MINISTRY OF FINANCE

Finnish productivity board

Productivity and resource allocation
– Weak level and growth of productivity in Finland's digital services

Boards

Publications of the Ministry of Finance – 2021:68

Publications of the Ministry of Finance 2021:68

Productivity and resource allocation
– Weak level and growth of productivity in Finland's digital services

Finnish productivity board

Ministry of Finance, Helsinki 2021

Publication sale

Online bookstore of the Finnish Government

vnjulkaisumyynti.fi

Publication distribution

Institutional Repository for the Government of Finland Valto

julkaisut.valtioneuvosto.fi

Ministry of Finance

ISBN pdf: 978-952-367-909-2
ISSN pdf: 1797-9714

Layout: Government Administration Department, Publications

Helsinki 2021 Finland

Description sheet
3 December 2021

Productivity and resource allocation – Weak level and growth of productivity and in Finland's digital services

Publications of the Ministry of Finance 2021:68		**Subject**	Board
Publisher	Ministry of Finance		

Author(s)	Stenborg, Markku; Maliranta, Mika; Kiema, Ilkka; Huovari, Janne; Elmgren, Peter;		
Group author	Finnish Productivity Board		
Language	English	**Pages**	86

Abstract

The labour productivity gap between Finland and the world's leading countries narrowed consistently until 2008, when the trend took a downward turn. Since then the productivity gap has been widening. While labour productivity in manufacturing is at a healthy international level, it remains far behind the reference countries in many service sectors. Surprisingly, productivity in Finland has fallen in digital-intensive services.

Finland's corporate sector shows a smaller dispersion of productivity than in the reference countries, which appears to be attributable to the lack of high-productivity companies. At the same time, however, the corporate sector seems to have been able to renew without any problems.

One reason for the lower productivity and weaker productivity growth in Finland compared to the reference countries is the poorer allocation of resources and capital to high-productivity units, and further deterioration in allocation in the early 2000s. However, there has been an improvement in allocation starting from 2012.

Although the aggregate labour income share has decreased, there has been a general increase in the corporate labour income share. Companies with a low labour income share and good profitability have increased their market shares, which translates into a lower aggregate labour income share.

Finland's price competitiveness seems to be historically relatively strong. The COVID-19 pandemic on the one hand and the policy measures taken to deal with its impacts on the other have led to a situation where statistical data do not provide a reliable basis for comparing recent developments.

Keywords	economic policy, board, productivity, economic growth, competitive strength, national economy, economic development		
ISBN PDF	978-952-367-909-2	**ISSN PDF**	1797-9714
URN address	http://urn.fi/URN:ISBN:978-952-367-909-2		

Kuvailulehti
3.12.2021

Tuottavuus ja voimavarojen kohtaanto – Digitaalisten palveluiden tuottavuuden taso ja kehitys Suomessa heikko

Valtiovarainministeriön julkaisuja 2021:68 **Teema** Lautakunnat
Julkaisija Valtiovarainministeriö

Tekijä/t Stenborg, Markku; Maliranta, Mika; Kiema, Ilkka; Huovari, Janne; Elmgren, Peter;
Yhteisötekijä Tuottavuuslautakunta
Kieli Englanti **Sivumäärä** 86

Tiivistelmä

Suomessa työn tuottavuus kuroi pitkään kiinni railoa suhteessa maailman eturintamaan, mutta kehitys kääntyi vuoden 2008 paikkeilla ja railo on sittemmin uudestaan levinnyt. Teollisuudessa työn tuottavuus on hyvää kansainvälistä tasoa, mutta monilla palvelualoilla kaukana vertailumaiden tasosta. Digitaalisesti intensiivisissä palveluissa tuottavuus Suomessa on yllättäen laskenut.

Tuottavuuden hajonta Suomen yrityssektorilla on vähäisempää kuin verrokkimaissa, minkä taustalla näyttäisi olevan puute korkean tuottavuuden yrityksistä. Yrityssektorin uudistumisessa ei kuitenkaan vaikuttaisi olevan ongelmaa.

Osasyy Suomen verrokkimaita alempaan tuottavuuteen ja huonompaan tuottavuuden kehitykseen on voimavarojen – työn ja pääoman – huonompi kohdentuminen korkean tuottavuuden toimipaikkoihin ja kohdentumisen heikkeneminen 2000-luvun alkupuolella. Kohdentuminen on kuitenkin parantunut noin vuodesta 2012 alkaen.

Vaikka aggregaattitasolla työn tulo-osuus on supistunut, yritystasolla työn tulo-osuudet ovat yleisesti olleet kasvussa. Yritykset, joissa työn tulo-osuus on ollut pieni ja kannattavuus hyvä ovat kasvattaneet markkinaosuuksiaan, mikä näkyy työn tulo-osuuden pienenemisenä aggregaattitasolla.

Suomen hintakilpailukyky vaikuttaisi nyt olevan suhteellisen hyvä historiaan verrattuna. Yhtäältä covid-19-pandemia ja toisaalta politiikkatoimet, joilla pandemian vaikutuksia on hoidettu, ovat kuitenkin johtaneet siihen, etteivät tilastotiedot tarjoa luotettavaa tietopohjaa viimeaikaisen kehityksen vertailulle.

Asiasanat talouspolitiikka, lautakunnat, tuottavuus, talouskasvu, kilpailukyky, kansantalous, taloudellinen kehitys

ISBN PDF 978-952-367-909-2 **ISSN PDF** 1797-9714

Julkaisun osoite http://urn.fi/URN:ISBN:978-952-367-909-2

Presentationsblad
3.12.2021

Produktivitet och matchning av resurser – produktivitetsnivån och -utvecklingen inom den digitala tjänstesektorn i Finland är svag

Finansministeriets publikationer 2021:68		**Tema**	Nämnder
Utgivare	Finansministeriet		

Författare	Stenborg, Markku; Maliranta, Mika; Kiema, Ilkka; Huovari, Janne; Elmgren, Peter;		
Utarbetad av	Produktivitetsnämnden		
Språk	Engelska	**Sidantal**	86

Referat

Finland höll länge på att minska avståndet till världstäten när det gäller arbetsproduktivitet, men utvecklingen vände nedåt 2008 och skillnaden har sedermera blivit större igen. Inom industrin ligger arbetsproduktiviteten på en god internationell nivå, men inom många servicebranscher är produktiviteten betydligt lägre än i jämförelseländerna. Inom digitalt intensiva tjänster har produktiviteten i Finland överraskande nog sjunkit.

Spridningen i produktiviteten inom den finländska företagssektorn är mindre än i jämförelseländerna, vilket verkar bero på brist på företag med hög produktivitet. Förnyelsen inom företagssektorn ser dock inte ut att vara ett problem.

En bidragande orsak till den lägre produktiviteten och den sämre produktivitetsutvecklingen i Finland är att allokeringen av resurserna, arbetet och kapitalet till verksamhetsställen med hög produktivitet är sämre och att den försvagades i början av 2000-talet, men har dock förbättrats igen sedan 2012.

Även om arbetets inkomstandel har minskat på aggregerad nivå, har den allmänt sett ökat på företagsnivå. Företag med små arbetsinkomstandelar och god lönsamhet har ökat sina marknadsandelar, vilket syns i att arbetets inkomstandel har minskat på aggregerad nivå.

Finlands priskonkurrenskraft verkar nu vara relativt god jämfört med tidigare. Samtidigt har covid-19-pandemin och de politiska åtgärder som vidtagits för att hantera effekterna av pandemin dock lett till att statistiska uppgifter inte ger ett tillförlitligt kunskapsunderlag för att utvecklingen under den senaste tiden ska kunna jämföras.

Nyckelord	finanspolitiken, nämnder, produktivitet, ekonomisk tillväxt, konkurrenskraft, samhällsekonomi, ekonomisk utveckling		
ISBN PDF	978-952-367-909-2	**ISSN PDF**	1797-9714
URN-adress	http://urn.fi/URN:ISBN:978-952-367-909-2		

Contents

To the reader 8

1 Introduction 9
1.1 Comparing labour productivity and total factor productivity 9
1.2 Competitiveness 15

2 Labour productivity in the corporate sector 19
2.1 Theories about productivity gaps between countries 19
2.2 Labour productivity development in the corporate sector 20
2.3 Manufacturing 24
2.4 Private services 26

3 Innovations and the functioning of markets 28
3.1 Competition, innovations and creative destruction 28
3.1.1 Paradigm shift in growth research 28
3.1.2 Schumpeterian economic growth model 29
3.1.3 The impact of competition on innovation 29
3.1.4 The impact of competition on firms' innovation activities and the increase of productivity in the national economy 33
3.2 Assessment of innovation, competitive nature and renewal in Finnish firms 34
3.2.1 Measuring competitive nature and renewal is important but difficult 34
3.2.2 Data 35
3.2.3 Consequences of innovation activities: productivity 36
3.2.4 Dispersion of labour productivity between firms 40
3.2.5 Market concentration 42
3.2.6 Renewal of business structures 43
3.2.7 Summary 46

4 Total factor productivity and resource allocation efficiency 48
4.1 Introduction 48
4.2 The impact of resource allocation on total factor productivity 49
4.3 Allocative efficiency in Finland 52
4.4 Developments in allocative efficiency in Finland 55
4.4.1 Introduction 55
4.4.2 Technology and allocative efficiency as factors of total factor productivity 55
4.4.3 Allocative efficiency development in Finland 56

4.4.4 Labour income share development 59
4.4.5 Connection between allocative efficiency and profits........ 61
4.4.5.1 Division of mark-ups into within and between components........ 62
4.4.5.2 Profits and business cycles have a strong correlation 64
4.4.5.3 Positive correlation between allocative efficiency and mark-ups 67
4.5 Summary........ 72

5 Cost competitiveness........ 73
5.1 Cost competitiveness in Finland........ 73
5.2 The impact of the COVID-19 pandemic on competitiveness indicators 76

6 Conclusions and policy recommendations 78
6.1 How can productivity growth be accelerated?........ 79
6.2 Ensuring price competitiveness 83

References 85

TO THE READER

Motivated by the Recommendation of the Council of the European Union's on the establishment of National Productivity Boards, the Finnish Government issued a decree in June 2018 to establish a Productivity Board 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 in the euro area.

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 until 30 August 2021. The Board is chaired by Docent Markku Stenborg (Ph.D.), Senior Ministerial Adviser at the Ministry of Finance. Its other members are Professor Mika Maliranta (Ph.D.), Director at the Labour Institute for Economic Research; Ilkka Kiema (Ph.D., Soc.Sc.D.), Research Coordinator and Chief of Forecasting at the Labour Institute for Economic Research; and Janne Huovari (M.Soc. Sc.), Forecasting Director at Pellervo Economic Research PTT. Furthermore, the Ministry of Finance's HGSE (Helsinki Graduate School of Economics) trainee Peter Elmgren has contributed to this report: Chapter 4.4 is based on his analysis.

The Board's first report was published in spring 2019. This third report focuses especially on the productivity impacts of innovation, resource allocation and the functioning of Finnish markets.

1 Introduction

The first report of the Finnish Productivity Board (Finnish Productivity Board, 2019) examined productivity and the second report considered (Finnish Productivity Board, 2020) competitiveness across a broad front. This third report focuses on the functioning of markets from the productivity perspective. We especially look into innovation incentives, corporate sector dynamics, creative destruction, and the significance of resource allocation. In addition, we also review recent productivity development and sources of productivity as well as comment on policy actions that promote productivity.

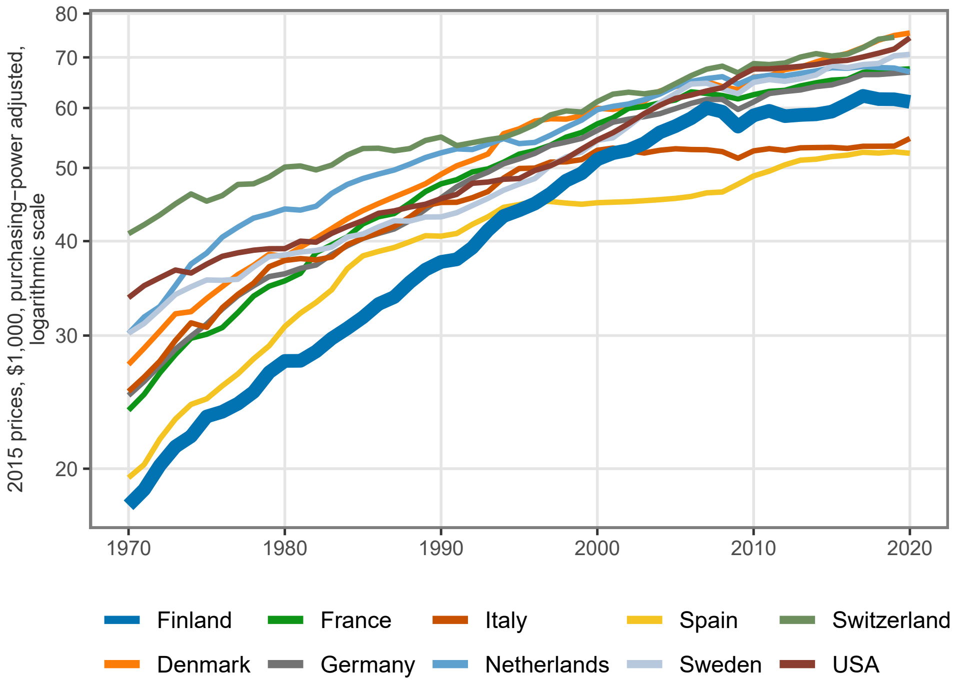
1.1 Comparing labour productivity and total factor productivity

First, we take a look at productivity development and competitiveness at the level of national accounts. Figures 1.1 and 1.2 compare labour productivity (GDP or value added per working hour) in Finland and its key reference countries. The figures are based on the OECD Labour Market and Productivity Statistics Database, in which each country's GDP is purchasing-power adjusted (USD in 2010) to ensure that the countries' figures are comparable.

Figure 1.1 shows that labour productivity in Finland (GDP per 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 but started to decline around the time of the financial crisis and since then the average productivity growth has been very slow.

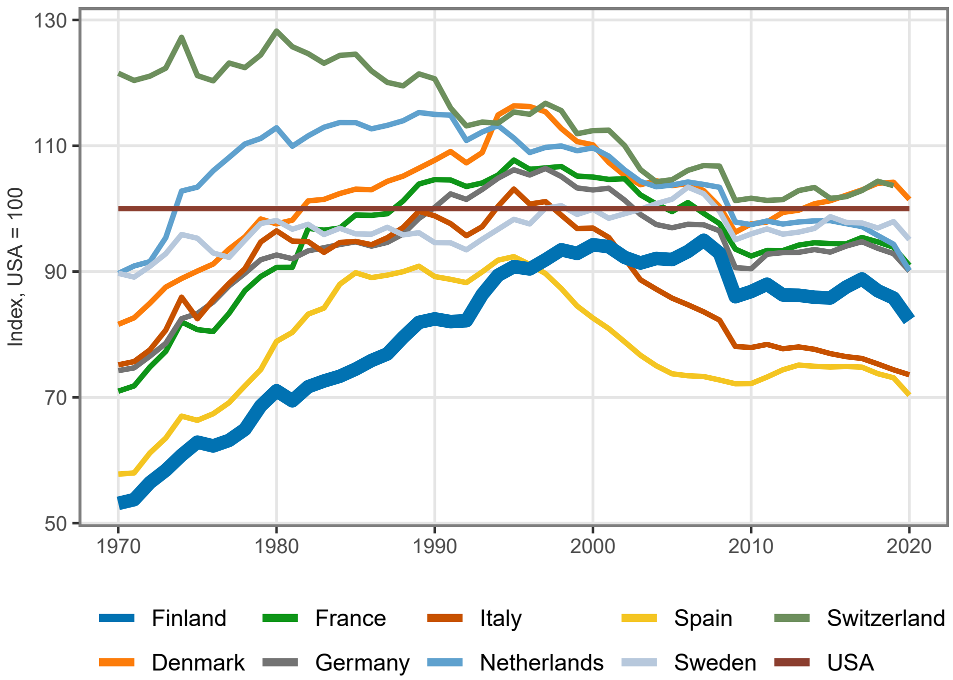
In 2020, labour productivity in Finland, and also in other countries, was affected by changes in the sectoral structure caused by the COVID-19 pandemic. As labour productivity varies across different sectors, the restrictions that were applied to only certain sectors during the crisis and the temporary decline in demand especially in service sectors changed average labour productivity. For the time being, it is still difficult to assess the extent to which the COVID-19 pandemic caused such lasting changes in the sectoral structure that would affect labour productivity permanently.

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 the United States.



Source: Macrobond, OECD

Figure 1.2 compares Finland and its reference countries to the United States. 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 the 2019 report (Productivity Board, 2019), which contains an extensive overview of productivity growth and the way it has come to a halt, among other things. However, it can be stated that the financial crisis was not the reason for the stagnating productivity growth and the fact that Finland could no longer catch up. Some 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 sector structure development, and Finland's very slow adaptation to the permanent shock that hit the electronics industry.

In Chapter 2, we take a closer look at development by focusing on value added in the corporate sector. At the level of the entire national economy, the comparison of productivity is complicated by factors such as the varying role of the public sector in different countries. In the public sector, it is difficult to determine value added as there usually is no market for these services. Another measurement-related problem is that the impacts of public-sector production are often indirect. Teaching, for example, produces hardly any measurable value added but a very large part of the actual value added arises from the fact that in the future, an educated person can produce more value added than an uneducated person. The third problem associated with measuring productivity is how to take quality into account. In market services, it is easier to take higher quality into account: the customer is ready to pay more for a higher-quality solution. This means that higher quality has a direct impact on value added. In the public sector, the improvement of quality has both direct and indirect impacts, and the latter are nearly impossible to measure.

Sources of long-term productivity growth can be sought by applying two complementary perspectives. On the one hand, in the neoclassical growth theory, technological development is assumed to be exogenous (having an external cause). On the other hand, in the newer theory of innovation-based growth, technological development is assumed to be endogenous (having an internal cause). In an analysis based on the neoclassical growth theory, growth in productivity is examined empirically using the so-called growth accounting. Suitable data for this accounting include aggregate statistics, which are obtained from such sources as national accounts data (see Finnish Productivity Board, 2019, Chapter 4). Instead, the empirical applications of the theory of innovation-based growth use so-called micro-data obtained at the firm or site level.

Growth in labour productivity is caused by three main factors:

1. growth in capital intensity (capital per working hour)
2. change in the quality of labour input and
3. total factor productivity (TFP).

The more and better machines, equipment and other capital an employee has available to them, the more output they will produce per hour. Similarly, the more skilled the employee is, the more output they will produce in an hour. Total factor productivity is a residual term of the growth accounting function. 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 produced with the same quantity and quality of labour and capital inputs. In addition to the residual term approach, total factor productivity can also be measured directly. This has two advantages: the analysis is not based on equilibrium assumptions, which combine several data feeds into one index, and the growth rate of total factor productivity can be divided directly into indicators of efficiency change and technological development, for example.

In the long term, roughly two thirds of the growth in labour productivity can be explained by growth in total factor productivity (Aghion & Howitt, 2007). Total factor productivity is also the most important factor explaining differences in standards of living between countries (Jones, 2016; Klenow & Rodriguez-Clare, 1997). It is often interpreted as technological development, but in that case, technology must be understood in a very broad sense.

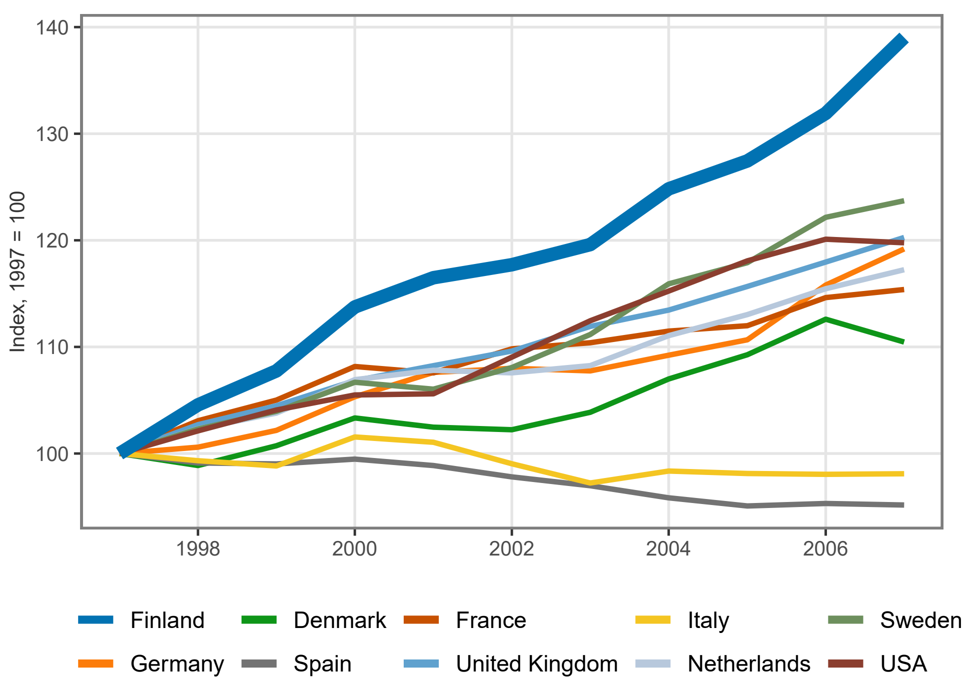
Figures 1.3 and 1.4 compare the development of total factor productivity in the market sector[1] in 1997–2007 and 2007–2017. On the basis of the figures, the growth of total factor productivity in Finland was very strong in 1997–2007 and exceptionally poor in 2007–2017. In 2017, total factor productivity still remained below its 2007 level. In Chapter 2, we look into the significance of innovation and market dynamics for total factor productivity, among other things. In Chapter 3, our topics include, for example, innovation and the renewal and dynamics of the corporate sector, as viewed on the basis of the OECD data, and in Chapter 4, we divide the development of total factor productivity into the efficiency of resource allocation and technological development by applying state-of-the-art economics research methods to Finnish data.

The use of so-called micro-data obtained at the firm or site level improves our understanding of innovation, productivity, firms' profits and the labour income share, among other things. This report emphasises the use of these firm-specific data in examining productivity.

1 The figures are based on the EU KLEMS data http://www.euklems.net/. In the data, the market sector is defined to consist of NACE2 categories excluding L (Real estate activities), O (Public administration etc.), P (Education), Q (Human health and social work activities), T (Activities of households as employers) and U (Activities of extraterritorial organisations and bodies).

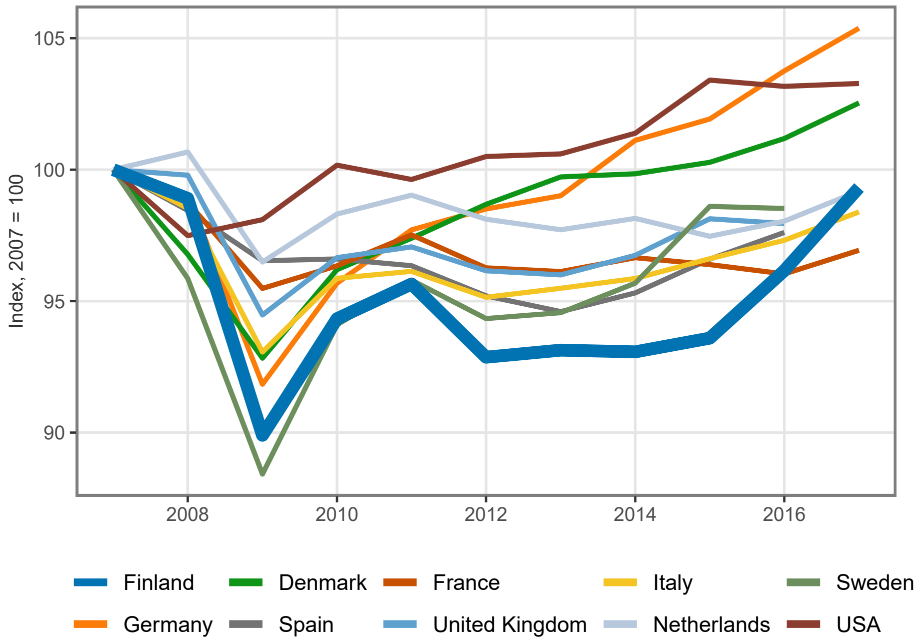
Aggregate data, such as sector-specific data, may convey a misleading picture of the development that takes place within the sector and between firms. For example, the increase in a sector's combined profits does not necessarily mean the weakening of competition. The phenomenon may have resulted from factors such as the reallocation of activities within the sector, with more profitable firms gaining a larger share of the sector's market. Similarly, the aggregate labour income share may decrease while at the corporate level labour income share increases. This happens when firms with a low labour income share grow faster than firms with a high share. This kind of impact cannot be distinguished in aggregate data.

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 in 2007–2017, market sector, 2007 = 100.

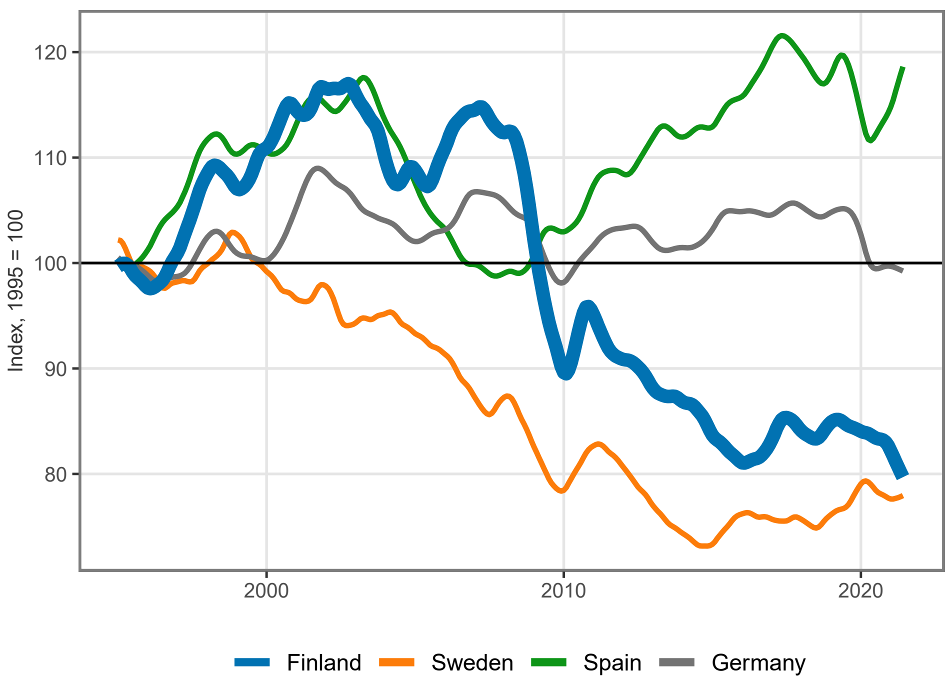


Source: EU KLEMS, Macrobond

1.2 Competitiveness

Long-term structural growth competitiveness and short-term price competitiveness (see Finnish Productivity Board, 2020) are important factors for a successful export sector. Figure 1.5 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 the market share took a downward turn. A number of developed economies have experienced the same as Sweden: exports of goods are developing at a slower pace than world imports, as parts of production have been relocated to China and other emerging economies. Germany and countries such as Spain demonstrate that this development is not inevitable; however, Germany's market share had already fallen previously.

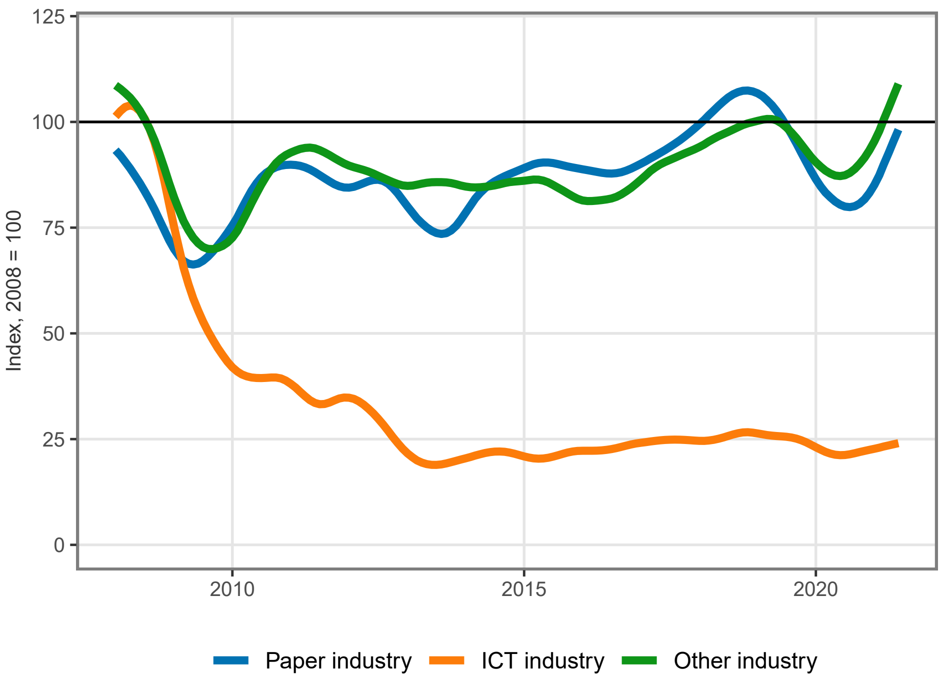
Figure 1.5. Development in the market share of exports of goods, 1995 = 100, HP-filtered trend.



Source: CPB World Trade Monitor, Macrobond

Figure 1.6 shows the exports of Finnish industry by sector. 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 newsprint and fine paper consumption, which the increased demand for paperboard and pulp has struggled to compensate for. Other sectors of industry have finally managed to exceed the peak year of 2008 in their exports.

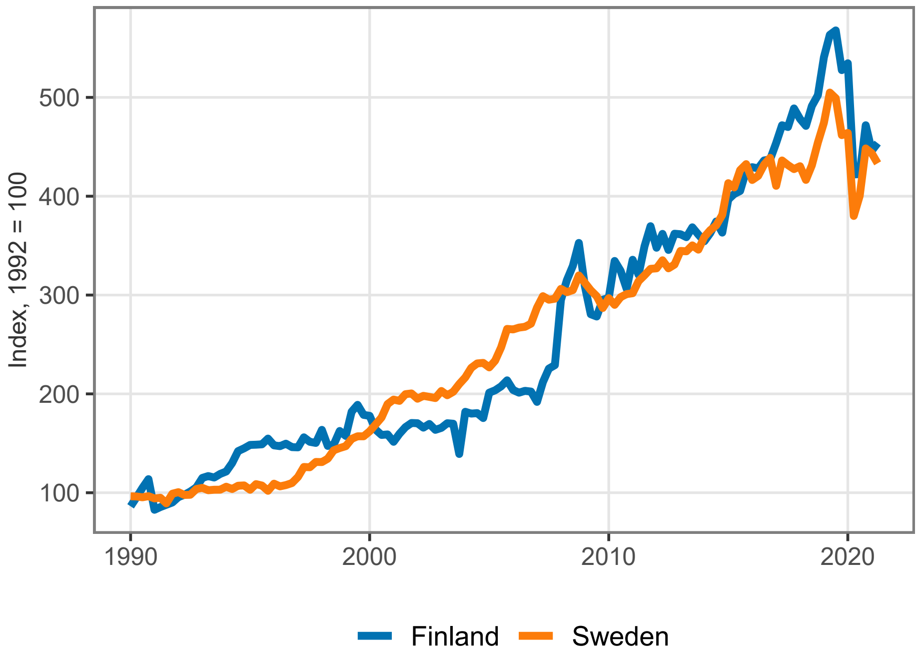
Figure 1.6. Volume of exports of goods by sector, HP-filtered trend.



Source: Statistics Finland, Macrobond

Figure 1.7 compares development in the exports of services in Finland and Sweden using the 1990s recession as the baseline. Finnish exports of services have done relatively well since the 1990s and particularly well in recent years before the COVID-19 pandemic. Service exports have not suffered from the weakening of competitiveness 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 per cent of the service exports in 2019. Some of the positive development in service exports and the negative trend in exports of goods is 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 still only worth about one half of the value of goods exports.

Figure 1.7. Volume of service exports in Finland and Sweden in 1990–2020.



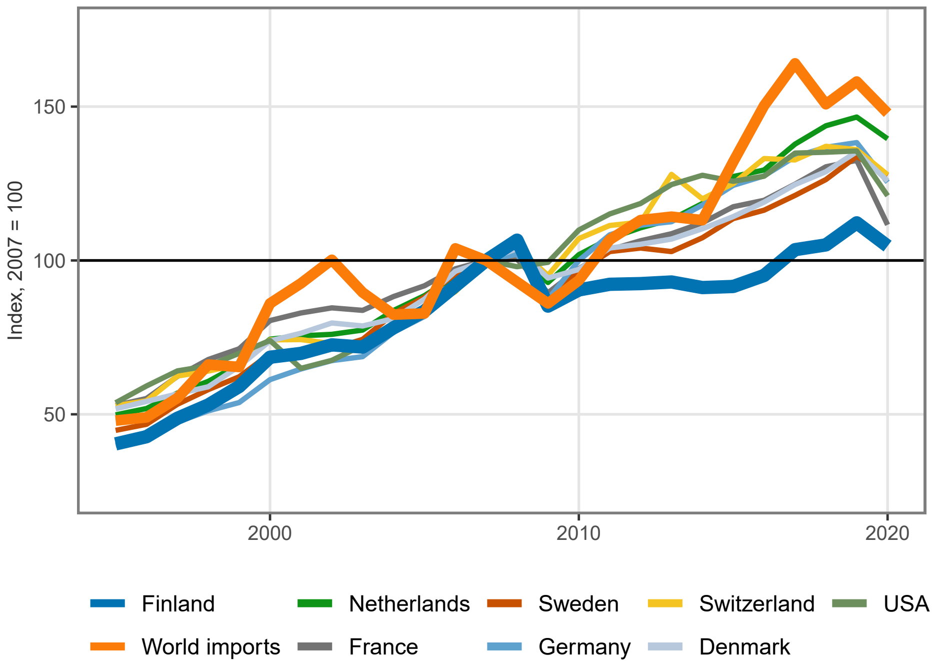
Source: Statistics Finland, Macrobond

The assessment of price competitiveness or cost competitiveness consists of the comparison of the development of export prices, labour costs and productivity. Several indicators have been proposed for cost competitiveness but, for Finland, the most important of them have usually developed into the same direction. One of the key indicators is labour costs per the value of production, or the so-called relative real unit labour costs. A specific set of countries, or individual countries, can be used as a reference point for this indicator. The real unit labour costs increase when 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.

Chapter 5 discusses competitiveness in more detail. It should be kept in mind that the policy actions taken to deal with the COVID-19 pandemic have complicated the measurement of price competitiveness.

Figure 1.8 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 1.8. Volume of world imports of goods and services and the exports of certain countries, 2007 = 100.



Source: World Bank, Eurostat, BEA, Macrobond

2 Labour productivity in the corporate sector

2.1 Theories about productivity gaps between countries

When looking at labour productivity, it is important to pay attention to both the level of productivity and the development of productivity. In the review of the level of productivity, the natural choice is to use other countries in a similar position as the reference point. For Finland, good reference points are the Nordic countries and other wealthy economies. The reason is that the level of productivity influences both the cost competitiveness of the national economy and the relative standard of living. The former is significant for how well the firms operating in Finland succeed in international trade and the latter for how attractive Finland is as a place of residence.

The level of productivity is an interesting phenomenon also because it influences productivity growth or at least the preconditions for growth. The traditional neoclassical growth theory states that the low level of labour productivity in a national economy in relation to other countries is due, first and foremost, to the country in question having less capital per labour input than other countries. According to the theory, more investments are made in low-productivity countries than in high-productivity countries. As a result, the productivity growth rate in low-productivity countries is faster than in high-productivity countries. This means that convergence of productivity levels takes place; in other words, productivity gaps between countries become narrower.

The newer, Schumpeterian economic growth literature emphasising the significance of innovation activities draws attention to the point that productivity gaps between countries are explained not only by capital but also by the level of technology: in some countries, the average level of productivity is lower than in the leading countries because the firms in the country in question use on average less advanced technology than those in the leading countries (Aghion & Howitt, 2009). Productivity gaps between countries become narrower when cutting-edge technological information spreads from the leading countries into lower-productivity countries.

However, this literature emphasises the fact that technology transfer from the leading countries to the countries trying to close the gap does not happen automatically. Technology is not solely easy-to-adopt 'formulas'. Even imitating cutting-edge technology requires technology and development investments. The more these investments are made in a national economy, the more frequently the adoption of new technology is successful and the closer the level of technology and productivity in the economy's firms is to that of the internationally leading firms – and the more competitive and prosperous the national economy is.

According to the theory, in a state of equilibrium, each national economy has a certain level of productivity in relation to the international leaders in productivity. The relative level of productivity is influenced by the extent of incentives and preconditions that firms have for investing in research and development. Influencing factors include, for incentives, the level of competition and the taxation of profits and, for preconditions, the amount and quality of educated labour force. If a national economy happens to suffer a so-called negative shock, its relative productivity may temporarily fall under the equilibrium level. Nevertheless, after this the level of productivity starts to converge towards the equilibrium again.

However, the theory points out that in some countries, incentives or preconditions for technology and development investments may be practically non-existent, in other words, there is no (or hardly any) imitation of technology. These countries may constantly be lagging behind in productivity in relation to the leading countries. In a sense, such countries form their own 'club', hence the term 'club convergence model'. Although the country's relative productivity starts to converge towards the equilibrium again after the shock, it is possible that some sets of countries are constantly lagging more and more behind the leading countries.

According to the theory, productivity gaps between countries are also influenced by the speed of development among the leaders in technology: the faster the technological development, the further the leaders have on average proceeded before a certain firm or sector has succeeded in imitation. In other words, the acceleration of technological development leads to an increase in relative productivity gaps between countries.

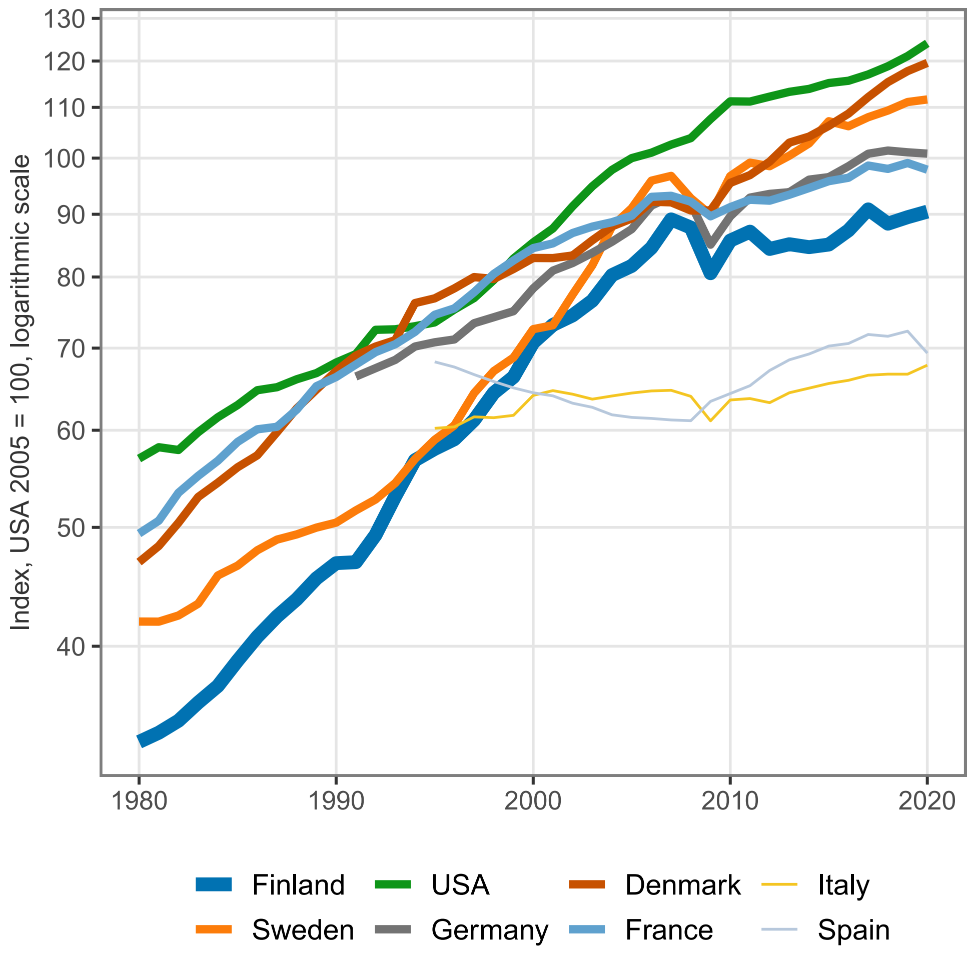
2.2 Labour productivity development in the corporate sector

Figure 2.1 shows the development of labour productivity in the corporate sector in Finland and some reference countries.[2] The figure illustrates the levels of productivity with the reference point being the level of labour productivity in the United States in 2005 (United

2 The values given for the labour productivity levels for 2005 are based the University of Groningen's database (https://www.rug.nl/ggdc/productivity/pld ; cf. Inklaar & Timmer, 2014). For other years, the estimates are obtained by extrapolating labour productivity in 2005 on the basis of the databases of Eurostat, the OECD and the Bureau of Labor Statistics (United States).

States in 2005 = 100). The figure uses a relative (logarithmic) scale, which means that the differences in the slopes of the lines in the graph indicate differences in productivity growth rates at different times and between different countries. If the gap between two countries becomes narrower, it means that the relative productivity gap between them decreases.

Figure 2.1. Labour productivity in the business sector, (United States 2005 = 100).

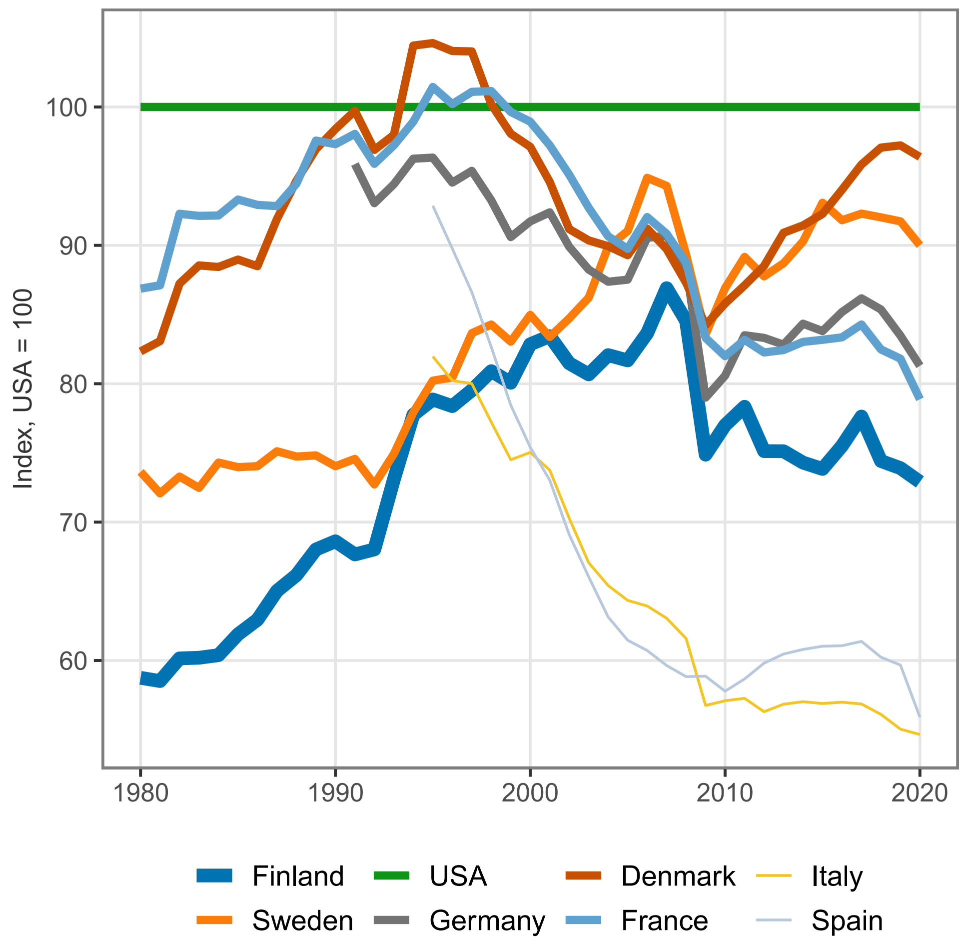


Source: Eurostat, OECD, BLS, Inklaar & Timmer (2014), Finnish Productivity Board.

As a rule, the United States has been a leading country in productivity in 1980–2020. It can also be seen that Finland was closing the relative gap until the early 2000s. After that, this development came to a halt, and after 2008, the gap between the United States and in Finland in relative productivity started to widen.

Figure 2.2 shows the development of relative labour productivity in Finland even more clearly. Looking at the figure, it seems that the 'equilibrium productivity' of the Finnish corporate sector is at approximately 80 per cent of the level of the leading countries. This level was exceeded somewhat in Nokia's heyday in 2000–2008 but after that, it has dropped to 75 per cent – roughly to the same level as in the mid-1990s.

Figure 2.2. Relative levels of labour productivity, United States = 100.



Source: Eurostat, OECD, BLS, Inklaar & Timmer (2014), Finnish Productivity Board.

On the basis of the figure, Denmark has risen to a level of roughly five percentage points below the United States but this should perhaps be taken with a pinch of salt due to reasons that will be discussed more in Chapter 2.3. In Sweden, relative labour productivity is at the moment about 90 per cent, as it was already some 15 years ago. Relative labour productivity in Germany and France has been on average about 15 percentage points behind the United States for the past ten years, or roughly 10 percentage points ahead of Finland. Spain and Italy clearly bring up the rear. Their labour productivity has been lagging on average 40 percentage points behind the United States for the past 15 years.

Figure 2.1 also shows that in the United states, the growth of labour productivity accelerated after the mid-1990s and then slowed down again after the early 2000s. Research on US productivity has determined that this acceleration of productivity growth can be explained, first and foremost, by successful ICT adoption: productivity growth accelerated above all in the sectors where the use of this technology was particularly intensive.

These same sectors also seemed to be the ones where productivity growth waned most clearly (see Fernald, 2015). The figure also shows that once the ICT transformation began, all other European countries apart from Finland and Sweden started to lag behind when compared to the United States. At that time, Finland and Sweden managed to keep up with the US development and, unlike Finland, Sweden still seems to do so.

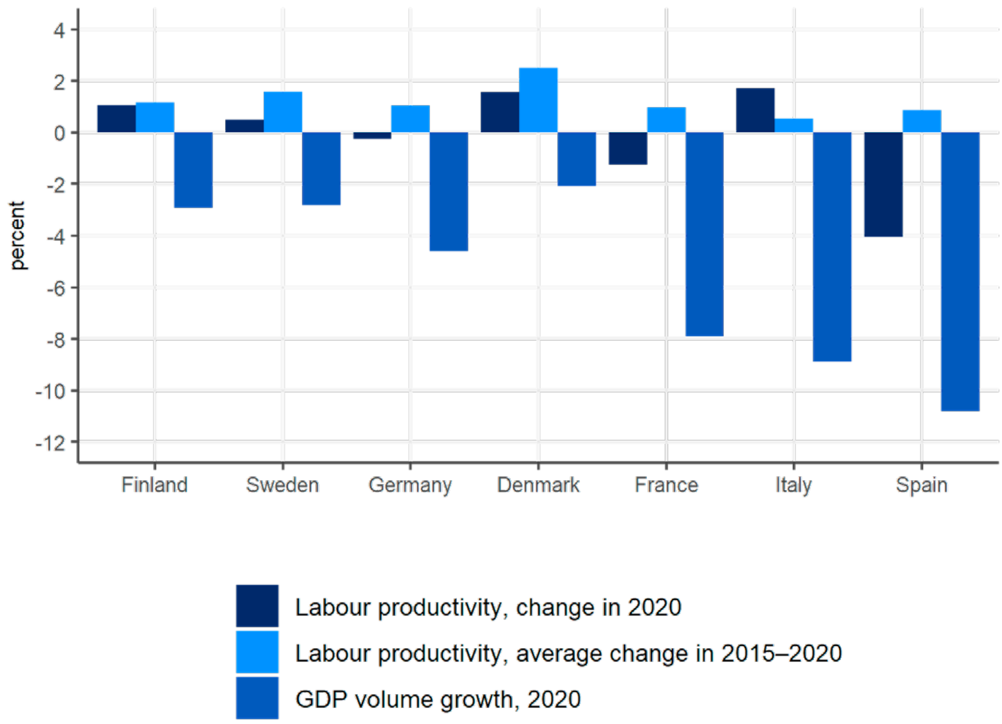
Figure 2.2 also illustrates the exceptionality of productivity development in 2020: in all countries in the figure, labour productivity decreased when compared to the United States and the decline was especially sharp in France and Spain. Figure 2.3 compares last year's labour productivity development in the corporate sector in the countries under review to the average development in the preceding five years. In addition, the figure shows the GDP change in 2020 as it can be considered indicative of the scope of the damage that the COVID-19 pandemic caused to the national economy in various countries.

The figure shows that labour productivity development in Finland in 2020 did not essentially differ from the average of the preceding years. In two other countries that suffered least from the pandemic – in Sweden and Denmark – the growth of labour productivity has been slower than in the preceding five years on average. In Spain, the country worst hit by the pandemic, labour productivity decreased by as much as four percentage points, but in Italy, labour productivity grew faster than in the preceding years on average, 1.7 percentage points.

The COVID-19 crisis has differed from ordinary financial crises in so far that during it, the sector structure in economy has also changed in some sectors due to the restrictions especially set on service sectors and due to consumer behaviour changes resulting from the pandemic. Productivity changes caused by such reasons are of a temporary nature and will result in equivalent changes in the opposite direction in the next few years but, for the time being, their contribution to the changes shown in Figure 2.3 is difficult to assess.

From the economic policy point of view, a crucial question is: What factors lock productivity in the Finnish corporate sector to under 80 per cent in relation to the leading countries and to approximately 10 per cent below Germany and France? What factors could explain why Denmark and Sweden have succeeded in rising to a new level, even to the group of the leading countries? The Schumpeterian growth theory suggests paying attention to factors that influence the development of the most advanced technologies and their adoption in the national economy. According to the theory, solutions should be sought in innovation, education and competition policy. However, to get a clearer overview, it is also useful to look into productivity gaps and development at the more detailed sector level, by reviewing the situation separately in manufacturing and private services, for example.

Figure 2.3. Labour productivity development in the corporate sector in 2020 and in the preceding five years and GDP growth in 2020.

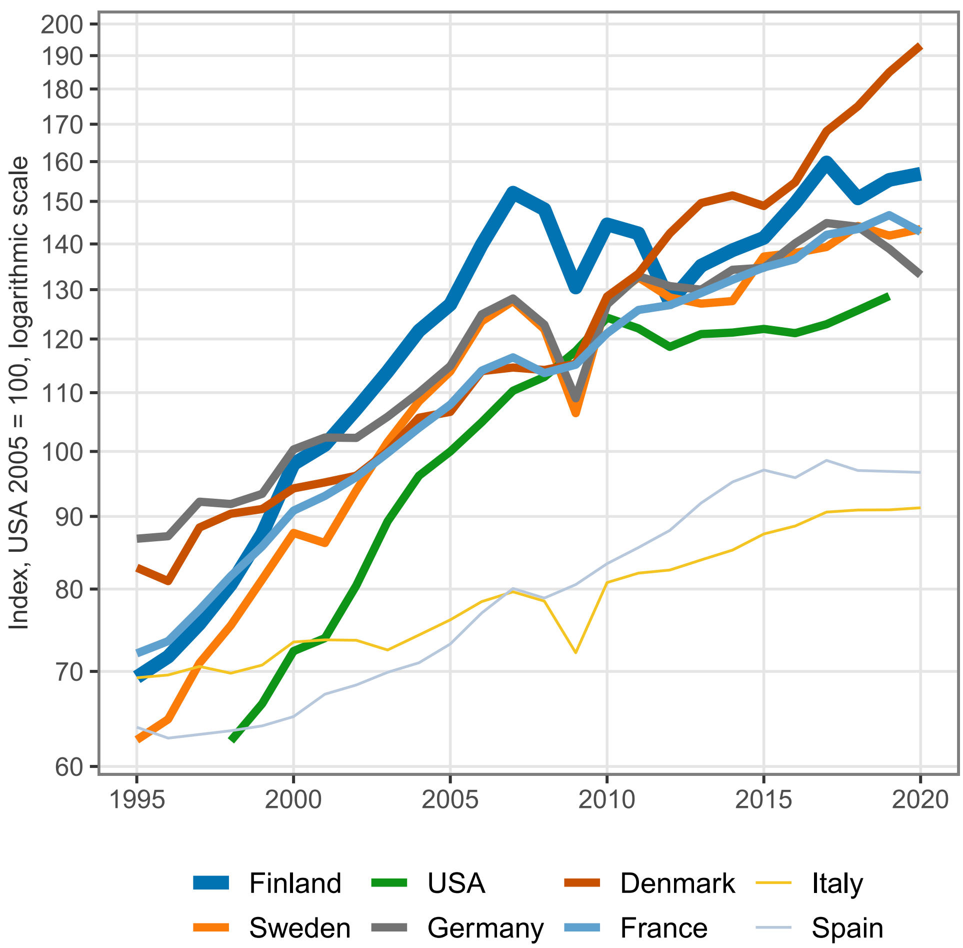


2.3 Manufacturing

Figure 2.4 shows the development of labour productivity in manufacturing. We can see how Finland first made a huge productivity leap and caught up with the leading countries by 2000 and then broke away from the pack. The internationally high level of productivity in the 2000s resulted primarily from the rise of the electronics industry. Its productivity was extremely high and its share of production grew exceptionally large in Finland. Finland remained at the top until the early 2010s. After that, Finland has still been slightly ahead of Sweden, Germany and France.

Development in Denmark, as shown in the figure, seems downright suspicious. Another sign of the unreliability of these results is that the country's figures vary a great deal in different sources due to significant retrospective corrections. As manufacturing is an important part of the entire corporate sector, suspicion also arises regarding how reliable the reviews of the entire Danish corporate sector presented above are. On the other hand, labour productivity in the United States perhaps seems somewhat surprisingly low in relation to Finland and other leading European countries.

Figure 2.4. Labour productivity in manufacturing, logarithmic conversion, United States 2005 = 100.

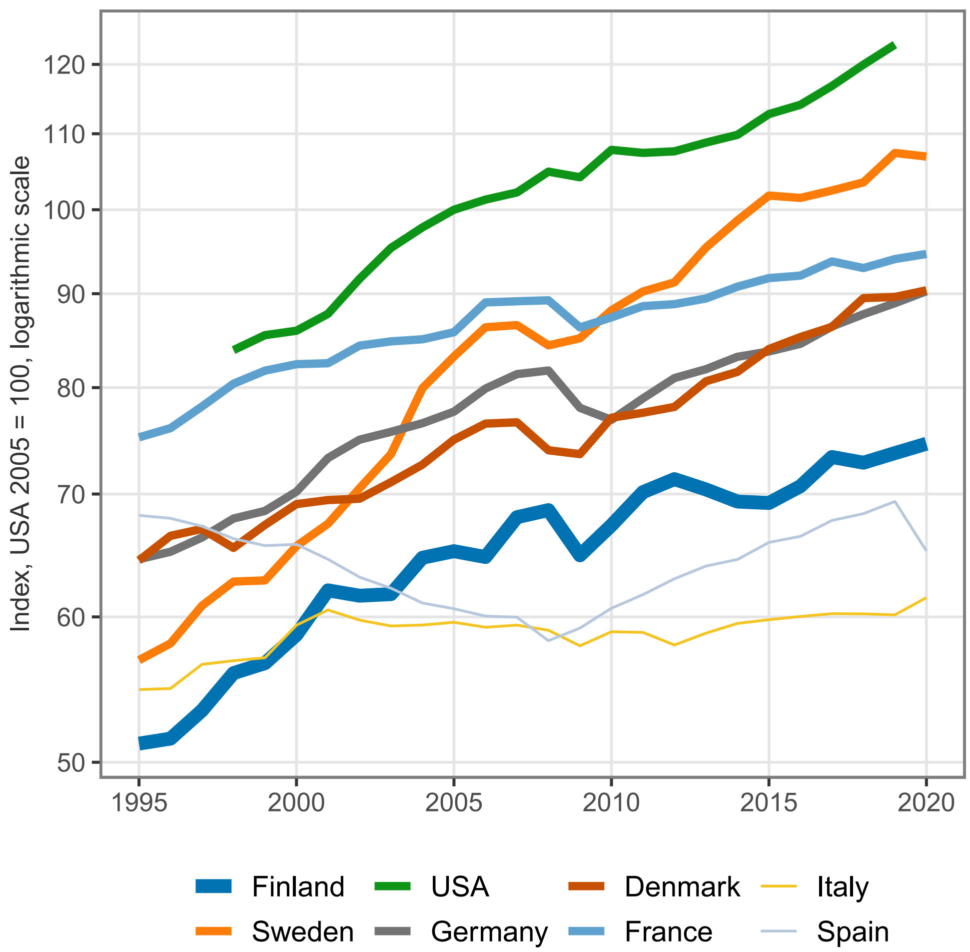


Source: Eurostat, OECD, BLS, Inklaar & Timmer (2014), Finnish Productivity Board.

2.4 Private services

Figure 2.5 shows labour productivity in private services. The United States has been a clear productivity leader in this sector in 1995–2020. Sweden has been reducing the gap vigorously throughout the entire review period. The gap between Finland and the United States was approximately 30 percentage points in 2000 and Finland has not been able to catch up – in fact, the gap has rather been widening. It seems that Finland's 'equilibrium productivity' in private services is at perhaps roughly 65 per cent of the level of the leading countries.

Figure 2.5. Labour productivity in private services, logarithmic conversion, United States 2005 = 100.



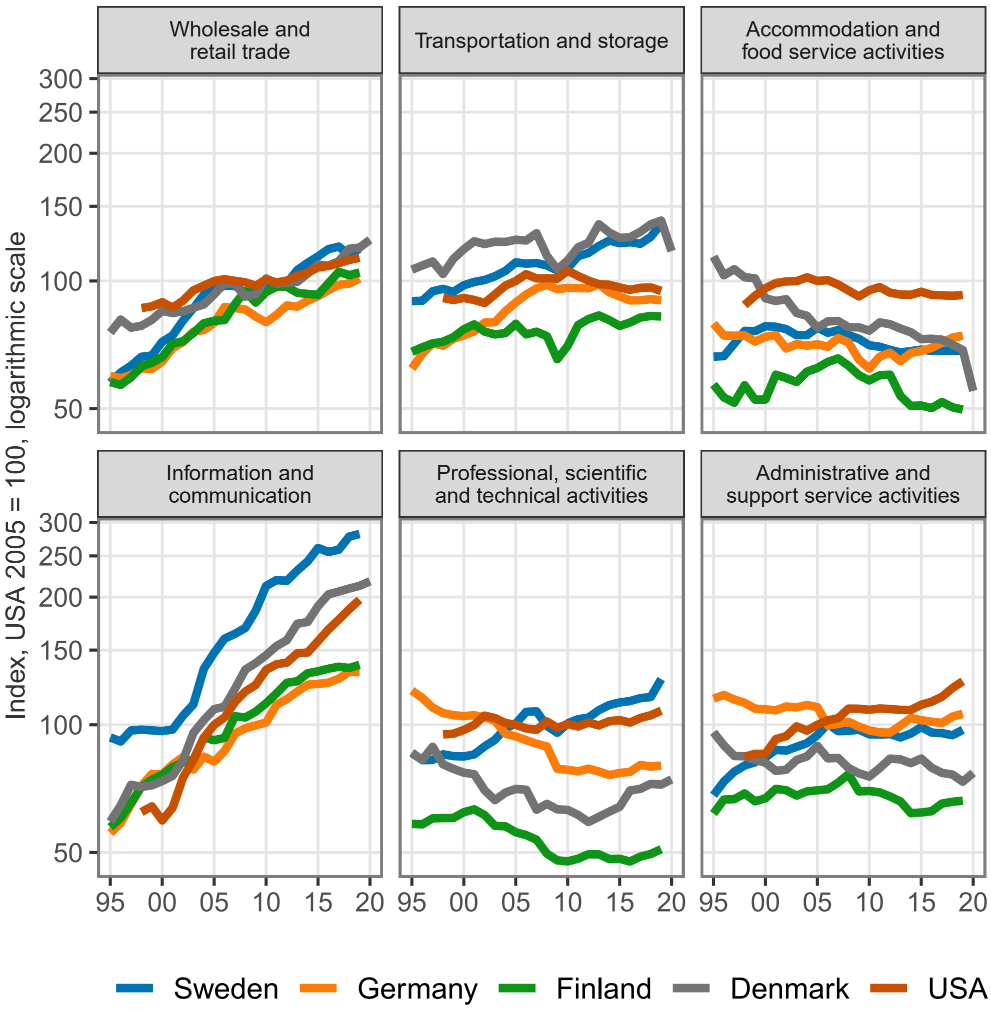
Source: Eurostat, OECD, BLS, Inklaar & Timmer (2014), Finnish Productivity Board.

The surprisingly weak productivity of Finnish service sectors is analysed in more detail in Figure 2.6, showing the situation in six private service sectors. Real estate activities and financial and insurance activities were excluded from the analysis.

In the three most traditional service sectors – wholesale and retail trade, transportation and storage, and accommodation and food service activities – Finland's development has quite closely resembled that of Germany and the United States. Labour productivity in these sectors is now weaker in Finland than in Denmark and Sweden.

In professional, scientific and technical activities, labour productivity has decreased for a large part of the review period in all comparison countries apart from Sweden. Somewhat surprisingly, when it comes to labour productivity in this sector as well as in information and communication and administrative and support service activities, Finland is at the bottom of the ranking.

Figure 2.6. Labour productivity in some main private service sectors.



3 Innovations and the functioning of markets[3]

3.1 Competition, innovations and creative destruction

3.1.1 Paradigm shift in growth research

In the traditional economic growth paradigm, technological development is determined exogenously, or by external factors outside the model. In this paradigm, innovations that advance technology come like 'manna from heaven'. The paradigm is based on the so-called neoclassical growth model, the most famous version of which was introduced by Robert Solow (Solow, 1956), who was later awarded the Nobel Prize in Economic Sciences. In addition to the pace of technological development being determined by external factors outside the model, it assumed that competition is perfect. In other words, the model does not state that (perfect) competition would be good for economic growth but that it is a basic assumption on which the neoclassical growth model is built. If the intention is to understand factors that influence innovations and especially the significance of competition, the economic growth paradigm that is based on the neoclassical model does not seem a very fruitful framework for thinking. Furthermore, all firms are assumed to be the same so the model is not suitable for determining the significance of entrepreneurship or innovators for economic growth.

Even before Solow, the Austrian economist Joseph Schumpeter had contemplated the fundamental factors of economic growth very perceptively. His first idea is that economic growth is based on innovations and the spreading of information. The second is that innovations require incentives and protection of ownership. The third idea is that economic growth happens through so-called 'creative destruction'. That is a process in which new innovations replace old ones and, as a result, business operations and jobs built on old innovations are destroyed. Thus, the idea is not that destruction would cause creation but that creation also causes, as a by-product, destruction in the economy.

3 This chapter is mainly based on a textbook by Aghion and Howitt (2009) and a recently published book by Aghion et al. (2021). The topic is also presented and discussed by Acemoglu (2009), Aghion et al. (2014), Grossman and Helpman (1991), Hyytinen and Maliranta (2016), Klette and Kortum (2004), and Takalo and Toivanen (2021), among others.

3.1.2 Schumpeterian economic growth model

Schumpeter's ideas seem reasonable. The problem was that he never formalised his hypotheses, let alone tested them empirically. Consequently, the consistency and explanatory power of the ideas could not be assessed reliably. Aghion and Howitt's (1992) article was an important turning point in economic growth research.

They formalised the 'creative destruction' model, which allows the incentives and consequences of firms' innovation activities to be analysed theoretically. The model is an innovation-based, endogenous creative destruction growth model, which is also called the Schumpeterian economic growth model. The foundation for the new Schumpeterian paradigm of economic growth research had thus been laid. It provides a theoretical framework for modern theoretical and empirical research into economic growth.

In Aghion and Howitt's model, a firm that succeeds in its innovation activities achieves a temporary monopoly and gains the resulting monopoly profits. These monopoly profits served as the initial incentive when the firm decided on its investment in R&D activities. The larger the profits on offer are, the more worthwhile it is for the firm to invest in R&D, because the more the firm invests in R&D, the more likely it is that the development project succeeds and the firm invents a new innovation and gets to benefit from monopoly profits. In addition, the more innovations the firms in an economy make, the faster economic growth is. However, when a successful innovator gains access to monopoly profits, earlier innovators lose their monopoly profits and jobs are destroyed in their firms.

3.1.3 The impact of competition on innovation

The neoclassical growth theory and the first-generation innovation model were the two opposite extremes as far as competition was concerned. As noted above, the former assumes competition to be perfect. On the contrary, in the first creative destruction models, the larger monopoly profits there are on offer for a successful innovator, or the less competition there is, the brisker innovation is and the faster is the productivity growth of the economy.

From the point of view of economic policy and especially competition policy, the conclusions of the first-generation innovation model seem striking. In the short term, the promotion of competition may benefit consumers as lower product prices and higher consumer surplus. However, the number of innovations decreases and economic growth slows down. That would eventually hurt not only producers but also consumers.

The neoclassical growth theory and the first creative destruction model were the two opposite extremes also in the sense that the former assumes that there are countless identical firms on the market. Instead, in the first creative destruction models, there is only one firm on the market at each particular moment and, in due course, it will be ousted by a firm that manages to make a new successful innovation.

Later creative destruction models were complemented to enable a better analysis of the connection between competition and innovation. The assumption was that there is competition between the firms operating on the market. To make the model as simple as possible, it is assumed that there are two firms on the market at each particular moment and that there can be two kinds of situations on the market.

Firstly, the firms can be on a technological par with one another, in other words, neither of them gains exclusive access to monopoly profits. If competition between them is perfect, they will compete themselves 'to death' so that both have zero profits. The other extreme is that the neck-and-neck firms form a cartel. They price their products in consensus, as if they formed a monopoly together, and share the profits in half. According to the model, the level of competition can vary between these two extremes.

Secondly, two firms can be one after the other so that the leader is one innovation step ahead of the follower. The leader has a monopoly and gains monopoly profits. The follower barely survives and gains no profits.

By investing in R&D activities, a firm can, with certain likelihood, take one innovation step. If it is a follower, a successful innovation enables it to get neck and neck with the other firm. If competition is non-existent, in other words, the cartel operates at full force, the rising firm gets half of the market's monopoly profits instead of its earlier zero profits. In this situation, lack of competition encourages the follower to innovate. The less competition there is, or the more perfect the division of profits between the firms in the cartel is, the higher additional profits the follower gains with successful innovation. And the higher the potential profits are, the more the follower invests in R&D and the more frequently it happens that the firms are neck and neck on the market and share the profits in harmony. On the other hand, the tighter the situation between neck-and-neck firms is, the smaller their profits are and the less incentives the follower has for reaching the other firm.

When the firms are neck and neck and share monopoly profits in half in harmony, in other words, there is little competition, the firm can double its profits with a successful innovation, which allows it to take the leading position and get monopoly profits in their entirety. When competition is weak, both firms have at least some kind of stimulus to innovate and thus increase their profits. What if competition between these neck-and-neck firms is extremely high and their profits are nearly zero? In this situation, a successful innovator increases its profits from nearly zero to monopoly profits in their entirety, which is nearly double the increase when compared to the opposite extreme. Thus, when competition between the neck-and-neck firms is extremely high, both have a particularly high incentive to become the market leader and get all the profits.

The model assumes that the follower is always one step behind the leader. If the leader takes one innovation step, the follower is also assumed to proceed one step in its wake. For this reason, the leader does not have innovation incentives. However, this is not consistent with empirical findings – leaders also innovate. Later models have been developed further to ensure that this characteristic is also modelled.

Above we could see that when competition increases (there are less profits for neck-and-neck firms), the innovation activities of the follower decrease. Thus, competition has a negative impact on the follower's innovation activities. This can be called the Schumpeter effect. On the other hand, when competition increases (there are less profits for neck-and-neck firms), neck-and-neck firms have higher innovation incentives. This could be called the escape competition effect. This applies to firms that are neck and neck to begin with.

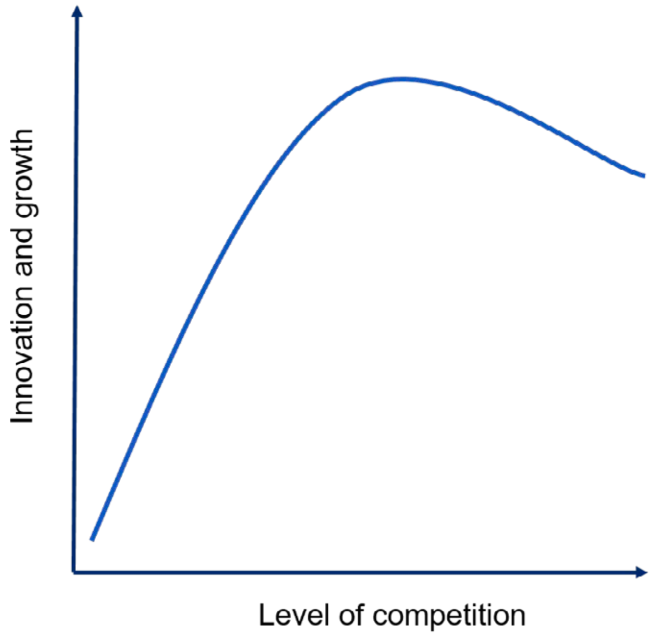
Thus, an increase in competition has two kinds of impacts on innovation. The impact that dominates at the level of national economy is determined by the situation in question. If competition is low to begin with, followers have high incentives for innovating and reaching the leader. However, neck-and-neck firms have only moderate incentives for becoming the leader. As a result, on most markets, firms are neck and neck and relatively few markets are in a state where firms are one after the other. When competition increases, the neck-and-neck firms' willingness to innovate also increases. As these cases are in majority, an increase in competition leads to an increase in innovation activities at the level of the entire national economy.

What if competition in the market is high to begin with? What happens if competition still increases? As stated above, when competition is extremely high, neck-and-neck firms have high incentives for innovating and becoming the leader. For this reason, they invest a lot in innovation and steps towards the lead are taken frequently. On the other hand, the followers have relatively low incentives for reaching the leader. An increase in competition does not increase the leader's or the follower's willingness to innovate. When competition is high to begin with, on most markets, firms are one after the other. In this kind of situation, the Schumpeter effect dominates and, consequently, an increase in competition may decrease innovation when assessed from the perspective of the entire national economy.

The above provides grounds for why, at the level of the national economy, there may be a so-called inverted-U relationship between competition and innovation (Figure 3.1). With low competition, an increase in competition increases innovation. However, the higher the level of competition is, the smaller the increase in innovation resulting from an increase in competition is. A peak can also be reached, after which an additional increase in competition can even lead to a decrease in innovation.

The formalised framework based on the above also helps assess in which situations an increase in competition is likely to lead to an increase in innovation and in which situations it is likely to lead to a decrease in innovation. On the basis of a theoretical and empirical analysis, it can be deduced that usually competition increases innovation, in other words, an increase in competition has a positive impact on the growth of productivity and the national economy.

Figure 3.1. Inverted-U relationship between competition and innovations.



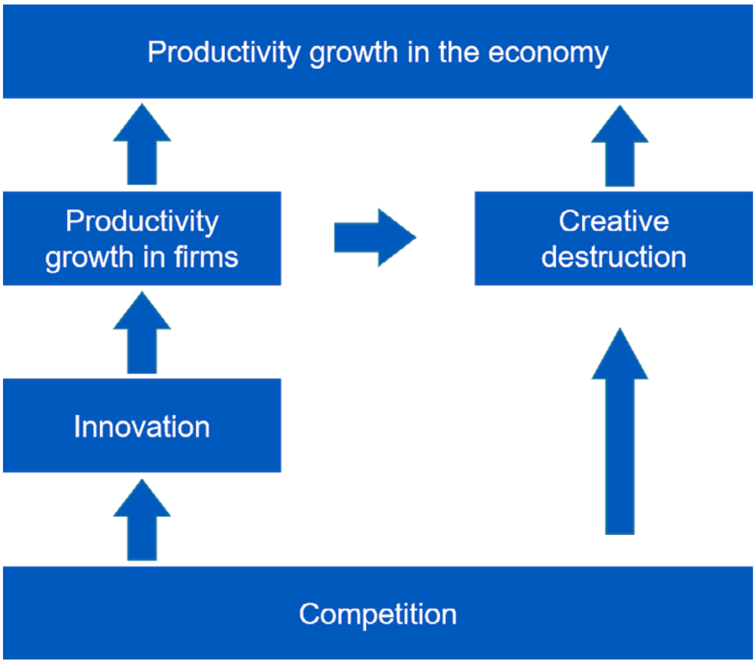
Source: Adapted from the article by Aghion et al. (2005)

There has been a great deal of empirical research on the connection between innovation and competition. Several studies have shown that an increase in competition leads to an increase in innovation but this is not necessarily always the case (see e.g. Aghion et al., 2021). In their article, Bloom et al. (2019, p. 178) came to the conclusion that greater competition and trade openness typically increase innovation. An increase in innovation occurs most surely in firms at or very near the frontier. On the other hand, as indicated by theory and supported by empirical evidence, an increase in competition may discourage followers and decrease their innovation (and likelihood to continue).

3.1.4 The impact of competition on firms' innovation activities and the increase of productivity in the national economy

Above we looked at the connection between competition and innovation in the light of modern growth research based on the Schumpeterian paradigm. As stated above, on the basis of theoretical and empirical research, competition typically accelerates innovation activities in firms – especially in those firms that are at or very near the technological frontier. Successful innovation by a firm increases its productivity, in other words, competition would seem to increase the growth of productivity in firms and, as a result, in the national economy. This channel of impact is shown on the left in Figure 3.2.

Figure 3.2. Competition and the increase of productivity in the national economy.



However, as stated above, competition and firms' innovation also lead to creative destruction, a change of corporate and job structures that increases the productivity of the national economy. In it, productive firms and jobs replace less productive ones. This requires the reallocation of labour force and other production resources between firms and their jobs. Part of the productivity impacts of competition and innovation take place through this mechanism. This is shown on the right in the figure. If this mechanism is disturbed, the productivity impacts of innovation activities on the national economy will be postponed and become weaker.

Weak creative destruction means that the national economy uses at each particular moment on average less advanced technology than could be. In that case, the labour productivity of the national economy in relation to the leading countries is lower than it would be if resources are briskly reallocated from inefficient firms that use low-productivity technology to efficient firms with better technology. Consequently, the permanent differences in the relative productivity levels of countries, as shown in Figures 2.1 and 2.2, can at least partly be explained by differences of creative destruction between the countries.

The impact of competition on the reallocation of resources between firms is looked into in more detail in the next chapter.

3.2 Assessment of innovation, competitive nature and renewal in Finnish firms

3.2.1 Measuring competitive nature and renewal is important but difficult

Below, we assess firms' innovation activities, the market's competitive nature and renewal in Finland by comparing its productivity development and business dynamics to those of key reference countries. As stated above, in most cases, competition between firms encourages innovation and the results of innovation activities are reflected not only on the average productivity of different sectors but also on the dispersion of productivity between firms. It was also noted above that, according to the Schumpeterian growth theory, firms invest in R&D activities with the aim of creating a new innovation. A new innovation leads to productivity exceeding that of other firms, which offers an opportunity to gain monopoly profits and a strong market position and encourages to expand production.

Only some firms succeed in innovation, which can be seen as productivity gaps between firms. Thus, wide productivity gaps can be a sign of intensive innovation activities. On the other hand, wide productivity gaps can also be an indicator of competition being so weak that also relatively inefficient firms survive on the market (see Leibenstein, 1966). The exceptionally good profitability of firms may indicate that, due to lack of competition, firms can use high margins in their pricing. Then again, as noted above, a firm's high margins can be explained by its supreme technology that has been developed with past innovation investments. If market shares are concentrated to few firms, it may indicate that some firms have a strong market position and competition is weak. On the other hand, just like good profitability, a large market share may also be result of supreme technology created with past innovation. A large market share in the domestic sector can thus be an imprecise indicator of competitive nature and its development as it does not take into account the competitive pressure from other sectors or countries (Bonfiglioli et al., 2021) or the local nature of competition (Rossi-Hansberg et al., 2021).

As described above, indicators for the dispersion of productivity, the profitability of different sectors and concentration should be interpreted with due discretion from many different perspectives. They may be inadequate or even misleading tools for measuring competition with special interest in innovation and its incentives. Indicators related to the renewal of economy play a key role here. Even if static indicators showed high profitability and concentration of sectors, it does not necessarily mean that there is cause for concern if dynamic indicators simultaneously show that there is strong renewal in sectors and economy. In addition to static indicators, dynamic indicators are also needed (see Vickers, 1995; Berry et al., 2019; Aghion et al., 2021).

3.2.2 Data

The following analyses are based on the calculations made by the OECD for this report, which use two extensive databases (MultiProd, version 1 and DynEmp, version 3). The databases contain a large amount of indicators regarding firms (productivity, profitability, size, age, sector etc.), business structures (number of firms, dispersion of productivity between firms, market structure etc.) and business dynamics (new and departing firms, growth of new firms, young firms' employment share etc.). In addition to assessing the successfulness of innovation activities, these indicators can also be used in the indirect assessment of the market's competitive nature from both a static and a dynamic perspective.

The indicators have been calculated on the basis of the corporate data of the Member States participating in projects, using the same methods developed in the OECD. To improve the comparability of the results, the aim has been to use as consistent specifications as possible in the calculations. The indicators have been calculated for a fairly long period (since 2003), which makes it possible to assess trends and ensures that business cycle fluctuations do not interfere with comparisons too much. Data come from many countries, ensuring that Finland has a sufficiently broad and representative reference group. The country group used as the reference point in the following analyses consists of the following countries: Sweden, Norway, Belgium, France and Portugal. The group of countries was largely determined by the available data.

The analyses use a classification in which sectors are divided into four groups: 1) digital industry 2) digital services, 3) non-digital industry and 4) non-digital services. The classification is based on the sectors as shown in Table 3.1. It is based on the analyses made in the OECD's DynEmp project (see Calvino et al., 2018)

Table 3.1. Classification of sectors

Digital industry	Digital services	Non-digital industry	Non-digital services
Computers and electronics	Telecommunications	Beverages and tobacco	Wholesale and retail trade
Machinery and equipment	IT	Textiles and clothes	Transport and storage
Means of transport	Legal affairs and accounting	Sawn timber and paper	Accommodation and food service activities
	Scientific research	Chemicals	Media
	Marketing	Medicinal products	
	Administrative and support service activities	Rubber and plastic	
		Metal products	
		Electrical equipment	
		Furniture etc.	

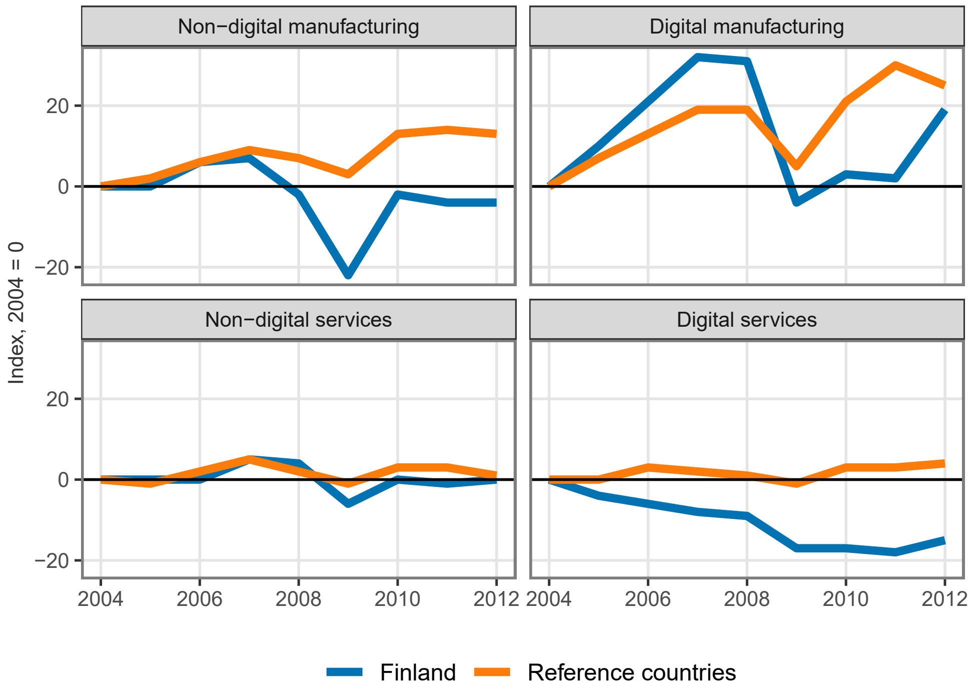
3.2.3 Consequences of innovation activities: productivity

Figure 3.3 shows the development of labour productivity in Finland in 2004–2012 in the four sectors described above. The reference country group consists of Sweden, Norway, Belgium, France and Portugal. We can see that in digital manufacturing, Finland's development compared to the reference countries has been downright dramatic until 2007, after which Finland's labour productivity plummeted exceptionally steeply. In recent years, productivity has again increased.

The findings regarding non-digital manufacturing are interesting: we see that in that sector, Finland's development started to lag behind the reference countries after 2007. Still in 2012, Finland was behind the reference countries if the year 2004 is used as the baseline. In non-digital services, significant fluctuations have taken place but all in all, Finland's development has been roughly in line with that of the reference countries during the period under review.

However, the findings related to digital services are somewhat striking. In the reference countries, labour productivity development has been very modest during the period under review, but in Finland, labour productivity has sunk both in absolute terms and in relation to the reference countries.

Figure 3.3. Labour productivity development in four sectors, 2004 = 0%. Reference countries: Sweden, Norway, Belgium, France and Portugal.



Source: OECD's MultiProd project, http://oe.cd/multiprod, June 2021

The labour productivity comparisons above are directly founded on the calculations based on corporate data. Corporate data have one advantage when compared to national accounts data: output and input figures come from the same units, which in itself increases the accuracy of productivity measurement. Namely, the output and input figures in national accounts are sometimes assessed separately using several different complementary data sources. This provides a more comprehensive overview of production and employment. In addition, this facilitates ensuring that production figures are consistent with income and expense figures, which is important for national accounts as a whole. However, there is the risk that the statistical figures about production and labour input are not optimally in line. As a result, output and input figures are not necessarily always comparable, which causes imprecision in productivity indicators (see van Ark, 1993, pp. 62–64).

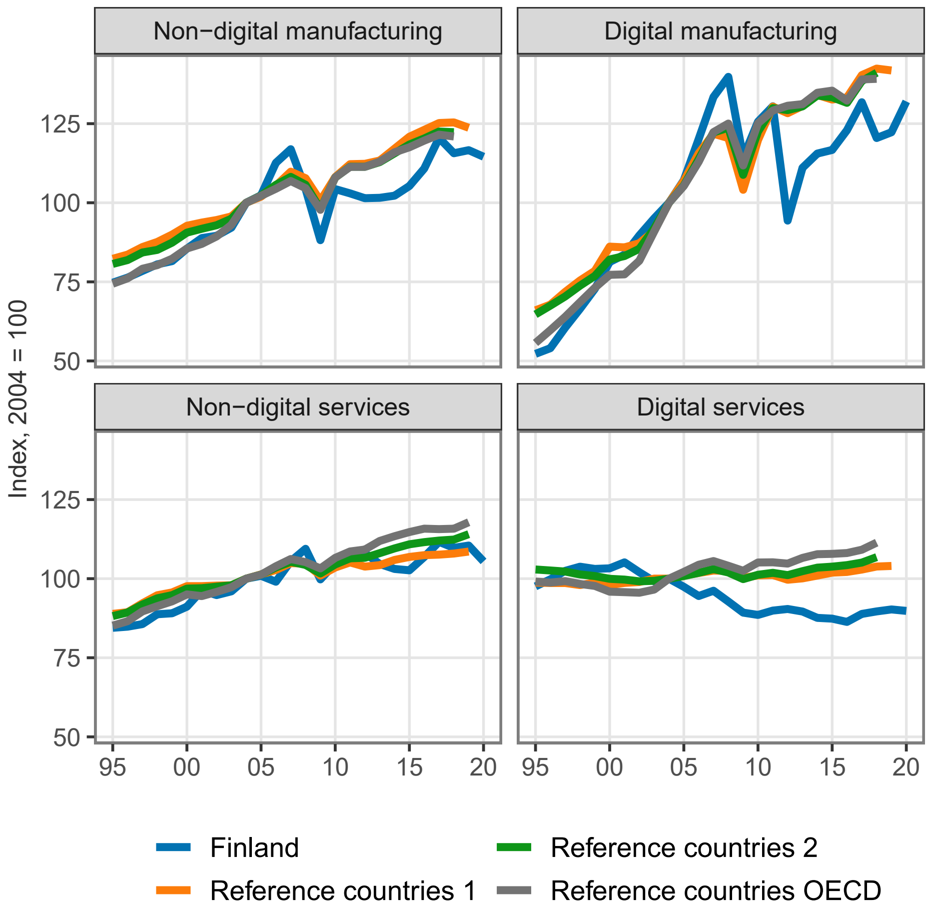
On the other hand, the corporate data used here have deficiencies. The country group is so limited that the available reference group is not ideal for assessing Finland's development. Furthermore, the most recent figures are not available, which complicates the assessment and interpretation of development. Due to reviewing and complementing, calculations have also been made with the aid of official statistical data. This offer the opportunity to assess three aspects:

1. Is productivity development similar on the basis of the alternative data source?
2. Is the reference country group used in the analysis based on corporate data representative?
3. What does development look like over a longer term?

In addition, the analysis based on accounts data also uses two alternative reference groups.

Figure 3.4 shows these alternative calculations for 1995–2019. To facilitate comparison, the figure uses the same reference point as the calculations made on the basis of the OECD's corporate data: the reference year 2004. It is a natural reference point also because, on the basis of the calculations in Chapter 2, Finland seems to have been closer to its 'equilibrium productivity' at that time than in 2007 or 1995, for example.

Figure 3.4. Labour productivity development in four sectors, index 2004 = 100. Reference countries 1: France, Belgium, Austria, Italy, Netherlands. Reference countries 2: Sweden, Norway, France, Belgium, Austria, Italy, Netherlands, Germany, Spain, Portugal. Reference countries OECD: Sweden, Norway, France, Belgium, Portugal.



Source: Eurostat, OECD, Inklaar & Timmer (2014), Finnish Productivity Board.

Essentially, the calculations based on accounts data confirm the above findings based on the corporate data. The alternative reference country groups seem fairly similar. However, in digital and non-digital services, some differences can be seen between the alternative reference groups in recent years. We can again see that in Finland's digital manufacturing, labour productivity first increased dramatically until 2007 and then plummeted steeply. In non-digital services, development has been more or less similar as in the reference countries. These calculations based on official accounts data also indicate how Finland's labour productivity has sunk in digital services both in absolute terms and in relation to the reference countries. These calculations also show how Finland's labour productivity in non-digital manufacturingfell in relation to the other countries after 2007. On the other hand, these calculations complement the findings above: in non-digital manufacturing, Finland has in recent years done an excellent job in closing the gap caused by its earlier plummet.

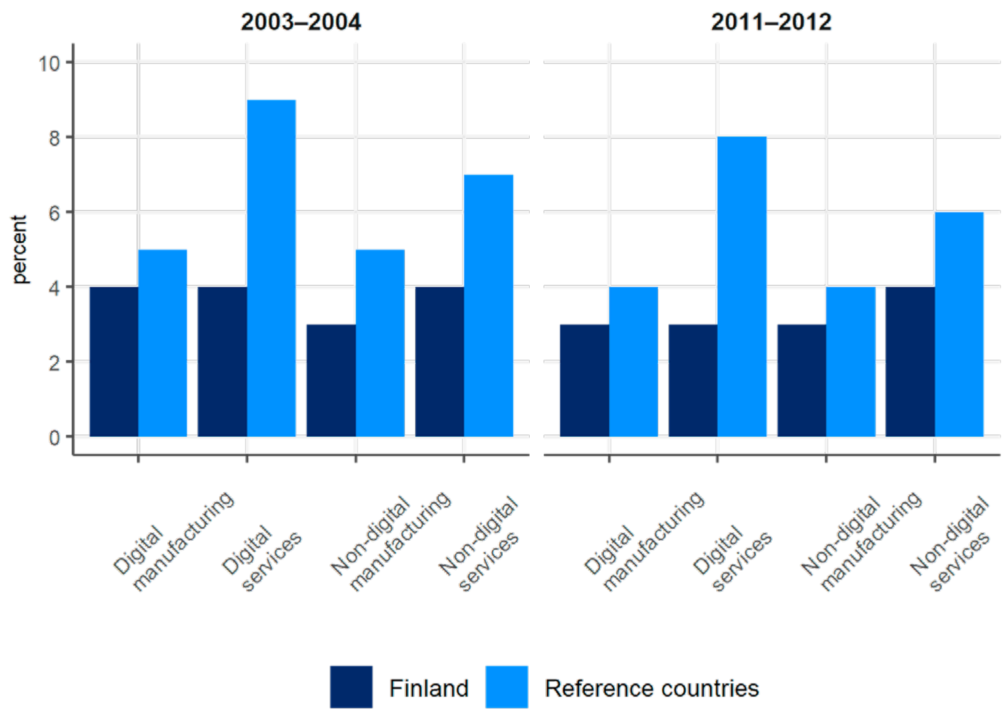
All in all, it seems that these OECD corporate data offer a good starting point for a more thorough and profound assessment of productivity development.

3.2.4 Dispersion of labour productivity between firms

The figures in the previous section described the development of average productivity (weighted with labour input, to be more specific). The averages hide the dispersion of productivity between firms. This is the topic that we will now focus on. The indicator used is the proportion of productivity in high-productivity (more specifically: their productivity level is at the 90th percentile of the productivity dispersion) and low-productivity (at the 10th percentile) firms. For example, if the indicator is 3, it means that the high-productivity firm's productivity is three times the low-productivity firm's productivity.

Figure 3.5 shows that the dispersion of productivity between firms is considerably larger in the reference countries than in Finland. In digital services, the dispersion difference between Finland and the reference countries is particularly large. In digital services in the reference countries, the productivity of the high-productivity firms was nearly nine times that of the low-productivity firms in 2011–2012. In Finland, the corresponding proportion was a little less than four.

Figure 3.5. Dispersion of labour productivity (proportion of high-productivity and low-productivity firms). A high-productivity firm refers to a firm at the 90th percentile of the productivity dispersion and a low-productivity to a firm at the 10th percentile.



Source: OECD's MultiProd project, http://oe.cd/multiprod, June 2021

The results are interesting when we bear in mind how significantly the average productivity of Finnish firms has decreased in comparison to the reference countries, in particular in digital services. The results suggest that Finland has been lagging behind other countries first and foremost because Finland lacks high-productivity firms, not because Finland would have many low-productivity firms. As exceptionally high productivity is often associated with radical innovation, one explanation for the above findings might be that in digital services in Finland, firms have invested less in ambitious innovation projects than firms in other countries.

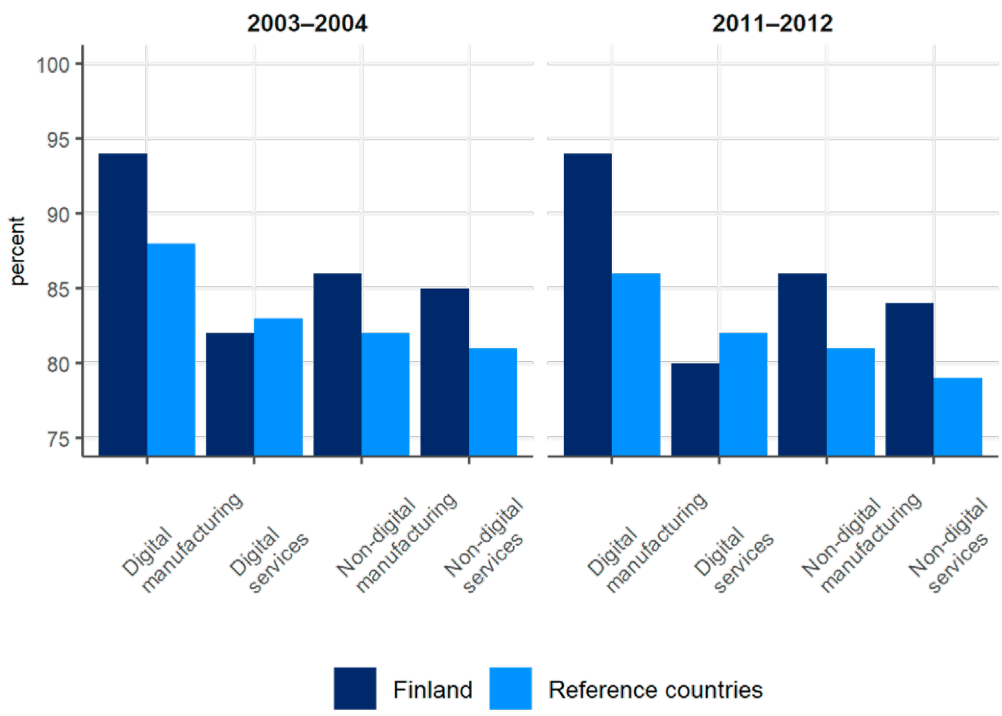
It is also interesting to compare these results to digital industry. As we know, Finland succeeded in this sector excellently especially before 2007. In this sector, too, Finland's dispersion of productivity is smaller than in the reference countries. However, the difference when compared to the dispersion of productivity in the reference countries is not as significant as in digital services. The best firms in Finland's digital industry were certainly among the leading firms internationally. On the other hand, Finland probably lacked low-productivity firms, which explains why the dispersion of productivity is smaller than in the reference countries.

3.2.5 Market concentration

The market's competitive nature is often measured by how concentrated production is, or how large the share of production covered by the largest firms is. In this section, concentration is measured by looking at the top 10% firms' share of production (see Figure 3.6). We can see that in Finland, the markets are more concentrated than in the reference countries in all sectors apart from digital services. This finding is interesting as it is precisely in digital services where Finland's development has been especially weak when compared to the reference countries. Above we could also see that in the reference countries, also the dispersion of productivity in this sector was notably larger than in Finland. One interpretation of these findings is that Finland has lacked high-productivity firms, to which production (and employment) could have concentrated naturally.

Instead, in digital industry, the Finnish market has been particularly concentrated. In this case, concentration would seem to be a consequence of favourable development rather than an obstacle to it. Finland has witnessed the emergence of high-productivity firms, to which production has concentrated strongly. On the other hand, it is possible that at the same time, low-productivity firms have disappeared in Finland and, as a result, the dispersion of productivity has not become very extensive.

Figure 3.6. Market share of the top 10% firms, %.



Source: OECD's MultiProd project, http://oe.cd/multiprod, June 2021

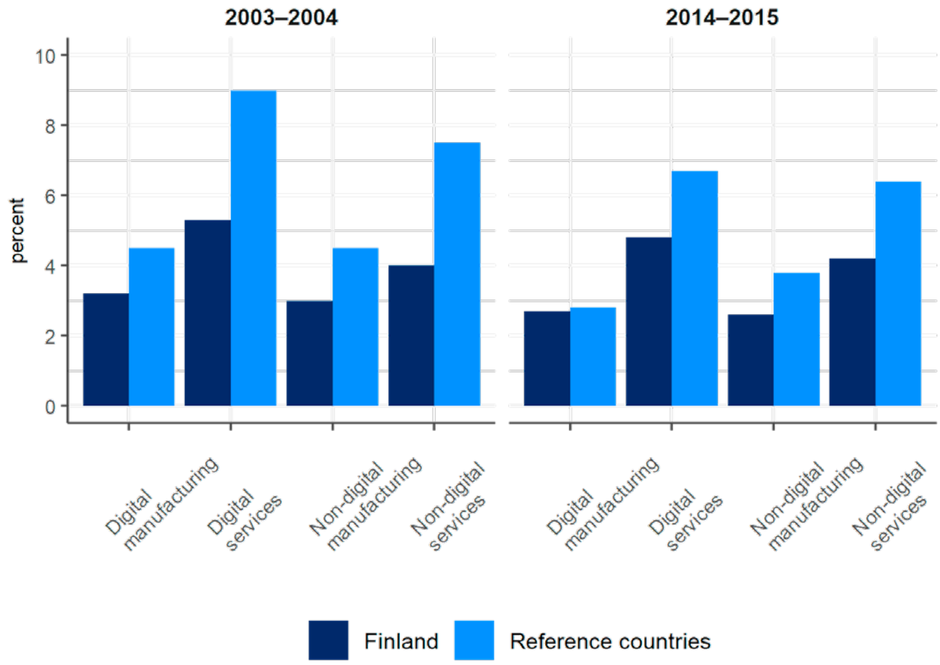
3.2.6 Renewal of business structures

As noted in Chapter 3.2.1, in order to verify interpretations, it is important that static indicators of production performance, dispersion and concentration are complemented with dynamic indicators. The market entry of new firms is an integral part of the renewal of economy and the growth of productivity. On the other hand, their average productivity is typically lower than that of firms that already are on the market. Many new firms cease to operate soon after their market entry. In the new firms that survive on the market, new productive jobs emerge, which starts gradually show as stronger productivity in the sectors.

This is an important element in the mechanism, in which labour input and production concentrate to firms that have a high level of technology and productivity (Hyytinen & Maliranta, 2013). Studies show that jobs and new production emerge especially in young firms (see e.g. Haltiwanger et al., 2013, Haltiwanger et al., 2017; Maliranta & Hurri, 2017).

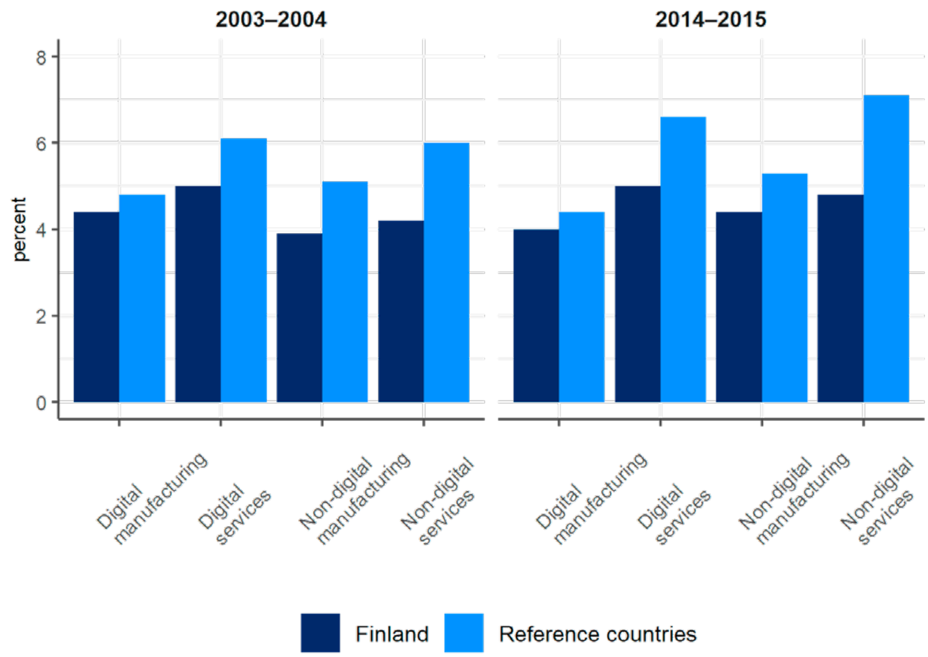
Figure 3.7 compares the percentages of market entry of new firms and Figure 3.8 compares the percentages of market exit. We can see that in Finland, both percentages are lower than in the reference countries, in other words, there is less churn of firms on the market in Finland. In general, the churn difference between Finland and the reference countries is especially clear in both digital and non-digital services. In digital industry, the difference is smaller.

Figure 3.7. Market entry of new firms, %



Source: OECD's MultiProd project, http://oe.cd/multiprod, June 2021

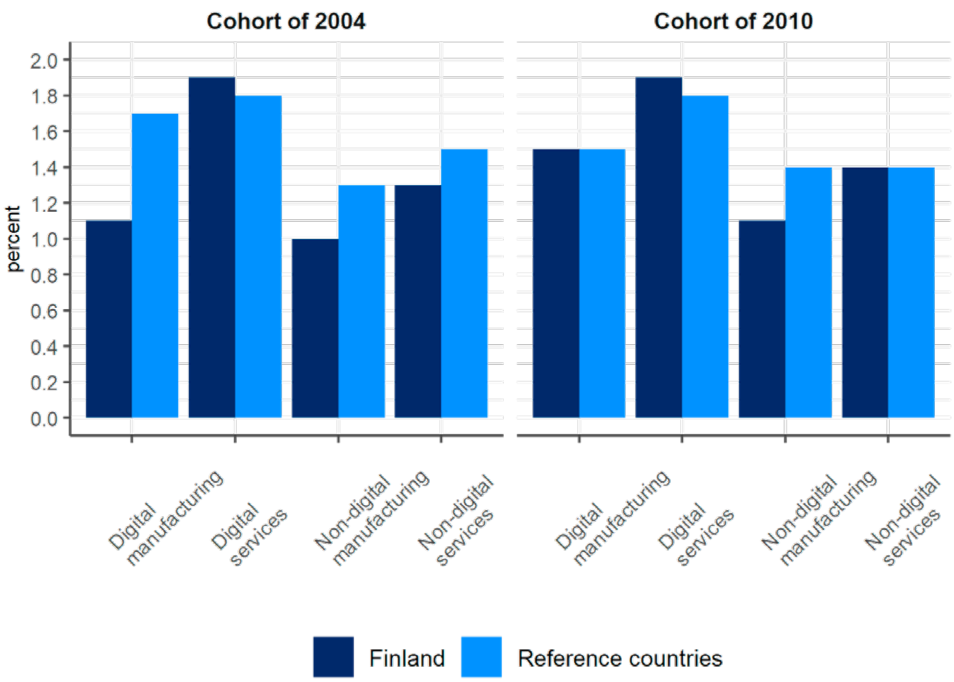
Figure 3.8. Market exit of firms, %



Source: OECD's MultiProd project, http://oe.cd/multiprod, June 2021

Figure 3.9 looks at growth of new firms five years after their market entry. We can see that in firms that entered the market in 2004, growth has been particularly weak when compared to the reference countries and this applies to both digital and non-digital industry. On the other hand, in digital and non-digital services, growth of firms that entered the market in Finland in 2004 does not differ significantly from the reference countries. The same can be seen when looking at firms that entered the market in 2010 so it seems that in this regard, dynamics in the service sectors has remained good. In digital industry, growth of new firms seems to have picked up after the financial crisis.

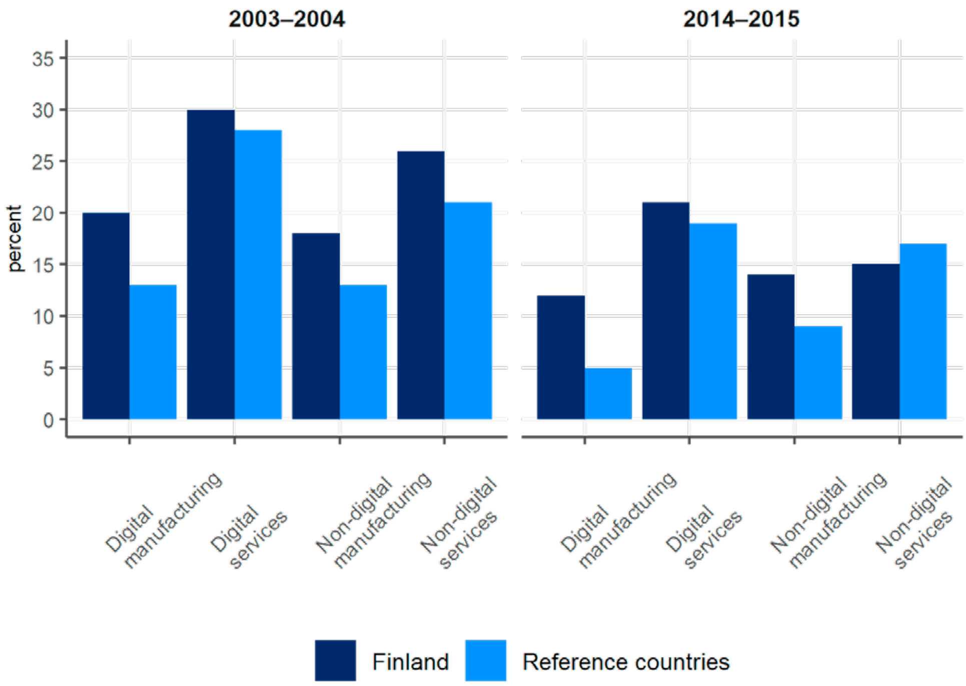
Figure 3.9. Employment growth five years after the market entry.



Source: OECD's DynEmp project, http://oe.cd/dynemp, June 2021

Figure 3.10 shows the employment share of firms that were established less than six years ago in four sectors. This indicator suggests that in general, there has been more production renewal in Finland than in the reference countries. The difference in favour of Finland is especially significant in digital industry. In digital services, renewal intensity in Finland has been roughly similar to that of the reference countries. However, in non-digital services, Finland's renewal intensity has fallen below the level of the reference countries.

Figure 3.10. Employment share of firms that were established less than six years ago, %.



Source: OECD's DynEmp project, http://oe.cd/dynemp, June 2021

3.2.7 Summary

As a summary, we can conclude that it seems that the intensity of labour market dynamics as such is not a problem. This is in line with the estimates presented in the Finnish Productivity Board's previous report, which indicated that in Finland, the renewal of job structures in manufacturing and services is at least at the same level as in the United States (Finnish Productivity Board, 2020, Figure 3.8). Even if churn of firms on the market is lower than in the reference countries, growth after market entry in Finland is not weaker than in the reference countries, at least not significantly weaker. The employment shares of young firms are also similar to those of the reference countries, which is also a sign of the renewal of economy.

The Finnish market is clearly more concentrated to few firms than in the reference countries. This kind of concentration can be a threat to the functionality of competition over a long term (Philippon, 2019). On the other hand, there is less cause for concern if dynamic indicators show that there is constant production renewal at the firm level; at least some signs of this could be seen above.

In Finland, the dispersion of productivity between firms is clearly smaller than in the reference countries. In Chapter 4 below, we can see that in Finland, the dispersion of productivity between firms has been clearly smaller than in Sweden (see Figure 4.1). The findings suggest that Finland's problem is not necessarily that there are many low-productivity firms but that we lack high-productivity firms. In this case, attention should be paid to innovation activities and especially development projects aiming at radical innovations. If innovation activities do no generate high-productivity business operations, there are limited possibilities to reallocate labour input so that it strengthens productivity.

The Finnish Productivity Board's 2019 report drew attention to the point that in Finland, the change of business structures that strengthens labour productivity was weak in the early 2000s when compared to earlier years or Sweden. At that time, signs of the intensifying of Finland's productivity micro-dynamics could be seen both in manufacturing and services. At this stage, we can note that the results cannot, or at least not yet, be seen as desired, especially in digital services, despite the fact that ICT service sectors, for example, have seen a significant increase in research and development investments, as was pointed out in the Finnish Productivity Board 2019 report.

4 Total factor productivity and resource allocation efficiency

4.1 Introduction

Sources of long-term productivity growth can be sought by applying two complementary perspectives. In the neoclassical growth theory, technological development is assumed to be exogenous (having an external cause). In the analysis, growth in productivity is examined empirically using the so-called growth accounting. Suitable data for this accounting include aggregate statistics, which are obtained from such sources as national accounts data (see Finnish Productivity Board, 2019, Chapter 4). In the theory of innovation-based growth, technological development is assumed to be endogenous (having an internal cause). Its empirical applications use so-called micro-data obtained at the firm or site level.

Growth in labour productivity is caused by three main factors: 1) growth in capital intensity (capital per working hour), 2) change in the quality of labour input and 3) total factor productivity (TFP) (output in relation to total labour and capital inputs). The more and better machines, equipment and other capital an employee has available to them, the more output they will produce per hour. Similarly, the more skilled the employee is, the more output they will produce in an hour. Total factor productivity is a residual term of the growth accounting formula. 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 obtained with the same quantity and quality of labour and capital inputs.

In addition to the residual term approach, total factor productivity can also be measured directly (Färe et al., 1994; Griffith et al., 2004). For example, Krüger (2003) calculates total factor productivity with the aid of the Malmquist index and nonparametric data envelopment analysis (DEA). This has two advantages: the analysis is not based on equilibrium assumptions, which combine several data feeds into one index, and the growth rate of total factor productivity can be divided directly into indicators of efficiency change and technological development, for example. For example, Haider et al. (2021) divide total factor productivity into catching-up and innovation and look into how R&D, international trade, ICT and catching-up influence total factor productivity.

In the long term, roughly two thirds of the growth in labour productivity can be explained by growth in total factor productivity (Aghion & Howitt, 2007). Total factor productivity is also the most important factor explaining differences in standards of living between countries (Jones, 2016; Klenow & Rodriguez-Clare, 1997).

The change in total factor productivity is often also used as an indicator of technological change. Since it is a residual term, technology should be understood in a very broad sense in this context. Another finding that speaks in favour of a broad interpretation is the negative development of total factor productivity during a recession, for example. It is difficult to understand how technology as such could weaken.

In addition to providing incentives that promote renewal, another task of markets is to allocate the resources of economy to different uses. What is essential for productivity is the ability of capital and labour markets to allocate the resources to their best use. Next, we will look into what recent literature has to say on resource allocation efficiency. Box 1 in Chapter 4.4 describes a state of the art economics method in more detail. With this method, the development of total factor productivity can be more specifically divided into the change in allocation and the contribution of technology. In Chapter 4.4, this method is applied to Finland by using Statistics Finland’s Business Register data.

4.2 The impact of resource allocation on total factor productivity

Recent expanding research literature tries to give a more profound understanding of total factor productivity and its development, rather than just categorise it as a residual. Firm-level or site-level data may provide a better understanding of total factor productivity than macro-level statistics. A significant finding is [that at the aggregate level, there are very significant differences in productivity even within very narrowly defined sectors. This indicates that firms and sites are heterogenous. Heterogeneity cannot be taken into account with methods that use macro-level aggregate statistics. Use of aggregate data might convey an inaccurate picture of the underlying reasons of development and lead to wrong policy recommendations.

One of the great insights provided by the literature is that misallocation at the micro level may be seen as weak total factor productivity at the aggregate level. In principle, this is easy to understand: if low-productivity sites get a larger share of working hours, the productivity of the entire economy is lower than if high-productivity sites get a larger share of working hours. However, studying and measuring this matter requires deeper delving into resource allocation at the firm or site level and more detailed theoretical and empirical modelling.

With the aid of site-level input use and production data, recent literature looks into how good resource allocation is or how misallocation impairs productivity, profitability and salaries in different sectors and in the national economy. Baily et al. (1992), Foster et al. (2008), Hsieh and Klenow (2009) and Restuccia and Rogerson (2008) are examples of early analyses, which showed how a better allocation of labour and capital would improve productivity and standard of living. Hopenhayn (2014) and Restuccia and Rogerson (2013, 2017), among others, provide early reviews of this literature.

Allocation may be poor statically, in which case resources have been misallocated: low-productivity firms produce too large a share of the national economy's production and high-productivity firms too small a share. Allocation may be poor dynamically, in which case it has a negative impact, from the point of view of productivity growth, on firms' R&D and other investments and market entry decisions.

Reasons for misallocation mentioned in the literature include, for example, poor regulation (such as land use planning as a factor restricting the availability of labour force, and influencing technological choices with political guidance); tax and subsidy policy that depends on the size of the firm or influences firms' growth appetite; discrimination against certain population groups; deficiencies in competition and market entry; and various frictions and deficiencies in labour and capital markets. It is also possible that resources are misallocated within a firm to protect jobs, for example, (e.g. Schmitz, 2005) but in this section, we focus on allocation between firms or sites.

The classical idea is that the overall economic impacts of market deficiencies would be very small. For example, Harberger (1954) estimates that the impact of the wedge created by lack of competition would be significantly less than 1 per cent of the GDP in the United States. This might have led to the persistence of the idea that the functionality of commodity, capital or labour market or bottlenecks preventing the improvement of resource allocation would have only a minor significance for productivity and wellbeing.

Since then, the idea has been frequently dismissed, and, for example, more recently in a cutting-edge economics study by Baqaee and Farhi (2020). They estimate the aggregate-level impact that is larger by two orders of magnitude (see Box 1 in Chapter 4.4). The explanation of this significantly larger impact is that

1. the wedges caused by distortions are significantly larger within a sector than between sectors and

2. there are better opportunities to reallocate inputs within a sector than between sectors.
3. In addition, distortions intensify in value chains as products from many firms are used as inputs in other firms.

Hsieh and Klenow (2009) use indirect modelling to show that the misallocation of inputs, caused by wedges, and nonoptimal firm sizes have a major impact on total factor productivity. For example, Hsieh and Moretti (2019) concluded that in the United States, poor land use regulation and planning cut approximately one third of potential economic growth in 1964–2009.

According to Da-Rocha et al. (2019), firing costs reduce total factor productivity both statically, by allocating resources less efficiently, and dynamically, by distorting firms' incentives for growing. Davis and Haltiwanger (2019) provide evidence about how young firms in the United States have been facing increasing difficulties in obtaining external financing, which has slowed down resource reallocation that supports growth.

De Locker et al. (2020) also provide evidence that wedges and allocation impacts resulting from market power have caused significant macroeconomic impacts. In their study focusing on capital allocation, David and Venkateswaran (2019) provide evidence that in the United States, only a small portion of the negative productivity impact of imperfections comes from capital adjustment costs or uncertainty and the largest impact comes from firm-specific factors, first and foremost firms' heterogeneity, the reasons of which are not explained in the study. On the other hand, Peters (2020) provides evidence the most significant impact of pricing power and misallocation comes primarily through market dynamics, not through static misallocation. According to this, the most efficient policy for both good allocation and productivity growth is to promote firms' access to the market and remove obstacles to market entry.

In this line of research, the key method is to examine the wedge between the value of marginal costs and the value of marginal product with the aid of site-level of firm-level data. The wedge is then explained by one or a few distortions or frictions that prevent the improvement of economy's static or dynamic efficiency. However, in reality, we live in a so-called 'second-best' economy, where there may be several sources that cause the values of marginal product and marginal costs not to meet. In this case, a single factor's impact revealed by a study may overestimate the overall economic significance of that factor. On the other hand, individual distortions may act against each other, in which case the impact obtained in the study may also underestimate the impact of the said factor.

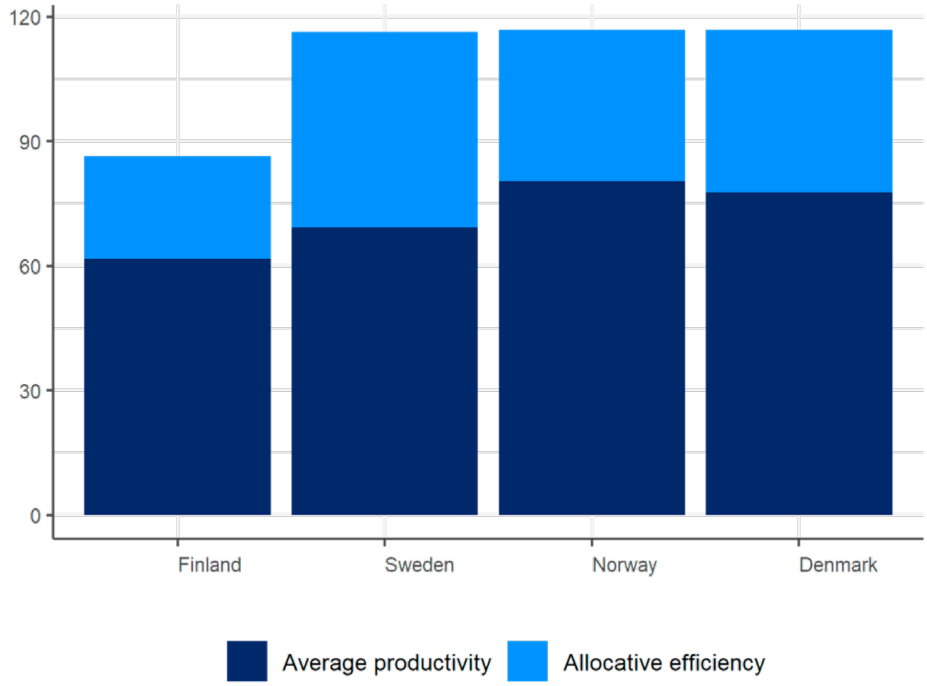
The national economy and firms encounter shocks with asymmetrical impacts. Shocks may be, among other things, innovations entering the market or new firms that impair the profitability of traditional players. For example, innovations and new players in digital technology have led to the deterioration of the opportunities in many firms relying on older technology and their exit from the market. Shocks may also be structural changes in global demand, which change the opportunities of different products and services to succeed on the market. For example, global demand for newsprint and fine paper has roughly halved from its peak at the turn of the millennium, while at the same time, global consumption of packaging materials and pulp has doubled.

As a result of shocks, capital and labour may be in uses that are not optimal from the productivity point of view. Different kinds of frictions and obstacles slow down the functioning of market dynamics and the reallocation of capital and labour to better uses. With labour market and industrial policy, for example, the frictions and obstacles can be removed or their impacts can be mitigated.

4.3 Allocative efficiency in Finland

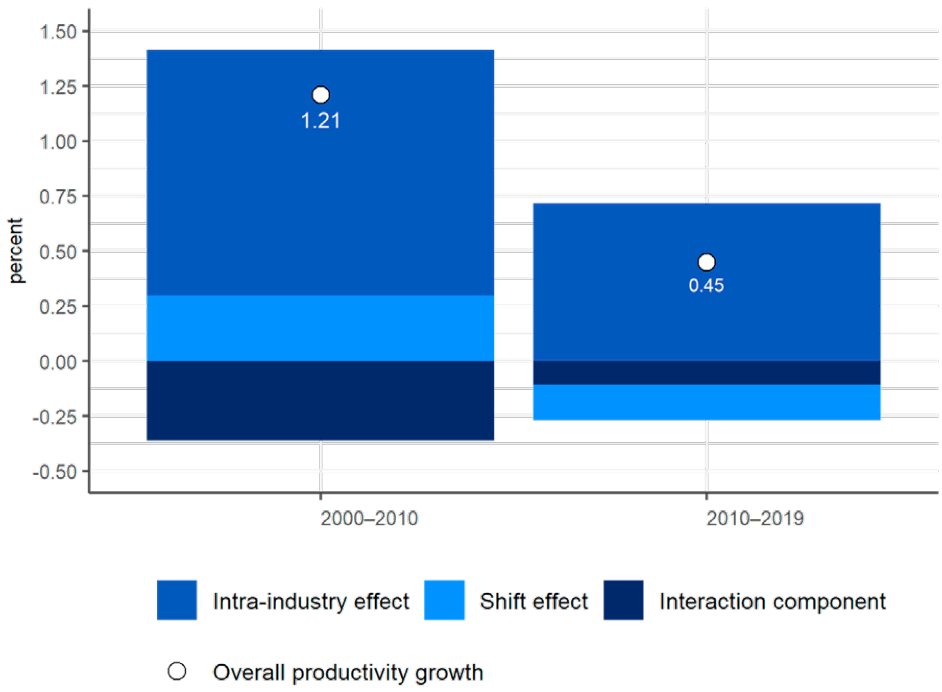
An earlier method called the Olley-Pakes approach (Olley & Pakes, 1996) divides productivity development into two components: on the one hand, the change of the firm's average productivity and, the covariance of the firm's employment share and productivity on the other. The latter is an indicator of allocative efficiency: it increases if more productive firms get a larger share of labour. By using the MultiProd database developed at the OECD (Berlingieri et al., 2017) and the Olley-Pakes approach, the OECD (2020) shows that Finland's allocative efficiency is lower than that of the other Nordic countries (Figure 4.1).

Figure 4.1. Labour productivity in industrial production by component, 2011 (USD 1,000, purchasing-power adjusted, 2005 prices).



Source: Berlingieri et al. (2017)

Figure 4.2. Productivity growth by component, %.



Source: OECD

Figure 4.2 shows the decomposition of productivity growth and labour shares as the averages of the first two decades of the millennium. In the figure, the intra-industry effect is the contrafactual productivity growth that would have been realised if labour had not shifted from one sector to another. The shift effect is the part of productivity change caused purely by the net shift of labour from one sector to another. A positive (negative) shift effect means that labour has moved to a sector that has higher (lower) original productivity.

The interaction component comprises the change in the labour share and productivity of each sector. Its negative impact means that productivity has increased in diminishing sectors and decreased in growing sectors. Consequently, reasons for poorer resource allocation in Finland would include, among other things, the fact that low-productivity sectors have received larger shares of labour than before.

In Finland, resource allocation is poorer than in the other Nordic countries and has evidently deteriorated further in the 2010s. Chapter 4.4 analyses resource allocation change and productivity impacts in more detail.

4.4 Developments in allocative efficiency in Finland[4]

4.4.1 Introduction

The private sector's total factor productivity grew fairly quickly in Finland from the beginning of the 2000s until 2008 (see Chapter 2.2 above). The financial crisis in 2007–2009 was a significant turning point, after which total factor productivity took a downward turn. This downward trend continued until 2015, after which total factor productivity finally started to grow.

For interpreting economic development and drawing economic policy conclusions, it is important to have a more detailed picture of the factors that explain the growth of total factor productivity and its developments. Total factor productivity is often considered the growth impact of technology, due to which more output may be obtained from a given numbe of inputs. However, a more appropriate interpretation is that total factor productivity development is influenced by technological development.

Total factor productivity can be influenced by many other factors in addition to technology. One significant impact can arise from resource allocation, as briefly described in Chapter 4.3 above. If part of resources are used by firms that do not fully use the production opportunities offered by technology, economy does not reach its full potential productivity. Why would these firms not use their production opportunities fully? Reasons could include, for example, lack of competition in product or production factor markets. A firm with market power wishes to increase prices to gain mark-ups, which naturally reduces demand and production. The term 'mark-up' refers to profits that exceed normal return on capital and that a firm would gain in circumstances where competition functions well.

4.4.2 Technology and allocative efficiency as factors of total factor productivity

In this chapter, the development of Finland's total factor productivity is divided into changes in both allocation and the residual. Therefore, changes in the residual this case may be interpreted as purely the impact of technology. Consequently, the total factor productivity of the national economy can grow as a result of both technological development and an increase in allocative efficiency. Allocative efficiency increases when the resources of the economy (labour and capital inputs) are reallocated between firms so that more productive firms get a larger share of these resources.

4 This chapter is based on the work of the Ministry of Finance's trainee Peter Elmgren in the Helsinki GSE traineeship programme.

The decomposition of total factor productivity growth into a technological component and an allocative efficiency component is a challenging task both theoretically and empirically. At the moment, the decomposition developed by Baqaee and Farhi (2020) (see Box 1 in Chapter 4.4) can be considered as one of the most advanced methods.

What is essential for wellbeing and cost competitiveness in the national economy is, first and foremost, total factor productivity growth. However, from the point of view of economic policy conclusions and the anticipation of future development, it is useful to know what has been the significance of technological development, on the one hand, and what has been the significance of allocative efficiency, on the other. Especially if the slow growth of total factor productivity is explained by a weak development of allocative efficiency, attention should be paid to measures that can resolve potential deficiencies in or obstacles to the functioning of commodity, capital and labour markets. This allows the situation to be improved even relatively quickly. Instead, the means of public authorities to promote technological development are demanding and give results with a considerable delay. On the other hand, the direct and indirect impacts of the improvement of technology are long-lasting.

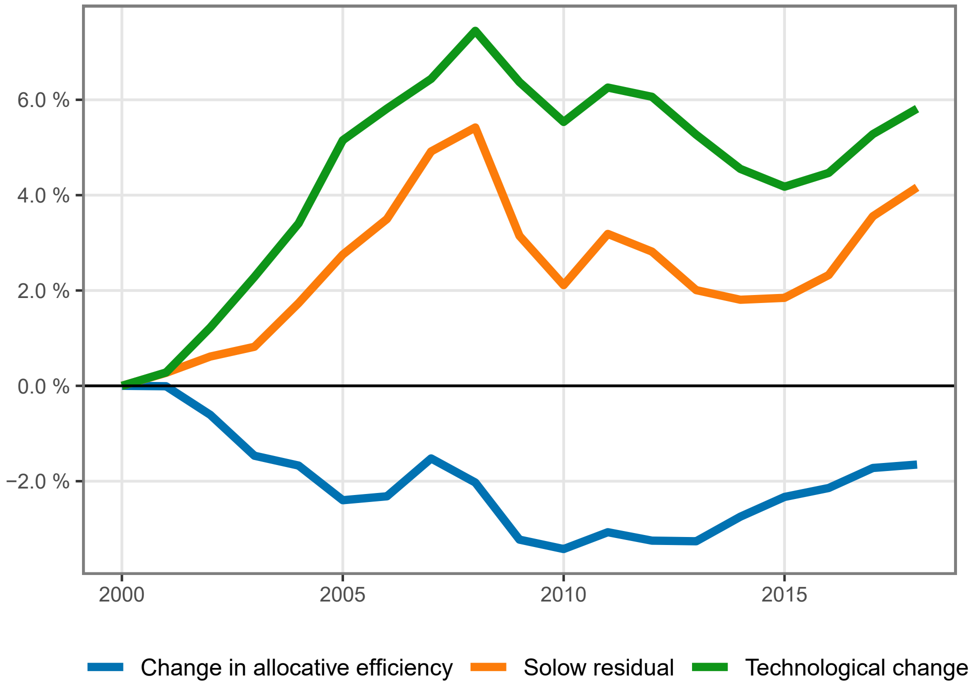
4.4.3 Allocative efficiency development in Finland

Figure 4.3 shows the decomposition of the cumulative growth of total factor productivity into changes in allocative efficiency and changes in the residual. The residual should here be interpreted as the impact of technology.

In the figure, we can see that the allocative efficiency decreased in the early 2000s in Finland's corporate sector. The cumulative decreasing impact on total factor productivity until 2010 was a little less than four per cent. A turn for the better took place roughly in the early 2010s. From 2010 to 2018, the improvement of allocative efficiency had increased total factor productivity by approximately two per cent.

Thus, the deterioration of allocative efficiency slowed down the impact of technological development on the growth of total factor productivity and the GDP in the first decade of the 2000s. After this, the improvement of allocative efficiency has slightly complemented the growth impact of technological development.

Figure 4.3. Total factor productivity and its components: allocative efficiency and technology, change (%).



Source: Calculations based on Statistics Finland's financial statements data and national accounts.

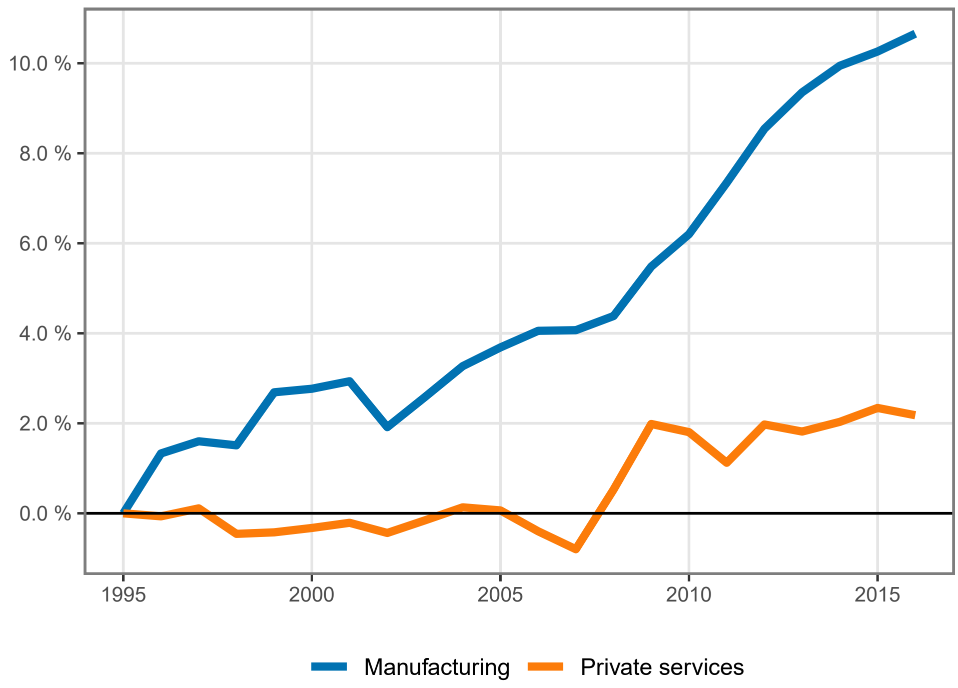
It is interesting to compare the results obtained with this decomposition regarding the components of total factor productivity development to the results of the site-level decomposition of labour productivity. Figure 4.4 shows the impact of worker reallocation between sites that continue to operate on the development of labour productivity in the corporate sector. Even though the method and productivity indicators are different, both indicators convey a very similar picture of the development of allocative efficiency in Finland's corporate sector: allocative efficiency decreased after the beginning of the 2000s and continued to decline until the years of the financial crisis, after which it started to improve again.

Figure 4.4. Worker reallocation between sites that has a strengthening impact on labour productivity, %.

Source: Productivity decomposition calculations based on Statistics Finland's financial statements statistics data.

Labour productivity decomposition has been made separately for manufacturing and private services (see Figure 4.5). As the figure shows, in manufacturing, worker reallocation between sites that has a strengthening impact on labour productivity has in general been clearly stronger than in private services; however, in both sectors, a positive turn can be seen in the years of the financial crisis.

Figure 4.5. Worker reallocation between sites that has a strengthening impact on labour productivity. Manufacturing and private services, %.



Source: Calculations based on Statistics Finland's financial statements data.

4.4.4 Labour income share development

The results of the decomposition of total factor productivity can also be compared to the results that Baqaee and Farhi (2020) obtained with US data. In the United States, the change of allocative efficiency in 1996–2014 has clearly supported GDP growth. The result may seem surprising as the statistics show that the profits of the entire corporate sector have, as a rule, been growing during this period, which is often interpreted as a sign of a decrease in competition in the markets. However, this kind of statistical indicator may convey a misleading picture of the market's competitive nature and dynamics. Nevertheless, a more detailed analysis based on corporate data reveals that the growth of profitability that can be seen at the overall corporate level is explained to a great extent by the fact the most profitable firms have grown more strongly than other firms (see Autor et al., 2020). Instead, in the US firms ('within firms'), profitability growth has been moderate.

Similarly, at the aggregate level, the labour income share in the United States has decreased strongly between 1967 and 2012. However, the labour income share at a median site has simultaneously increased. This paradox is explained by the fact that during this period, labour has transferred to firms in which the labour income share is lower than average and the capital income share is higher than average. In addition, the labour income share declined even further in these firms when they grew. When the labour income share is divided into the average change, the faster growth of low-income-share firms and the correlation between these two, it can be noted that the negative correlation explains practically the entire decrease of the income share (Kehrig and Vincent, 2021). Here, too, the aggregate-level view might convey an inaccurate picture of the underlying reasons of development and lead to wrong policy recommendations.

Analyses made with Finnish firm-level data convey a similar picture of the situation. The decomposition by Böckerman and Maliranta (2012) indicates that even though the labour income share has declined at the level of the entire corporate sector (at the expense of the capital income share), the labour income shares at the firm level have in general been increasing. Firms with a low labour income share (and high profitability) have increased their market shares, which translates into a lower labour income share at the level of the entire corporate sector.

Maliranta and Määttänen (2018) studied the development of the profitability of different sectors with a similar firm-level decomposition. In their analysis, industries had been divided into four groups according to their technology level and the decomposition of firm-level profitability had been conducted separately for these four groups. The change of business structures that strengthens the industry's profitability was clearly strongest in the industries at the highest technolog level and clearly weakest in the industries at the lowest technology level. In the industries at the highest technology level, profitability typically decreases as the firm's lifecycle advances. Instead, in the industries at the lowest technology level, firms' profitability is more stable during the lifecycle.

The results can be interpreted so that they are explained by creative destruction associated with a high technology level (and innovation) and the related dynamic competition (e.g. Vickers, 1995, and Audretsch et al., 2001). Firms that have been successful in their innovation activities get a chance to enjoy exceptionally good profitability. They grow and increase their market shares. At the same time, the profitability of other firms on the market typically declines and they lose their market shares. Such firm-level decompositions of profitability change describe the competitive nature of sectors in a dynamic sense (see also Aghion et al., 2021, pp. 55–57 and 64–67).

An allocation calculation in which the impact of firms that manufacture computers and electronic and optical products was eliminated was also prepared for this report. This was done on the basis of the assumption that the mark-ups of the sector's firms are in line with the average of all other firms. It seems that the electronics industry contributed to the decline of the allocative efficiency especially after the financial crisis. However, the impact of the electronics industry on the national economy's allocative efficiency is clearly positive in the last years of the period under review.

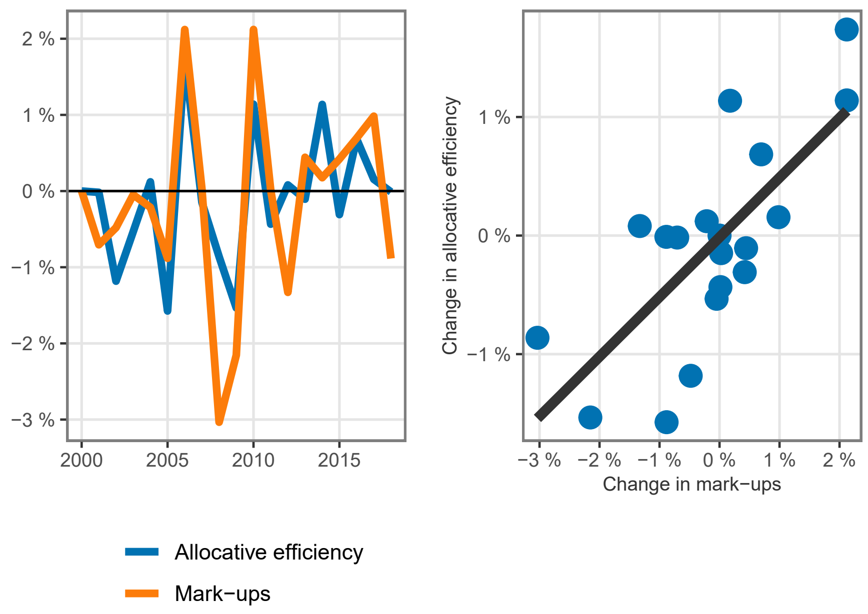
4.4.5 Connection between allocative efficiency and profits

The allocative efficiency calculation described above is based on the assumption that the only distortions in economy originate from imperfect competition and can be seen in firms' mark-ups (a more detailed description of Baqaee and Farhi's (2020) method can be found in Box 1). This makes the connection between allocative efficiency and profits especially interesting and important.

Intuitively, one could think that allocative efficiency and mark-ups had a negative correlation. If mark-ups increase when everything else remains constant, this would suggest the weakening of competition, in which case resources would have been allocated in a manner that decreases efficiency. However, in the United States, both allocative efficiency and mark-ups have increased during the past few decades. Allocative efficiency and the weighted mark-ups of economy turn out to have a positive correlation both in Finland and in the United States. What is the reason for this?

We will now look into this connection in slightly more detail for Finland. Figure 4.6 (left panel) shows the annual changes in firms' weighted total mark-ups and allocative efficiency. The right panel of the figure shows how a linear interdependency can be established for the variables in question. The change in average mark-ups explains half of the change in allocative efficiency. It seems that allocative efficiency and mark-ups have a clear positive correlation.

Figure 4.6. Connection between allocative efficiency and mark-ups.

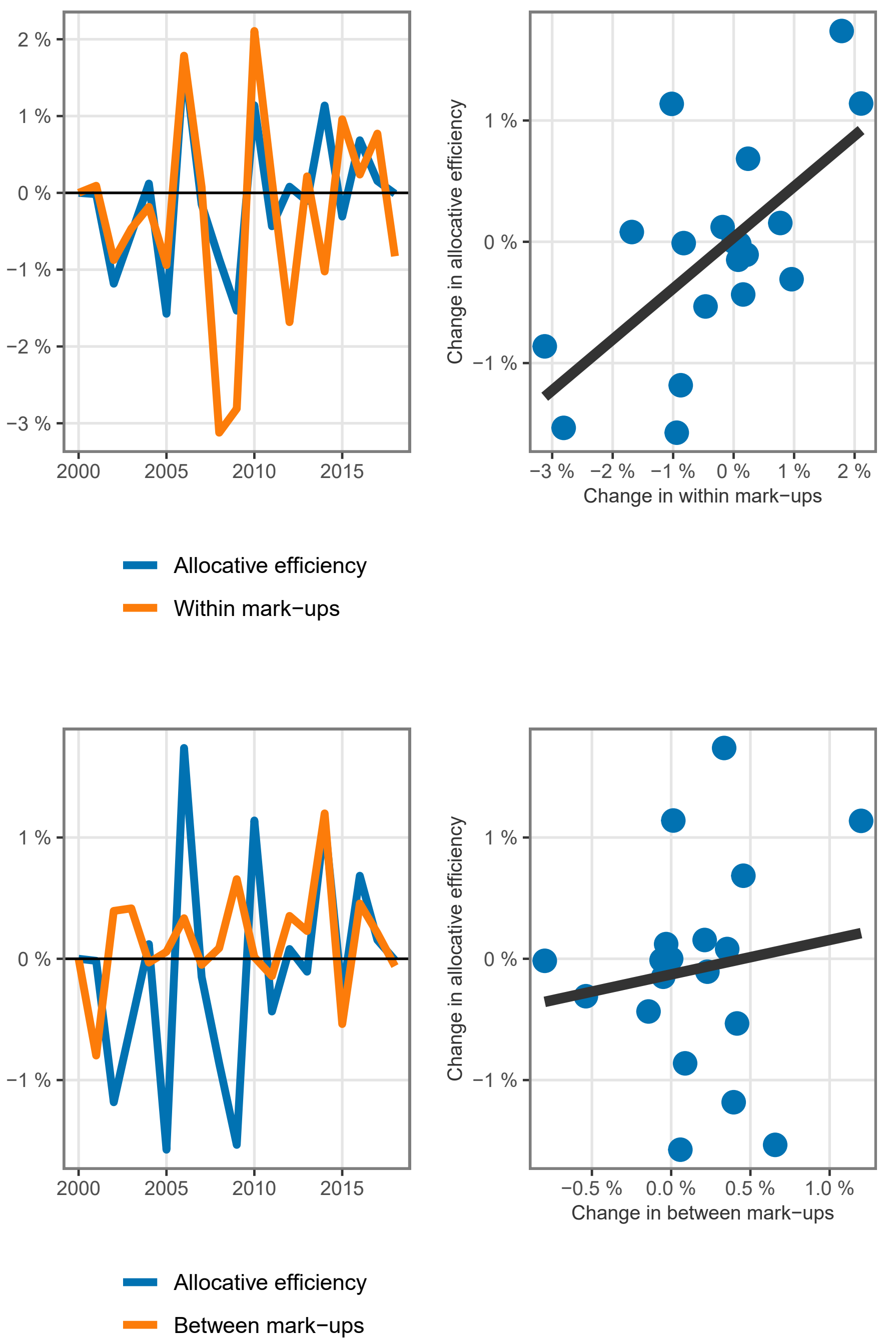


Source: Calculations based on Statistics Finland's financial statements data and national accounts.

4.4.5.1 Division of mark-ups into within and between components

The change in mark-ups can also be calculated separately according to the origin of the change (Baqaee & Farhi, 2020, p. 42). If firms on average increase their mark-ups over time, the change happens within firms, which is called the within component of mark-ups. Similarly, the between component of mark-ups increases when firms that have a high (low) level of profits, compared to other firms, increase (decrease) their market shares. The connection between these components with the allocative efficiency can be seen in Figure 4.7.

Figure 4.7. Connection between allocative efficiency and mark-up components.



Source: Calculations based on Statistics Finland's financial statements data and national accounts.

It seems that especially the between component correlates weakly with allocative efficiency, with the exception of the last years of the period under review. The changes in allocative efficiency and the between component do not have a statistically significant connection either. Instead, the connection between the within component and allocative efficiency seems to be stronger, at least in the beginning of the period under review. The change in the allocative efficiency and the within component also have a clearly positive and statistically significant connection.

4.4.5.2 Profits and business cycles have a strong correlation

To which extent do business cycles influence the correlation between allocative efficiency and mark-ups? The positive connection described above may be due to the fact that business cycles influence both allocative efficiency and mark-ups. Do firms' mark-ups increase during an economic boom while at the same time more intensive market activity directs resources to more efficient use?

We will now look at the correlation of the within and between components of mark-ups and the growth of the national economy's production volume. In the development of profits, there is some variation that cannot be directly explained by business cycles. However, it is clear that business cycles influence profits. This can be seen especially in the within component, which has a positive correlation with the change in real value added (Table 4.1). An increase of one percentage point in the growth rate of the production volume increases profits' within component by approximately 0.22 percentage points. This suggests that mark-ups tend to increase when the business cycle is improving and decrease when the cycle is going downwards.

Nevertheless, a similar connection cannot be seen in the between component. Instead, the impact of business cycles on the within component is weaker and potentially even negative. It would seem that business cycles do not really influence profits through market shares.

Table 4.1. Firm-level mark-up components and the business cycle

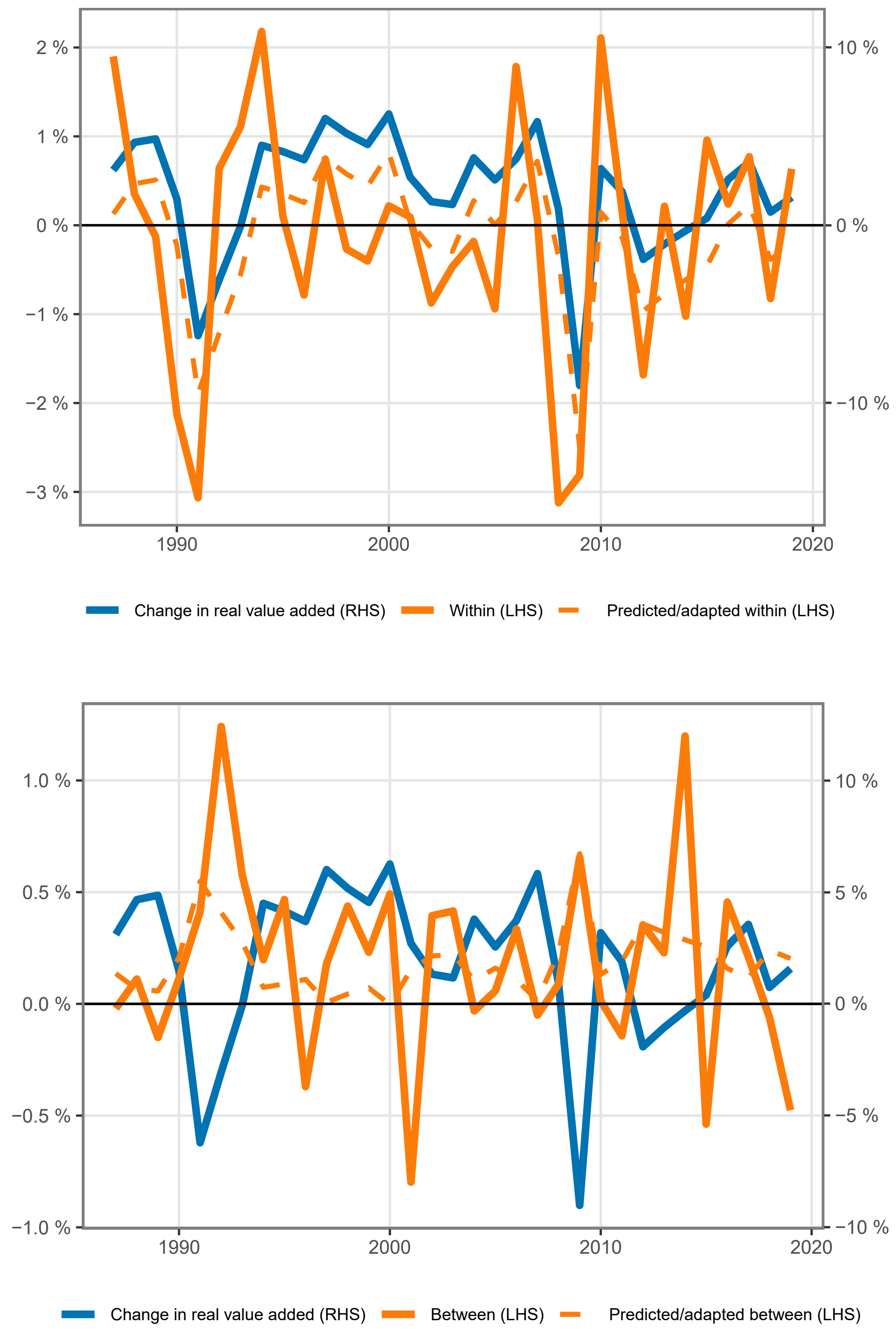
	Change in mark-ups	
	Within component	**Between component**
Intercept	-0.005 **	0.003 ***
	(0.002)	(0.001)
Change in real value added	0.217 ***	-0.044 **
	(0.061)	(0.021)
Number of observations (years)	33	33
R^2	29.1%	12.3%

Standard errors are shown in parentheses. ***p <0.01**p<0.05

Figure 4.8 illustrates the connection between the within and between components and business cycles, measured as the change of real value added. In addition, the figure shows the within and between components predicted on the basis of the change of real value added.

The within component predicted on the basis of the change of real value added is fairly well in line with the actual within component. As we can see in the figure, the within component can hardly be predicted on the basis of the change of real value added. However, it seems that the within component rises during deep recessions, in the beginning of the 1990s and during the financial crisis, for example. This is natural as during recessions, many poorly profitable firms lose their market shares and even have to cease to operate. This, in turn, reduces the market shares of low-profit firms, which leads to an increase in the between component.

Figure 4.8. Business cycle fluctuation of firm-level mark-up components.

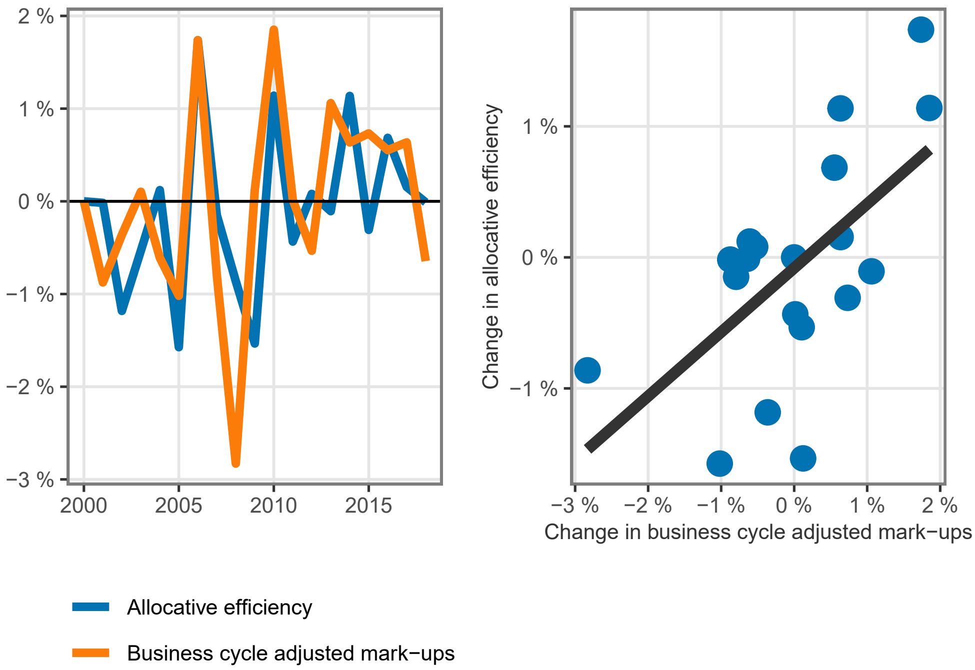


Source: Calculations based on Statistics Finland's financial statements data and national accounts.

4.4.5.3 Positive correlation between allocative efficiency and mark-ups

Finally, we will exclude the impact of business cycles on changes in mark-ups by deducting changes in profit predicted with a simple linear regression model from the real profit changes. The relation of average profits, with the impact of business cycles excluded, to the change in allocative efficiency is shown in Figure 4.9. Even after the impact of business cycles is excluded, allocative efficiency and profits have a clearly positive correlation.

Figure 4.9. Connection between allocative efficiency and mark-ups (the impact of business cycles excluded).



Source: Calculations based on Statistics Finland's financial statements data and national accounts.

The positive correlation between the business cycles and profits does not mean that an increase in mark-ups as such would lead to an improvement in allocative efficiency. The positive correlation mainly indicates that, on average, productivity has improved (declined) in connection with an increase (decrease) of mark-ups during the period under review. When the within component of firms' mark-ups increases, it is usually a sign of an increase in firms' internal productivity. Similarly, business cycle fluctuations can be seen in firms' internal profitability. On average, firms increase their margins during an economic boom, whereas during a recession, firms' internal margins decrease. As poorly profitable exit the market or downsize their operations, total profitability does not necessarily decline as clearly, in which case the impact of allocation on profitability strengthens.

However, it should be kept in mind that in this allocative efficiency calculation, mark-ups have been calculated only in one way. Using Baqaee and Farhi's (2020) method, mark-ups can easily influence allocative efficiency. Therefore calculating allocative efficiency with other mark-up assumptions may potentially affect the outcome. However, this would still require further research.

Box 1. Method for dividing total factor productivity into allocative efficiency and technology

Introduction

Total factor productivity is one of the key indicators of productivity. Simply put, the growth of total factor productivity is that part of GDP growth that cannot be explained with the growth of production inputs.

In other words, it is a growth residual, which is often called Solow residual (Solow, 1957). Solow residual is known to have its weaknesses. The calculation of the residual entails the assumptions that competition is perfect and resources are divided efficiently in economy. If the assumptions do not hold true, the residual cannot be calculated correctly with traditional methods.

In their recent study, Baqaee and Farhi (2020) created a total factor productivity calculation method, which tries to take the inefficiencies of economy into account. In their method, Baqaee and Farhi divide total factor productivity change into two components: allocative efficiency and technological change. This box provides a summary of Baqaee and Farhi's method.

Intuition

In practice, economy functions inefficiently due to many reasons. A significant factor is imperfect competition and the resulting distortions caused by positive mark-ups.[1] For example, if a sector has a one-firm monopoly, the relative price in the sector increases and relative production decreases in comparison to a situation in which the sector would have perfect competition. In other words, the competitive situation influences how much resources different sectors use. This is an essential observation when looking into productivity.

It can be shown that part of total factor productivity change comes in fact from the change in allocative efficiency caused by market power.

Next, consider a simple example, in which one sector's observed TFP increases more than that of other sectors. If the reason is an improvement of the competitive situation in this one sector so that the sector's production increases more than the use of capital and labour inputs, it means an improvement in allocative efficiency. In that case, the 'real' total factor productivity (let's call it technology) of the sector in question has not increased as much as the sector's TFP would lead to assume.

Baqaee and Farhi calculated that nearly half of the growth of total factor productivity in the United States in 1997–2015 in fact results from the improvement of allocative efficiency.

Allocative efficiency and productivity

When economy is efficient, TFP is calculated by deducting the weighted increases of factors of production from GDP growth. The weight used is typically the income shares of the factors of production. This productivity value can also be reached through approximation. Hulten (1978) demonstrates how total factor productivity can be determined as the sum of individual producers' TFP growth by weighing each producer's TFP growth with a Domar weight[2].

$$\Delta \log Y_t - \Lambda'_t \log L_t \approx \lambda_t' \Delta \log TFP_t, \qquad (1)$$

In this equation, Y_t is the private sector's value added, Λ'_t is the vector of the income shares of the factors of production, L_t is the vector containing the factors of production and λ'_t is the vector of the producers' Domar weights. As part of the producers' output is used as intermediate products of other firms, the productivity growth of individual producers should not be seen only as macroeconomic TFP, but also as an increase in production factor volumes. This is why the sum of the microeconomic TFP multipliers is more than one in this equation. When the economy is efficient, resources are constantly allocated efficiently so there are no changes taking place in the allocative efficiency.

When the economy is not efficient, total factor productivity cannot similarly be summed up from individual producers' weighted productivities because changes may have taken place in resource allocation as a result of productivity shock and mark-up changes. In other words, changes in allocation usually also lead to production changes, which influence the measured productivity.

When changes in allocative efficiency are also taken into account, productivity can be divided in the following manner, as shown by Baqaee and Farhi (2020):

$$\Delta \log Y_t - \tilde{\Lambda}'_t \log L_t \approx \tilde{\lambda}'_t \Delta \log A_t + (-\tilde{\Lambda}'_t \Delta \log \Lambda_t - \tilde{\lambda}' \Delta \log \mu_t), \qquad (2)$$

where μ_t is a vector containing mark-ups and is a vector of cost-based Domar weights for different sectors. The vector contains cost-based factor shares. As there are imperfect competition and mark-ups in economy, or $\tilde{\Lambda}'_t \neq \Lambda'_t$, the Solow residual will be distorted if it is calculated with the traditional method using income shares.

With the aid of the formula above, total factor productivity can also be divided into two components. First, $-\tilde{\lambda}_t' \Delta \log A_t$ on the right side of the equation is the direct impact of technology, as described by Hulten (1978). Second, the last terms on the right side, $-\tilde{\Lambda}'_t \Delta \log \Lambda'_t - \tilde{\lambda}'_t \Delta \log \mu t$, is the impact of allocation changes on Solow residual in relation to the previous period. In other words, to determine the (still unobserved) pure impact of technology, allocative efficiency changes are deducted from the Solow residual. Allocative efficiency change is directly influenced by changes in mark-ups and in the shares of the factors of production. If $\tilde{\lambda}'_t \Delta \log \Lambda_t < 0$ reduces, it means that resources are increasingly allocated towards sectors where competition is weaker. However, the previous term already contains some direct impacts of mark-up changes so they are eliminated with the formula's last term, $\tilde{\lambda}'_t \Delta \log \mu_t$.

Data requirements and calculation methods

Below, we will briefly look at the data requirements of the equation (2) and the main characteristics of the calculation. The calculation needs total factor productivity statistics from the private sector. In addition, it needs firm-level data about profits and turnover as well as input-output statistics so that the income- and cost-based Domar weights can be calculated. For Finland, all these annual data have been available starting from 2000.

Mark-ups can be calculated in many different ways. In our calculations, a firm's mark-up is calculated by dividing turnover by turnover minus net income[3]. The income-based Domar weights can be calculated directly from the data. They are obtained by multiplying the sectors' GDP shares with the Leontief Inverse Matrix. To calculate the cost-based Domar weights, we need to use mark-ups. In addition, the calculations assume that the only factors of production in economy are labour and capital.

In the calculations, the factors of production are added to the input-output table in the same manner as producers, with the difference that no inputs are needed for 'producing' the factors of production. This is how we get the vector Λ'_t, which can be interpreted as a vector of Domar weights for the production factors.

If we assume that all firms in the same sector have identical production functions but that their productivities and thus also mark-ups vary, the Domar weights and the left side of the equation (2) can be calculated at the sector level. Mark-ups, on the other hand, are calculated at the firm level. However, the assumptions behind this calculation are fairly strong and should be kept in mind in empirical reviews.

In our calculation, we deviate from Baqaee and Farhi's (2020) calculation method in that we use delay (instead of the future value of the variable) when calculating mark-up changes and we do not use delay in the times series in the graphs. In our opinion, the change corresponds better with the content of equation (2) than the method used by Baqaee and Farhi. We can see that this change does not have any major impact on the results that Baqaee and Farhi obtained with the US data. However, when using the Finnish data, the change is notable, which is why we decided to present the results with the adjusted calculation method.

1 Baqaee and Farhi apply their theory under the assumption that imperfect competition is the only distortion in economy and it is signified by mark-ups. These mark-ups are a favourable object of analysis as they are relatively easy to determine with the aid of corporate data. However, the theory can – at least in theory – be applied with regard to other distortions.

2 The Domar weight for the producer i is calculated by dividing the producer i's total production by the GDP.

3 Baqaee and Farhi (2020) calculate mark-ups in three different ways. In their calculations, the calculation method clearly, but not decisively, influences the magnitude of the change in allocative efficiency.

4.5 Summary

In Finland, resource allocation is weaker than in the other Nordic countries. This reduces the total factor productivity of the national economy considerably. A significant productivity impact is created by the wedges caused by distortions being larger within a sector than between sectors. At the same time, there are better opportunities to reallocate inputs within a sector than between sectors. In addition, distortions intensify in value chains as products from many firms are used as inputs in other firms.

Allocative efficiency decreased in the early 2000s in Finland's corporate sector. The cumulative decreasing impact on total factor productivity until 2010 was a little less than four per cent. A turn for the better took place roughly in the early 2010s. From 2010 to 2018, the improvement of allocative efficiency had increased total factor productivity by approximately two per cent. The deterioration of allocative efficiency slowed down the impact of technological development on the growth of total factor productivity and the GDP in the first decade of the 2000s. After this, the improvement of allocative efficiency has slightly complemented the growth impact of technological development.

The aggregate labour income share has decreased. At the same time, there has been a general increase in the corporate labour income share. The explanation is that firms with a low labour income share and good profitability have increased their market shares, which translates into a lower aggregate labour income share.

5 Cost competitiveness

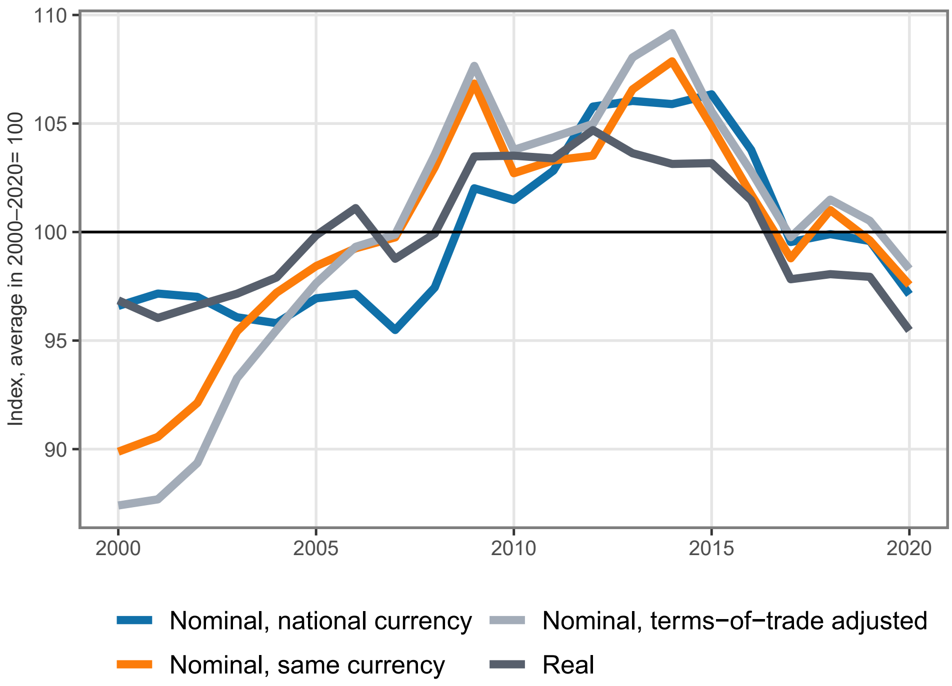
5.1 Cost competitiveness in Finland

Cost competitiveness has a clear impact on economic growth and above all success in export markets. However, defining and measuring cost competitiveness are not unambiguous or simple tasks. The previous report of the Finnish Productivity Board (Finnish Productivity Board, 2020) discussed cost competitiveness and its measurement in more detail. In this report, we go through the recent development of cost competitiveness with the aid of the most commonly used indicators.

Usually short-term cost competitiveness is measured with unit labour costs, or average labour costs in proportion to labour productivity. Unit labour costs are typically reviewed as indices and thus they do not describe the level of cost competitiveness, only its change. In this case, the change is analysed in proportion to the change in other countries and a unit labour cost change faster than in reference countries means that cost competitiveness is declining. This proportional approach is usually applied in relation to key trading partner countries at the same development level.

Unit labour costs can also be calculated in many ways. Below, we look at nominal relative unit costs in own currency, in the same currency and as terms-of-trade adjusted as well as real relative unit costs. Their developments differ from each other if production prices in relation to other countries or exchange rates change considerably.

Figure 5.1. Relative unit labour costs of the entire Finnish economy calculated on the basis of the number of employed persons. Calculated in relation to 16 key reference countries. Reference countries: BE, DK, DE, IE, ES, FR, IT, NL, AT, SE, NO, PT, EL, US, JP and CH.



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

Figure 5.1 describes cost competitiveness with the aid of all these different indicators. In recent years, the picture that different unit labour cost indicators have conveyed of cost competitiveness development has been very uniform: cost competitiveness improved in relation the reference countries. However, the improvement of cost competitiveness stalled in 2017–2019. Last year, relative unit labour costs again decreased clearly. The factors behind this decrease include the exceptional changes in production and working hours caused by the COVID-19 crisis. Nevertheless, on the basis of the data regarding the early 2021, relative unit labour costs are below the 2019 level even though production has recovered.

Compared to the longer-term average, relative unit labour costs are now below the average on all analysed indicators. This means that Finland's cost competitiveness is better than on average in 2000–2020. In terms of real unit labour costs, cost competitiveness is even better than at any point since 1995.

Figure 5.2. Components of the same-currency relative nominal unit labour cost index: average relative employee compensation, relative labour productivity and nominal effective exchange rate. Calculated in relation to 16 key reference countries.

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

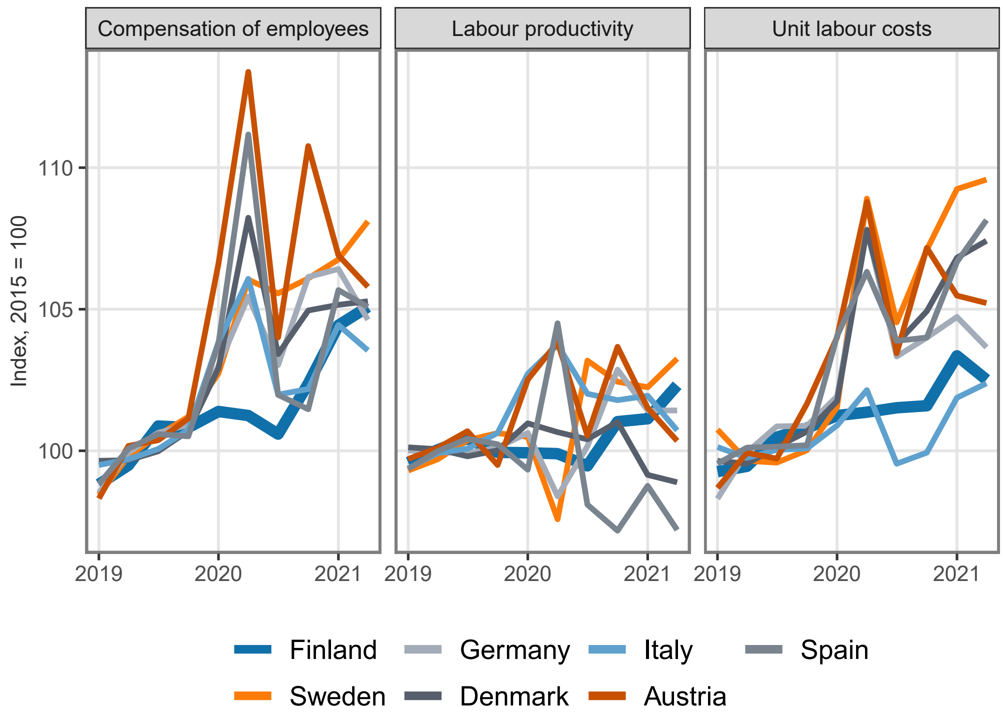
Figure 5.2 shows the components of the same-currency relative nominal unit labour cost index: average relative employee compensation, relative labour productivity and nominal effective exchange rate. The fact that employee compensation has risen more slowly than in the reference countries has improved price competitiveness constantly since 2012. The decrease of relative employee compensation continued also in 2020. However, relative productivity declined for a long time, until 2015, after which it has improve slightly but not significantly. On the basis of cost competitiveness data, labour productivity increased clearly in 2000. This differs from other productivity data of the report, which indicate that labour productivity decreased marginally.

The difference is due to the fact that the cost competitiveness analysis used labour productivity in the entire economy, not only the productivity of the easily measurable private sector, and that this uses labour productivity calculated on the basis of the number of employed persons, not working hours. The fact that the number of employed persons is hardly significant for unit labour costs as employee compensation is also put in proportion to the number of employees.

5.2 The impact of the COVID-19 pandemic on competitiveness indicators

The COVID-19 pandemic has influenced unit labour cost components and some caution should be applied regarding the fluctuations of competitiveness indicators.

Figure 5.3. Average employee compensation and labour productivity per working hour as well as nominal unit labour costs in certain EU countries.



Source: Eurostat, Finnish Productivity Board.

The major fluctuations of cost competitiveness components shown in Figure 5.3 have in part been influenced by temporary sector structure changes, too. This is especially evident with regard to the strong labour productivity increase that took place in some countries in the second quarter of 2020.

For example, when it comes to the sectors G–I (Wholesale and retail trade, Transportation and storage, and Accommodation and food service activities), in which labour productivity is below the average, their share of the working hours in the national economy decreased in all countries under review during the second quarter of 2020.

The change at that point was particularly dramatic in Spain, where labour productivity increased more steeply than in any of the other countries, as shown in Figure 5.3, but then also declined most drastically. In Spain, the share of the sectors G–I of working hours declined by a fifth (6 percentage points from 30 per cent to approximately 24 per cent) during last year's second quarter without a corresponding decline in labour productivity in the said sectors, which explains about 1.5 percentage points in the approximately eight-per-cent temporary increase in labour productivity in the entire national economy, as shown in the figure.

In general, some caution should be applied when looking at the data for 2020 even though they are now based on the more reliable annual accounts data. During that year, which was characterised by the COVID-19 pandemic, many countries made working hours arrangements, which may have influenced statistical data about working hours or employee compensation payable by firms.

Employee compensation per working hour increased last year. As a result, unit labour costs also increased clearly in many EU countries as working hours were cut more than wages and salaries. Instead, in Finland, employees were laid off temporarily, which meant that wages and salaries were not paid either. Thus, employee compensation and unit labour costs in Finland did not increase to the same extent as in many other countries. However, the situation has returned to normal this year and there no longer is 'excessive' employee compensation per working hour.

Regardless, from 2019 to the second quarter of 2021, employee compensation has increased in most countries more than in Finland. As Finland's productivity development has also been faster than in many reference countries this year, Finland's unit labour costs have increased less than in most reference countries during the COVID-19 crisis.

6 Conclusions and policy recommendations

The key new findings and interpretations of this report are:

1. Productivity in the Finnish corporate sector is lagging behind the key reference countries and the globally leading countries. It seems that the gap to the leading countries cannot be closed without structural renewal.
2. The level of productivity varies extensively among firms. Finland lacks high-productivity firms in relation to the key reference countries.
3. While labour productivity in manufacturing is at a healthy international level, it still remains far behind the reference countries in many service sectors.
4. In some digital service sectors, productivity has decreased.
5. From the total factor productivity perspective, resource allocation is poorer in Finland than in the reference countries. The most productive firms operate on too small a scale considering the national economy.
6. Resource allocation deteriorated at the beginning of the 2000s. In net terms, labour has moved away from highly productive sites to less productive ones. Since then, resource allocation has improved slightly.
7. Although the aggregate labour income share has decreased, there has been a general increase in the corporate labour income share. Firms with a low labour income share and good profitability have increased their market shares, which translates into a lower aggregate labour income share.

However, productivity development is the key to improving wellbeing and the standard of living. 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. Nevertheless, the impacts arising through 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 should strive to examine the impact of the action on 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, this 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 regarding the supply in the electronics industry, and the economy has not been able to carry out sufficient renewal by developing replacing sites of high productivity or fast productivity growth.

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 two perspectives: short-term cost competitiveness and the preconditions for 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.

6.1 How can productivity growth be accelerated?

Firms' decreasing R&D inputs are not the key to explaining the slowing down of 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&I 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 on 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 strengthen not only by cooperation and the creation of new technology but also the spreading of 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 support is targeted at young firms.

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

Weak or weakened business dynamics also fails to explain the stagnating productivity growth in Finland. Analyses and indicators that draw on corporate and site data indicate that business and job 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 sectors. 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 business 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 exist, 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 obtain 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 can only be seen with a significant delay.

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 COVID-19 pandemic, the need for these investments is made more urgent by it. In times of a recession or economic crisis, the opportunity 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 private funding for R&D inputs, or even surviving on 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 challenges to Finland's long-term structural competitiveness are related mainly to 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.

This report especially highlights three questions to be considered by policymakers.

1. How can the number of high-productivity firms be increased in Finland?
2. How can better resource allocation and movement from low-productivity sites to more productive ones be promoted?
3. How can productivity in service sectors be improved and how can productivity development especially in digital service sectors be directed to a growth path?

The promotion of competition, market entry and investments would encourage high-productivity firms to increase their production and obtain a larger share of resources. The regulation of business operations and especially investments should be considered also from this point of view.

The improvement of professional and other mobility of labour force, including the immigration of skilled employees, might promote better resource allocation and, as a result, total factor productivity. The regulation of the labour market should be considered also from this point of view.

Digital services may have great potential for productivity growth as the opportunities of a significant production scale increase could be larger than in non-digital production. In these sectors, productivity problems may be specific to each sector or firm so at this level of analysis, it is difficult to say anything more precise about them. This question would merit deeper exploration.

6.2 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, employee compensation 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. Relative employee compensation has, however, declined so much that the unit labour costs have changed little in 2017–2019.

Finnish industry has lacked success on the export market for over ten years, and there is an obvious shortage of production investments. The persistently poor export performance and poor ability to attract production 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 clearly 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.

REFERENCES

Acemoglu, D. (2009). *Introduction to Modern Economic Growth*. Princeton University Press.

Aghion, P., Akcigit, U., & Howitt, P. (2014). What do we learn from Schumpeterian growth theory? In *Handbook of Economic Growth* (Volume 2, pp. 515–563). Elsevier.

Aghion, P., Antonin, C., & Bunel, S. (2021). *The Power of Creative Destruction: Economic Upheaval and the Wealth of Nations* (translated by J. Cohen-Tanugi). Belknap Press.

Aghion, P., Bloom, N., Blundell, R., Griffith, R., & Howitt, P. (2005). Competition and Innovation: An Inverted-U Relationship*. *The Quarterly Journal of Economics*, *120*(2), 701–728. https://doi.org/10.1093/qje/120.2.701

Aghion, P., & Howitt, P. (1992). A Model of Growth Through Creative Destruction. *Econometrica*, *60*(2), 323–351. JSTOR. https://doi.org/10.2307/2951599

Aghion, P., & Howitt, P. (2007). Capital, innovation, and growth accounting. *Oxford Review of Economic Policy*, *23*(1), 79–93. https://doi.org/10.1093/oxrep/grm007

Aghion, P., & Howitt, P. (2009). *The Economics of Growth*. MIT Press.

Audretsch, D. B., Baumol, W. J., & Burke, A. E. (2001). Competition policy in dynamic markets. *International Journal of Industrial Organization*, *19*(5), 613–634. https://doi.org/10.1016/S0167-7187(00)00086-2

Autor, D., Dorn, D., Katz, L. F., Patterson, C., & Van Reenen, J. (2020). The Fall of the Labor Share and the Rise of Superstar Firms*. *The Quarterly Journal of Economics*, *135*(2), 645–709. https://doi.org/10.1093/qje/qjaa004

Baily, M. N., Hulten, C., Campbell, D., Bresnahan, T., & Caves, R. E. (1992). Productivity Dynamics in Manufacturing Plants. *Brookings Papers on Economic Activity. Microeconomics*, *1992*, 187. https://doi. org/10.2307/2534764

Baqaee, D. R., & Farhi, E. (2020). Productivity and Misallocation in General Equilibrium. *The Quarterly Journal of Economics*, *135*(1), 105–163. https://doi.org/10.1093/qje/qjz030

Berlingieri, G., Blanchenay, P., Criscuolo, C., & Calligaris, S. (2017). *The Multiprod project: A comprehensive overview* (OECD Science, Technology and Industry Working Papers 2017/04; OECD Science, Technology and Industry Working Papers, Volume 2017/04). https://doi.org/10.1787/2069b6a3-en

Berry, S., Gaynor, M., & Scott Morton, F. (2019). Do Increasing Markups Matter? Lessons from Empirical Industrial Organization. *Journal of Economic Perspectives*, *33*(3), 44–68. https://doi.org/10.1257/jep.33.3.44

Bloom, N., Van Reenen, J., & Williams, H. (2019). A Toolkit of Policies to Promote Innovation. *Journal of Economic Perspectives*, *33*(3), 163–184. https://doi.org/10.1257/jep.33.3.163

Bonfiglioli, A., Crinò, R., & Gancia, G. (2021). Concentration in International Markets: Evidence from US Imports. *Journal of Monetary Economics*, *121*, 19–39. https://doi.org/10.1016/j.jmoneco.2021.04.008

Böckerman, P., & Maliranta, M. (2012). Globalization, creative destruction, and labour share change: Evidence on the determinants and mechanisms from longitudinal plant-level data. *Oxford Economic Papers*, *64*(2), 259–280. https://doi.org/10.1093/oep/gpr031

Calvino, F., Criscuolo, C., Marcolin, L., & Squicciarinii, M. (2018). *A taxonomy of digital intensive sectors* (OECD Science, Technology and Industry Working Papers 2018/14; OECD Science, Technology and Industry Working Papers, Volume 2018/14). https://doi.org/10.1787/f404736a-en

Da-Rocha, J.-M., Restuccia, D., & Tavares, M. M. (2019). Firing costs, misallocation, and aggregate productivity. *Journal of Economic Dynamics and Control*, *98*, 60–81. https://doi.org/10.1016/j.jedc.2018.09.005

David, J.M. and V. Venkateswaran (2019). The Sources of Capital Misallocation. *American Economic Review* 109(7): 2531–2567. https://doi.org/10.1257/aer.20180336

Davis, S., & Haltiwanger, J. (2019). *Dynamism Diminished: The Role of Housing Markets and Credit Conditions* (Number w25466; p. w25466). National Bureau of Economic Research. https://doi.org/10.3386/w25466

De Loecker, J., J. Eeckhout and G. Unger (2020). The Rise of Market Power and the Macroeconomic Implications. *The Quarterly Journal of Economics*, Volume 135, Issue 2, May 2020, Pages 561–644, https://doi.org/10.1093/qje/qjz041

Fernald, J. G. (2015). Productivity and Potential Output before, during, and after the Great Recession. *NBER Macroeconomics Annual*, *29*(1), 1–51. https://doi.org/10.1086/680580

Finnish Productivity Board. (2019). The State of Productivity in Finland: Why did its growth stop? Will it start again? Publications of the Ministry of Finance, 2020(60). https://julkaisut.valtioneuvosto.fi/handle/10024/162427

Finnish Productivity Board. (2020). Productivity and competitiveness in Finland. Which factors affect competitiveness? Why do we need it? Publications of the Ministry of Finance, 2021(20). https://julkaisut.valtioneuvosto.fi/ handle/10024/163063

Foster, L., Haltiwanger, J., & Syverson, C. (2008). Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability? *American Economic Review*, *98*(1), 394–425. https://doi.org/10.1257/aer.98.1.394

Färe, R., Grosskopf, S., Norris, M., & Zhang, Z. (1994). Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries. *The American Economic Review*, *84*(1), 66–83. JSTOR.

Griffith, R., Redding, S., & Reenen, J. V. (2004). Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Industries. *Review of Economics and Statistics*, *86*(4), 883–895. https://doi. org/10.1162/0034653043125194

Grossman, G. M., & Helpman, E. (1991). *Innovation and Growth in the Global Economy*. MIT Press.

Haider, F., Kunst, R., & Wirl, F. (2021). Total factor productivity, its components and drivers. *Empirica*, *48*(2), 283– 327. https://doi.org/10.1007/s10663-020-09476-4

Haltiwanger, J., Jarmin, R. S., & Miranda, J. (2013). Who Creates Jobs? Small versus Large versus Young. *Review of Economics and Statistics*, *95*(2), 347–361. https://doi.org/10.1162/REST_a_00288

Haltiwanger, J., Jarmin, Ron S., Kulick, R., & Miranda, Javier. (2017). High Growth Young Firms: Contribution to Job, Output, and Productivity Growth. In J. Haltiwanger, E. Hurst, J. Miranda, & A. Schoar (eds.), *Measuring Entrepreneurial Businesses: Current Knowledge and Challenges*. The University of Chicago Press.

Harberger, A. C. (1954). Monopoly and Resource Allocation. *The American Economic Review*, *44*(2), 77–87. JSTOR.

Hopenhayn, H. A. (2014). Firms, Misallocation, and Aggregate Productivity: A Review. *Annual Review of Economics*, *6*(1), 735–770. https://doi.org/10.1146/annurev-economics-082912-110223

Hsieh, C.-T., & Klenow, P. J. (2009). Misallocation and Manufacturing TFP in China and India *. *Quarterly Journal of Economics*, *124*(4), 1403–1448. https://doi.org/10.1162/qjec.2009.124.4.1403

Hsieh, C.-T., & Moretti, E. (2019). Housing Constraints and Spatial Misallocation. *American Economic Journal: Macroeconomics*, *11*(2), 1–39. https://doi.org/10.1257/mac.20170388

Hulten, C. R. (1978). Growth Accounting with Intermediate Inputs. *The Review of Economic Studies*, *45*(3), 511– 518. https://doi.org/10.2307/2297252

Hyytinen, A., & Maliranta, M. (2013). Firm lifecycles and evolution of industry productivity. *Research Policy*, *42*(5), 1080–1098. https://doi.org/10.1016/j.respol.2013.01.008

Hyytinen, A., & Maliranta, M. (2016). *Yritysjohdon taloustiede: Yritykset taloudessa ja taloustieteessä* (2nd ed.). Spillover Economics Oy.

Inklaar, R., & Timmer, M. P. (2014). The Relative Price of Services. *Review of Income and Wealth*, 727–746. https://doi.org/10.1111/roiw.12012

Jones, C. I. (2016). The Facts of Economic Growth. In *Handbook of Macroeconomics* (Volume 2, pp. 3–69). Elsevier. https://doi.org/10.1016/bs.hesmac.2016.03.002

Kehrig, M., & Vincent, N. (2021). The Micro-Level Anatomy of the Labor Share Decline*. *The Quarterly Journal of Economics*, *136*(2), 1031–1087. https://doi.org/10.1093/qje/qjab002

Klenow, P. J., & Rodríguez-Clare, A. (1997). The Neoclassical Revival in Growth Economics: Has It Gone Too Far? *NBER Macroeconomics Annual*, *12*, 73–103. https://doi.org/10.1086/654324

Klette, T. J., & Kortum, S. (2004). Innovating Firms and Aggregate Innovation. *Journal of Political Economy*, *112*(5), 986–1018. https://doi.org/10.1086/422563

Krüger, J. J. (2003). The Global Trends of Total Factor Productivity: Evidence from the Nonparametric Malmquist Index Approach. *Oxford Economic Papers*, *55*(2), 265–286. JSTOR.

Leibenstein, H. (1966). Allocative Efficiency vs. "X-Efficiency". *The American Economic Review*, *56*(3), 392–415. JSTOR.

Maliranta, M., & Hurri, P. (2017). Kasvuyritykset ja talouskasvu: Empiirinen analyysi kasvuyritysten työllisyyden ja tuottavuuden dynamiikasta. *Kansantaloudellinen aikakauskirja*, *113*(1). http://www.taloustieteellinenyh-distys.fi/wp-content/uploads/2017/03/kak-1-2017-MalirantaHurri.pdf

Maliranta, M., & Määttänen, N. (2018). Toimialojen kannattavuus, työpaikkavirrat ja luova tuho Suomen tehdasteollisuudessa. *ETLA Muistio*, *74*, 9. OECD. (2020). *OECD Economic Surveys: Finland 2020*. OECD. https://doi.org/10.1787/673aeb7f-en

Olley, G. S., & Pakes, A. (1996). The Dynamics of Productivity in the Telecommunications Equipment Industry. *Econometrica, 64*(6), 1263. https://doi.org/10.2307/2171831

Peters, M. (2020). Heterogeneous Markups, Growth, and Endogenous Misallocation. *Econometrica, 88*(5), 2037–2073. https://doi.org/10.3982/ECTA15565

Philippon, T. (2019). The Great Reversal: How America Gave Up on Free Markets. The Belknap Press of Harvard University Press.

Restuccia, D., & Rogerson, R. (2008). Policy distortions and aggregate productivity with heterogeneous establishments. *Review of Economic Dynamics, 11*(4), 707–720. https://doi.org/10.1016/j.red.2008.05.002

Restuccia, D., & Rogerson, R. (2013). Misallocation and productivity. *Review of Economic Dynamics, 16*(1), 1–10. https://doi.org/10.1016/j.red.2012.11.003

Restuccia, D., & Rogerson, R. (2017). The Causes and Costs of Misallocation. *Journal of Economic Perspectives, 31*(3), 151–174. https://doi.org/10.1257/jep.31.3.151

Rossi-Hansberg, E., Sarte, P.-D., & Trachter, N. (2021). Diverging Trends in National and Local Concentration. *NBER Macroeconomics Annual, 35*, 115–150. https://doi.org/10.1086/712317

Schmitz, J. A. Jr. (2005). What Determines Productivity? Lessons from the Dramatic Recovery of the U.S. and Canadian Iron Ore Industries Following Their Early 1980s Crisis. *Journal of Political Economy, 113*(3), 582–625. https://doi.org/10.1086/429279

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics, 70*(1), 65–94. https://doi.org/10.2307/1884513

Solow, R. M. (1957). Technical Change and the Aggregate Production Function. *The Review of Economics and Statistics, 39*(3), 312. https://doi.org/10.2307/1926047

Takalo, T., & Toivanen, O. (2021). Sääntelyn vaikutukset innovaatiotoimintaan ja innovaatiotoimintaa edistävä sääntely. *Kansantaloudellinen aikakauskirja, 117*(1), 28.

van Ark, H. H.. (1993). International comparisons of output and productivity: manufacturing productivity performance of ten countries from 1950 to 1990. Rijksuniversiteit Groningen.

Vickers, J. (1995). Concepts of Competition. *Oxford Economic Papers, 47*(1), 1–23. https://doi.org/10.1093/ oxfordjournals.oep.a042155

MINISTRY
OF FINANCE

MINISTRY OF FINANCE
Snellmaninkatu 1 A
PO BOX 28, 00023 GOVERNMENT
Tel. +358 295 160 01
financeministry.fi

ISSN 1797-9714 (pdf)
ISBN 978-952-367-909-2 (pdf)

December 2021