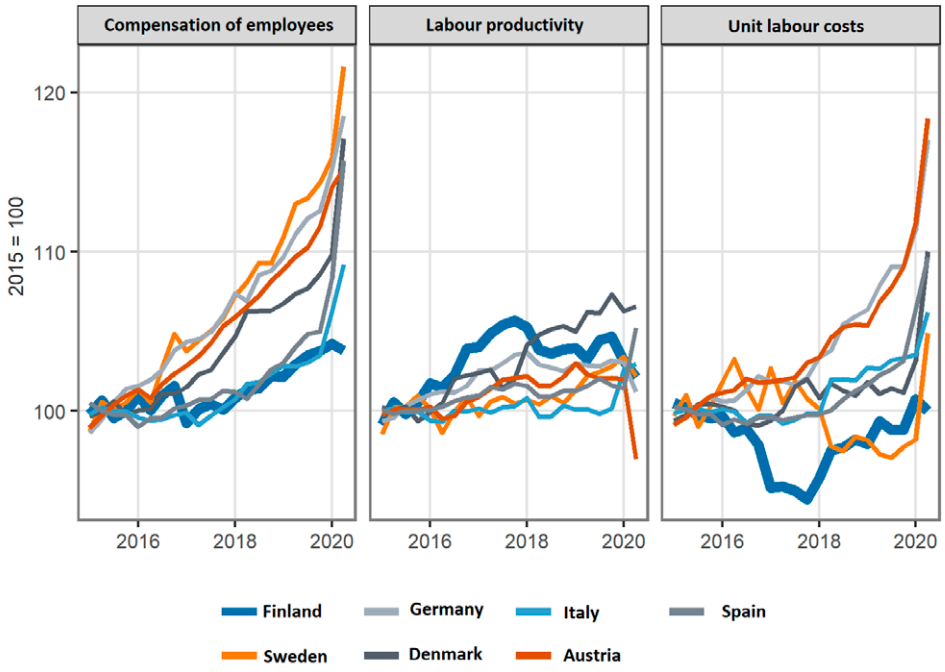
The coronavirus pandemic has had little or no effect on statistical labour productivity in most countries, which means that working hours have decreased at the same rate as production. Nevertheless, labour productivity has clearly declined in such countries as Austria, and increased in Spain. It is likely that this indicates differences in short-term statistics on production or working hours rather than actual changes.

The quarterly production figures of all countries should also be taken with a pinch of salt at this stage. Quarterly accounts are produced quickly and with clearly less source data than the actual annual accounts. While data concerning output can be readily available based on firms' sales, quarterly accounts contain little or no genuine data on intermediate product use. Added value, which underlies the GDP, nevertheless is the difference between output and intermediate consumption. This is why the amount of added value will revised later, potentially to a significant degree.

Measuring production in the public sector is an even greater problem than those discussed so far. In quarterly accounts, the output of the public sector is mainly determined on the basis of wage costs. The services produced in the public sector are also used in annual accounting. We know that such services as healthcare were not used to full

capacity in the spring, as procedures were cancelled. This will probably be seen as reduced production in revised figures later.

Figure 6.1. Average compensation of employees and productivity per working hour as well as nominal unit labour costs in certain EU countries.



Source: Eurostat, Finnish Productivity Board.

The changes in unit labour costs during the coronavirus pandemic have been greater. In most countries, the unit labour costs went up sharply in early 2020. This resulted from a clear increase in the average compensation of employees. The only exception in Europe is Finland, in fact, where the average compensation of employees and unit labour costs have not increased.

The reason for this is the Finnish lay-off system, which offers firms a better adaptation mechanism than the systems in many other countries. Firms were able to quickly stop paying wages to employees for whom they did not have work.

However, this comparison is hampered by the fact that wage subsidy schemes for firms have been introduced in many countries. They are not included in compensation of employees in the national accounts. Temporary wage subsidy models and their durations vary greatly from country to country. Any comparisons of trends in the average

compensation of employees during the coronavirus pandemic also rest on a very shaky ground.

The wage flexibilities in other countries are often an object of envy in Finland. It is obvious that wage flexibilities are inadequate as a response to such a great shock. They may have an important role after the acute crisis, however. The development of unit labour costs in the reference countries after the crisis should thus be monitored. The short-term statistical effects of the crisis make this task much more difficult, and we should be careful when making any conclusions.

6.2 Longer-term impacts are possible

The Covid-19 pandemic may also have long-term effects. Economic cycles are often seen as fluctuations of activity around potential economic growth: a downturn or a recession is followed by a period of rapid growth as the economy returns to its growth path. This is not always the case, however (e.g. Ball, 2014; Cerra et al., 2020). In fact, the non-existent recovery in Finland after the financial crisis reminds us of the long-term impacts that shocks may have. Historically, the consequences of epidemics have sometimes been visible for decades (Jordà et al., 2020).

This section contains a concise discussion of these potential effects that extend further than the usual economic cycles. The pandemic may lead to more permanent negative impacts through several channels. The more persistent impacts may manifest themselves in employment and human capital, investments and capital, reallocation needs, and long-term decline in demand.

While the pandemic is a shock that affects demand, above all, it may later also affect supply. For example, Bonadio et al. (2020) model global restrictive measures as a negative shock on labour supply in 64 countries. Most of the negative impacts on the GDP are caused by disruptions to global value chains. Elenev et al. (2020) model the pandemic as a shock affecting the supply of labour and productivity that reduces firms' revenue. This creates difficulties related to debt management for firms, leading to a wave of bankruptcies and threatening the stability of the financial sector. Céspedes et al. (2020) predict a vicious circle in which reduced productivity will result in a decrease of collateral value for firms, reducing their ability to borrow and leading to lower employment and productivity.

These more permanent supply side effects created over the longer term may reduce productivity and limit economies' capacity to generate growth in real incomes. On the other hand, the speeding up of digitalisation and new operating methods may

ameliorate the negative effects. This Chapter mainly contains a speculative discussion of the ways in which the impacts may be manifested, as few relevant empirical analyses have been produced. So far, no significant impacts on supply have been observed. A survey conducted by the Technology Industry (2020), for example, lists various problems caused by the coronavirus pandemic and asks whether they affect the firm 'very much/moderately/slightly'. If we exclude those who responded 'slightly', the worst problem by far is the decline in demand (mentioned by approx. 54% of firms in the survey conducted on 23 October), whereas the availability of components, intermediate products or raw materials is a problem for 8% of firms only.

6.2.1 Employment and human capital

While mortality rises during epidemics, Covid-19 is mainly fatal to older people and those with serious illnesses. Unlike in previous epidemics, it appears that there has been no substantial decrease in labour force. Consequently, the capital-to-labour ratio does not increase and as a result, a decrease in the level of investments is not expected, as was the case during the influenza epidemic of 1918 (Fan et al., 2016).

Prolonged unemployment could be another mechanism. Efforts to prevent the epidemic and the measures taken to contain it will reduce the need for labour force, at least temporarily. In such countries as Finland, labour force has largely been reduced by means of layoffs (or other similar arrangements) but in the United States, for example, the pandemic has led to a sharp increase in unemployment. In the past, unemployment has been a significant channel through which recessions have had more permanent consequences in the long term. Prolonged unemployment has been found to undermine future employment opportunities and pay rises. The employment and wage development of the cohort entering the labour market during a recession are weaker than those of other groups (Cerra et al., 2020). Unemployment may also have other negative long-term impacts on individuals and families. Young employees are more likely to be affected by the long-term impacts than others, and the longer the period of unemployment, the more severe the impacts become (e.g. Arulampalam et al., 2001; Tumino, 2015). Participation rates also fall during a recession (Ball, 2014).

The third mechanism is the erosion of human capital. Employees accumulate specialised expertise at workplaces and in their tasks that is not of equal value when used elsewhere. Employees who have lost their jobs are not immediately equally productive in alternative tasks. Similarly, even if a firm survives a recession, employee turnover may have undermined its productivity. Other consequences of unemployment include erosion of human capital, decline of skills, and reduced attachment of individuals to the labour market. Human capital is critical to future productivity growth, however (Delong et al., 2002).

6.2.2 Capital and investments

Lower capital stock is another main channel through which permanent impacts are manifested. When investments are substantially reduced during an epidemic, this leads directly to lower potential growth in the future. The renewal of the capital stock also slows down, with a negative impact on productivity growth.

The degree of uncertainty concerning the future is essential for investments (Bloom, 2009). The Covid-19 epidemic has increased both short-term and long-term uncertainty, perhaps much more than during the financial crisis, for example (Baker et al., 2020). This will lead to substantially lower investments, especially in R&D and other intangible investments, which are the most sensitive to uncertainties (Barrero et al., 2017).

The channel related to capital may be strengthened by the disruption to global value chains and the tortuous process of their re-establishment. Acemoglu et al (2012, 2020) have shown that when a firm-specific shock spreads along the value chain, its indirect impacts may be more substantial than the impulse and its direct multiplier effects. Some of the benefits of globalisation have arisen precisely from these indirect impacts. As a result of the Covid-19 epidemic, the indirect impacts of reorganised value chains may act in a similar manner, however this time negatively.

Efforts to prevent the epidemic and the measures taken to contain it may cause temporary liquidity problems that will, however, lead to bankruptcies if they are prolonged. A recession may also change demand or other structures to the point where previously profitable business becomes loss-making. In bankruptcies, tangible and intangible capital is destroyed. Trust and tacit firm-specific knowledge and competence are also lost. Moreover, a firm has accumulated organisational capital during its existence that is valuable in that particular firm. Organisational capital has been estimated to account for an average of 3% of the value of a firm's turnover (Lev and Radhakrishnan, 2003). A new firm built using the pieces left behind after a bankruptcy is not as good as the original one would have been, had it survived the recession.

6.2.3 Loss of firms and need for reallocation

The third possible channel for long-term effects consists of the wave of bankruptcies caused by the crisis and the need to reorganise labour and capital in the changing circumstances in the aftermath of the epidemic. The crisis treats different sectors and firms asymmetrically; some firms may even benefit from the pandemic (such as healthcare instruments, the pharmaceutical industry, e-commerce). Profitable firms with strong balance sheets and firms whose product development, purchasing, production and distribution practices are little affected by the virus and the measures to contain it will

be the best placed to cope with a recession. Firms whose activities are heavily affected by the virus or its prevention measures will be the worse off during a recession. They include young firms and those with a weak balance sheet, such as small firms focusing on immaterial operations. It seems that the most productive, dynamic and innovative firms are no more likely to survive the crisis than the others (Arrighetti et al., 2015). Young, growth-oriented firms play a key role in terms of productivity development. They also create the greatest numbers of new jobs (Adelino et al., 2017; Haltiwanger et al., 2013).

It is possible that after the epidemic, a reallocation of products and services will be needed, which in the corporate sector would mean a different way of allocating capital and employment. For example, if commercial aviation and international conferences decline and teleconferencing becomes more widespread, new, efficient allocation means that capital and labour should transfer from air traffic and congress centres to other activities.

Poor allocation is a bottleneck for productivity growth (Hopenhayn, 2014; Restuccia and Rogerson, 2017). Young firms' new products and the expansion of small firms will play a crucial role in the reallocation as extremely important productivity drivers (Argente et al., 2017). Such renewal does not usually take place during recessions, which further weakens productivity growth.

6.2.4 Demand

Epidemics may also cause a long-term reduction in demand, which in turn will lead to lower investments. Jordà et al. (2020) found that previous epidemics increased prudential saving among consumers, discouraged investments and lowered market-clearing interest rates. A recession also treats different employees asymmetrically. Unemployment hits employees with a high propensity to consume particularly hard, which further reinforces the demand impact of the recession. There are often more employees with a high propensity to consume in small and young firms (Patterson, 2019).

We argued above that the risks inherent in a recession caused by an epidemic might cause productivity to remain below pre-crisis levels for a long time. On the other hand, Fernald (2104) argues that the financial crisis did not lower productivity or potential output in the United States, as they had already declined before the crisis. Perhaps this might also apply to the recession triggered by the Covid-19 epidemic in Finland?

6.2.5 Digitalisation and remote work

The crisis has forced firms and organisations to adopt and experiment with new technologies more quickly. The most significant experiment presumably is the dramatic growth in remote work and the use of digital tools. Bloom et al. (2015) found that in normal conditions, remote work improved productivity in Chinese call centres. A survey conducted in Japan indicated that remote work during the epidemic has reduced productivity in the short term (Morikawa, 2020). Some causes disappear over time (such as inexperience in using the software needed for remote work), whereas other factors indicate that the difference in productivity will persist. According to Ozimek (2020), on the other hand, a survey conducted with a limited number of employees in the United States (recruiters) indicated that remote work brought productivity benefits.

Over the longer term, productivity growth could improve if the crisis encourages more extensive and smarter deployment of efficient remote work practices in ways that improve employee wellbeing and efficiency and reduce the costs for firms. This could speed up the transition to a new mode of working which, without the crisis, would have taken place more gradually. A recent OECD policy brief discusses ways to improve the productivity of remote work over the longer term (Criscuolo et al., 2020).

7 Conclusions and policy recommendations

Competitiveness is a multidimensional and to some extent unclear concept, which hampers economic policy debate on this topic. On the one hand, it is useful to distinguish between the perspectives of short-term cost competitiveness and long-term productivity growth. On the other hand, these two phenomena are linked by economic logic. Looking after short-term cost competitiveness can support long-term productivity development, and firms' productivity development contributes to their cost competitiveness.

Productivity development is the key to improving wellbeing and the standard of living, however. Wellbeing is a multidimensional entity that cannot be summed up in one or a few indicators. A policy action that promotes productivity can also affect wellbeing through other mechanisms besides productivity. For example, higher productivity may mean decreased use of natural resources, with indirect wellbeing benefits. However, the impacts of these other channels may also be detrimental to wellbeing. Deregulation, for example, may improve productivity but have adverse effects on health. When planning a policy action, composite indicators should not be relied on; instead, policy-makers can and should strive to examine the impact of the action on price competitiveness and productivity on the one hand, and its impacts on health, the environment and other factors of wellbeing on the other, each one individually. This is the only way to achieve a balanced political consideration of the actions' impacts.

The slow productivity growth in Finland is a key problem in terms of promoting wellbeing, among other things. Most developed countries have experienced stalling productivity growth for over a decade. In Finland, the decline has been somewhat stronger than usual. This is partly explained by the fact that Finland has experienced stronger negative shocks than other countries, especially in the electronics industry.

7.1 How can productivity growth be accelerated?

Decreasing R&D inputs are not the key to explaining the slow productivity growth in Finland. When we look at the corporate sector excluding the electronics industry, R&D inputs have increased significantly between 2008 and 2018. However, this increase does not appear to be reflected as increased productivity in the same way as before. This observation is global. It seems that the productivity of R&D inputs has deteriorated, which

means that the same real R&D inputs generate fewer innovations. More and more R&D inputs would be needed to maintain the previous level of productivity growth.

Possible economic policy instruments include increased public R&D funding or actions that provide better R&D incentives for firms. Firms do not need R&D inputs only to generate new technological know-how but also to deploy technology created elsewhere in a way that improves their productivity. In a manner of speaking, R&D inputs thus have two faces. Consequently, R&D inputs help firms exploit the spread of technology between firms better.

Globalisation may not reduce the importance of R&D inputs. Opening up the market to international competition may increase R&D incentives for the most profitable firms but also reduce incentives for low-productivity firms. While the national economy benefits, this results in turbulence in firms and in the labour market.

If there is a scarcity of skilled labour, increasing innovation incentives or public R&D funding will not lead to the desired increase in real R&D inputs and productivity growth. Education policy, through which the number of workers skilled in R&D can be increased, is needed as a complementary factor to produce the optimal productivity impacts. These impacts only materialise with a significant delay, however. As an additional measure, actions for attracting global talents to the country may be needed. They can be vital for both innovation and business dynamics. Consequently, immigration can help strengthen the national innovation ecosystem, which is a key prerequisite for successful innovation activities.

The attributes of a well-functioning innovation ecosystem also include effective division of labour and cooperation between firms and universities. Direct public support for large-scale technology projects, for example, in which both universities and large and small firms participate can be promoted not only by stepping up cooperation and producing new technologies but also by spreading technological knowledge in the national economy. In this sense, direct public R&D grants to universities and firms can be a more effective way of bolstering the Finnish innovation ecosystem and productive exploitation of technological knowledge than, for example, tax incentives. This impact is weakened, however, if public funding partially replaces firms' internal R&D funding. This risk is likely to be smaller when the aid is targeted at young firms.

One of the challenges associated with direct subsidies, however, is the question of how the subsidies could be allocated without influencing the direction of technological development and corporation dynamics in a way that is detrimental to productivity growth.

Weak or weakened corporation dynamics also fails to explain the stagnating productivity growth in Finland. Analyses and indicators that draw on corporation and establishment data indicate that corporation and workplace dynamics have remained fairly strong in Finland and are not necessarily weaker than in such countries as the United States, where the dynamics has been deteriorating throughout the 2000s and appears to be linked to weakened productivity development.

Surveys indicate, however, that access to funding is not a major problem for SMEs in Finland. On the other hand, the availability of skilled personnel and competent managers has been seen as a more significant obstacle to growth by Finnish SMEs. This observation highlights the need to pay attention to education policy and the immigration of skilled labour.

In the United States, an explanation for the weaker dynamics has also been sought in less effective competition policy. In the EU, competition policy has developed more favourably than in the United States. However, vigilant supervision of cartels, mergers and public procurement is needed, and regulation should be developed to improve the functioning of the market in different branches. Finland is a small and sparsely populated country. In the local domestic market, in particular, there is a risk of some firms gaining a dominant position. In addition to pushing up prices, this can reduce innovations vital for productivity growth and put the brakes on firm dynamics.

Consequently, the basic preconditions for productivity development in Finland appear to be better than what a superficial examination would indicate. R&D inputs as a percentage of GDP remain at a high level by international standards. If we exclude the electronics industry, the real R&D inputs in the corporate sector have been clearly growing. A structural change of R&D inputs is underway in Finland, and this process can be expected to be gradual and have a long time span.

But if the basic preconditions are there, why has Finland's productivity developed so weakly? As we have noted, this problem also affects other developed countries. It appears that the most significant potential of the ICT transformation of the 1990s has been used up for now. To achieve the same volume of innovation and productivity development, more R&D inputs are needed. The productivity impacts of these inputs materialise through different mechanisms, and significant delays are associated with all of them.

Consequently, it may be premature to say whether the 'Finnish innovation and productivity machine' is somehow out of order. While productivity development has been weak for a long time, it is likely that public inputs in universities' and firms' R&D activities should be increased.

Rather than being reduced by the economic crisis caused by the coronavirus pandemic, the need for these investments is made more urgent by it. In times of a recession or economic crisis, the alternative costs of R&D go down, which means that increasing such investments would be justified. In addition, when the crisis strikes deep into economic structures, there may be a particularly great need for investments aimed at renewal. Firms' R&D expenditure typically declines during a recession, however.

During a recession, incentives for firms' R&D investments are reduced more than what would be beneficial for the national economy, which is a justification for increasing public R&D inputs in such times. During and after an economic crisis, the economy has a particular need for young firms, as they are important for renewal. Because they lack collateral, however, they may experience particular difficulties during a crisis in obtaining funding in the private financial markets for R&D inputs, or even surviving in the market.

This means that the mechanism of creative destruction, which is important for long-term productivity development, may be disrupted during a crisis. Particular attention should consequently be paid to young firms' possibilities to access funding for their R&D projects. Complementary policy actions aiming to promote the dynamics of firms and the functioning of markets are additionally needed, thus enhancing and accelerating the productivity impacts of R&D inputs in the national economy.

Total factor productivity is the most important element of productivity. The examination of structural competitiveness seeks to determine how institutions and other slowly changing factors affect total factor productivity. The question is difficult and will require more research and, in particular, analyses based on 'hard' statistical data. The existing analyses, which are largely based on limited 'soft' survey data, indicate that the main challenges to Finland's long-term structural competitiveness are found in the areas of the labour market and creative renewal.

The crisis caused by the Covid-19 pandemic has hampered the interpretation of short-term statistics, and far-reaching conclusions should not be made from quarterly data. Over the longer term, the pandemic appears to be a negative risk to productivity growth.

7.2 Ensuring price competitiveness

Good price competitiveness promotes exports and employment in the open sector as well as attracts investments. Similarly, poor price competitiveness has a negative impact on them. Price competitiveness is mainly influenced by domestic costs, which are determined by the market and in negotiations on employment conditions, as well as by labour productivity and the productivity and costs of competing countries. Wages and other

employment conditions should remain within the limits of productivity, the costs of other inputs and competitor countries' prices in order to enable the open sector to generate wealth. On the other hand, 'excessively good' competitiveness can also be a problem in the sense that domestic purchasing power and improvement in the standard of living may remain poor. Influencing the factors of price competitiveness by policy actions is difficult.

The unit labour costs in Finland, which describe the price competitiveness of the entire national economy, increased strongly in relation to the reference countries after the financial crisis. The variables which describe the different unit labour costs indicate this fairly consistently. On the other hand, relative unit labour costs have fallen considerably since 2015 at the latest and been close to the longer-term average since 2017.

The simultaneous impacts of labour productivity, compensation of employees and the exchange rate, which all affected unit labour costs in the same way, improved Finland's price competitiveness between 2015 and 2017. No direct interpretations concerning the level of price competitiveness can be made based on indexes. However, all relative indicators measuring competitiveness have been close to the longer-term average in 2017–2019. The currency is again stronger, and growth in labour productivity has slowed down slightly in relation to reference countries. The relative compensation of employees has, however, declined so much that the unit labour costs have changed little in 2017–2019.

Finnish industry has lacked success in the export market for over ten years, and there is an obvious shortage of productive investments. The persistently poor export performance and poor ability to attract productive investments may indicate low competitiveness of industry. Service exports, on the other hand, have been successful.

Measuring and monitoring price competitiveness is not easy. The economy works in a general balance where everything affects everything else. The economy sustains unexpected shocks that affect domestic and foreign demand and supply to varying degrees. An ability to anticipate the future, rather than just looking at the rear-view mirror, would be essential.

Central organisations have called the shots in the Finnish labour market for a long time. While the central organisation of large enterprises has withdrawn from the collective bargaining process, it will take time for the impacts of the old system to disappear. Wages and other employment conditions will not be coordinated as explicitly in the future as they were in the past. The labour market and institutions under the new model are only taking shape, and at the time of writing this report, we do not yet know what the new Finnish model will look like. It is likely that the labour market will continue to need common situational awareness and anticipation of the future to ensure that wages and other employment conditions can be kept within limits that safeguard purchasing power and competitiveness.

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