MINISTRY
OF FINANCE

Wages and competitiveness depend on productivity

How can we foster productivity growth?

Board

Publications of the Ministry of Finance – 2022:79

Publications of the Ministry of Finance 2022:79

Wages and Competitiveness Depend on Productivity

How Can We Foster Productivity Growth?

Finnish Productivity Board

Ministry of Finance 2022

Julkaisujen jakelu
Distribution av publikationer

Valtioneuvoston julkaisuarkisto Valto

Publikations-arkivet Valto

julkaisut.valtioneuvosto.fi

Julkaisumyynti
Beställningar av publikationer

Valtioneuvoston verkkokirjakauppa

Statsrådets nätbokhandel

vnjulkaisumyynti.fi

Publication distribution

Institutional Repository for the Government of Finland Valto

julkaisut.valtioneuvosto.fi

Publication sale

Online bookstore of the Finnish Government

vnjulkaisumyynti.fi

Ministry of Finance

ISBN pdf: 978-952-367-213-0
ISSN pdf: 1797-9714

Layout: Government Administration Department, Information Support and Publications Unit

Helsinki 2022 Finland

Description sheet
9 December 2022

Wages and competitiveness depend on productivity How can we foster productivity growth?

Publications of the Ministry of Finance 2022:66		**Subject**	Board
Publisher	Ministry of Finance		

Author(s)	Huovari, Janne; Stenborg, Markku; Lassi, Auri; Kiema, Ilkka; Kuosmanen, Natalia; Kangaspunta, Seppo; Maliranta, Mika; Obstbaum, Meri		
Group author	Finnish Productivity Board		
Language	English	**Pages**	157

Abstract

The report examines Finland's cost-competitiveness, development of earnings, innovation policy and the causes of its exceptionally slow productivity growth.

The underlying cause of Finland’s slow productivity growth is the permanent negative technology shock experienced by Finland's electronics industry; the weakened cost-competitiveness of the export industry following the financial crisis, which reduced incentives to invest; and the poor allocation of resources: the most productive companies do not have a sufficiently large share of the labour force. The analysis suggests that the poor allocation of resources significantly reduces productivity. However, this does not seem to be because of a lack of competition or because of the economy renewing slowly due to insufficient business dynamism.

Companies seem to be using less labour force and more capital inputs than what would be required to make a profit. On the one hand, this phenomenon indicates that there are problems in the availability of skilled labour and in labour market regulation, and on the other hand, that there are distortions in capital taxation.

Finland’s cost-competitiveness has remained reasonable over the past years. The competitiveness decomposition based on registry data indicates that the flexibility of wage formation has supported both cost-competitiveness and the development of earnings. Wages react not only to cyclical fluctuations, but also to differences in productivity and profitability, among other things. This kind of flexibility evens out the consequences of fluctuations and differences in the demand for labour and promotes the stable development of the economy.

Keywords economic policy, productivity, economic growth, technological development, competitive strength, national economy, board, Finnish Productivity Board

ISBN PDF	978-952-367-213-0	**ISSN PDF**	1797-9714
Reference no.	VN/15413/2021	**Project no.**	VM075:00/2021
URN address	https://urn.fi/URN:ISBN:978-952-367-213-0		

Kuvailulehti
9.12.2022

Palkat ja kilpailukyky tuottavuuden varassa
Miten tuottavuuskasvua voidaan edistää?

Valtiovarainministeriön julkaisuja 2022:79		**Teema**	Lautakunnat
Julkaisija	Valtiovarainministeriö		
Tekijä/t	Huovari, Janne; Stenborg, Markku; Lassi, Auri; Kiema, Ilkka; Kuosmanen, Natalia; Kangaspunta, Seppo; Maliranta, Mika; Obstbaum, Meri		
Yhteisötekijä	Tuottavuuslautakunta		
Kieli	englanti	**Sivumäärä**	157

Tiivistelmä

Raportti tarkastelee Suomen poikkeuksellisen hitaan tuottavuuskasvun syitä, kustannuskilpailukykyä ja ansioiden kehitystä sekä innovaatiopolitiikkaa.

Hitaan tuottavuuskasvun taustalla on Suomen elektroniikkateollisuuden kokema pysyvä negatiivinen teknologiashokki; finanssikriisin jälkeinen vientiteollisuuden heikentynyt kustannuskilpailukyky, joka mm. vähensi kannusteita investoida sekä voimavarojen huono kohdentuminen: tuottavimpien yritysten osuus työvoimasta ei ole riittävän suuri. Analyysi viittaa siihen, että voimavarojen heikko kohdentuminen alentaa merkittävästi tuottavuutta. Tämä ei kuitenkaan näytä johtuvan kilpailun puutteesta tai siitä, että talous uudistuu hitaasti puutteellisen yritysdynamikan vuoksi.

Yritykset näyttäisivät käyttävän vähemmän työvoimaa ja enemmän pääomapanoksia kuin voiton tavoittelu edellyttäisi. Ilmiö viittaa yhtäältä ongelmiin osaavan työvoiman saatavuudessa ja työmarkkinoiden sääntelyssä ja toisaalta pääomaverotuksen vääristymiin.

Suomen kustannuskilpailukyky on viime vuosina säilynyt kohtuullisena. Rekisteriaineistoihin nojaava kilpailukyvyn hajotelma kertoo, että palkanmuodostuksen joustavuus on tukenut sekä kustannuskilpailukykyä että ansioiden kehittymistä. Palkat reagoivat paitsi suhdannevaihteluun, myös muun muassa tuottavuuden ja kannattavuuden eroihin. Tällainen jousto tasoittaa työvoiman kysynnän heilahduksien ja erojen seurauksia, ja edistää talouden vakaata kehitystä.

Asiasanat	talouspolitiikka, tuottavuus, talouskasvu, teknologinen kehitys, kilpailukyky, kansantalous, lautakunnat, tuottavuuslautakunta		
ISBN PDF	978-952-367-213-0	**ISSN PDF**	1797-9714
Asianumero	VN/15413/2021	**Hankenumero**	VM075:00/2021
Julkaisun osoite	https://urn.fi/URN:ISBN:978-952-367-213-0		

Presentationsblad
9.12.2022

Produktivitet som grund för löner och konkurrenskraft
Hur kan man främja produktivitetstillväxt?

Finansministeriets publikationer 2022:66		**Tema**	Nämnder
Utgivare	Finansministeriet		

Författare	Huovari, Janne; Stenborg, Markku; Lassi, Auri; Kiema, Ilkka; Kuosmanen, Natalia; Kangaspunta, Seppo; Maliranta, Mika; Obstbaum, Meri		
Utarbetad av	Produktivitetsnämnden		

Språk	engelska	**Sidantal**	157

Referat

Rapporten innehåller en analys av orsakerna till Finlands exceptionellt långsamma produktivitetstillväxt och av kostnadskonkurrenskraften, inkomstutvecklingen och innovationspolitiken i Finland.

Den långsamma produktivitetstillväxten beror på den finländska elektronikindustrins bestående negativa teknikchock, på exportindustrins försämrade kostnadskonkurrenskraft efter finanskrisen, vilket bland annat har minskat incitamenten för investeringar, och på en svag resursallokering, som innebär att de mest produktiva företagen inte utgör en tillräckligt stor andel av arbetskraften. Analysen tyder på att den svaga resursallokeringen minskar produktiviteten avsevärt. Detta verkar dock inte vara en följd av brist på konkurrens eller av att ekonomin förnyas långsamt på grund av bristfällig företagsdynamik.

Företagen verkar använda mindre arbetskraft och mera kapitaltillskott än vad strävan efter ekonomisk vinst skulle förutsätta. Fenomenet tyder å ena sidan på problem med tillgången på kompetent arbetskraft och med regleringen av arbetsmarknaden och å andra sidan på snedvridningar i kapitalinkomstbeskattningen.

Finlands kostnadskonkurrenskraft har hållits på en skälig nivå under de senaste åren. Registermaterial visar att en flexibel lönebildning har stött såväl kostnadskonkurrenskraften som inkomstutvecklingen. Lönerna reagerar förutom på konjunkturväxlingar också bland annat på skillnader i fråga om produktivitet och lönsamhet. En sådan flexibilitet jämnar ut effekterna av fluktuationer och skillnader i efterfrågan på arbetskraft och bidrar till en stabil ekonomisk utveckling.

Nyckelord	ekonomisk politik, produktivitet, ekonomisk tillväxt, teknologisk utveckling, konkurrenskraft, samhällsekonomi, nämnder, produktivitetsnämnden		
ISBN PDF	978-952-367-213-0	**ISSN PDF**	1797-9714
Ärendenr.	VN/15413/2021	**Projektnr.**	VM075:00/2021
URN-adress	https://urn.fi/URN:ISBN:978-952-367-213-0		

Contents

PREFACE

In June 2018, the Government issued a decree establishing the Finnish Productivity Board. This was motivated by the Recommendation of the Council of the European Union on the establishment of National Productivity Boards. The Recommendation was justified by Europe's modest potential economic growth, poor competitiveness, underlying slow productivity growth and the need to coordinate productivity-related measures in the euro area.

The Productivity Board is an independent and autonomous expert body operating in conjunction with the Ministry of Finance but not as part of its organisation. The Board is tasked with monitoring the development of productivity, competitiveness and earnings in the Finnish economy, producing independent evaluations of this and publishing an annual report.

The Government appointed the members of the Productivity Board for a term of office running from 1 September 2021 to 30 August 2024. The Board is chaired by Markku Stenborg (Docent, PhD), Senior Ministerial Adviser at the Ministry of Finance. The other members are Professor Mika Maliranta (PhD), Director, Labour Institute for Economic Research (Labore); Ilkka Kiema (PhD, DSocSc), Research Leader, Labour Institute for Economic Research (Labore); Janne Huovari (MSocSc), Forecasting Director, Pellervo Economic Research PTT; Meri Obstbaum (DSc), Head of Forecasting, Bank of Finland; Natalia Kuosmanen (DSc, Agriculture and Forestry), Chief Research Scientist, ETLA Economic Research; and Seppo Kangaspunta, Ministerial Adviser, Ministry of Economic Affairs and Employment. The Secretary of the Board is Olli Palmén, Senior Specialist, Ministry of Finance. Auri Lassi, trainee at the Ministry of Finance, also contributed to this report.

In this report, we examine the functioning of the labour market, wages and salaries as well as cost competitiveness both from the perspective of aggregate statistics and from the employee and enterprise perspectives, the reasons for Finland's slow productivity growth, and the effects of resource allocation on productivity. We also discuss innovation policy. Analyses for the report benefitted from cooperation with the OECD Directorate for Science, Technology and Innovation, for which we extend our warm thanks.

1 Introduction

The first report of the Finnish Productivity Board (Finnish Productivity Board, 2019) focused on examining productivity and the second report (Finnish Productivity Board, 2020) on competitiveness across a wide spectrum. The third report (Finnish Productivity Board, 2021) focused on the functioning of markets from the productivity perspective and looked into themes including innovation incentives, corporate-sector dynamics, creative destruction, and the significance of resource allocation.

In this fourth report, we continue to examine competitiveness, resource allocation and competition. A new theme in this report is an examination of the components of cost competitiveness using microdata and aggregate statistics. The report also discusses Finnish innovation policy and evaluates a variety of policy measures for improved productivity growth.

In Chapter 2, we report on the development of cost competitiveness and wage and salary earnings in the light of aggregate data. In Chapter 3, we use microdata to examine the functioning of the labour market. Once again, enterprise- and employee-level register data allows us to paint a more nuanced and complex picture of the functioning of the labour market and of pay development than would be possible using aggregate data.

In Chapter 4, we examine the allocation of factors of production at the industry and enterprise levels and consider the role it plays for productivity at the aggregate level. This follows on from the examination presented in the 2021 report. At the enterprise level, productivity (production or value added per hour worked) and its development are primarily driven by the enterprise's technology and its capacity for innovation and imitation. At the level of the national economy, the allocation of resources between enterprises also plays a decisive role. In the 2021 report, we found that productivity in Finnish manufacturing is reduced by less efficient allocation of resources: in Finland, the most productive enterprises receive a smaller share of resources and production than in the other Nordic countries. We also found that, from the productivity perspective, resource allocation in Finland remained poorer in 2018 than it had been in 2000.

In Chapter 5, we continue, and provide greater detail on, the empirical examination of the functioning of the product markets and the dynamics of the non-financial corporations sector. In previous reports, we attributed some of Finland's very slow and at times even negative productivity development to a permanent negative technology shock. In this regard, the Productivity Board has cooperated with the OECD Directorate for Science, Technology and Innovation and examined empirically how and how much the permanent negative technology shock has affected the Finnish economy.

Cooperation with the OECD has also provided more detail on the market's competitive nature and business dynamics, which we already covered in the 2021 report. We report on this theme in Chapter 6.

In our previous reports, we have also discussed the significance of cost competitiveness. It is clear that better productivity development enables improved cost competitiveness more easily than poorer productivity development. However, economic activity and international competition also link competitiveness and productivity the other way round: Good cost competitiveness enables the expansion of exports and production in the open sector, which means more hours worked and higher employment. At the same time, it motivates investments in larger and newer production capacity. Investments improve the potential for productivity growth thanks to new technology. Empirical cooperation with the OECD has also improved our understanding of the significance of competitiveness; we cover this topic in Chapter 7. Chapter 3 also sheds light on this aspect by examining the micro factors of competitiveness at the employee and enterprise levels.

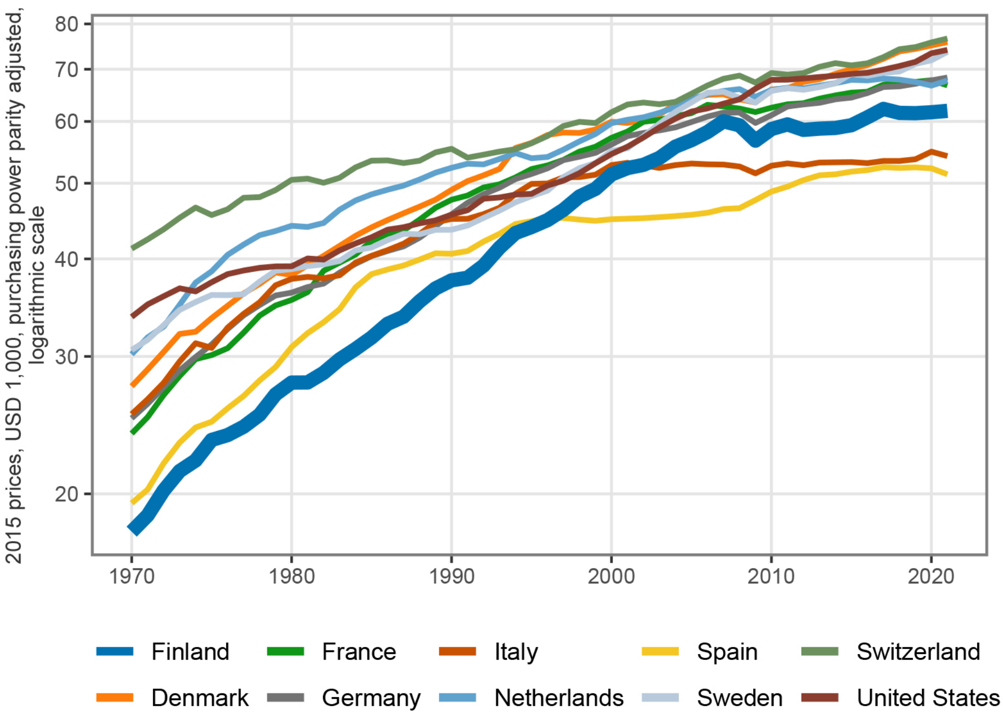
Significant factors for productivity growth are enterprise innovation, imitation of best practices of other enterprises, and capabilities of employees and management promoting innovation and imitation. Innovation policy seeks to boost these factors. Successful innovation policy is much more than just financing for research and development (R&D). However, the innovation policy debate often revolves mainly around R&D for reasons including the measurement of R&D inputs being clearer and easier than examining the vaguer outputs of innovation. In one sense, however, innovations are the opposite of R&D: R&D uses money (and other resources) to generate knowledge and competence, whereas innovations use knowledge and competence to generate money (and other benefits). Innovation policy is discussed in Chapter 8.

In Chapter 9, we summarise our findings concerning the development of productivity, cost competitiveness and wages and salaries and discuss policy measures that could be employed to improve productivity and competitiveness.

1.1 Labour productivity and total factor productivity compared

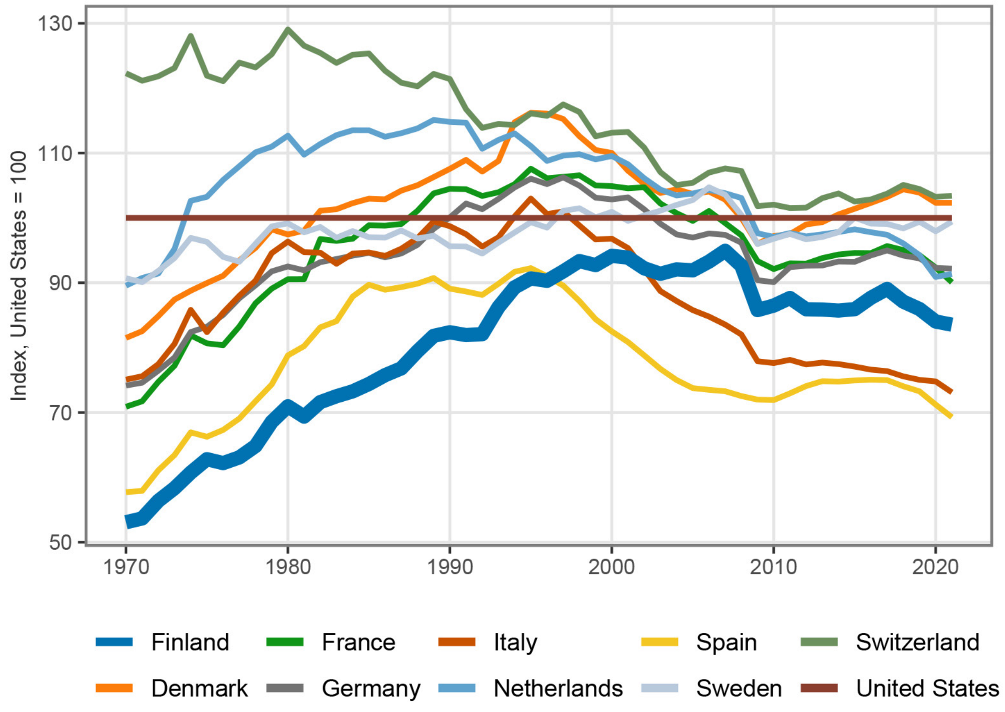
First, we take a look at productivity development and competitiveness at the level of national accounts. Figures 1.1 and 1.2 compare labour productivity (GDP or value added per hour worked) in Finland and its key reference countries. The figures are based on the OECD Labour Market and Productivity Statistics 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. GDP volume per hour worked, USD 2010, purchasing power parity (PPP).



Source: OECD

Figure 1.2. Labour productivity compared with the United States.



Source: OECD

Figure 1.1 shows that labour productivity (GDP per hour worked) in Finland is lower than in the top-ranking countries. The figure also shows that 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. Since then, average productivity growth has been very slow.

In 2020, labour productivity in Finland, and similarly in other countries, changed as the COVID-19 crisis affected different industries in different ways. As labour productivity varies from one industry to another, the COVID-19 restrictions imposed on only certain industries and the temporary decline in demand in the service industries in particular affected average labour productivity. For the time being, it is difficult to assess whether the COVID-19 crisis caused such permanent changes in industrial structure that would have a permanent impact on labour productivity.

Figure 1.2 compares Finland and its reference countries with the United States. The figure shows that Finland was closing the gap to the leading countries in terms of productivity during the decades preceding the financial crisis. Although this development stalled at the financial crisis, the crisis was not the reason for this relative slowing of productivity growth. These trends are described in more detail in Chapters 5 and 7.

At the level of the entire national economy, comparisons of labour productivity are complicated by factors such as the role of the public sector varying from one country to another. In the public sector, it is difficult to determine the value added as there usually is no market for the sector's services. Another measurement-related problem is that the impacts of public-sector production are often indirect. For example, teaching 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, an improvement of quality has both direct and indirect impacts, and the latter are nearly impossible to measure. It is therefore often necessary to compare productivity in manufacturing and market services (Figures 1.3 and 1.4 below).

On closer thought, there is a kind of paradox in labour productivity growth. On the one hand, it is clear that the use of factors of production is reflected in decreasing marginal revenue. In the old, neoclassical growth model, labour productivity growth along the balanced growth path is indeed zero. On the other hand, it is obvious that productivity has grown substantially. In the neoclassical growth model, the problem was solved by assuming exogenous technological development, which in itself boosts productivity. New technologies and new, improved ways of doing things are usually more productive than old ones. The answer, however, is unsatisfactory and does not, for example, provide tools for considering the reasons underlying productivity growth or variations in its pace.

More satisfactory ways of approaching productivity are, on the one hand, endogenising technological development, as is the case in the innovation-based growth model, and, on the other hand, expanding the concept of capital to include human capital (e.g. Kokkinen et al., 2021). The former theme has been discussed extensively in the Board's previous reports. We will revisit the latter in more detail in our future reports.

The ordinary view is that labour productivity growth is due to three main factors:

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

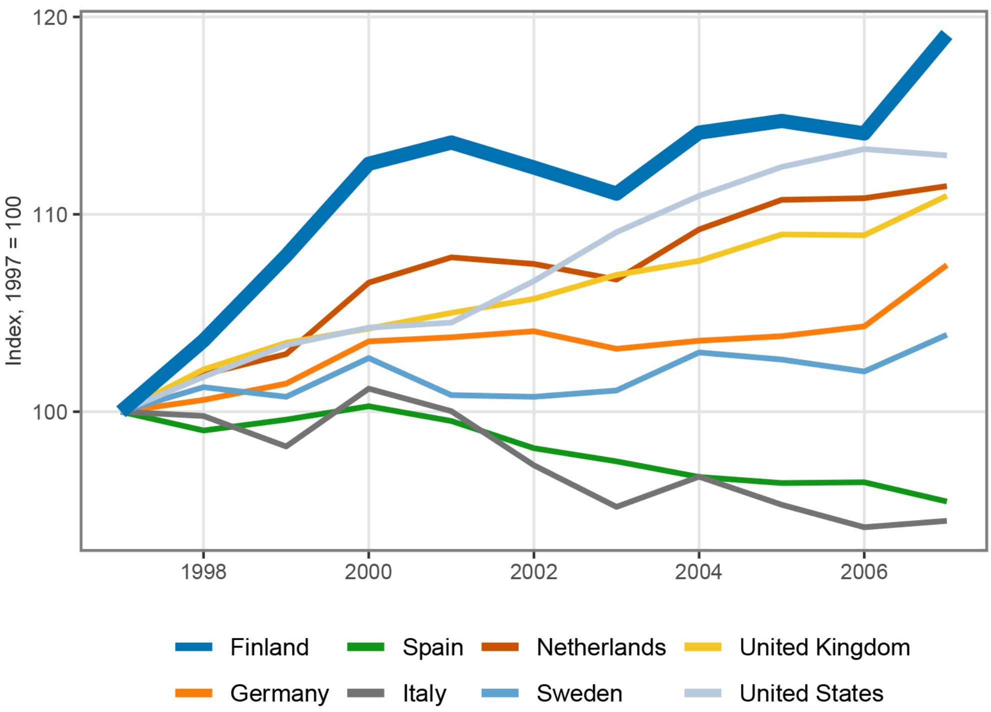
The higher the quantity and quality of machinery, equipment and other capital available to an employee, the higher the employee's output per hour. Correspondingly, the higher the employee's competence, the higher the employee's output per hour. Total factor productivity (TFP) in turn is obtained from the growth accounting formula as a residual term of the above-mentioned effects. As a concept, TFP is in a sense an acknowledgment of our ignorance of the details of sources of productivity. It concerns the part of labour productivity growth that cannot be explained by changes in capital intensity and in the quality of labour input. As TFP increases, more output can be obtained with the same quantity and quality of labour and capital inputs. TFP is often interpreted as technological development, but in that case technology as a concept must be understood in a very broad sense including aspects such as the quality of management.

In addition to the residual approach, TFP can also be measured directly with indexes. TFP is defined as the ratio of the output index to the input index. When measuring TFP, the input index measures not only labour input but also capital input and possibly also the use of intermediate inputs. This approach has two advantages: the analysis is not based on equilibrium assumptions, which combine several data feeds into one index, and the TFP growth rate can be divided directly into indicators of efficiency change and technological development, for example.

In the long term, roughly two thirds of labour productivity growth can be explained by growth in total factor productivity (Aghion & Howitt, 2009). TFP is also the most important factor explaining differences in standards of living between countries (Jones, 2016; Klenow and Rodriguez-Clare, 1997). Another branch of the literature argues that TFP accounts for a clearly smaller share of growth if factors of production, including human capital, are measured correctly. As mentioned above, we will revisit human capital in our future reports.

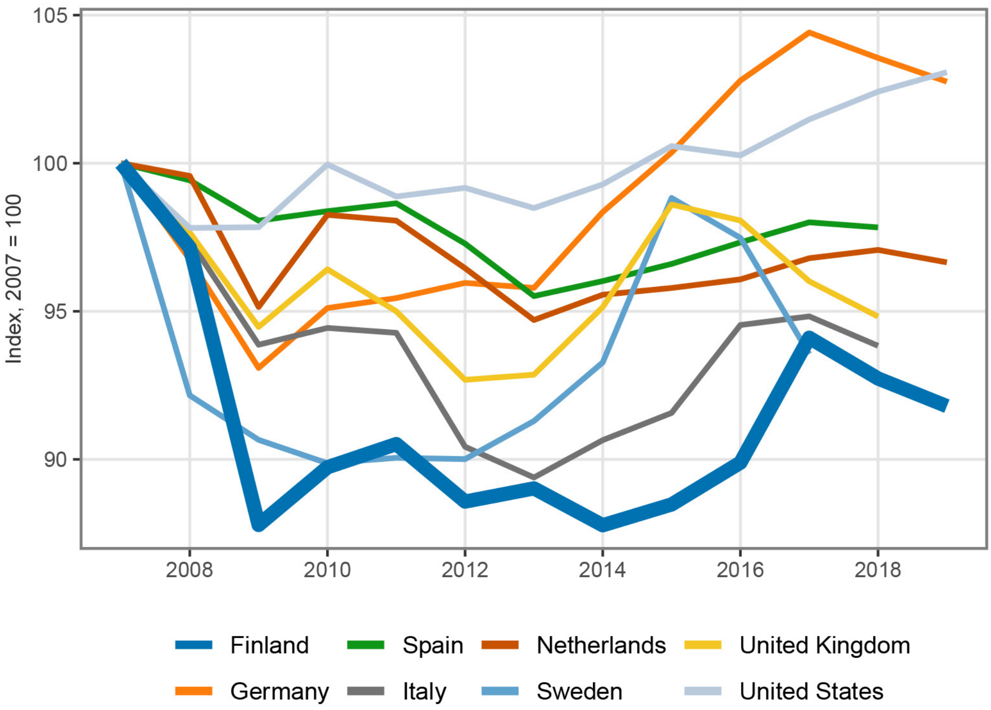
Figures 1.3 and 1.4 compare the development of TFP in the market sector in 1997–2007 and 2007–2019. On the basis of the figures, TFP growth in Finland was very strong in 1997–2007 and exceptionally poor in 2007–2019. In 2019, TFP still remained below its 2007 level.

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



Source: EU KLEMS

Figure 1.4. Growth in total factor productivity in 2007–2019, market sector, 2007=100.



Source: EU KLEMS

1.2 Competitiveness

At the enterprise level, the concept of competitiveness is relatively clear. It may mean, for example, the capability of the enterprise to profitably gain market share from less capable competitors. While competitive enterprises survive in the market, the market position of uncompetitive enterprises is unsustainable, forcing them to exit the market as their expenses exceed their income.

At the national economy level, competitiveness is a fuzzier concept. Firstly, national economies do not compete against each other. According to economic theory, each economy specialises in producing and exporting those goods which the country can produce the most efficiently, following the principle of comparative advantage. Secondly, a national economy with low competitiveness will not cease to exist. Thirdly, no single definition exists for competition at the level of national economies. For more detailed debate, we refer to the 2020 report of the Finnish Productivity Board.

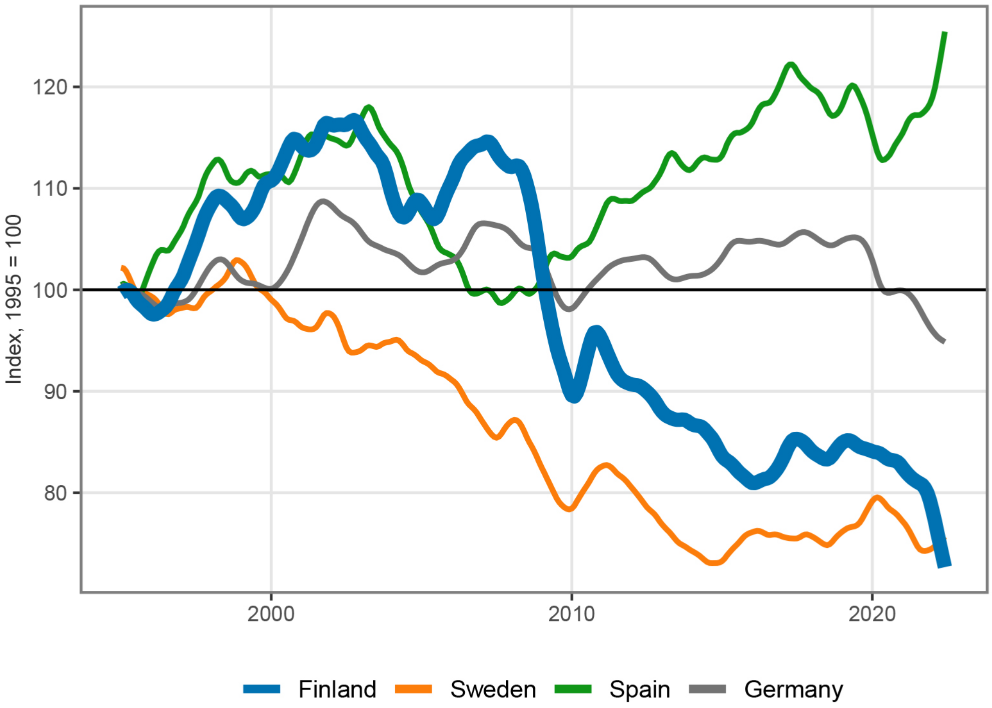
The main distinction concerns short-term and long-term competitiveness. In the short term, prices and costs in particular are factors that can be changed, whereas many others, such as the quantity and quality of physical and human capital are unalterable constants. In the long term, not only prices but also capital and employment, among other things, have found their equilibrium, and structural factors become important as they determine such things as the capital stock, export market share and employment in the equilibrium of the national economy.

Simply put, short-term competitiveness is about optimising the external and internal balance. “Excessively good” competitiveness on the one hand boosts exports, profit-seeking by exporters and, indirectly, the earnings of export-sector employees, while on the other hand it weakens the earnings development of enterprises and employees operating in the domestic market. “Excessively poor” competitiveness does the opposite. Short-term cost competitiveness is examined in more detail in Chapter 2 in the light of aggregate statistics and in Chapter 3 in the light of register data, including from the enterprise and employee perspectives. The debate on competitiveness mostly concerns short-term price competitiveness, as in Mankinen et al. (2012) and Kajanoja (2012, 2015, 2016, 2017). Examining and measuring cost competitiveness is more straightforward than analysing structural competitiveness, which plays out over the long term, and this is why the analysis and measurement of the former have been developed further.

Long-term structural growth competitiveness should be thought of as maximising the citizens’ standard of living and prosperity: rather than competing with each other, countries can be seen as trying to outdo each other in the level of prosperity they can produce for their citizens. Structural competitiveness plays a part in how close to the global leaders in terms of productivity the national economy is able to get.

Long-term structural growth competitiveness and short-term cost competitiveness are important factors for a successful export sector. Figure 1.5 compares development in the volume of exports of goods for Finland and certain other countries with the trend in world imports. The share 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 downturn. A number of developed economies have experienced a similar development to that of 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 other countries such as Spain, demonstrate that this development is not inevitable, although it should be noted that Germany’s market share had already fallen previously.

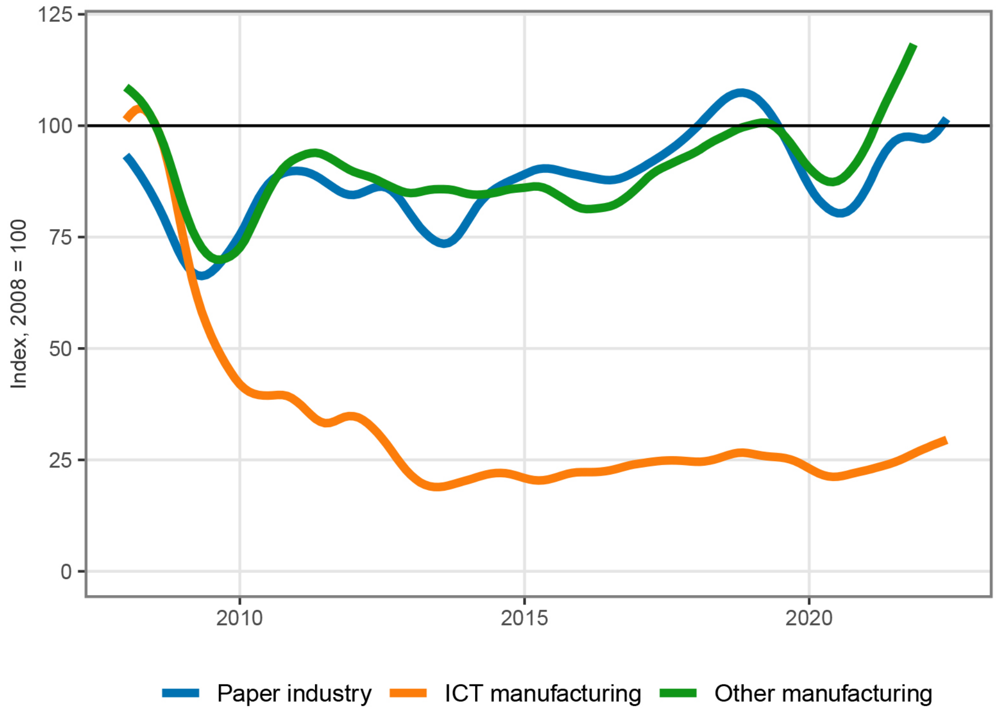
Figure 1.5. Development in the market share of exports of goods, 1995=100, HP filter trend.



Source: CPB World Trade Monitor, Macrobond

Figure 1.6 shows the exports of the Finnish manufacturing industry by sector. The electronics industry's exports of goods have still not recovered from the negative technology shock. 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 manufacturing sectors have finally managed to exceed the peak year of 2008 in their exports.

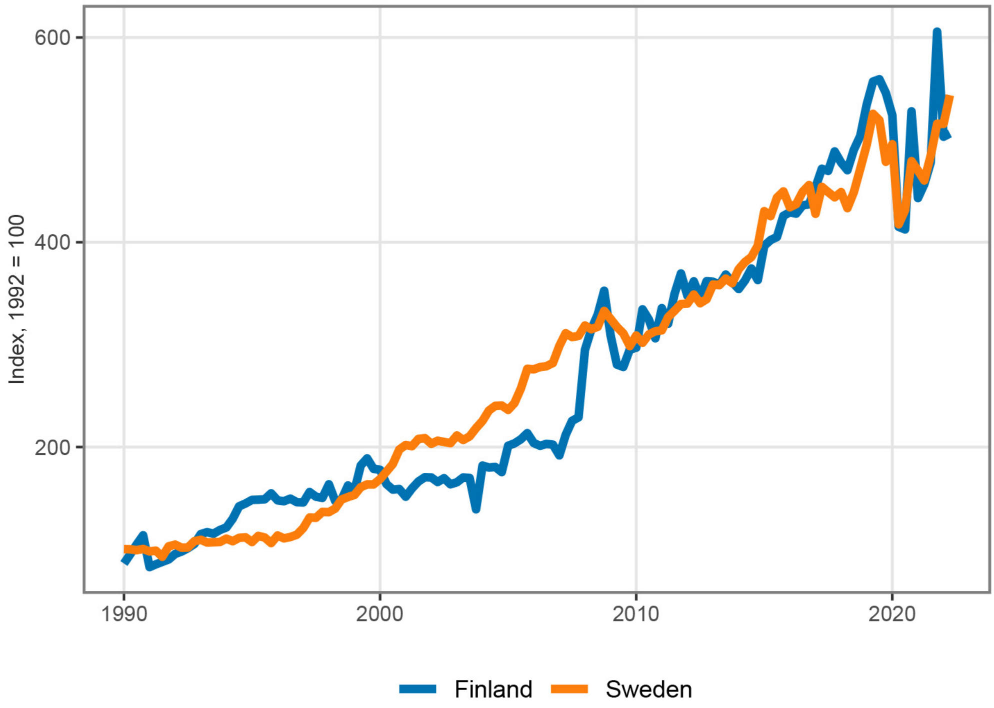
Figure 1.6. Volume of exports of goods by industry, HP filter trend.



Source: Statistics Finland, Macrobond

Figure 1.7 compares development in the exports of services for Finland and Sweden using the 1990s depression 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% 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 including part of ICT production having been transferred from the category of goods to services. However, service exports are still only worth about one half of the value of goods exports.

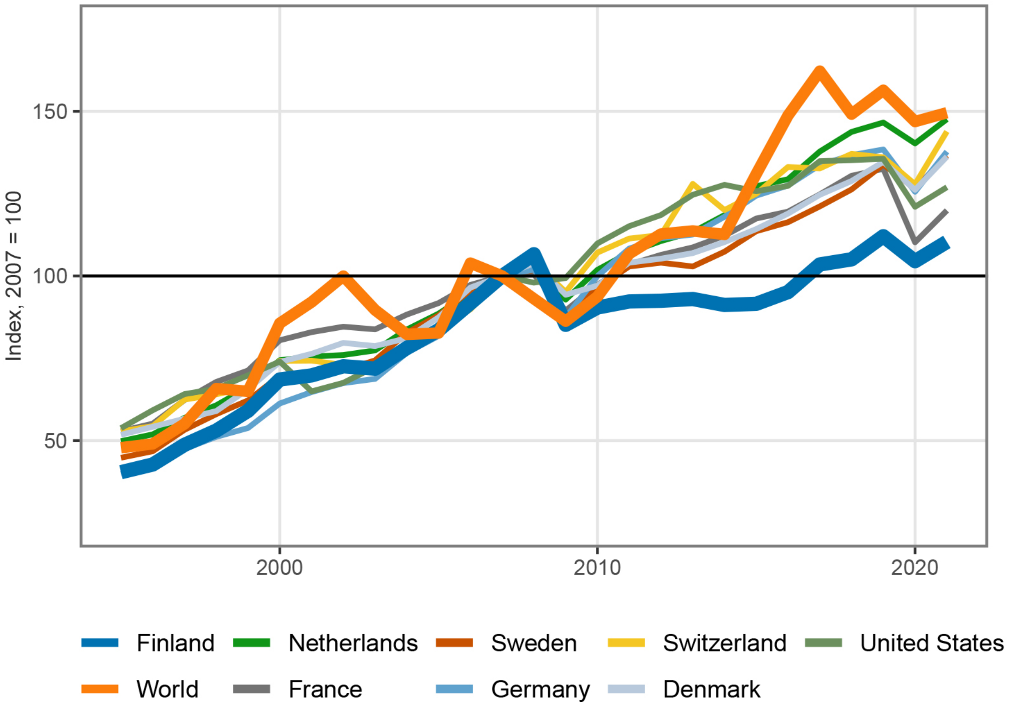
Figure 1.7. Volume of service exports in Finland and Sweden in 1990–2020.



Source: Statistics Finland, Macrobond

Figure 1.8 sums up Finland's export performance in comparison with world imports and reference countries. Until 2007, Finland's overall export performance was excellent, with Finnish exports growing on average faster than world imports. Since that year, Finland was 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

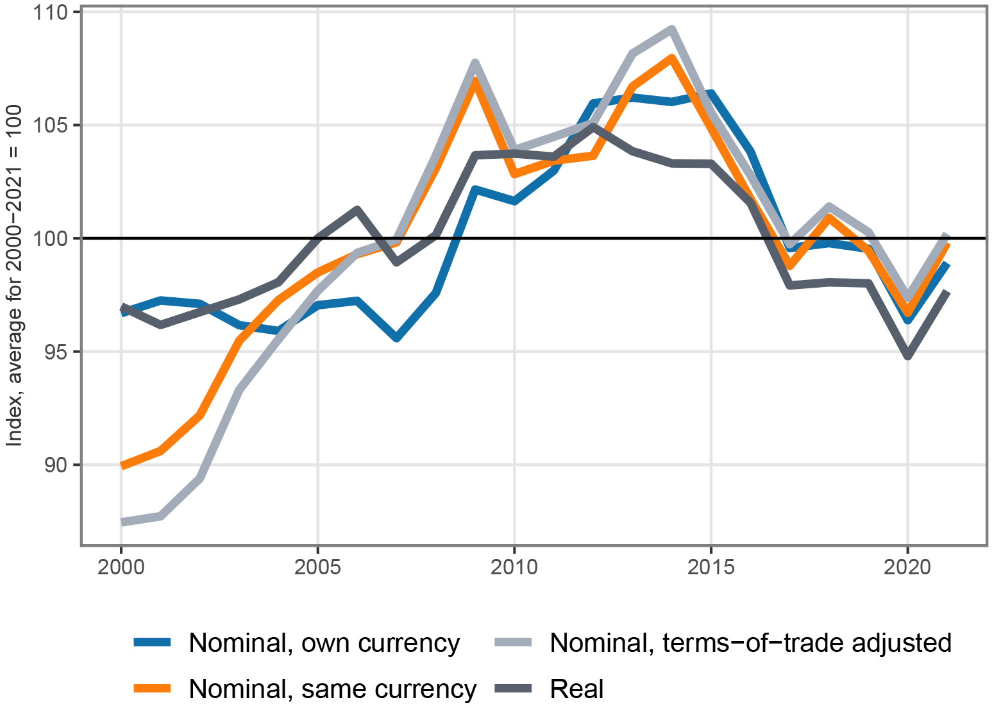
2 Cost competitiveness and development of wages and salaries at the aggregate level

2.1 Cost competitiveness in Finland

In the first COVID-19 year in 2020, Finland's nominal unit labour costs decreased clearly in comparison with reference countries. In 2021, however, relative nominal unit labour costs increased by roughly as much as they had decreased in 2020. Consequently, Finland's nominal price competitiveness has remained more or less around the 2000s average since 2017.

Figure 2.1 compares the development of Finland's relative unit labour costs indexes. The figure shows that the picture of cost competitiveness does not change much even when examining real or terms-of-trade adjusted unit labour costs instead of nominal unit labour costs. In the reference countries, the increase in real unit labour costs has exceeded the increase in nominal unit labour costs, which means Finland's price competitiveness is at a better level than on average in the 2000s.

Figure 2.1. Development of Finland's relative unit labour cost indexes in 2000–2021.

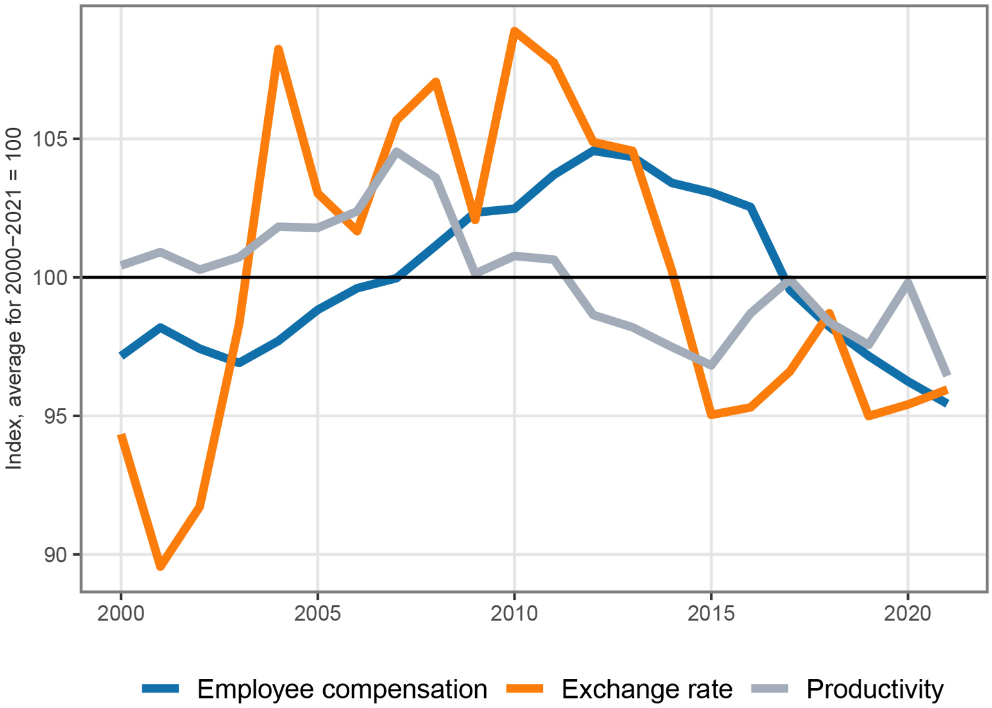


Source: Eurostat, OECD, IMF, Finnish Productivity Board.

Figure 2.2 shows the development of the components of Finland's relative unit labour cost index. The figure shows that the rise in employee compensation has remained slower than in the reference countries. This has been the case every year since 2012, following efforts to recover the competitiveness lost in the early 2000s by means of moderate pay settlements and later by means of the Competitiveness Pact.

Since 2015, the pace of labour productivity growth in the economy as a whole has been approximately as fast as in the reference countries. There have, however, been annual fluctuations, with some even quite large. In 2000, productivity development outperformed that of the reference countries, as the Finnish economy suffered less from the effects of COVID-19 than most countries. When the economies recovered, however, Finland's productivity development again declined in comparison with the reference countries.

Figure 2.2. Components of Finland's same-currency relative nominal unit labour cost index in 2000–2021.



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

2.2 Development of wage and salary earnings level in Finland

As shown in Figure 2.2, the change in Finland's relative nominal unit labour costs is divided into relative changes in employee compensation and productivity and exchange rate changes. The development of employee compensation shown in the figure differs from the development of employees' wages, salaries and fees for reasons including the fact that changes in employer's social insurance contributions included in employee compensation do not affect the earnings level. The purpose of the index of wage and salary earnings is to illustrate the development in the average earnings of full-time wage and salary earners, which is why it also differs from wages and salaries of employees calculated per hour worked.

Figure 2.3 illustrates the annual movement in the index of wage and salary earnings and in wages and salaries of employees per hour worked in Finland. The figure shows that, following the signing of the Competitiveness Pact, in 2016–2017 earnings growth measured by both indicators slowed and that in 2018–2021 growth has bounced back close to 2%.

Figure 2.3. Annual movements in the index of wage and salary earnings and in wages and salaries of employees calculated per hour worked (%).

Future earnings development is currently exceptionally difficult to forecast, as the current high inflation ramps up pay demands in a manner that is difficult to anticipate. The latest Economic Survey published by the Ministry of Finance in June projects an increase in the level of earnings measured by the index of wage and salary earnings of 2.6% in the current year, 3.0% in 2023 and 2.6% in 2024. In the next few years, wages and salaries of local government employees can be assumed to increase exceptionally fast compared with the pay level of other sectors thanks to the pay programme adopted by most of the labour market organisations in the local government sector in June.

Statistics Finland used to provide the Information Committee on Cost and Income Development, which ended its operations in 2020, with estimates of the development of the index of wage and salary earnings and the index of negotiated wages and salaries for each current year. Statistics Finland forecasts concerning the development of the index of negotiated wages and salaries are based on the collective agreements available when drawing up the forecast. The calculation of the index of wage and salary earnings is examined in more detail in a text box below.

Figures 2.1 and 2.2 show the results of corresponding calculations prepared by Statistics Finland in June 2022. Due to the surge in inflation, the Statistics Finland forecast for the current year corresponds to a considerable decrease in real earnings. For example, the Economic Survey of the Ministry of Finance published in June projects a 5.8% rise in consumer prices this year. A simple calculation of carry-over effects shows that, even if the price level measured by the consumer price index were to remain at the July level for the rest of the year, the current year's inflation rate would exceed 6%.

Table 2.1. Earnings development for all wage and salary earners, by employer sector and for manufacturing industry

	On average from previous year, %			From Q4 of previous year, %	
	2020	2021	2022	Q4/2021	Q4/2022
Index of wage and salary earnings (all)	1.9	2.4	2.2	2.4	2.3
Index of negotiated wages and salaries	1.3	1.8	1.7	1.8	1.8
Other factors	0.7	0.6	0.5	0.6	0.5
Private sector	1.9	2.5	2.3	2.6	2.3
Index of negotiated wages and salaries	1.3	1.7	1.7	1.8	1.7
Other factors	0.6	0.8	0.6	0.8	0.6
Manufacturing	1.3	2.7	2.3	2.7	2.5
Index of negotiated wages and salaries	1.0	1.9	1.8	2.0	1.9
Other factors	0.2	0.8	0.5	0.7	0.6
Central government	2.2	2.1	2.3	2.1	2.4

	On average from previous year, %			From Q4 of previous year, %	
Index of negotiated wages and salaries	1.7	1.9	1.9	2.0	2.0
Other factors	0.5	0.2	0.4	0.1	0.4
Local government	2.1	2.3	2.0	2.0	2.5
Index of negotiated wages and salaries	1.5	2.0	1.7	1.8	2.2
Other factors	0.6	0.3	0.3	0.2	0.3

Table 2.2. Development of regular earnings for all wage and salary earners, by employer sector and for manufacturing industry. The indexes of regular earnings and the corresponding indexes of negotiated wages and salaries do not include performance-based bonuses or non-recurring items included in collective agreements.

	On average from previous year, %			From Q4 of previous year, %	
	2020	**2021**	**2022**	**Q4/2021**	**Q4/2022**
Index of regular earnings (all)	1.6	2.3	2.2	2.4	2.3
Index of negotiated wages and salaries		1.8	1.7	1.8	1.8
Other factors		0.5	0.5	0.6	0.5
Private sector	1.8	2.4	2.3	2.5	2.3
Index of negotiated wages and salaries		1.7	1.7	1.8	1.7
Other factors		0.7	0.6	0.7	0.6
C Manufacturing	1.5	2.4	2.3	2.4	2.5
Index of negotiated wages and salaries		1.9	1.8	2.0	1.9
Other factors		0.5	0.5	0.4	0.6

	On average from previous year, %			From Q4 of previous year, %	
Central government	1.4	2.2	2.3	2.2	2.4
Index of negotiated wages and salaries		1.9	1.9	2.0	2.0
Other factors		0.3	0.4	0.2	0.4
Local government	1.3	2.4	2.0	2.1	2.5
Index of negotiated wages and salaries		2.0	1.7	1.8	2.2
Other factors		0.4	0.3	0.3	0.3

Calculation and revisions of index of wage and salary earnings

Published by Statistics Finland on a quarterly basis, the purpose of the index of wage and salary earnings is to depict the development of earnings of full-time wage and salary earners for regular working hours. The calculation of the index of wage and salary earnings is ultimately based on basic series that contain data on narrowly defined industries or their constituents. The basic series are used to compile data depicting the average earnings of wage and salary earner groups, and movements in the index of wage and salary earnings are calculated as a weighted average of this data, with the shares of the wage and salary earner groups of the total sum of wages and salaries used as weights. As the index of wage and salary earnings is based on average pay development in industries defined by basic series, it depicts, as shown by Figure 2.3, mainly the development of average wages and salaries and not the pay development of employees continuing in the same duties.

Statistics Finland receives the data required for the basic series from sources, which include employers' organisations. Most basic series are updated annually, but Statistics Finland also releases quarterly estimates of the index of wage and salary earnings in addition to values representing the average annual level. For the intermediate quarters of each basic series – i.e. for those quarters for which basic series statistical data is not available – the values assigned to the basic series are calculated values obtained by assuming the development represented by the basic series to be linear during the period between the quarters corresponding to the statistical data. If the most recent quarter is an intermediate quarter in the basic series, the corresponding value in the basic series is based on a development estimate produced by Statistics Finland in cooperation with labour market organisations.

Statistics Finland releases the first estimate of the previous year's annual-level index of wage and salary earnings in February and revises it in late May. The final value of the index of wage and salary earnings for the previous year is usually released in August. In the first estimate, the data on the basic series development in the last months of the previous year is largely based on development estimates instead of final statistics. Therefore, the preliminary estimate provided in the first release may differ from the final estimate released by Statistics Finland in August.

Figures 2.4 and 2.5 compare the first estimates of the previous year's index of wage and salary earnings released by Statistics Finland in February in 2011–2022 with the final revised estimates. The figures include the same employer sectors as Tables 2.1 and 2.2.

The values released by Statistics Finland do not show any appreciable systematic positive or negative error except for manufacturing where the first estimate (used from February to the end of May) has given earnings at a level on average 0.26% higher than earnings in accordance with the final figures released by Statistics Finland. The average errors (i.e. the average distances of the curves from the horizontal axis in Figures 2.4 and 2.5) are not very large, either, only ranging between 0.1% and 0.4%.

In individual cases, however, errors may be quite large. For example, the preliminary data released in February 2015 estimated the index of wage and salary earnings for central government employees for 2014 as being 111.2, whereas the correct value according to current statistics is 112.0. This means that the increase in 2014 in wages and salaries paid by the central government employer had been more than 0.7% higher than what was reported in spring 2015. As regards manufacturing, there was a corresponding error in the opposite direction in spring 2017, amounting to 1.2%.

Figure 2.4. Deviation of the value of the index of wage and salary earnings for the Finnish economy as a whole and for manufacturing given in the first release compared with the final value, %

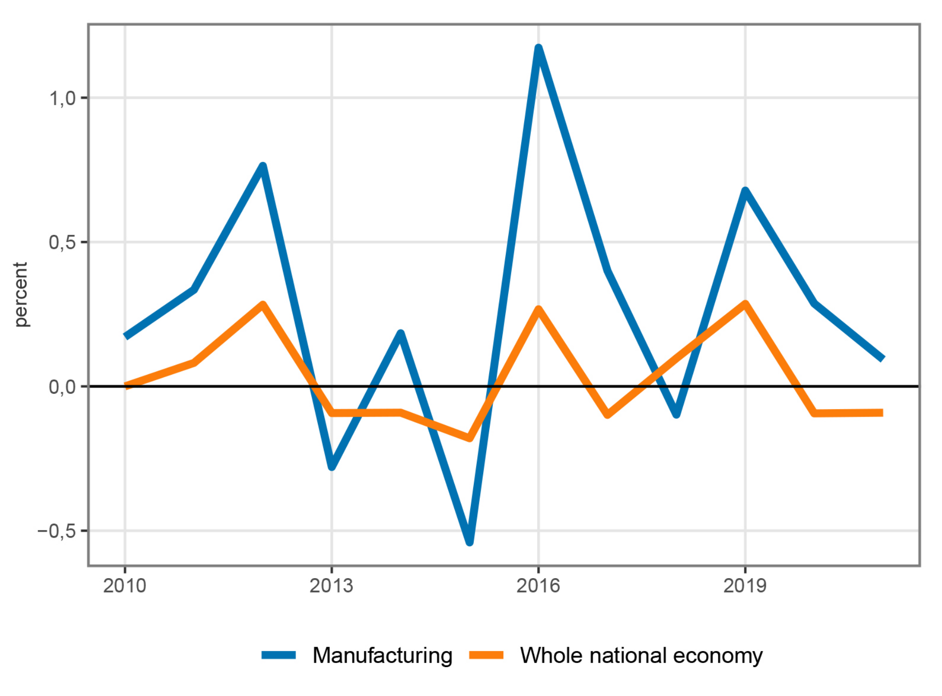
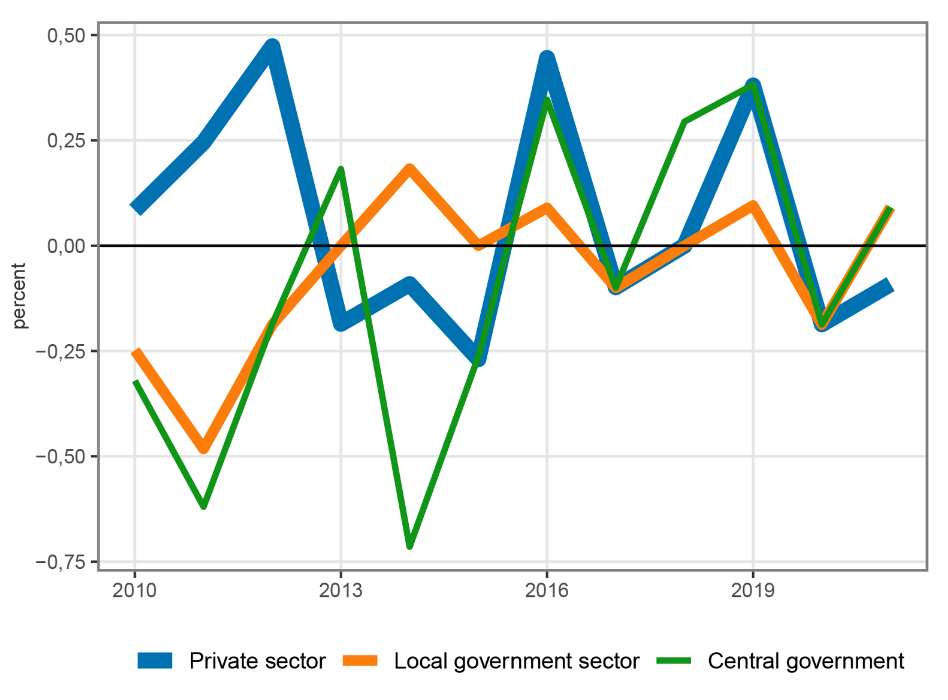


Figure 2.5. Deviation of the value of the index of wage and salary earnings for different employer sectors in the first release compared with the final value, %

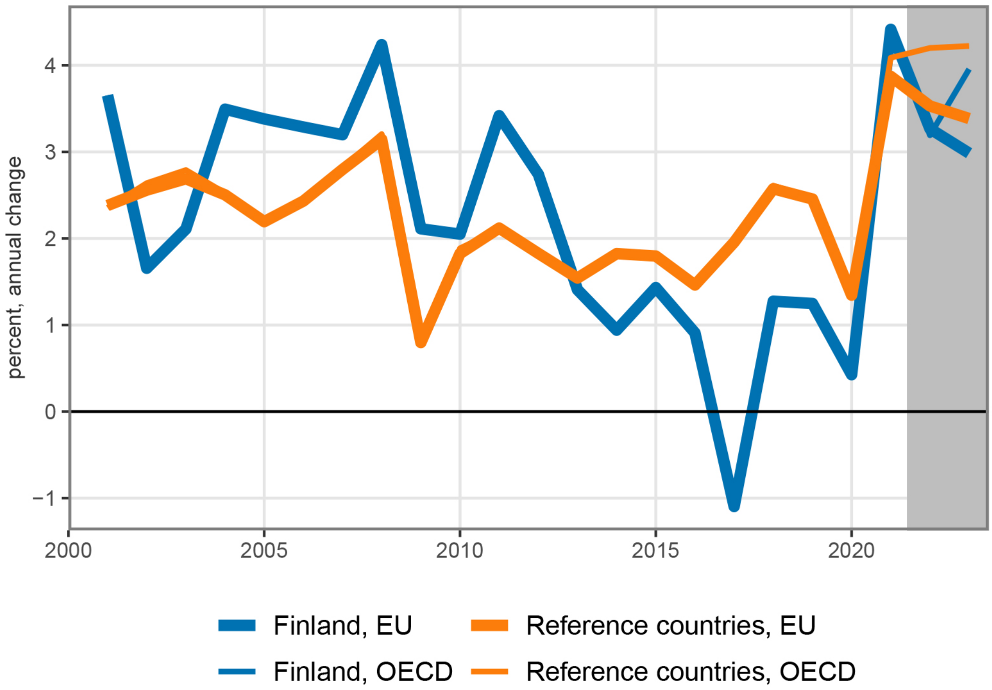


2.3 Forecasts of wage and salary earnings development and competitiveness development

In the 2010s, employee compensation growth has been clearly slower in the reference countries and particularly in Finland. The Finnish development has been affected in particular by the lowering of the social security contributions paid by employers and the corresponding increase in employees' contributions in conjunction with the 2017 Competitiveness Pact.

In 2021, wages and salaries increased in Finland as well as in the reference countries clearly more than in recent years, by around 4%. The rapid increase in employee compensation is also projected to continue. Accelerating inflation and shortage of labour while economies are still recovering from the COVID-19 crisis has pushed up wages and salaries particularly in the United States, but also in Europe.

Figure 2.6. Employee compensation per employed person, annual change in 2000–2021 and European Commission and OECD forecast for 2022–2023.



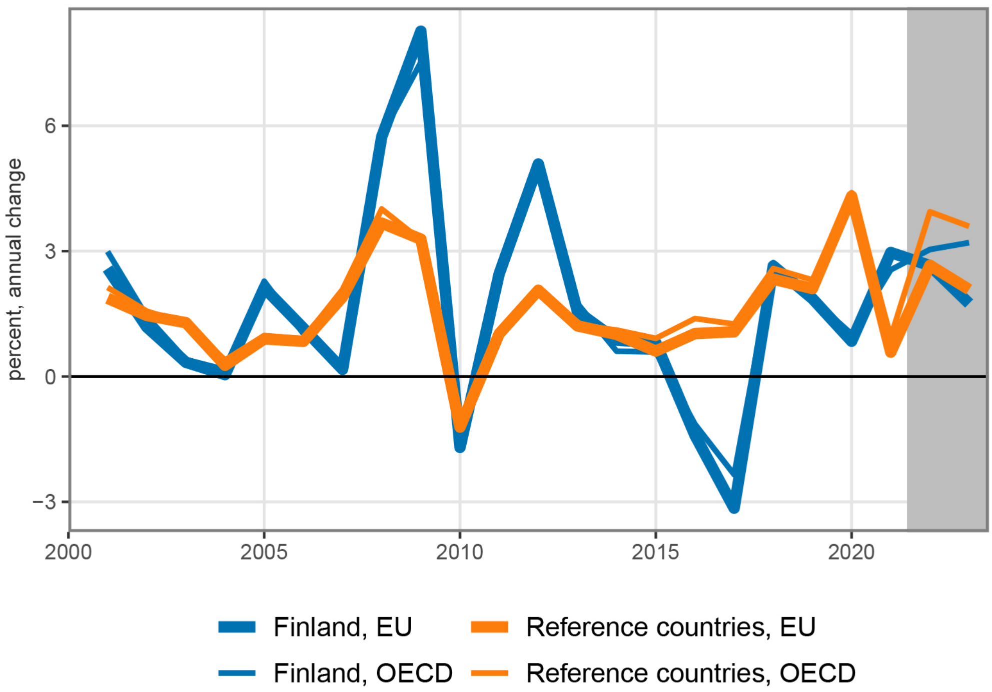
Among international forecasters, the OECD and European Commission project the increase in employee compensation in 2022 and 2023 to either be as fast as in 2021 or only slightly slower (Figure 2.6). In the context of surging inflation, the accuracy of forecasts concerning wages and salaries is, however, quite uncertain.

As regards cost competitiveness, the change in employee compensation is not decisive; what matters is the change in employee compensation in relation to the reference countries as well as the change in labour productivity, that is, in employee compensation relative to production.

Alongside the development of unit labour costs in Finland and in reference countries, Figure 2.7 shows the forecasts produced by the OECD and the European Commission for these. The forecasts indicate that the development of employee compensation in Finland would not differ essentially from the development in the reference countries this year or next. However, the increase would be slightly lower than in the reference countries. The forecasts concerning productivity do not show any essential difference either, indicating that there is no major difference between

Finland and the reference countries in the forecasts of increase in nominal unit labour costs.

Figure 2.7. Annual change in nominal unit labour costs in Finland and in reference countries in 2000–2021 and European Commission and OECD forecasts on these for 2022–2023.



3 Refined analysis of components of cost competitiveness

3.1 Real unit labour costs and cost competitiveness

This chapter describes how the cost competitiveness of enterprises can be measured by so-called real unit labour costs (RULC) and assesses the association between cost competitiveness measured this way and Finland's economic situation. The development of hours worked is used as the assessment criterion. This is followed by a section on how cost competitiveness can be broken down into its components. The components are assessed from two mutually complementary perspectives: the macro-level perspective and the micro-level perspective.

3.1.1 Real unit labour costs and enterprise profitability

Many different metrics can be used to assess cost competitiveness. An indicator that is both theoretically and empirically justified is based on so-called real unit labour costs (RULC) (Maliranta, 2014a). Formally, this can be written as follows:

$$\text{real unit labour costs} = \frac{W/P}{(VAL/P)/L},$$

where *W* is the price of labour, *P* is the price of production (value added), *VAL* is the nominal value added and *L* is the hours worked (by wage and salary earners and entrepreneurs).

In the equation, W/P is real wages and salaries measured by prices of products (value added) and $(VAL/P)/L$ is the (real) productivity of labour.

RULC can also be written as $\frac{W \times L}{VAL}$, which is the labour share of income. The inverse of this, $\frac{VAL}{W \times L}$, is the value added relative to the sum of wages and salaries. It measures how profitable it is for the employer to hire labour. It can also be written as $\frac{W \times L + O}{W \times L} = 1 + \frac{O}{W \times L}$, where *O* is the operating margin (NB: $VAL = W \times L + O$).

The latter equation shows that RULC (or more specifically its reciprocal) can be used to measure how much margin is generated in production activity for each euro paid for an hour worked.

Labour productivity is affected by both wage and salary earners and entrepreneurs, which is why, when measuring labour productivity, the number of hours worked must take into account not only the hours worked by wage and salary earners but also the hours worked by entrepreneurs. In statistics, however, the price of labour only includes labour force compensation paid for the hours worked by wage and salary earners. This means that the statistics on the sum of wages and salaries and employers' contributions do not include the value of the hours worked by entrepreneurs. For the unit labour cost indicator to take account of the price of all hours worked, the sum of wages and salaries used in the indicator therefore needs to undergo a calculated entrepreneur input adjustment. It is difficult to measure the value of entrepreneurs' labour input, but a reasonably accurate estimate can probably be obtained by using the average price per hour of wage and salary earners. Particularly in manufacturing, the share of hours worked by entrepreneurs is relatively small[1] and changes in the hours even much smaller, which means this factor is of minor importance when assessing changes in cost competitiveness.

3.1.2 Real unit labour costs and employment

Figure 3.1 examines the development of real unit labour costs (RULC) in the Finnish non-financial corporations sector in 1990–2021 relative to the 1995–2020 average.[2] The scale in the figure is inverted so that that the curve moving up means decreasing RULC, increasing profitability of hiring labour and improving cost competitiveness.

The figure also shows the number of hours worked by wage and salary earners in the non-financial corporations sector (scale on the right). For the series to better reflect the labour market situation at different times, the number of hours worked is shown relative to the number of 20–69-year-olds in the national economy as a whole. This series has also been normalised so that the 1995–2020 average is 100.

---

[1] The hours worked by entrepreneurs in Finnish manufacturing industry have accounted for around 5% in recent years.

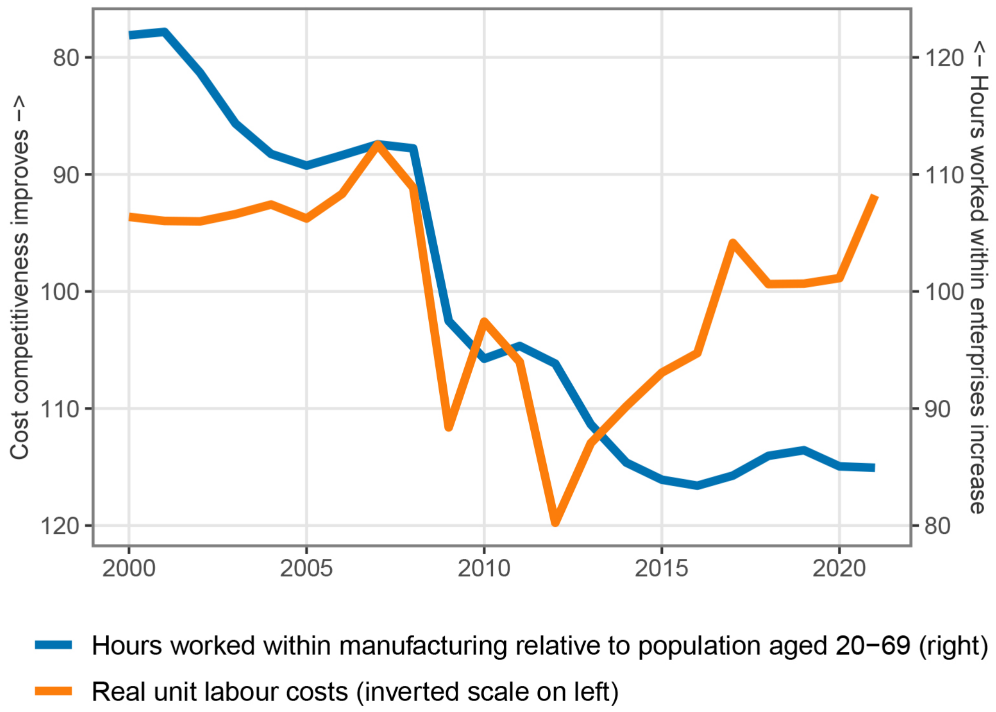
[2] In this and the subsequent figures, the so-called entrepreneur adjustment has been made to the amount of employee compensation so that the cost of labour also includes the "implicit cost" of the hours worked by entrepreneurs. This is based on the assumption that the price of an hour worked by entrepreneurs equals the average price of an hour worked by all wage and salary earners.

The figure suggests that there is a positive association between the profitability of hiring labour (i.e. the reciprocal of RULC) and the number of hours worked. However, there appears to be a time lag in the association in that changes in the profitability of hiring precede the change in hours worked. In addition, it appears that the duration of the lag has ranged from one to three years. Based on a simple correlation analysis, the association between profitability and hours worked is strongest when the lag is two to four years, where the correlation coefficient is around 0.7. Figure 3.2 examines the development of RULC and hours worked in the manufacturing industry since 2000. This also shows a similar association as is the case for the entire non-financial corporations sector, although in the past five years the hours worked in manufacturing have no longer increased despite the clear growth in profitability.

Figure 3.1. Real unit labour costs (inverted scale on left) and hours worked (scale on right) in the non-financial corporations sector.

Source: National accounts. NB: Employee compensation has undergone an entrepreneur adjustment.

Figure 3.2. Real unit labour costs (scale on left) and hours worked relative to population aged 20–69 (scale on right) in manufacturing industry. NB: Employee compensation has undergone an entrepreneur adjustment.



3.1.3 Relative real unit labour costs as indicator of competitiveness

The above suggested that the operational profitability of enterprises is associated with their employment decisions: when operations are profitable, enterprises have incentives and opportunities to increase employment. On the other hand, particularly for enterprises operating in the international market, a vital aspect is the profitability of operations in relation to *alternative* locations of production. Even if the operations are profitable, alternative costs may be high if operations are even more profitable in an alternative location.

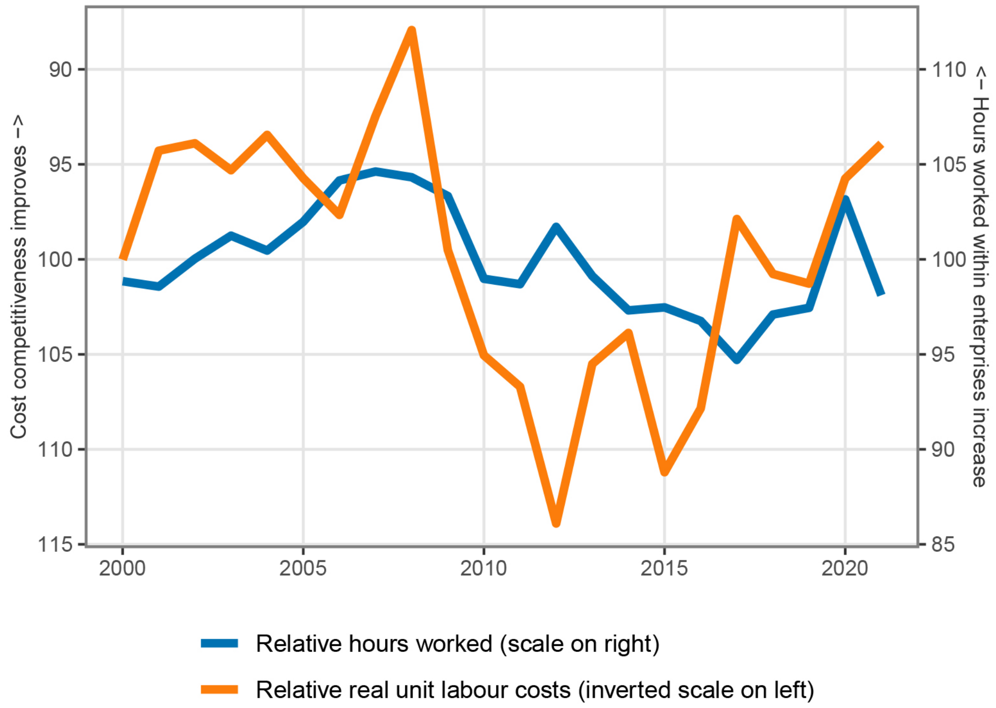
This is why it is useful, especially for manufacturing and for certain service sectors open to competition, to measure real unit labour costs (RULC) (i.e. profitability of operations) in relation to relevant competitor countries. It is also justifiable for the cost competitiveness of the economy as a whole to specifically examine the profitability of the open sector of the economy. Even though the importance of service exports has grown over time, the open sector in terms of foreign trade still mainly consists of manufacturing industries.

Figure 3.3 compares RULC and employment (measured by hours worked) in Finnish manufacturing with those in the EU-12 and in Sweden and Germany. The comparison suggests that Finland's cost competitiveness measured by RULC is often associated with employment development (measured by hours worked) in relation to competitors. However, this association is not very close or in all cases clear. This may be due to employment development being affected not only by cost competitiveness but also by other factors (such as labour supply) or due to changes in enterprise structures caused by external factors possibly resulting in a bias in macro-level indicators, as is discussed below.

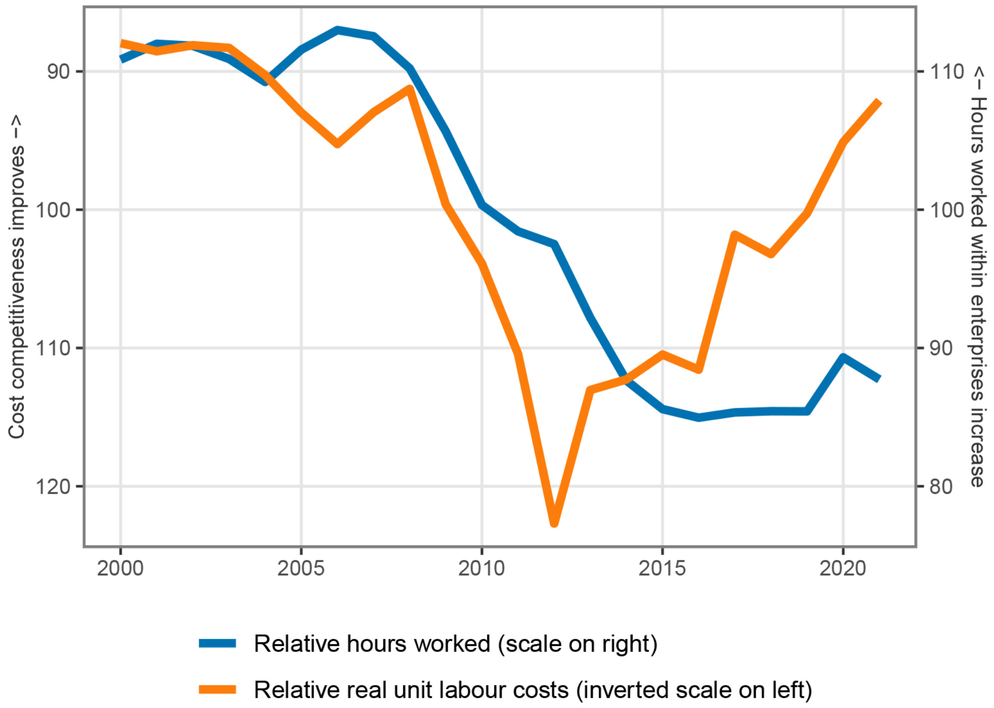
Figure 3.3. Finland in relation to competitors (2000–2020 average = 100).

a. Finland in relation to the EU-12

b. Finland in relation to Sweden



c. Finland in relation to Germany



Lähde: Eurostat.

NB: Employee compensation has undergone an entrepreneur adjustment.

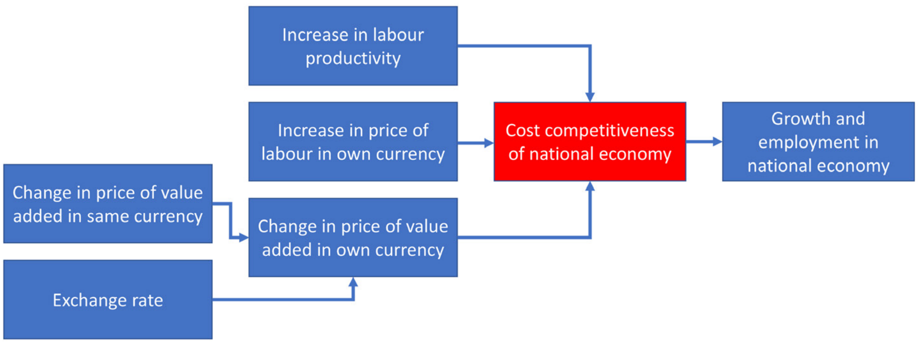
3.2 Macro-level components of real unit labour costs: labour productivity, price of labour, price of value added and exchange rate

In this examination, the cost competitiveness of the national economy consists of three macro-level components: labour productivity, price of labour and price of value added (see Figure 3.4).[3] As pointed out above, in the open market it is vital for the development of cost competitiveness how these components develop in relation to the

[3] The cost competitiveness of the national economy is measured here by the profitability of the open sector, and the open sector is represented by the manufacturing industry. Accordingly, the components of competitiveness are the price and productivity of labour in manufacturing and the price of value added in manufacturing.

most important competitor countries. In international trade, price comparisons are made in the same currency. If the quality of products improves in relation to competitors, the price of value added measured in the same currency increases and, consequently, the cost competitiveness of the national economy improves. On the other hand, the profitability of enterprises may also improve owing to a depreciation of the currency against competitor countries, which is when the value of the same export volume increases when measured in the country's own currency.

Figure 3.4. Macro-level components of cost competitiveness in the national economy.



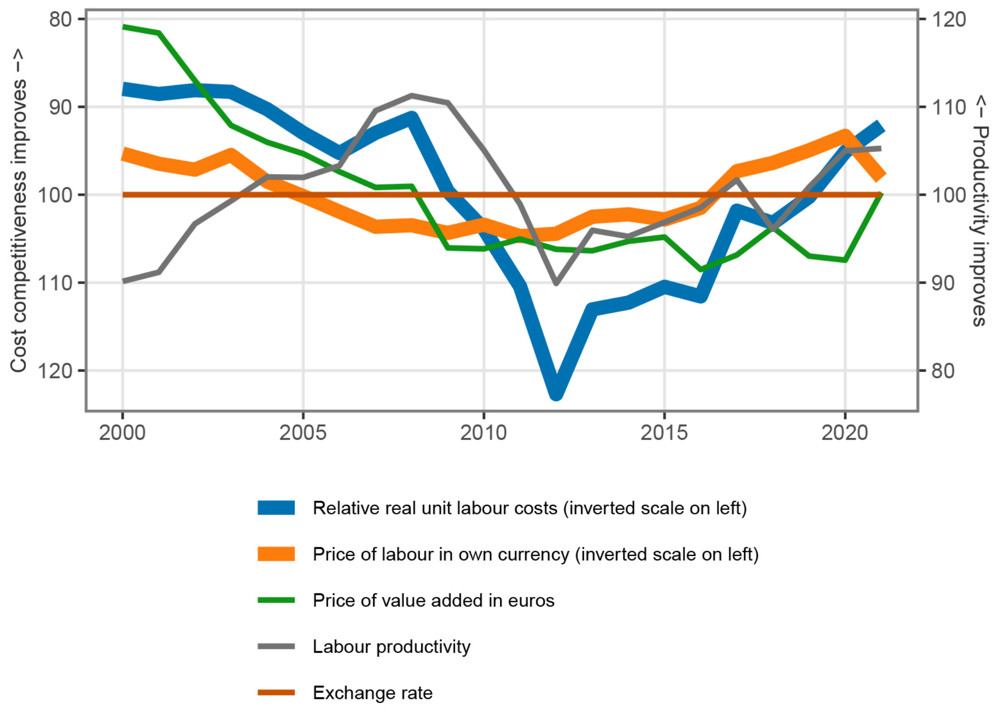
This means that the cost competitiveness of the national economy can be broken down into four components: 1) labour productivity, 2) price of value added in the common currency (euro), 3) exchange rate and 4) price of labour (wages, salaries and employers' contributions) in the country's own currency.

Figure 3.5 examines the relative RULC of Finland's manufacturing industry and their macro-level components in relation to the EU-12, Sweden and Germany. RULC and their components have been scaled so that the average of all years in 2000–2020 is 100. The series are always presented so that a curve moving up shows positive development in terms of Finland's relative competitiveness.

The cost competitiveness of Finnish manufacturing declined in 2008–2012 regardless of whether compared with the EU-12, Sweden or Germany. In all cases, the drop was as much as 20–30% and mainly explained by a drop in relative labour productivity. Figure 3.5 also shows that, since 2012, the competitiveness of Finnish manufacturing in relation to Sweden and Germany has recovered to a level close to the pre-crash levels but, in relation to the EU-12, there is still catching up to do.

The relative increase in labour productivity explains a significant part of the improvement in cost competitiveness in all cases. In addition, the moderate increase in the price of labour in Finnish manufacturing since 2015 explains a major part of the improved cost competitiveness especially in relation to Sweden and Germany. Compared with Sweden, Finland has lost cost some of its competitiveness owing to the devaluation of the Swedish krona but, on the other hand, this drop has been compensated by the price of value added calculated in euros having risen more rapidly in Finland than in Sweden since 2012.

Figure 3.5. Cost competitiveness and its macro-level components in the manufacturing industry.



Source: Eurostat. NB: Employee compensation has undergone an entrepreneur adjustment.

3.3 Micro-level components of cost competitiveness: increase in labour productivity and price of labour within enterprises and employees as well as “creative destruction”

3.3.1 Development of labour productivity and price of labour within national economy, enterprises and employees

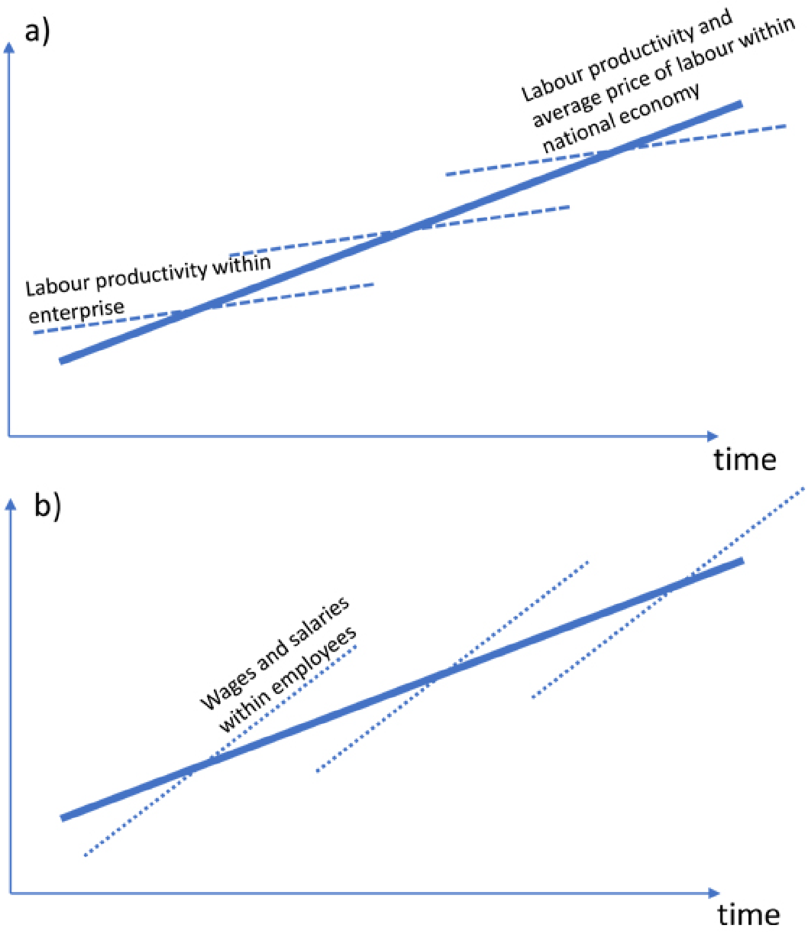
If labour productivity within the national economy or an industry grows at the same pace as the average price of labour measured by prices of value added, real unit labour costs (RULC) remain unchanged. If there is similar development in competitor countries, too, cost competitiveness remains unchanged.

When “creative destruction” occurs in the economy – that is, when new, more profitable enterprises enter the market and less profitable enterprises exit the market – enterprise productivity growth may remain continuously slower within all enterprises than in the national economy as a whole. Innovation-based endogenous growth theories offer an explanation to such occurrences of creative destruction (Aghion et al., 2021; Aghion & Howitt, 2009).

According to the theory, enterprises use innovation to make improvements (improved product or production process) to previous technology. When successful, an enterprise takes a technology step that is reflected in a higher level of productivity within the enterprise. This means that technological knowledge accumulates when new innovators are in a way able to “stand on the shoulders of giants who came before them”. As a result of this, the productivity of new (and young) enterprises is higher than that of old ones. Figure 3.6(a) illustrates this by showing enterprises established more recently on a higher productivity level than ones established earlier. In addition, the productivity of an individual enterprise may increase for reasons such as the experience-based knowledge of the enterprise growing or the enterprise having made incremental innovations (ones made continually by the enterprise). This is why the curves representing enterprise productivity growth move up in the graph. However, the productivity curve of the national economy as a whole shows a sharper rise because new enterprises are on average more productive than old ones.

Accordingly, the structure of the non-financial corporations sector becomes more productive over time.

Figure 3.6. Development of labour productivity and the price of labour within the national economy, enterprises and employees.



Correspondingly, it is possible that the wages and salaries of all individual employees increase more rapidly than the average wages and salaries within the national economy. This is illustrated by Figure 3.6(b). This takes place when new employees whose pay level is lower than that of older employees already in the labour market enter the labour market. Over a working career, an employee's human capital grows as a result of experience. Their work performance becomes more efficient and they are able to take on more demanding and productive tasks.

Figure 3.6(b) illustrates this by showing a steep upward slope in the curves representing employees' pay development. Thanks to the human capital generated by work experience, the wages and salaries of retiring employees are on average higher than those of young employees. Wages and salaries in the national economy as a whole also increase over time thanks to productivity growth in the national economy. As was seen above, this in turn is based on technological development. Thanks to technological development and the productivity growth it generates, the initial pay level of an employee entering the market more recently is higher than the initial pay level of older employees was at the time when they started their working career.

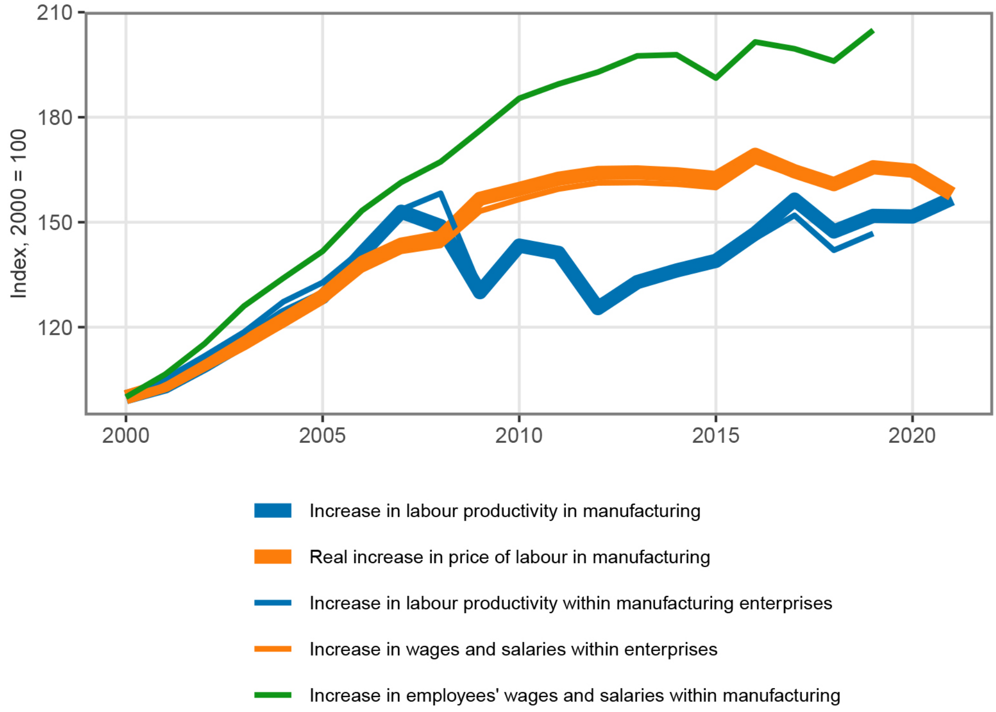
Comparisons between Figures 3.6(a) and 3.6(b) illustrate an important conceptual difference between technological knowledge and human capital: Technological knowledge accumulates and improves the productivity of the national economy regardless of enterprises coming and going. By contrast, the human capital of an employee ceases to increase the productivity of the national economy once the employee has retired.

Most enterprises have both young and older employees and experience employee turnover, which means the employee structures of enterprises change. This is also reflected in enterprise productivity growth (Ilmakunnas & Maliranta, 2016). It is therefore very possible that the average price of labour within enterprises changes at the same rate as the average price of labour within the national economy (or industry) as a whole. In other words, the slope of the curve representing the development of the price of labour within enterprises could in Figure 3.6(b) be the same as the curve representing the average price of labour (and labour productivity) within the national economy as a whole (thick line).

This means that, for an enterprise, the profitability of labour typically grows more slowly than its average price of labour, i.e. the profitability of the enterprise declines over its lifecycle (Böckerman & Maliranta, 2012; Kyyrä & Maliranta, 2008; Maliranta & Määttänen, 2018). This also means that an employee’s pay (at value added prices) typically increases at a rate that clearly outpaces the labour productivity growth of their enterprise, i.e. the dotted lines in Figure 3.6(b) are considerably steeper than the dotted lines in Figure 3.6(a).

Figure 3.7 shows an empirical examination of the development of labour productivity and the price of labour within Finnish manufacturing industry, its enterprises and its employees. Labour productivity and the average price of labour (at value added prices) in manufacturing developed at roughly the same pace in 2000-2006, i.e. RULC remained highly stable (see also Figure 3.2). After 2008, labour productivity in turn declined strongly in relation to the average price of labour and RULC surged. After 2015, the difference started to contract and in 2021 the ratio of labour productivity and price of labour was approximately the same as on average in 2000-2006.

Figure 3.7. Development of labour productivity and the price of labour within Finnish manufacturing industry, its enterprises and its employees (2000=100)*.



* The development of labour productivity and the average price of labour (at value added prices) was calculated on the basis of Eurostat statistics. The increase in labour productivity within manufacturing enterprises was calculated by deducting the effect of enterprise structures from manufacturing productivity growth calculated on the basis of Eurostat statistics. The effect of changes in enterprise structures was calculated by using a decomposition similar to that employed by Böckerman and Maliranta (2012), and the increase in the price of labour within enterprises was calculated in a corresponding manner. The increase in wages and salaries within employees within manufacturing in turn was calculated on the basis of Statistics Finland's Structure of Earnings data. For each year, the annual change in hourly earnings for each manufacturing employee (for those who had been employed in manufacturing in the previous year, too) was calculated and the average (weighted by hours worked) of these was taken.

Figure 3.7 shows that in 2000–2005 labour productivity growth within manufacturing enterprises was even somewhat faster than at the macro level within manufacturing, i.e. “negative creative destruction” occurred in those years. The 1995–2005 period saw an important turn in the development of productivity growth compared with 1985–1995, which is when creative destruction had a significant positive effect on labour productivity growth within manufacturing (Maliranta, 2014b; Maliranta et al, 2010). As shown in Figure 3.7, since 2015 the role played by creative destruction has again become stronger, i.e. the development since 2015 has been in line with that outlined in Figure 3.6(a).

Figure 3.7 also shows that in 2008–2015 the average price of labour within manufacturing increased somewhat faster than the price of labour within manufacturing enterprises. This is explained by the fact that in 2009–2014, the period when cost competitiveness declined, low-paying enterprises decreased in size in relation to others or disappeared altogether. By 2019, the situation in this respect returned to a trend similar to that seen on average in 2000–2006 when the average price of labour within manufacturing developed roughly at the same pace with the development of the price of labour within manufacturing enterprises.

Figure 3.7 also shows that the annual increase in the wages and salaries of manufacturing employees has typically outpaced the increase in the average wages and salaries within the manufacturing industry. In other words, employees' pay development has been in line with that outlined in Figure 3.6(b).

When examining the pay development of employees, it is important to take into account the fact that changes in enterprise and job structures require employee mobility and this in turn may be reflected in the pay development of mobile employees. Employees who have been employed in two consecutive years can be divided into two groups: "stayers" and "switchers". Stayers means employees who in the year in question work in the same enterprise and the same role as in the preceding year. Switchers means a group who during this year work either in a different enterprise or in a different role than in the preceding year (but work within manufacturing in both years). There are on average eight times as many stayers as there are switchers.

The annual change in the switchers' pay has averaged 1.2 percentage points higher than that of the stayers. Figure 3.8 shows the difference between the switchers' real pay change compared with that of the stayers in 2001–2019. We can see that the difference was below the average in 2009–2014. By contrast, the difference has been growing since 2014.

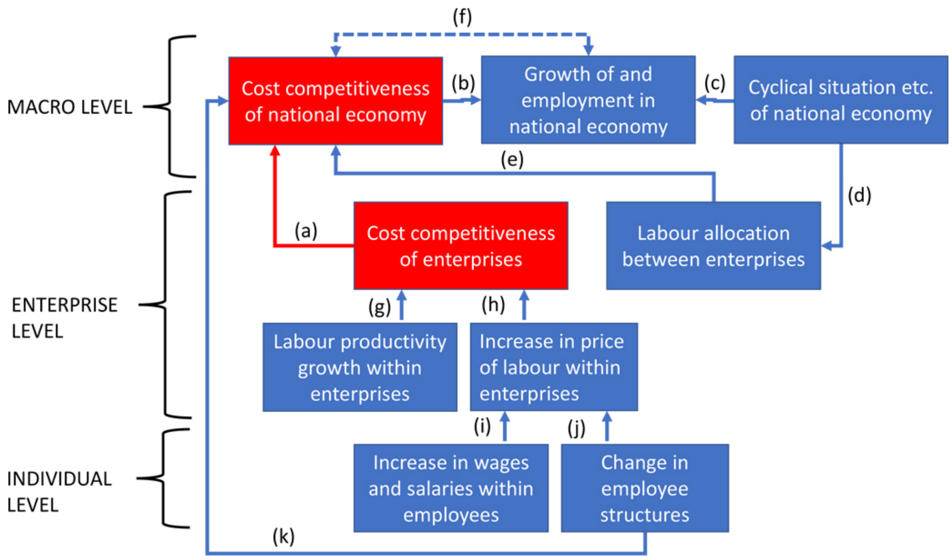
Consequently, the calculations presented above indicate that the wages and salaries of manufacturing employees typically increase clearly faster than the average wages and salaries within the manufacturing industry. The rate of increase is particularly rapid in the pay of those employees whose employer or role changes – especially during good economic times (Fornaro & Maliranta, 2022).

Figure 3.8. Difference in pay change between switchers and stayers within manufacturing (%).

3.3.2 Components of cost competitiveness at the macro, enterprise and individual level

The theoretical discussion and empirical examinations presented above reveal that, when interpreting macroeconomic cost-competitiveness indicators, it is important to take account of the underlying microeconomic structural changes. Otherwise, interpretations of economic development and economic policy conclusions may be skewed. It is necessary to assess cost competitiveness and its components at the macro level (national economy or sectoral level) and at two micro levels: the enterprise level and the wage and salary earner level. This is illustrated by Figure 3.9.

Figure 3.9. Components of cost competitiveness at the enterprise and individual levels.



Typically, the implicit (or not directly expressed) idea is that the performance indicators for the cost competitiveness of the national economy reflect the development of cost competitiveness within enterprises in the economy. It is thought that the economy's improved cost competitiveness is based on improved cost competitiveness within enterprises (see *a*) in Figure 3.9).

When cost competitiveness (and profitability) within enterprises improves, the export performance[4] and capacity to compete with imports improves within export enterprises operating in Finland. Finland also becomes more attractive as a production location. All this can be assumed to be reflected in investments and employment development (*b*).

It is, however, important to note that investments and employment in the national economy are also affected by other factors such as international and domestic economic cycles (*c*).

Economic cycles also affect enterprise structures and labour allocation between enterprises (*d*). Recessions typically have the strongest impact on low-productivity enterprises, i.e. those whose real unit labour costs (RULC) are higher than average and, consequently, whose profitability is lower than average (see Finnish Productivity

[4]Export performance is used in a broad sense here and in Figure 3.9. It means the capability to succeed in the international market so that value added and productive jobs are created in Finland.

Board, 2019, section 6.3). During a recession, enterprises that are the weakest in terms of production make proportionally the biggest labour cuts or end their operations altogether.

If, due to an international or domestic negative shock, low-productivity and high-RULC enterprises exit the market or make particularly large labour cuts, the average profitability of the remaining enterprises and jobs is higher than before. This is reflected in improvements in macro-level cost-competitiveness indicators (*e*).

It may therefore seem that the national economy's poor export and employment development is associated with *improving* cost competitiveness, i.e. the association is opposite to what could be expected (*f*). This means that the macro-level cost-competitiveness indicator gives a picture of cost-competitiveness development from the perspective of enterprises in the market that is *excessively positive*, i.e. the association between the development of cost competitiveness and employment may seem *weaker* than it is from the perspective of enterprises operating in the market.

This, however, is only due to a measurement bias. Because of the bias, the macro-level cost-competitiveness indicator does not reflect how cost competitiveness or profitability has developed at the enterprise level. By using enterprise-level data and so-called micro-level decompositions, changes in macro-level cost-competitiveness indicators can be broken down into micro-level components (Böckerman & Maliranta, 2012; Finnish Productivity Board, 2019).

Enterprise profitability and (cost competitiveness) is affected by the change in its productivity growth (*g*) and in its price of labour (at value added prices) (*h)*. The development of an enterprise's labour costs in turn depends on how its employees' wages and salaries (plus employers' contributions) have increased. In addition to this, the labour costs of an enterprise are also affected by its labour force structure.

3.3.3 Macro- and micro-level decomposition of changes in enterprise profitability

As noted above, the above-mentioned perspectives can be assessed by using micro-level decompositions. A suitable decomposition can be used to examine the extent to which changes in macro-level real unit labour costs (RULC) are based on what has taken place within (continuing) enterprises and which role is played by a variety of structural factors (Barth et al, 2019).

Aggregate-level (e.g. manufacturing) profitability (reciprocal of RUCL) change can be broken down into three main components (see Böckerman & Maliranta, 2012; Kauhanen & Maliranta, 2019):

- change in continuing[5] enterprises (the “within” component)
- the “convergence” component[6]
- the “creative destruction” components

In this decomposition, the “creative destruction” components consist of a variety of components. These include new enterprises entering the market (the “entry” component), enterprises exiting (the “exit” component) and shifts in shares[7] between continuing enterprises (the “between” components).

Table 1 presents a macro-level decomposition (horizontal) and a micro-level decomposition (vertical) of profitability (reciprocal of RULC) in manufacturing industry. The decompositions were produced separately for 2008–2013 and 2014–2019.

3.3.3.1 Macro-level components of profitability change

Table 3.1 shows that in 2008–2013 there was a strong profitability decline in Finnish manufacturing (-4.2% per year). This was due to labour productivity declining (by 1.8% per year) and to the nominal price of labour increasing at the same time (by 2.4% per year). The price of value added remained on average unchanged.

In 2014–2019, a trend change was seen: profitability started to improve (by 0.8% per year). This was due to labour productivity starting to grow (by 1.4% per year), the nominal increase in the price of labour slowing (by 1.5% per year) and the price of value added starting to increase (by 0.9% per year).

[5] Here a continuing enterprise means an enterprise that was in the market in the preceding year, too.
[6] The convergence component consists of the product of the *change* in productivity within the enterprise and the *level* of productivity within the enterprise and can therefore also be called the cross-term of development within enterprises (Maliranta & Hurri, 2017).
[7] The profitability decomposition examines changes in shares of labour force compensation between continuing enterprises. The decompositions concerning labour productivity and price of labour measure the “between components” by means of shares of labour force compensation.

Table 3.1. Macro- and micro-level components of annual changes in enterprise profitability (reciprocal of RULC) in Finnish manufacturing industry, %.

2008–2013

	$\frac{1}{\textit{real unit labour costs}}$	$=$ *Labour productivity*	$-$ *price of labour*	$+$ *price of value added*
Aggregate	-4.2	-1.8	2.4	0.0
Within enterprises	-4.4	-1.7	2.4	0.0
Convergence term	-0.6	-0.9	-0.1	
“Creative destruction”	0.7	0.8	0.2	
Market entry	-0.2	-0.4	-0.2	
Market exit	0.2	0.5	0.2	
Between components	0.7	0.8	-0.2	

2014–2019

	$\frac{1}{\textit{real unit labour costs}}$	$= \textit{Labour productivity}$	$- \textit{price of labour}$	$+ \textit{price of value added}$
Aggregate	0.8	1.4	1.5	0.9
Within enterprises	0.0	0.8	1.8	0.9
Convergence term	0.3	0.3	0.0	
“Creative destruction”	0.6	0.3	-0.2	
Market entry	-0.1	-0.3	-0.2	
Market exit	0.3	0.5	0.2	
Between components	0.4	0.2	-0.2	

NB: The calculations were made using Statistics Finland’s financial statements data. Due to rounding errors, the rows and columns may not always sum up to the total. The calculations were made using Statistics Finland’s financial statements data.

3.3.3.2 Micro-level components of profitability change

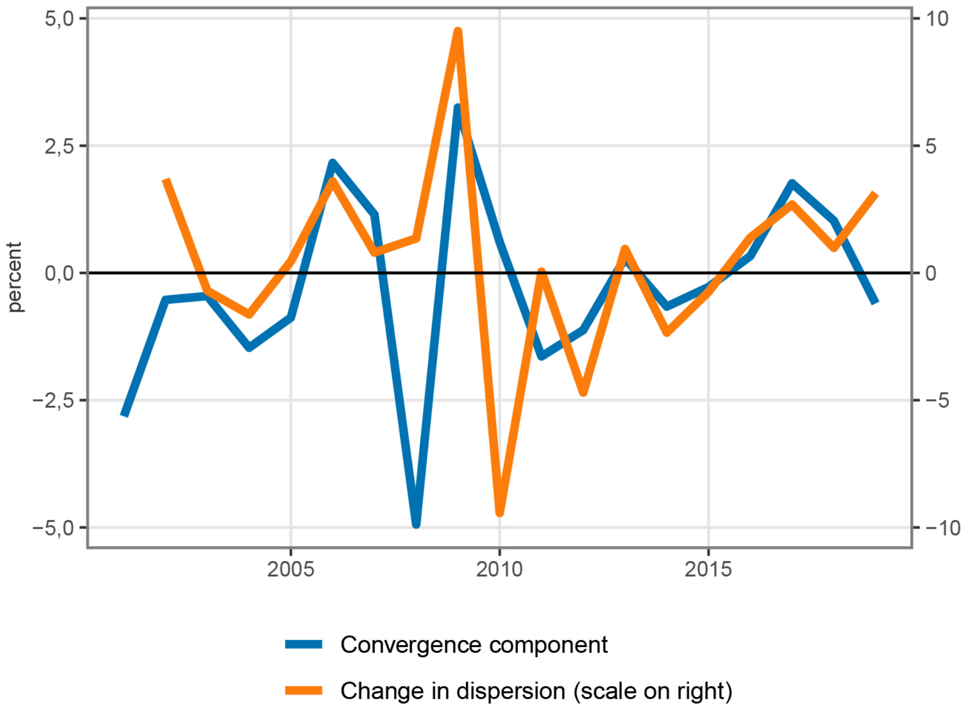
In 2008–2013, profitability within the manufacturing industry declined (-4.2% per year) at the same rate as within manufacturing enterprises (-4.2% per year). The convergence term was negative (-0.6% per year).

Figure 3.10 examines the development of the convergence term. The convergence term represents the product of the *change* in productivity and the *level* of productivity within the enterprise (Kauhanen & Maliranta, 2019, page 106). It is negative when there is a negative association between the level of profitability and the change in profitability within the enterprise, i.e. when low-profitability enterprises have made progress in catching up with high-profitability enterprises. This narrows the profitability differences between enterprises.[8]

[8] The negative effect is related to the fact that if the productivity change within low-productivity enterprises on average outperforms that within high-productivity enterprises, the average productivity growth within enterprises overestimates the industry-level effect. This is due to the fact that if the rate of productivity growth is the same within two same-sized high- and low-productivity enterprises, the productivity

Figure 3.10 shows that, save for certain exceptions, there has been such an expected association between the profitability (value added/labour costs) convergence component and the dispersion[9] of enterprise profitability change. The convergence component has often decreased when enterprise profitability dispersion has decreased and vice versa. The figure also shows that, in the early years of the 2010s, profitability dispersion decreased, whereas in the late years of the decade an increase in profitability dispersion can be seen.

Figure 3.10. Profitability (reciprocal of RUCL) convergence component and change in enterprise profitability dispersion within manufacturing.



NB: Enterprise profitability dispersion has been measured using the log of enterprise productivity's standard deviation.

The contribution of creative destruction to improved manufacturing profitability (decrease in RULC at the macro level) was on average 0.7% in 2008–2013. The effect of market entry was slightly negative (-0.2% per year), which indicates that the

change taking place within the high-productivity enterprise has a bigger effect at the level of the industry as a whole.

[9] Profitability dispersion between enterprises has been measured by profitability dispersion weighted by enterprise labour costs. Here profitability has been measured using the log ratio of value added and labour costs.

profitability of enterprises entering the market was on average lower than that of enterprises already in the market. The contribution of market exit (0.2% per year) negates the effect of market entry. Its positive value indicates that the profitability of enterprises that exited the market was on average higher (RULC higher than average).

The “between components” are important components of creative destruction. In 2008–2013, they accounted for an average of 0.7% per year. A positive between component indicates here that enterprises with above-average profitability (with below-average RULC) have increased their share of the sum of wages and salaries (including employer’s social security contributions). This may have taken place either though increased employment or through increased wages and salaries in relation to others, or through both. In 2014–2019, manufacturing profitability improved considerably more strongly at the macro level (0.8% per year) than at the enterprise level. The change from earlier was primarily due to the convergence term turning positive (see also Figure 3.10). The effect of creative destruction was in the same order of magnitude (0.6% per year) as in the preceding period. The effect of the between components decreased slightly (from 0.7% to 0.4% per year).

Some macro-level components of profitability change, namely labour productivity and price of labour, can also be broken down into enterprise-level components. In 2008–2013, creative destruction had a significant effect on labour profitability growth (0.8% per year). This indicates that a significant share of jobs destroyed in that period were in enterprises with below-average productivity[10]. The contribution of creative destruction to change in the price of labour was also positive but significantly smaller (0.2% per year) than to labour productivity. This means that the disappearance of jobs focused on enterprises where the price level of labour was below average but to a clearly smaller extent than in labour productivity.

As manufacturing cost competitiveness and the economic trend turned more positive in the 2014–2019 period, the contribution of creative destruction to labour productivity growth decreased from the preceding period’s 0.8% to 0.3% per year. The contribution of creative destruction to the price of labour turned negative, i.e. the number of jobs created was proportionally higher in enterprises where the price level of labour was below average.

[10] It should be noted that the profitability of these enterprises may have been high in previous years but, for reasons such as the permanent negative technological shock, their productivity level has dropped.

3.4 Conclusions

This chapter has described a novel way of breaking down the cost competitiveness development taking place at the level of the whole economy into its components. This provides valuable additional information as regards to which extent macro-level development directly reflects within-enterprise cost competitiveness and to which extent it in turn depends on the creative destruction process taking place in the market and on the development of profitability differences between enterprises.

In this examination, cost competitiveness is described by using real unit labour costs (RULC), the reciprocal of which, i.e. value added in relation to the sum of wages and salaries, measures how much margin production activity generates for each euro paid for an hour worked. The profitability of hiring labour can be seen to correlate positively with the number of hours worked in the national economy.

When the cost competitiveness of the national economy is broken down into four components: 1) labour productivity, 2) price of value added in the common currency (euro), 3) exchange rate and 4) price of labour (wages, salaries and employers' contributions) in the country's own currency, it is observed that the 2008–2013 decline in cost competitiveness was primarily due to a decline in labour productivity that was clearly more drastic than in other countries. In recent years, improvements in competitiveness have in turn been boosted mainly by the moderate increase in the price of labour, but labour productivity has also recovered to some extent from its 2008–2013 collapse.

Enterprise productivity growth may, however, continue to be slower within all enterprises than within the national economy as a whole as, due to creative destruction, new, more productive enterprises enter the market and less productive enterprises exit the market. Correspondingly, it is possible that the wages and salaries of all individual employees increase more rapidly that the average wages and salaries in the national economy, as new employees whose pay level is lower than that of older employees already in the labour market enter the labour market.

Closer profitability examinations show that in 2008–2013 the profitability of the national economy declined slightly less than within-enterprise profitability, as creative destruction increased the significance of enterprises with above-average profitability in the economy. Both labour productivity and the price of labour at the level of the national economy as a whole during this period primarily reflect within-enterprise development despite also being affected by structural changes in enterprise profitability dispersion and the between components that had effects in opposite directions.

In 2014–2019, in turn, the slight improvement in the profitability of the entire non-financial corporations sector conceals the fact that within-enterprise profitability did not improve at all. Instead, the real unit labour costs of the national economy decreased (profitability improved) because the convergence term turned positive but also because enterprises with below-average profitability exited the market and the share of enterprises with above-average profitability grew. The convergence term turning positive indicates that high-profitability enterprises have increased their lead over low-profitability enterprises, which widens the profitability gap between enterprises. For the same reasons, in recent years labour productivity growth has been much brisker in the national economy than within enterprises. By contrast, in recent years the increase in the price of labour has been lower in the national economy than within enterprises, as the number of jobs created has been proportionally higher within enterprises where the price of labour is below average.

4 Does inefficient allocation of production factors explain slowing productivity growth?

4.1 Introduction

At the level of the national economy, productivity depends on how efficiently factors of production such as labour as well as physical and human capital are allocated across enterprises and industries. Misallocation of factors of production at the micro level can show up as a reduction in total factor productivity at the aggregate level (Jones, 2016). Several studies suggest that misallocation of resources can be a substantial source of productivity differences across countries (Restuccia and Rogerson, 2008, 2013, 2017; Hsieh and Klenow, 2009). Recent studies provide evidence on a considerable resource misallocation even across enterprises that operate within narrowly defined industries in a variety of countries, including Italy (Calligaris et al., 2016), Ukraine (Ryzhenkov, 2016), Portugal (Dias et al., 2016), Türkiye (Nguyen et al., 2016) and Malaysia (Chuah et al., 2018).

In Finland, resource allocation is considered to be weaker than in the other Nordic countries (OECD, 2020b; Finnish Productivity Board, 2021). However, what is the situation at a lower level of aggregation in Finland, namely the industry and enterprise level? In this chapter, we summarise the most recent findings concerning resource allocation in 16 Finnish industries. The results presented here are based on a recent research report by Kuosmanen (2022), in particular on the articles by Kuosmanen et al. (2022) and Dai et al. (2022). These studies were conducted as part of the research project commissioned by the Prime Minister's Office and entitled *Allocation of labor and capital at the establishment, firm, and industry levels: Creative destruction, smart planning and effective regulation.*[11] The results are summarised in the light of the following questions in particular:

[11] To read more about the project (in Finnish), visit: https://tietokayttoon.fi/-/tyon-ja-paaoman-allokaatio-toimipaikka-yritys-ja-toimialatasoilla-luovaa-tuhoa-alykasta-suunnittelua-ja-vaikuttavaa-saantelya.

- How efficient is resource allocation in Finnish industries?
- Are there differences between the allocation of labour and capital inputs?
- Are there differences in allocation between industries?
- How far is the current allocation from the optimal one?

4.2 Resource misallocation and its estimation

Although the efficient allocation of resources has been among key economic concepts ever since *The Wealth of Nations* by Adam Smith, empirical interest in misallocation gained fresh impetus from research by Hsieh and Klenow (2009) that translated the conceptual idea into an empirical framework. In this approach, work on misallocation of resources is based on the equilibrium condition of a monopolistic competition model where the marginal revenue products of capital and labour are equalised across heterogenous producers. Hsieh and Klenow's (2009) estimation method has been employed extensively in several studies (e.g. Busso et al., 2013; Nguyen et al., 2016; Cirera et al. 2017, 2020).

Recent studies, however, have criticised Hsieh and Klenow's (2009) model for constraining assumptions concerning enterprise homogeneity as regards, for example, markups and capacity utilisation (see e.g. Haltiwanger et al., 2018; Baqaee and Farhi, 2020; Bils et al., 2021; Li and Wang, 2021; Hang, 2022). Kuosmanen et al. (2022) seek to respond to these challenges by, like Hsieh and Klenow (2009), examining misallocation on the basis of the equilibrium condition of a monopolistic competition model, but from a more data-driven perspective avoiding constraining homogeneity assumptions.

Empirical studies have found that productivity differences between enterprises may be large and persistent even in narrowly defined industries (see e.g. Syverson, 2011). Productivity differences may be largely due to quality differences in labour and capital inputs. To model heterogeneity explicitly, Kuosmanen et al. (2022) resort to local estimation of marginal products using convex quantile regression (CQR) (see Wang et al., 2014; Kuosmanen and Zhou, 2021). CQR is a fully nonparametric method that does not require any prior assumptions about the functional form of the production function. CQR builds directly on the monotonicity and concavity properties implied by the Weak Axiom of Profit Maximisation by Varian (1984). In contrast to the deterministic test approach (Varian, 1984), Kuosmanen et al. (2022) estimate multiple quantiles to account for the productivity differences and use the nearest quantiles to the enterprise to locally estimate the marginal products of labour and capital.

4.3 Allocation of factors of production in Finnish non-financial corporations sector

Kuosmanen et al. (2022) examined 16 Finnish industries in 2005, 2012 and 2018. The industries examined were at the 2–5-digit level of the Finnish Standard Industrial Classification TOL 2008 (Table 4.1). The first eight industries represent the manufacturing sector and the other eight industries represent other sectors of the economy, including service industries. These 16 industries were selected on the one hand to obtain a relatively large sample size and on the other because they produce relatively homogenous products.

The allocation of resources, namely labour and capital, within these industries was examined using Statistics Finland's financial statements data[12]. The data contains enterprise-level accounting data with exhaustive coverage of enterprises in almost all industries in Finland. Following Hsieh and Klenow's (2009) model, the extent of resource misallocation is measured by estimating the marginal products of labour and capital and comparing them with the average marginal costs of labour and capital. In contrast with previous studies, the marginal products of capital and labour are estimated for each enterprise by using convex quantile regression (CQR) (see Wang et al., 2014; Kuosmanen and Zhou, 2021). The major advance of this approach over more commonly used methods is that it allows to estimate the partial derivatives of the production function locally without imposing any prior constraining assumptions about the functional form.

[12] Statistics Finland, Structural business and financial statement statistics, https://www.stat.fi/en/statistics/yrti.

Table 4.1. Analysed industries and their Standard Industrial Classification TOL 2008 codes.

Industry	TOL 2008
Manufacturing	**C**
- Manufacture of food products	C10
- Sawmilling and planing of wood	C16100
- Manufacture of paper and paper products	C17
- Manufacture of chemicals and chemical products	C20
- Manufacture of basic pharmaceutical products and pharmaceutical preparations	C21
- Manufacture of basic metals	C24
- Manufacture of computer, electronic and optical products	C26
- Manufacture of furniture	C31
Electricity, gas, steam and air conditioning supply	**D**
- Production of electricity with hydropower and wind power	D35111
- Combined heat and power production	D35113
Construction	**F**
- Construction of residential and non-residential buildings	F41200
Transportation and storage	**H**
- Freight transport by road	H49410
Accommodation and food service activities	**E**
- Hotels	I55101
Information and communication	**J**
- Computer programming activities	J62010
Human health and social work activities	**Q**
- Dental practice activities	Q86230
Arts, entertainment and recreation	**R**
- Activities of sports clubs	R93120

Source: Kuosmanen et al. (2022).

The aim is to identify any misallocation by comparing the estimated marginal products of labour and capital with their marginal costs. To account for the heterogeneity across firms, the average marginal costs of labour and capital were assessed at the enterprise level to best reflect quality differences in these inputs across enterprises. Since marginal costs cannot be directly observed in the statistical data, the study assumed that enterprises obtain their labour and capital inputs from the competitive market, taking wages and salaries as well as required return on capital as given. This way the marginal costs of factors of production can be estimated on the basis of average unit costs (including taxes and employers' contributions). Costs of labour and capital were estimated in accordance with functional income distribution by first dividing the value added of the enterprise between labour and capital into labour costs and operating profit. After this, unit costs were calculated by dividing labour costs by the number of employees and operating profit by fixed assets.

Marginal products and heterogeneity of enterprises

For a profit-maximising enterprise under monopolistic competition, demand for inputs (labour L and capital K) is obtained by solving the following optimisation problem (see e.g. Restuccia and Rogerson, 2017)

$$\max_{L,K} z_i f(L,K) - w_i L - r_i K, \qquad (1)$$

where f is a monotonic increasing and conclave production function, z_i is enterprise-specific productivity term and w_i, r_i are the prices of labour and capital faced by enterprise i. Possible output price differences are assimilated to the productivity terms z_i.

The first-order condition states that the marginal costs are set equal to the marginal products:

$$z_i f'_L(L,K) = w_i \qquad (2)$$

$$z_i f'_K(L,K) = r_i. \qquad (3)$$

where f'_L and f'_K denote the partial derivatives of the production function, and hence $z_i f'_L(L,K)$ [$z_i f'_K(L,K)$] is the marginal product of labour [capital]. In other words, the profit-maximising enterprise increases its labour and capital inputs until the marginal increase in output equals the input price (i.e. the cost of inputs). It is important to note that heterogeneity of enterprises in terms of their productivity and factor prices can render the first-order conditions very different across enterprises. Consequently, the enterprise-specific first-order conditions (2) and (3) provide a more general framework for the empirical examination of whether the observed allocation of labour and capital resources is efficient.

Consider possible violations of the first-order conditions (2) and (3). Suppose, for example, that

$z_i f'_L(L,K) > w_i$,

$z_i f'_K(L,K) < r_i$.

This would imply that the enterprise is using too much capital input K and too little labour input L compared with the optimal profit-maximising solution. The sign of the inequality indicates whether the enterprise is using too much or too little of a specific resource. Note, however, that the adjustment to the optimal allocation would typically require adjustments to both inputs: the marginal product of labour depends on the capital input, and vice versa.

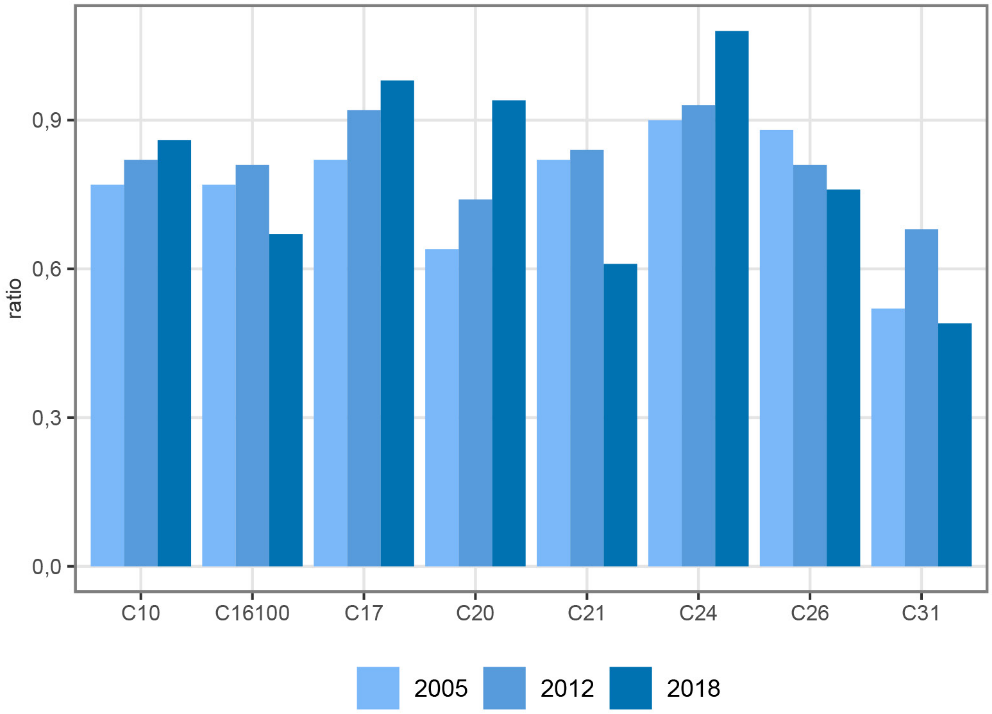
Because the production functions of enterprises are not directly observable, the marginal products must be estimated from empirical data. The main challenge in the estimation is the fact that enterprises are heterogenous and so are their technologies and input resources. Even in a relatively narrowly defined industry, there are large productivity differences across enterprises, which may relate to the quality of employees (e.g. education and experience) and the vintage of capital.

4.4 Allocation of labour

Let us first examine the allocation of labour input. The bars in Figure 4.1 represent the ratio of the average unit cost of labour and the marginal product in eight manufacturing industries in 2005, 2012 and 2018.[13] The closer the ratio is to 1, the more efficient the industry's allocation from society's perspective. A ratio below 1 implies the under-use of labour input. A ratio higher than 1 in turn points towards over-use of labour input compared with the marginal product of labour.

[13] See Kuosmanen et al. (2022), Kuosmanen and Maczulskij (2022).

Figure 4.1. Allocation of labour input in eight manufacturing industries in 2005, 2012 and 2018: The bars represent the average ratio of unit costs and marginal products.

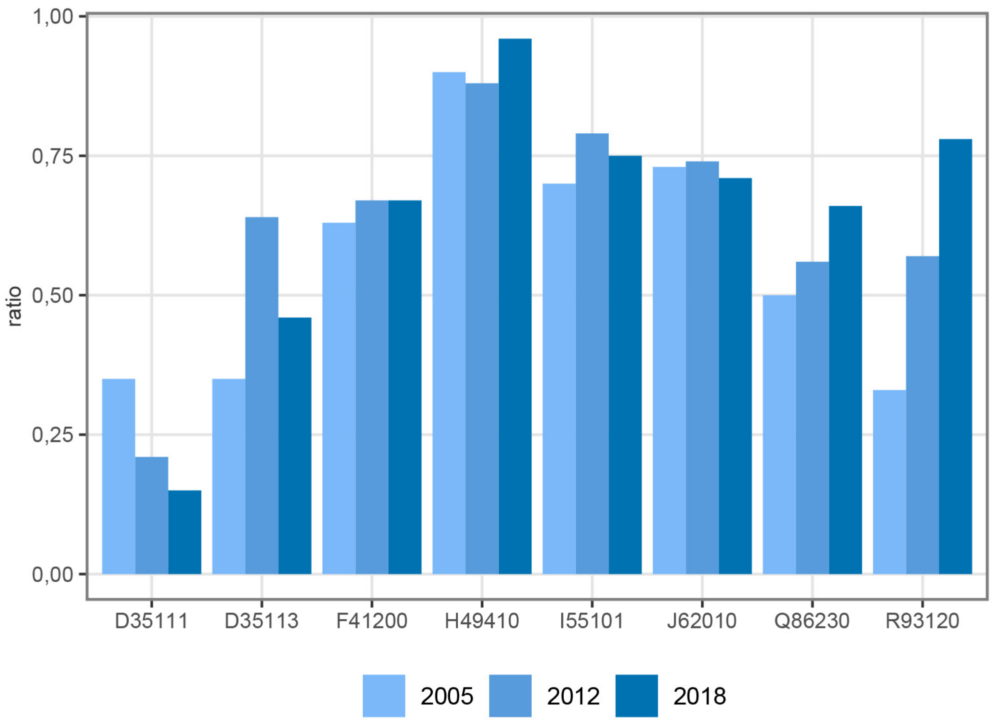


Source: The figure is based on results presented in the article by Kuosmanen et al. (2022).

Among manufacturing industries, the ratio for the manufacture of basic metals (C24) was close to 1 in 2005 and 2012, being the only industry with a ratio above 1 in 2018. In the manufacture of paper and paper products (C17) and in the manufacture of chemicals and chemical products (C20), the ratios of labour costs and marginal products are also reasonably close to 1 in 2018. Labour allocation has declined in the sawmilling and planing of wood (C16100) and in the manufacture of basic pharmaceutical products and pharmaceutical preparations (C21). The lowest ratio is seen in the manufacture of furniture (C31).

Let us next examine the allocation of labour input in eight other industries. The bars in Figure 4.2 represent the ratio of the average unit cost of labour and the marginal product in the same way as in Figure 4.1.

Figure 4.2. Allocation of labour input in eight other industries in 2005, 2012 and 2018: The bars represent the average ratio of unit costs and marginal products.



Source: The figure is based on results presented in the article by Kuosmanen et al. (2022).

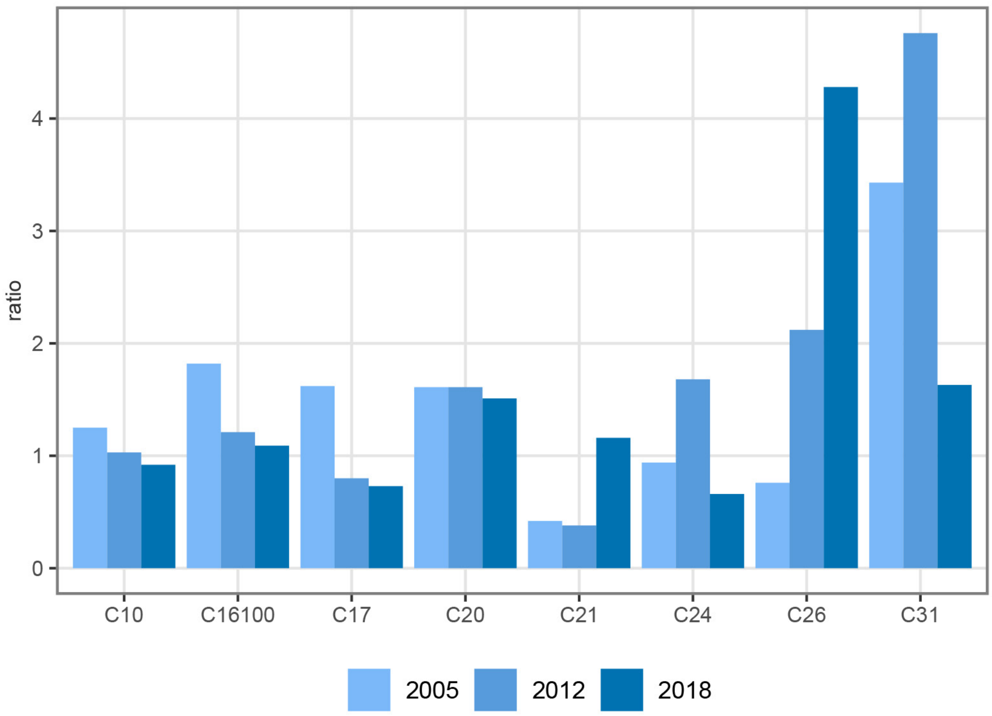
In freight transport by road (H49410), the ratio of unit costs and marginal products is relatively close to 1 in all three years examined. This points towards reasonably efficient allocation of labour in the industry. The allocation of labour input greatly improved in the activities of sport clubs (R93120) during the period examined. In the energy sector, the allocation of labour appears the least efficient, especially in the production of electricity with hydropower and wind power (D35111). In combined heat and power production (D35113), the allocation of labour input is a bit closer to 1.

To sum up, the unit costs of labour are lower than the marginal product in all 16 examined industries in all three years with the exception of one. This implies that enterprises employ fewer people than could be expected from the perspective of marginal products and maximisation of profit. Possible reasons for the under-use of labour input may include shortage of skilled labour, various mismatch problems in the labour market, and issues related to labour market regulation. More detailed analyses of causes and effects would require further research into the topic.

4.5 Capital allocation

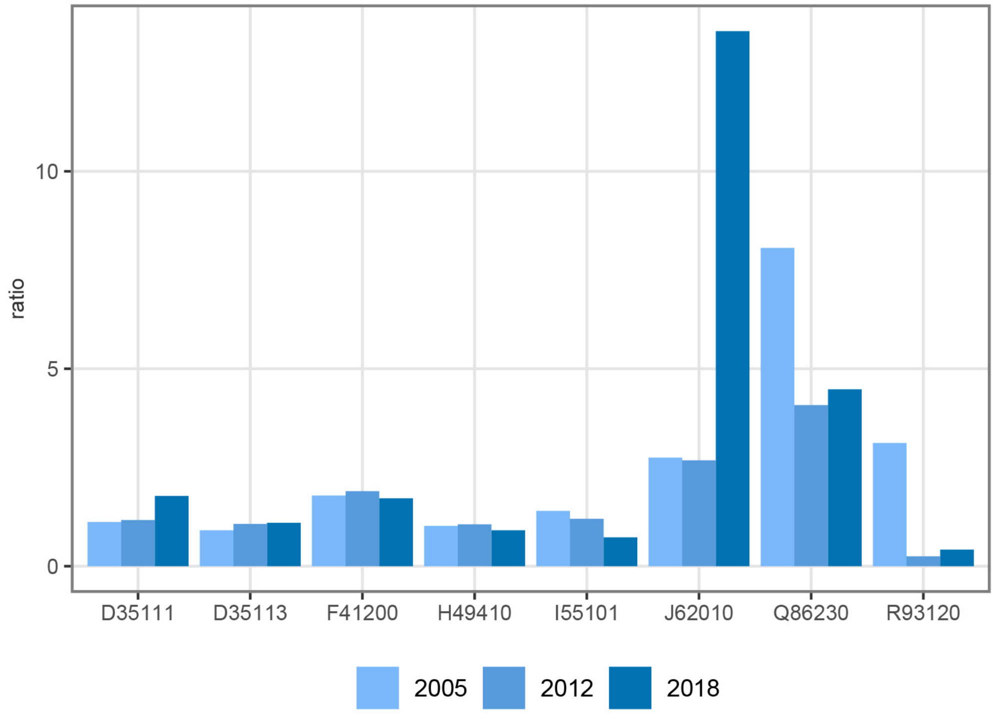
Next, consider the allocation of capital input. The ratios of the averages of the unit costs and marginal products of capital in manufacturing and other industries are displayed in Figures 4.3 and 4.4 in the same way as in Figures 4.1 and 4.2 above. The graph scales are graduated differently: Figure 4.4 in particular includes industries where the ratio of unit costs and marginal products gains very high values. The key comparison point in all of the Figures 4.1–4.4 is the numerical value of 1, which is where the industry's average unit costs and marginal products are equal in amount.

Figure 4.3 Capital allocation in eight manufacturing industries in 2005, 2012 and 2018: The bars represent the average ratio of unit costs and marginal products.



Source: The figure is based on results provided in the article by Kuosmanen et al. (2022).

Figure 4.4. Capital allocation in eight other industries in 2005, 2012 and 2018: The bars represent the average ratio of unit costs and marginal products.



Source: The figure is based on results provided in the article by Kuosmanen et al. (2022).

As regards capital allocation, the ratios are above 1 in many industries, which may imply there is significant over-capacity in these industries. For example, in the manufacture of chemicals and chemical products (C20), manufacture of computer, electronic and optical products (C26) and manufacture of furniture (C31), the ratios are considerably higher than 1. This indicates that capital intensity in the years examined is higher than optimal. Capital allocation is relatively good in the manufacture of food products (C10) and in the sawmilling and planing of wood (C16100) in 2012 and 2018. There are, however, also industries where the unit cost of labour is lower than the marginal product of capital. In 2018, these included the manufacture of paper and paper products (C17) and manufacture of basic metals (C24).

Over-capacity of capital can also be seen in non-manufacturing industries, see Figure 4.4. The most extreme case is computer programming activities (J62010) in 2018. The allocation of capital input remains at a relatively good level in combined heat and power production (D35113) and in freight transport by road (H49410) in all years. Capital stock is less than optimal in the activities of sport clubs (R93120) in 2012 and 2018.

To summarise, the majority of the enterprises studied operate more capital intensively than is optimal in terms of marginal products and profit maximisation. A significant share of the enterprises examined have invested more in capital inputs than could be expected with a view to profit maximisation. On the other hand, we observed above that the majority of the enterprises do not employ as many people as profit maximisation would require. In small, entrepreneur-driven enterprises in particular, the high capital intensity may be partly explained by the more advantageous tax treatment of capital income compared with earned income. On the other hand, it should be noted that the lowering of the relative share of labour costs in income distribution in Western countries is a very common phenomenon associated in many studies with low productivity growth (e.g. Grossman et al., 2017) but the more specific reasons for which are still subject to active debate (see e.g. Grossman and Oberfield, 2022).

4.6 Efficiency loss from misallocation

The previous section examined the efficiency of labour and capital allocation from the perspective of the first-order conditions of profit maximisation in 16 industries in Finland. In many industries, the average unit costs of labour were lower than the marginal products, suggesting that labour is under-utilised. In contrast, the marginal products of capital tended to be lower than the corresponding unit cost of capital, which suggests that capital intensity is too high.

Dai et al. (2022) assessed the efficiency of current resource allocation relative to societally optimal allocation and estimated the largest potential efficiency loss from misallocation. Loss was estimated by comparing the value added generated by the current allocation with counterfactual optimal allocation in 2005, 2012 and 2018 in the same 16 Finnish industries that were examined in the section above.

Counterfactual efficient allocation is based on a constrained optimisation model developed by Dai et al. (2022) where the social planner maximises the industry’s value added by reallocating labour and capital resources between enterprises. For optimal allocation to be feasible in practice, constraints are imposed to ensure that the productivity level of the enterprises and the labour and capital resources of the industry will not change due to the reallocation. The analysis is based on local estimation of production functions using convex quantile regression (CQR) (Kuosmanen and Zhou, 2021). The optimisation model employs 10 equidistant quantiles, which can be interpreted as the deciles of the performance distribution for an industry. In other words, the enterprises within an industry are partitioned to ten groups of equal sizes representing the 0%–10%, 10%–20%, …, 90%–100% levels of the industry’s performance distribution.

The study examined four alternative scenarios concerning resource allocation between deciles and the planner's possibility of leaving enterprises totally without resources and thereby forcing their exit from the market:

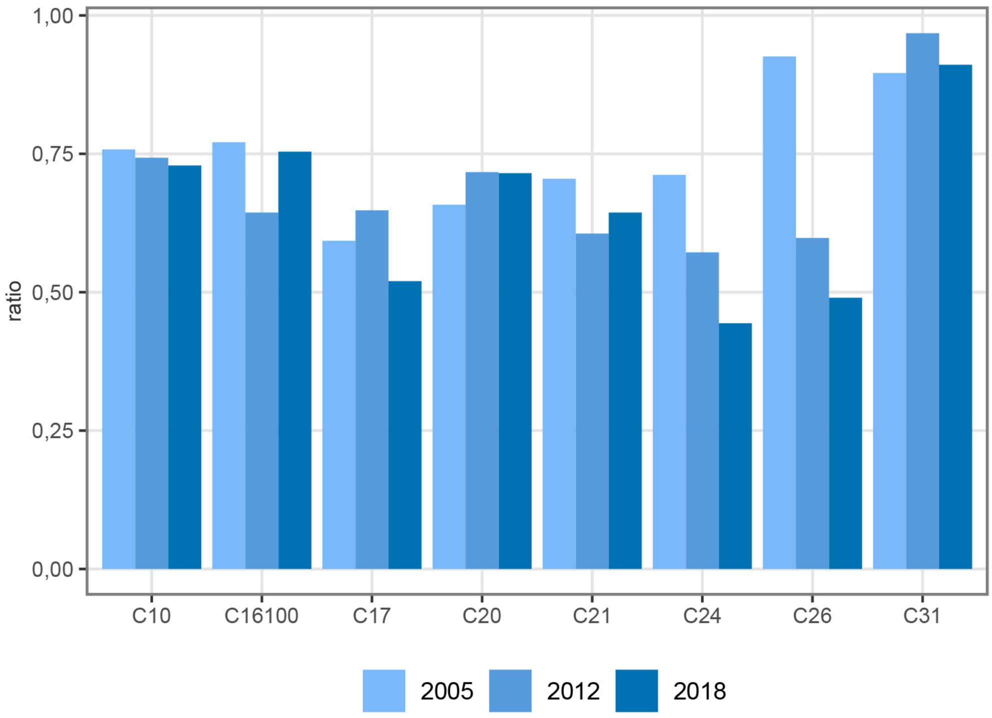
1. Maximise output allowing reallocation only within deciles, no exit allowed.
2. Maximise output allowing reallocation only within deciles, forced exit allowed.
3. Maximise output allowing reallocation both between and within deciles, no exit allowed.
4. Maximise output allowing reallocation both between and within deciles, exit allowed.

In the first two scenarios, the deciles in the performance distribution are interpreted as different to such an extent (e.g. quality differences in labour and capital inputs) that reallocation of resources from low-productivity to higher-productivity enterprises is not possible. In the last two scenarios, productivity differences are interpreted as arising from factors other than quality differences in factors of production (e.g. management capabilities), which is when resources can be allocated from low-productivity to higher-productivity enterprises provided, however, that this does not affect the industry's total resources. It was found that the possibility of forcing exit by leaving enterprises totally without resources that was allowed in scenarios (2) and (4) had only marginal impact on the planner's optimal allocations. This is why we only examine scenarios (1) and (3) in the following.

The results for scenario (1) are presented in Figure 4.5 for manufacturing industries in 2005, 2012 and 2018. The bars in the figure represent allocative efficiency in the industry as ratios obtained by dividing the industry's observed value added by value added generated by optimal allocation. The closer to 1 an industry gets, the more efficient the allocation. Conversely, the relative loss of efficiency arising from misallocation is obtained by deducting the ratio from 1.

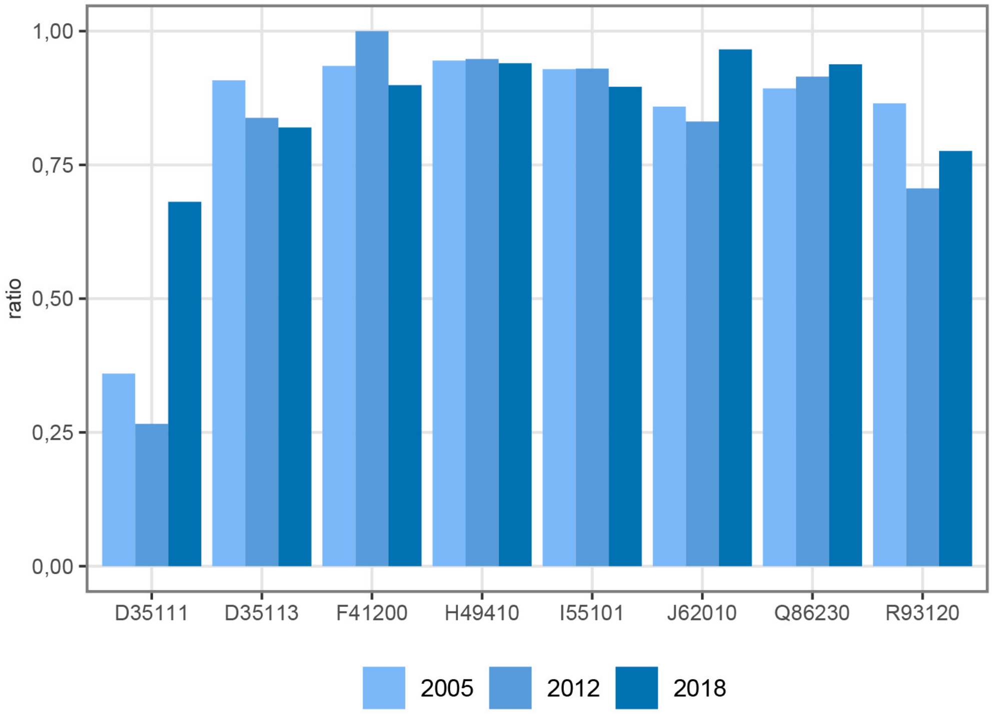
Although scenario (1) only allows reallocation of resources within deciles and not between them, the observed allocation turns out to be relatively inefficient in most manufacturing industries, except for the manufacture of furniture (C31) and the manufacture of computer, electronic and optical products (C26) in 2005. In 2018, the loss of efficiency from misallocation was proportionally the highest in the manufacture of basic metals (C24) and the manufacture of computer, electronic and optical products (C26). The estimated value added generated by the current allocation is less than half of what the optimal allocation could generate with the same resources and at the same productivity level. The rapid decline of Finland's ICT sector can partly explain the deteriorated allocation in industry C26.

Figure 4.5. Allocative efficiency in eight manufacturing industries in 2005, 2012 and 2018: The bars represent the ratio of observed value added and value added from efficient allocation when reallocation of resources within deciles is allowed.



Source: Figure based on results provided by Dai et al. (2022).

Figure 4.6. Allocative efficiency in eight other industries in 2005, 2012 and 2018: The bars represent the ratio of observed value added and value added from efficient allocation when reallocation of resources within deciles is allowed.

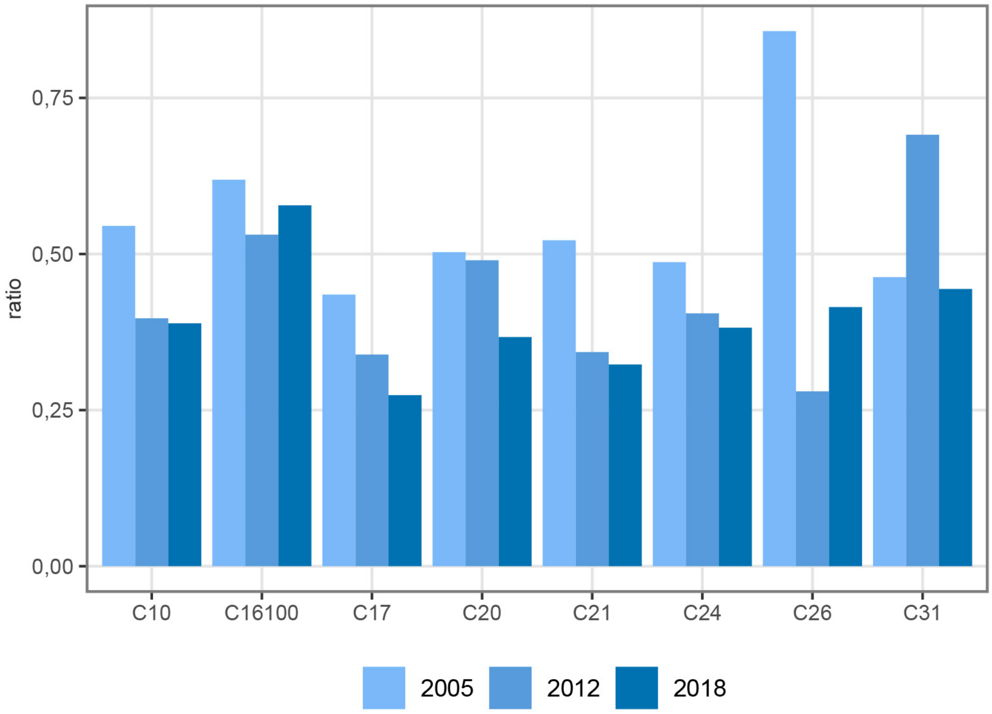


Source: Figure based on results provided by Dai et al. (2022).

Figure 4.6 shows corresponding results for eight other industries in 2005, 2012 and 2018. Compared with manufacturing industries, allocative efficiency appears to be at a higher level in service industries. Allocative efficiency is the highest in service industries such as freight transport by road (H49410) and dental practice activities (Q86230). These industries feature relatively large numbers of enterprises and a high degree of market competition. In the energy sector, the allocative efficiency of renewable energy production (D35111) is considerably lower than that of conventional combined heat and power production (D35113).

By way of comparison, scenario (3) compares the value added from the current allocation with the optimal allocation where reallocation is allowed within as well as between deciles. This means labour and capital inputs can be reallocated from low-productivity enterprises to higher-productivity enterprises. As above, Figures 4.7 and 4.8 illustrate the allocative efficiency ratios of scenario (3) in manufacturing and other industries.

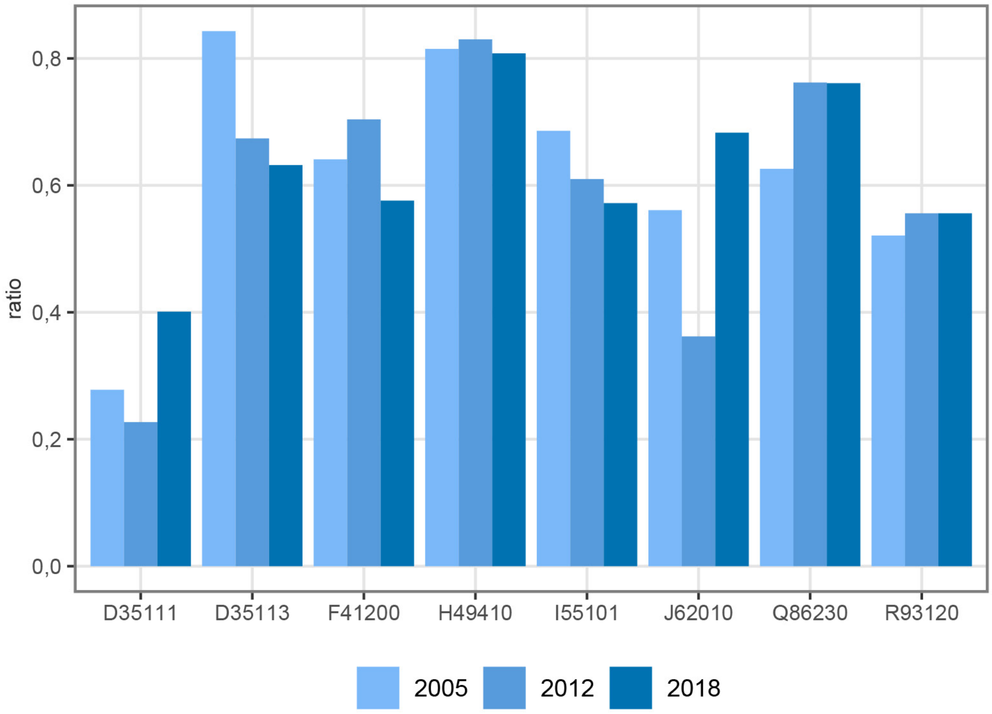
Figure 4.7. Allocative efficiency in eight manufacturing industries in 2005, 2012 and 2018: The bars represent the ratio of observed value added and value added from efficient allocation when reallocation of resources within and between deciles is allowed.



Source: Figure based on results provided by Dai et al. (2022).

In scenario (3), allocative efficiency declines as expected compared with scenario (1). Where reallocation between deciles is possible, better allocation could generate higher added value. The drop in efficiency ratios is particularly notable in the service industries that performed relatively well in scenario (1).

Figure 4.8. Allocative efficiency in eight other industries in 2005, 2012 and 2018: The bars represent the ratio of observed value added and value added from efficient allocation when reallocation of resources within and between deciles is allowed.



Source: Figure based on results provided by Dai et al. (2022).

The results of scenarios (1) and (3) can be interpreted as kinds of lower and upper bounds of loss of efficiency from misallocation. It is probably too constraining to assume that enterprises operating in different deciles of the same industry's productivity distribution are so different from each other that no reallocation of labour and capital resources at all can take place between them. On the other hand, totally free reallocation does not appear fully realistic either, as productivity differences between deciles may at least in part arise from quality differences in labour and capital inputs (such as employee education and training, experience and motivation factors and vintage of capital). It can be generally concluded on the basis of the results of the study that more efficient resource allocation in all of the industries examined could considerably improve productivity. Since the industries' labour and capital resources were held constant, the relative loss of efficiency from misallocation is at the same time also the impact of misallocation on the industry's productivity level.

4.7 Summary

This chapter provided an overview of recent Finnish research findings on the misallocation of factors of production. In response to the questions presented in the introduction, we note the following. The findings presented strongly indicate that the inefficient allocation of labour and capital between enterprises is a very significant factor weakening labour productivity growth in the Finnish non-financial corporations sector. Empirical results reinforce the view that both labour and capital resources are allocated rather inefficiently in many of the industries examined.

Based on the estimated marginal products, it would be profitable for most enterprises operating in the 16 industries examined to hire more employees, but for some reason enterprises do not employ as many people as would be optimal in terms of profit maximisation and societal prosperity. In contrast, notable overcapacity exists in the form of excessive capital intensity in most of the industries.

An examination of the relative level of allocative efficiency shows considerable allocative inefficiencies even in relatively homogenous industries. Misallocation seems particularly severe in manufacturing. Many industries achieve only about half of the potential output that could be produced with the same labour and capital resources if these were allocated more efficiently between enterprises. This implies that there exists enormous potential for productivity growth at the industry level through better allocation of resources without requiring more resources, technical progress or efficiency improvement at the enterprise level.

There could be a number of possible explanations for this misallocation of resources in Finland, with most of these relating to market imperfections concerning factors of production. Firstly, the misallocation of resources may relate to lack of competition and local market power (cf. e.g. Böckerman and Maliranta, 2003). On the other hand, there is a mismatch of jobs and skills in many industries and enterprises. The shortage of labour, and skilled employees in particular, has been observed in many studies and reports (see e.g. Alasalmi et al, 2022; Ministry of Economic Affairs and Employment, 2022a). One potential explanation relates to the outsourcing of labour, which may cause bias in the measurement of the primary factors of production and the intermediate inputs (see e.g. Elsby et al., 2013).

In addition to the market of factors of production, allocative efficiency is also affected by enterprise strategy and decision-making. On the one hand, the management time horizon may be longer than the timespan examined in the studies, while on the other hand management decisions may subsequently prove to be wrong. It is also possible that management strategy differs from maximisation of profit that is societally optimal.

A recent study by Acemoglu et al. (2022) finds that business managers with a business-school degree in the United States and Denmark hire fewer employees and pay lower wages than managers with other educational backgrounds. If a similar phenomenon also applies in the Finnish non-financial corporations sector, this might explain some of the deviations between unit costs of labour and marginal products.

Although there are many possible explanations for inefficient allocation of labour and capital, further research is needed to form a better picture of potential channels of influence. It would be particularly important to gain a better understanding of how policy measures could help to stimulate and guide market actors to achieve better allocation of labour and capital inputs in order to improve total factor productivity.

5 Productivity effects of difficulties experienced by the electronics industry[14]

5.1 Introduction

As pointed out in previous reports of the Finnish Productivity Board, Finland's rapid productivity growth halted and took a downturn around the time of the financial crisis. Productivity growth has also slowed in other countries, but an even weaker trend has been seen in Finland than elsewhere.

The financial crisis caused a sudden drop in productivity in Finland. During the crisis, the collapse of demand led to a contraction of value added, due to both lower prices and reduced volumes. For various reasons, the number of hours worked did not contract in the same proportion as value added, which resulted in a drop in productivity (Finnish Productivity Board, 2019). However, the financial crisis is not the actual distinguishing factor underlying Finland's poor productivity growth compared with other countries. Access to finance or interest rate levels did not reduce investment or other enterprise activity any more than in other countries (see e.g. Hukkinen et al., 2015; Suni & Vihriälä, 2016). Instead, the deteriorating competitiveness of the national economy may well have been a distinguishing factor: Finland's competitiveness loss had a negative impact on exports and investments. The weak competitiveness resulted, among other things, from the inflexibility of labour costs (Suni & Vihriälä, 2016; Finnish Productivity Board, 2019, 2020).

In addition to these challenges, the economy of Finland has experienced several negative shocks, such as Nokia's collapse from being the world's leading manufacturer of mobile phones, the global deterioration in demand for capital goods after the financial crisis, and the decline in demand for forest industry products (Finnish Productivity Board, 2019).

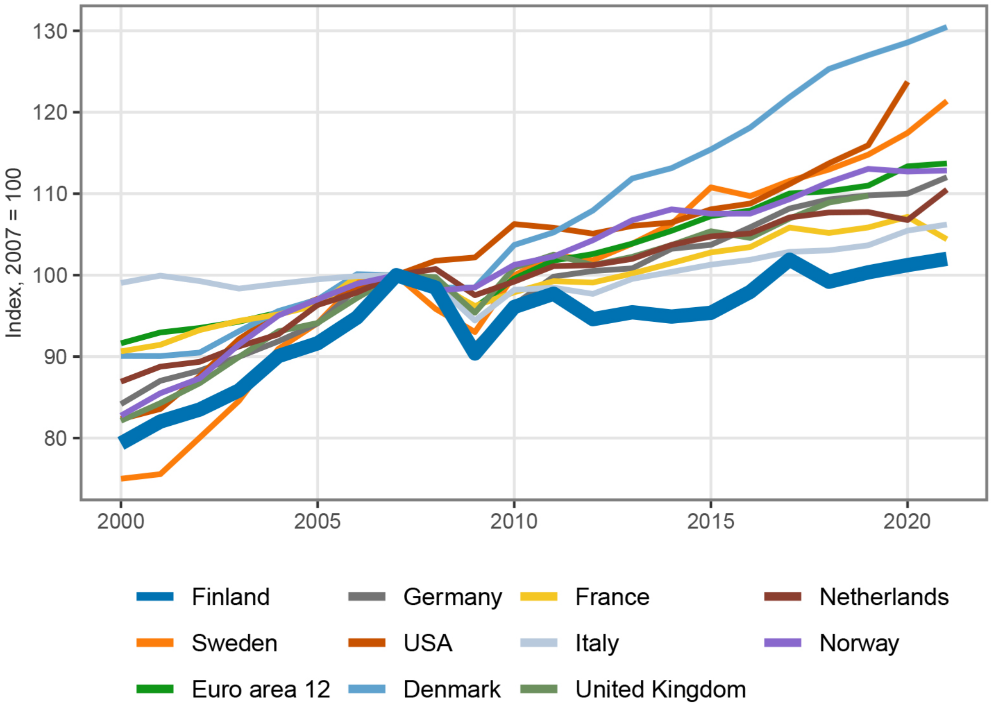
[14] This chapter is based on a productivity analysis commissioned from the OECD by the Finnish Productivity Board, the Economic Policy Council and the Research Division on Business Subsidies. The analysis was conducted by the OECD Directorate for Science, Technology and Innovation (STI), which will also publish a research paper on the topic in autumn 2022, presenting the analysis methods and results in more detail than this chapter (OECD, upcoming).

With their impacts often asymmetrical, shocks may result in capital and labour ending up in the wrong places with regard to productivity. A shock initially hitting an individual enterprise or industry may also spread to other industries through value chains. This involves networks propagating and amplifying the impacts of the initial shock in both the positive and the negative direction (Acemoglu et al., 2016).

Previous reports of the Finnish Productivity Board have attributed a significant part of the productivity decline and slow recovery of the Finnish economy to the negative shock experienced by the electronics industry and the Finnish economy's slow adaptation to it. This can be seen when, for example, comparing Figures 5.1 and 5.2: with the electronics industry included (Figure 5.1), the recovery of labour productivity was slower than with the electronics industry excluded (Figure 5.2). We have now been able to analyse the significance of this so-called Nokia shock more specifically.

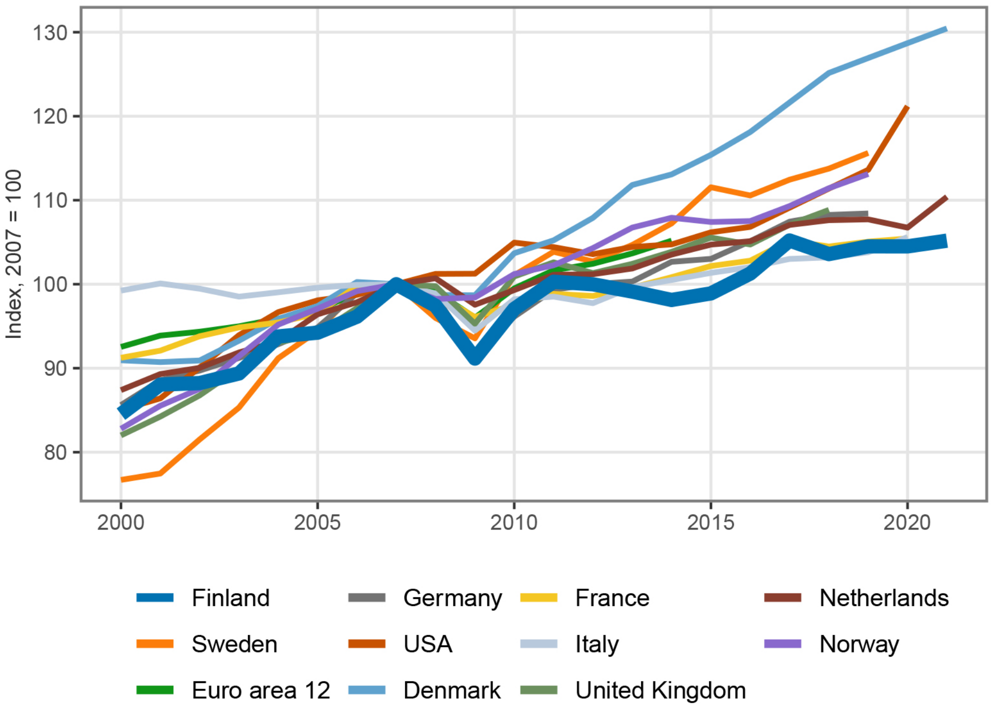
Although many of Nokia's subcontractors and contract manufacturers operated outside Finland, Nokia's significance to the Finnish economy was still high just before the crisis. Nokia accounted for 4% of Finland's gross domestic product in 2000 and still more than 3% in 2007. Before the crisis, Nokia employed almost 1% of Finland's total employed labour force and accounted just over 40% of Finland's R&D expenditure (Ali-Yrkkö, 2010).

Figure 5.1. Real aggregate labour productivity in the non-financial corporations sector, 2007=100.



Source: Eurostat and OECD

Figure 5.2. Real aggregate labour productivity in the non-financial corporations sector excluding the electronics industry, 2007=100.



Source: Eurostat and OECD

Other industries have also experienced long-running problems with the recovery of productivity growth (Figure 5.2). Even with the electronics industry excluded, Finnish productivity development differs from most countries in that labour productivity took another downturn in 2012–2014 (Finnish Productivity Board, 2019).

This chapter analyses how the negative demand shock experienced by the electronics industry affected other industries in Finland through subcontracting chains. Recent literature shows that, in practice, demand shocks hitting an industry only propagate upstream to input-supplying (subcontracting) industries rather than downstream to customer industries (Acemoglu et al., 2016). This is why this analysis focuses on examining how the impacts of the shock spread through subcontractors of the electronics industry to the development of their industries.

5.2 Data and basic idea of analysis

The analysis makes use of numerous OECD databases (STAN, ICIO, MultiProd, DynEmp), using data on a total of 16 OECD countries[15]. The countries were selected on the basis of availability and quality of data as well as comparability with Finland. The period examined is 2000–2018, depending, however, on the variable, industry and country. The analysis covered 21 industries in the private sector (manufacturing and services).

The analysis illustrates how a shock in one industry affects enterprises and their industries operating lower in the production chain. The model employs input-output tables and the Leontief Inverse Matrix derived from these. In the Leontief Inverse Matrix, an individual coefficient denotes the production input required from an industry for another industry to be able to produce one dollar's worth of its own output. Accordingly, this analysis is interested in Leontief coefficients where the industry producing the output is the electronics industry. This enables the assessment of how strongly Finnish industries have been dependent on the electronics industry.

More details on the model

In the Leontief Inverse Matrix, an individual coefficient $\lambda_{c,s\rightarrow b,q,t}$ denotes how much input in country c from industry s is required to produce one dollar's worth of output in country b , industry q at time t. If $c = b$, the Leontief coefficient is a domestic one. A domestic Leontief coefficient $\lambda_{c,s\rightarrow c,computer,t}$ relative to the electronics industry ($computer$) is likely to be dependent on endogenous (industry-, country- and time-dependent) factors. This is why the average Leontief coefficient for each industry is calculated over the number of countries N_c and over the number of years T relative to the electronics industry:

$$\lambda_{s\rightarrow computer} = \frac{\sum_{t=2000}^{2018} \sum_c \lambda_{c,s\rightarrow c,computer,t}}{T * N_c}.$$

The country-industry-specific change is calculated by multiplying each industry's average Leontief coefficient by the change in the value added share $\Delta_h \log VA_{c,t}^{computer}$ of the Finnish electronics industry over timespan h.

The following regression equation is obtained:

$$\Delta_h DV_{c,s,t} = \beta_h \lambda_{s\rightarrow computer} * \Delta_h \log VA_{c,t}^{computer} + \gamma_{c,s} + \theta_t + X_h\delta + \varepsilon_{c,s,t} .$$

[15] The countries were Austria, Belgium, Canada, Chile, Estonia, Finland, France, Hungary, Italy, Japan, Latvia, Lithuania, the Netherlands, Portugal, Slovenia and Sweden.

where $\Delta_h DV_{c,s,t}$ is the dependent variable denoting development in industry s, $\gamma_{c,s}$ is the country-industry fixed effect, θ_t is the time fixed effect and X_h is the control variable selected in accordance with the dependent variable. In practice, it is often the value of the dependent variable at a time in the past h.

If there was a large enough number of industries, the analysis could be performed exclusively for Finland. However, this analysis focuses on the manufacturing and service industries, as these industries account for the largest share of value added in the national economy and employ the largest number of people in many countries. The analysis ended up covering a total of 21 industries, as some industries were excluded from the analysis due to data deficiencies. With the number of industries being small, 16 OECD countries were included in the analysis. It was, however, tested during the analysis that the results for Finland did not differ statistically significantly from the results for the group of countries as a whole.

5.3 Results

The examination begins by establishing how the shock experienced by the electronics industry, i.e. the change in its value added, in general affects the value added, output, employment and labour productivity of other input-supplying subcontracting industries. Table 5.1 shows the results of the estimation for three different timespans h: 1, 3 and 5 years after the shock. In the table, the effect coefficients are standardised to allow for better comparisons of the associations between the various independent variables and the dependent variable. In the table, a positive effect means that the sign of the effect is the same as the direction of the shock. In other words: in the case of a shock increasing value added, a positive sign means that other industries also benefit from it, whereas in the case of a shock decreasing value added, other industries suffer from it, and vice versa.

Table 5.1 shows that the effect on growth in value added and output in other industries is in the same direction as the direction of the shock for all timespans. On the other hand, the effect on employment over shorter timespans is the opposite to the direction of the shock, which is in line with the effect on more productive enterprises being greater (see below the table). As a result of these, the effect on labour productivity is in the same direction as the shock, over longer timespans also statistically significantly. In other words, the negative shock experienced by the electronics industry had a negative effect on labour productivity in other industries.

The model was also estimated separately for manufacturing and service industries, and by separating digital-intensive and non-digital-intensive services from each other.[16] The results (not included in Table 5.1) show that the electronics industry shock had a statistically significant effect on labour productivity in manufacturing and digital services, whose links to the electronics industry are closer than those of non-digital services.

Table 5.1. Effect of electronics industry shock on development of subcontractor industries

		Change in value added	Change in output	Change in employment	Change in labour productivity
After a year	Effect on other industries	0.0163 (0.0109)	0.0258* (0.0136)	0.00493 (0.0114)	0.00532 (0.00864)
	Number of observations	4,956	4,495	4,942	4,338
	R^2	0.631	0.663	0.243	0.459
After three years	Effect on other industries	0.0143 (0.0104)	0.0184 (0.0122)	-0.0290** (0.0144)	0.0370*** (0.0115)
	Number of observations	4,378	3,973	4,364	3,810
	R^2	0.770	0.757	0.534	0.708
After five years	Effect on other industries	0.0178 (0.0113)	0.0184 (0.0129)	-0.0202 (0.0167)	0.0430*** (0.0146)
	Number of observations	3,798	3,449	3,784	3,280
	R^2	0.861	0.840	0.719	0.816

The effects have been standardised, which means their interpretation is not as direct as with non-standardised coefficients. Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.001.

The estimation results can be employed to estimate more precisely the overall effects of the shock experienced by the electronics industry on the private sector and, consequently, the national economy as a whole after 2008. The effect on labour

[16] In this case, the split between digital-intensive and non-digital-intensive manufacturing could not be made due to the small number of digital-intensive manufacturing industries (with only two industries in this category when excluding the electronics industry).

productivity in an individual industry is calculated by multiplying the (non-standardised) effect of the fifth timespan by the industry's Leontief coefficient in relation to the electronics industry and then by the observed change in value added in the electronics industry in 2009–2013. After this, we take the average for the industries weighted by the industries' employment shares and compare the figure with the actual decline in productivity. Based on these calculations, the electronics industry shock explains at least 30% of the decline in productivity growth in the private sector (excl. the electronics industry) in the years in question. This result can, however, be regarded as the lower limit for the actual overall effects of the Nokia crisis, as the model does not take account of other channels of the effect of the shock, such as a decline in investments and innovation. In addition, it could be argued that, since Nokia played such a significant role in the Finnish economy, the role played by the electronics industry for other domestic industries was also more significant in Finland than was the case on average in other countries. This, too, would make the results of this estimation cautious and, consequently, the effects of the shock on other industries may, in reality, have been greater. It was, however, tested during the analysis that the results for Finland did not differ statistically significantly from the results for the group of countries as a whole.

By way of further examination, it was also studied whether the shock affected productivity dispersion, concentration or allocative efficiency within subcontracting industries. The model was estimated one by one for each dependent variable. It was observed that the electronics industry shock affects all of these three factors in the same direction as the direction of the shock. According to the estimation of the model, the negative shock experienced by the electronics industry lowers productivity dispersion within other industries in the private sector. Productivity differences decreased between the 90th and 50th percentiles by around 30% and between the 50th and 10th percentiles by around 15%. In other words, productivity dispersion became lower at the top end of the productivity distribution, between enterprises with the highest and average productivity. Lower dispersion is seen in both manufacturing and services, but particularly in digital-intensive services. The analysis indicates that, in manufacturing, lower productivity dispersion is also combined with lower concentration within the industry, which results in lower allocative efficiency. The shock did not have much of an effect on allocative efficiency of services.

5.4 Summary

To sum up, it can be concluded that the results of the model mean that the decline in the demand for Nokia products was a relatively significant factor also underlying the slowing of productivity growth in other industries. The shock experienced by the electronics industry explains at least 30% of the decline in labour productivity seen in the private sector (excl. the electronics industry) in 2009–2013. The biggest effect was seen in the manufacturing and digital-intensive services industries with the closest links to the electronics industry. The result is interesting, as it is specifically in these sectors that productivity growth has been observed to be the weakest (Finnish Productivity Board, 2021, Figures 3.3 and 3.4).

The negative shock had a particular effect on the most productive enterprises in the subcontracting industries, which in turn resulted in lower productivity dispersion and allocative efficiency. As shown in conjunction with the previous report of the Finnish Productivity Board (2021) and Chapters 4 and 6 of this report, productivity dispersion and allocative efficiency are lower in Finland than on average in the reference countries. This means that the results of the analysis presented in this chapter would imply that the shock that hit Nokia was a factor contributing to these structural features typical of the Finnish market.

The change in demand structure experienced by Nokia and, consequently, its subcontractors in practice turned into a permanent negative supply shock for the Finnish economy. Nokia accounted for a considerable share of enterprise R&D expenditure in Finland. The shock probably also resulted in the destruction of a lot of technology, whereby measures such as demand stimulus would not have helped in a situation like this. Instead, supporting and developing new substitute technologies might have prevented the productivity collapse. However, such innovation requires significant R&D investments, and there is a long time lag before the impacts can be seen. After this, enough new enterprises and their market trials are still needed and, after that, it will still take time to allocate resources between new and old enterprises. Knowing that resource allocation is poorer in Finland than in the reference countries, it is very possible that the time lag between R&D investments and effects is even longer than usual.

6 Competitive nature of markets and business dynamics

This chapter supplements the analysis of the previous report of the Finnish Productivity Board (2021) concerning enterprise innovation activities as well as the competitive nature and regeneration of markets.

6.1 Introduction

According to Schumpeterian endogenous growth theory, productivity growth is primarily based on innovations and creative destruction, i.e. change in enterprise and job structures increasing the productivity of the national economy. Competition in turn is one of the factors underlying both of these. Theoretical and empirical studies indicate that competition typically boosts enterprise innovation activity – especially in enterprises that are at the forefront of technological progress or at least close to it. Competition and enterprise innovation also result in creative destruction when more productive enterprises and jobs replace less productive ones. The underlying economic theory was discussed in Chapter 3 of the previous report, which is why we will not go into further detail on the theory here.

The purpose of this chapter is to assess whether there have been changes in the competitive situation of markets and in business dynamics that would explain Finland’s slower productivity growth since the financial crisis. The competitive nature and business dynamics of markets can be assessed using a variety of economic indicators. This chapter includes both static and dynamic indicators of competition. If the aim is to obtain a picture of the market’s competitive situation that is as accurate as possible, it is important to examine both of these. At times, even if static indicators such as high enterprise profitability and high industry concentration indicate a weak competitive situation, dynamic indicators may show strong regeneration of industries and the economy, whereby there may possibly be less cause for concern.

6.2 Data

As in the previous report of the Finnish Productivity Board (2021), the analysis is based on OECD calculations. Received by the Productivity Board in December 2021, the calculations used two extensive databases (MultiProd, version 2 and DynEmp, version 3.2). The databases contain a large quantity of indicators regarding enterprises (productivity, profitability, size, age, industry, etc.), enterprise structures (number of enterprises, productivity dispersion across enterprises, market structure, etc.) as well as business dynamics (new and exiting enterprises, growth of new enterprises, employment contribution of young enterprises, etc.).

This chapter includes both competitiveness and business indicators presented in the previous report as well as new indicators. Unlike earlier, this chapter does not discuss allocative efficiency, as Chapter 4 provides a broader look at the theme. However, the results of OECD's allocative efficiency calculations are in line with Chapter 4. The time series of all indicators are longer than before, starting from 2004 and extending to 2018. This time we also present the entire time series instead of just averages, which helps to see the big picture. Due to a time series gap relating to the overhaul of Statistics Finland's business statistics, 2013 was omitted from the time series for Finland. In the analysis, Finland is compared with a group of reference countries comprising the following countries: Belgium, France, Italy, Portugal and Sweden. The group of reference countries was determined on the basis of data availability and comparability with Finland.[17]

The analysis focuses on the manufacturing and service industries, as these industries account for the largest share of value added in the national economy and employ the largest number of people in many countries. The indicators feature a classification where these industries have been divided further into four groups: 1) digital manufacturing, 2) non-digital manufacturing, 3) digital services and 4) non-digital services (see Calvino et al., 2018). As regards new micro-enterprises, however, for confidentiality reasons, data is only available at SNA A7 level, which is why the industries have been divided into manufacturing and services.

[17] The robustness of the results was ensured by performing an analysis of a broader group of reference countries too. The group of countries used was ultimately selected on the basis of them being found in both the MultiProd and the DynEmp database.

Table 6.1. Industry classification

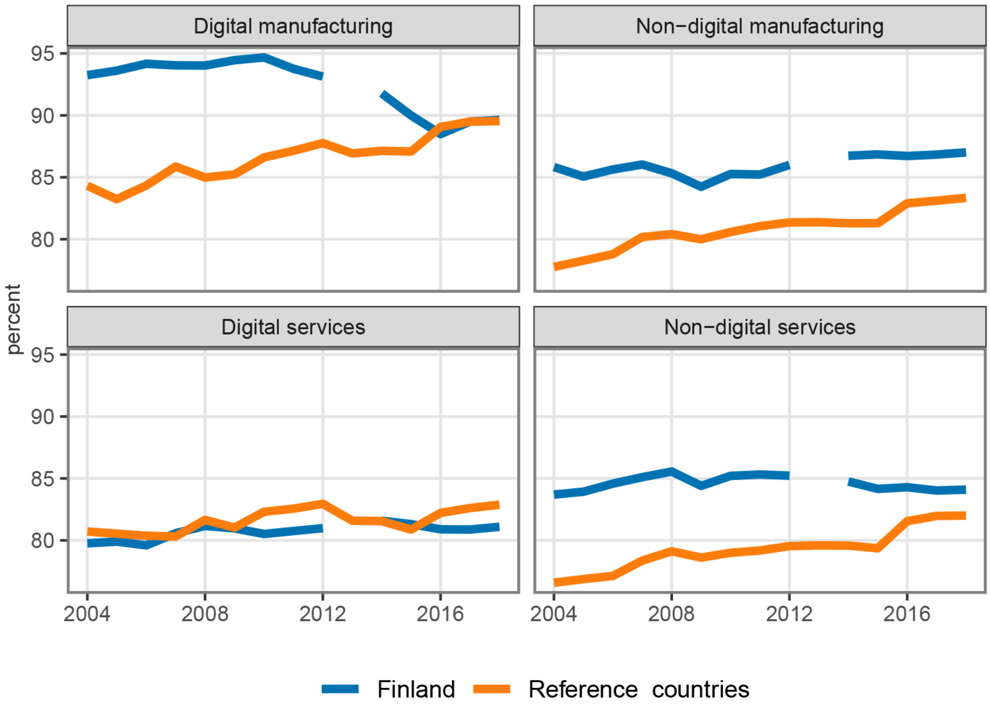
Digital manufacturing	Non-digital-manufacturing	Digital-services	Non-digital-services
Computer, electronic and optical products	Food products, beverages and tobacco	Telecommunications	Wholesale and retail trade
Machinery and equipment	Textiles and wearing apparel	IT	Transportation and storage
Transport equipment	Wood and paper products	Legal and accounting	Accommodation and food service activities
	Chemicals	Scientific research	Media
	Rubber and plastics products	Marketing	
	Metal products	Administrative and support services	
	Electrical equipment		
	Furniture and other		

6.3 Market concentration

Market concentration can be measured in various ways. Here it is examined using two indicators: the market share of the output of the top 10 enterprises (Figure 6.1) and the market share of enterprises calculated using the Herfindahl-Hirschman Index (HHI) (Figure 6.2), which gets the value 1 in a monopoly situation and a value close to 0 when the market share of all enterprises is low. Both indicators show that the Finnish market is more concentrated than the markets of the group of reference countries. Unlike in the group of reference countries, the market share of the top 10 countries has also remained at a relatively stable level over the period examined, with the exception of digital manufacturing where the difficulties of the electronics industry are reflected as a decline in the indicator. On the other hand, the HHI indicates slightly higher market concentration in Finland over the period examined in digital services, but the scale is very small.

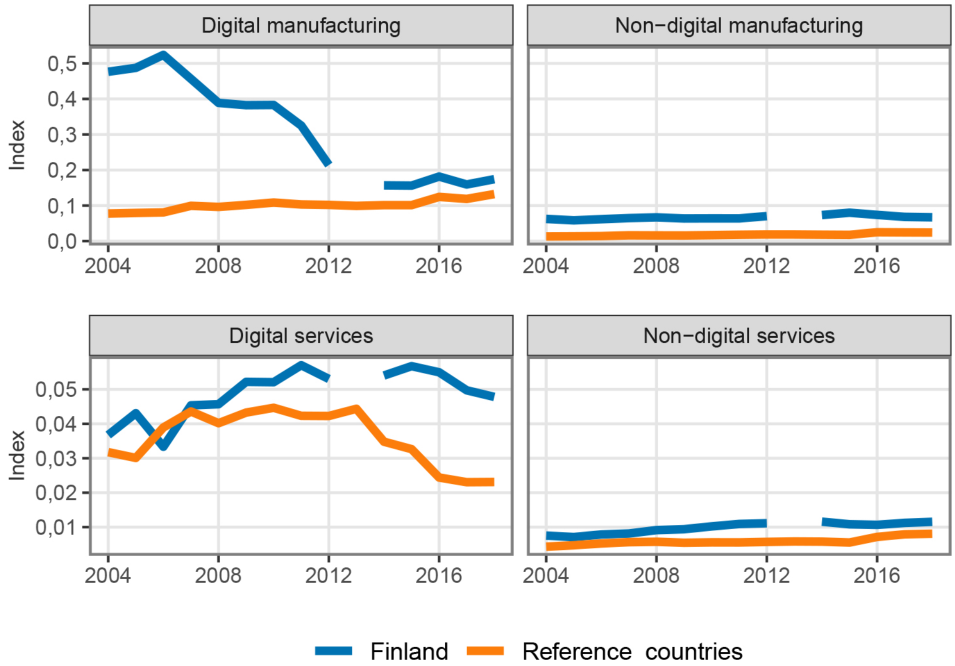
A particularly concentrated market may indicate low competition. This, however, is not necessarily the case due to, for example, competition from outside the market or if a strong market position results from successful past innovation. It is therefore necessary to also examine other indicators before drawing any further-reaching conclusions.

Figure 6.1. Market share of output of top 10 enterprises, %



Source: OECD MultiProd project, http://oe.cd/multiprod, December 2021

Figure 6.2. Herfindahl-Hirschman Index.



Source: OECD MultiProd project, http://oe.cd/multiprod, December 2021

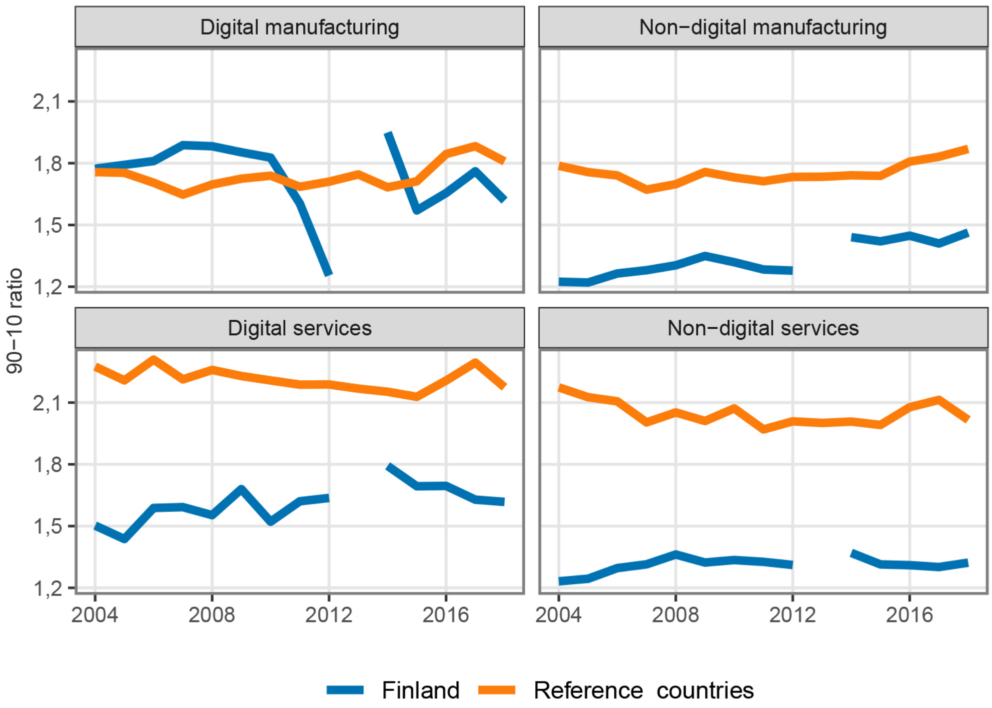
6.4 Dispersion of total factor productivity between enterprises

This time the indicator used for total factor productivity (TFP) dispersion is the ratio of the TFP of high-TFP enterprises (those at the 90th percentile of the productivity distribution) and to the TFP of low-TFP enterprises (those at the 10th percentile). For example, a value of two for this indicator shows that the TPF of the high-productivity enterprise is twice as high as that of the low-productivity enterprise.

Figure 6.3 shows that TFP dispersion across enterprises is lower in Finland than in the group of reference countries. However, once again the exception to this is the electronics industry where productivity dispersion, which at the start of the period examined had been higher than in the group of reference countries, dropped following the collapse of a high-productivity enterprise (Nokia). In other industries, productivity dispersion has also remained relatively unchanged over time.

Low productivity dispersion is not necessarily a cause for concern from the competition perspective. High productivity dispersion in turn might indicate that competition is so low that low-productivity enterprises also manage to remain in the market. On the other hand, high productivity dispersion is often also a sign of intensive innovation thanks to which enterprises at the forefront of technological progress have managed to make a break from the others. Therefore, low productivity dispersion may also point to a lack of high-productivity enterprises or their too low a share of production inputs and outputs.

Figure 6.3. Dispersion of total factor productivity (ratio of high- and low-productivity enterprises).



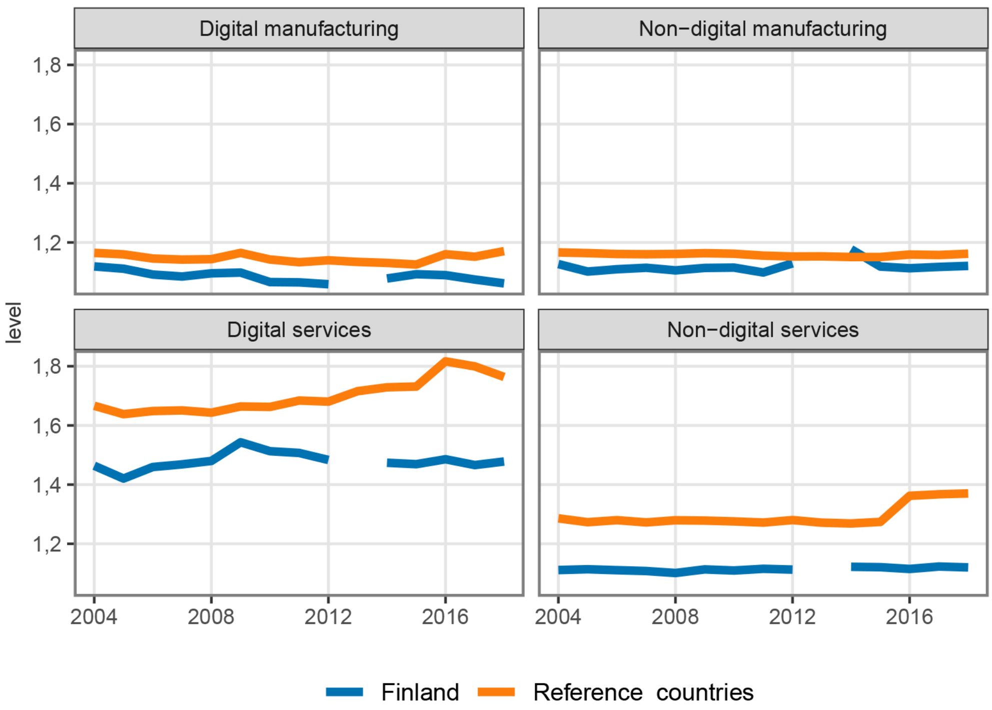
Source: OECD MultiProd project, http://oe.cd/multiprod, December 2021

6.5 Markups

Figure 6.4 shows that enterprise markups, which reflect enterprise profitability, are lower in Finland than in the group of reference countries on average. This is the case particularly in services. In manufacturing, international competition is likely to have harmonised markups of enterprises of different countries to an internationally competitive level. The figure shows that markups have remained relatively unchanged throughout the period examined. Fluctuation has been highest in digital industries.

Low markups are a positive sign when assessing the market's competitive nature. High markups in a highly concentrated market situation might indicate that enterprises are able to increase the margins on their goods and, consequently, their profitability as they have significant market power. In the case of Finland, however, this does not appear to be the case despite the concentrated market. Low markups would indicate a relatively competitive market.

Figure 6.4. Enterprise markups (calculated using the De Loecker & Warzynski (2012) method).



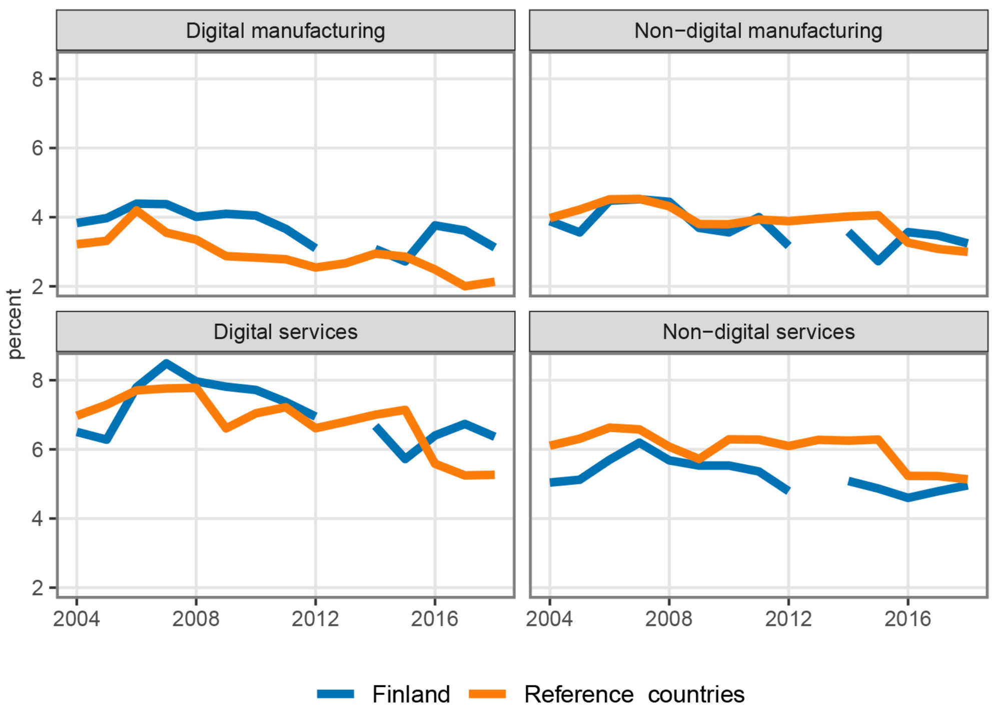
Source: OECD MultiProd project, http://oe.cd/multiprod, December 2021

6.6 Business dynamics

The market entry of new enterprises is a key element of economic regeneration and productivity growth. According to Schumpeterian growth theory, the market entry of new and more productive enterprises increases competition and creative destruction. The market entry of new enterprises either incentivises enterprises already in the market to innovate even more or, correspondingly, forces their exit from the market when they fail to compete against the new enterprises.

Figure 6.5 shows that the market entry of new enterprises is at a relatively similar level to that seen in the group of reference countries. There is, however, industry-specific variation: in digital manufacturing industries, more new enterprises enter the market than in the group of reference countries, whereas in non-digital service industries fewer new enterprises enter the market than in the group of reference countries. The share of new enterprises of all enterprises operating in the market has declined in Finland from 2007 onwards, but this has also occurred in the group of reference countries. This is in line with analysis by Calvino et al. (2020), according to which business dynamics have declined in many countries in recent decades.

Figure 6.5. Market entry of new enterprises, %.

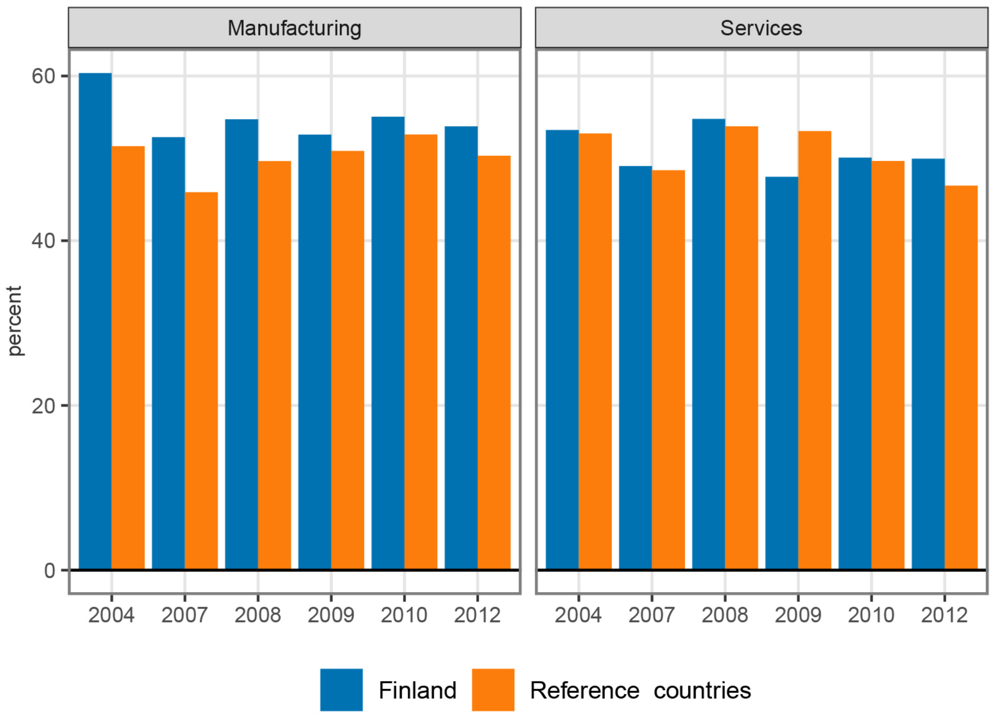


Source: OECD DynEmp project, http://oe.cd/dynemp, December 2021

The market entry of new enterprises is not an entirely unproblematic indicator. High market entry rates of new enterprises may result from, for example, mergers and acquisitions due to which business identity codes change and appear in data as new enterprises. This is why the following focuses only on new micro-enterprises with 2–9 employees. In addition, it is specifically new micro-enterprises that have been found to significantly boost the creation of new jobs (see e.g. Criscuolo et al., 2017; Haltiwanger et al., 2013).

Figure 6.6 shows the percentage of new micro-enterprises still remaining in the market of all new micro-enterprises five years after market entry, in other words the market survival of new micro-enterprises. The years on the x-axis are the years when the enterprises entered the market. The figure shows that the market survival of micro-enterprises is largely in line with the group of reference countries. In manufacturing, new micro-enterprises appear to have survived better in Finland, especially in the earlier cohorts. In services, too, the survival rate of new micro-enterprises has been slightly higher in Finland, except for the 2009 cohort.

Figure 6.6. Share of new micro-enterprises still in the market five years after market entry, %.

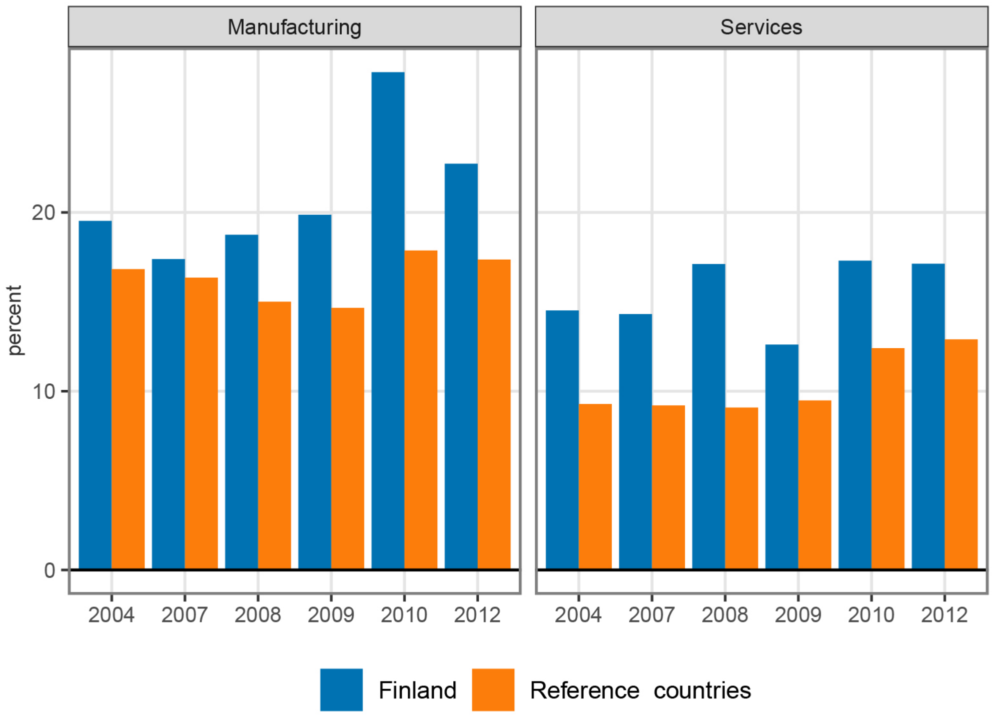


Source: OECD DynEmp project, http://oe.cd/dynemp, December 2021

The higher survival rate may indicate that enterprises manage to operate in the market even if not successful. However, figures 6.7 and 6.8 indicate that this is not the case for Finland, as the higher survival rate is also associated with stronger growth.

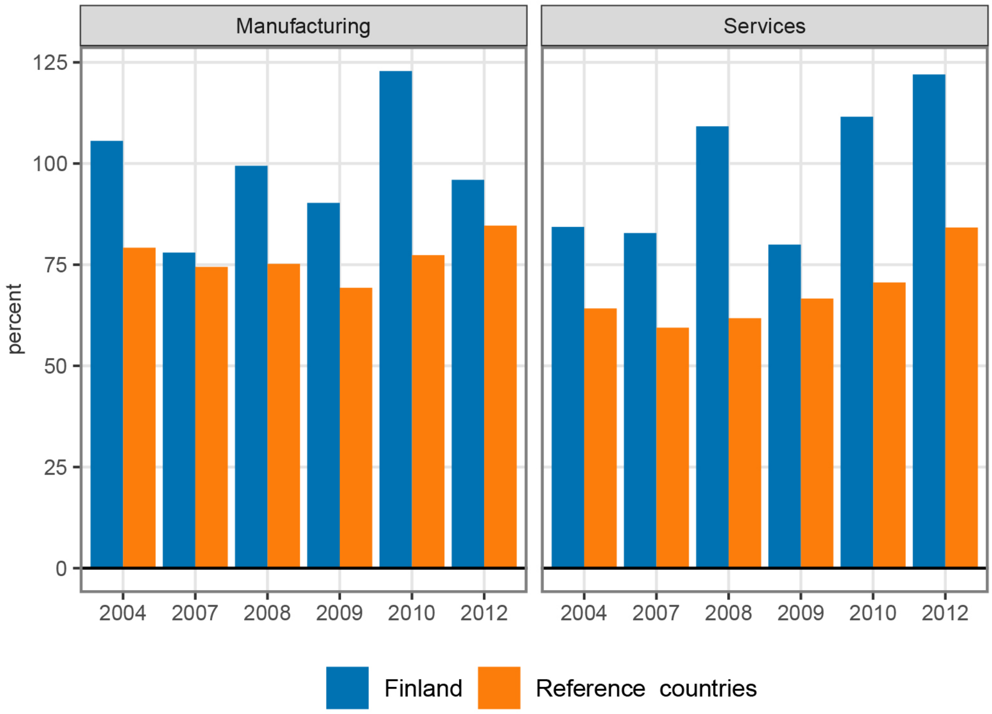
According to Figure 6.7, a considerably higher percentage of micro-enterprises manages to grow in Finland than on average in the group of reference countries. By calculating the averages of the cohorts shown in the figure for manufacturing (services), we obtain that, in five years after market entry, 21% (16%) of enterprises with 2–9 employees had grown into enterprises with 10 or more employees in Finland. The corresponding figure for the group of reference countries is 16% (10%). Figure 6.8 also shows that these enterprises that survived and grew also grew more in Finland than in the group of reference countries.

Figure 6.7. Share of new micro-enterprises that grew of all new micro-enterprises that survived five years after market entry, %.



Source: OECD DynEmp project, http://oe.cd/dynemp, December 2021

Figure 6.8. Employment growth of new micro-enterprises five years after market entry, %.

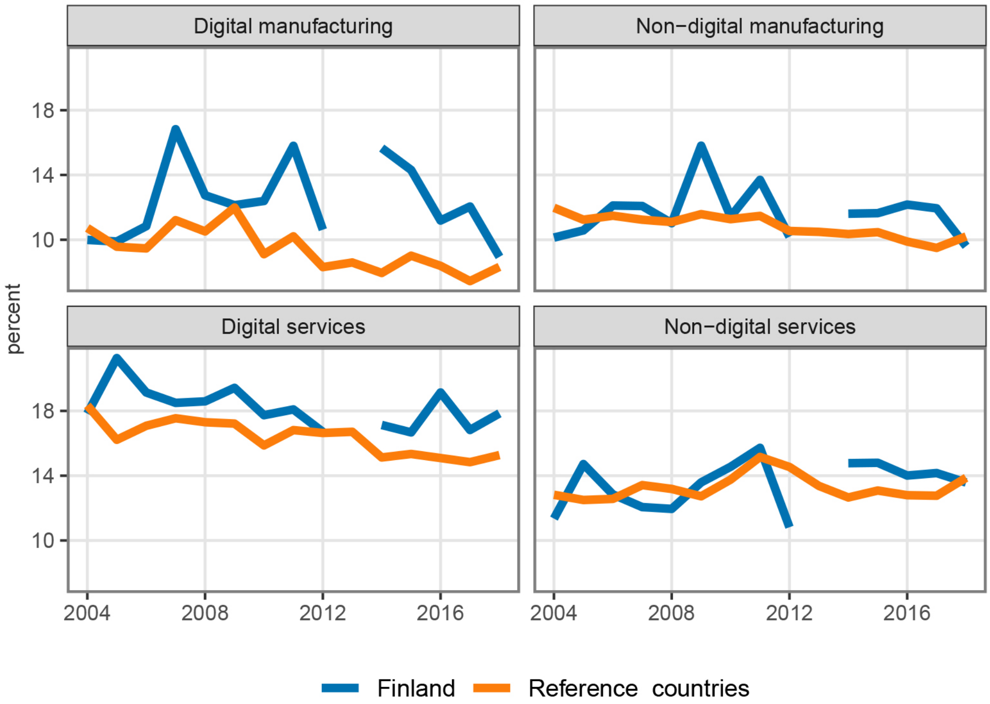


Source: OECD DynEmp project, http://oe.cd/dynemp, December 2021

All in all, these three indicators show that startup growth is faster and larger in Finland than in the group of reference countries. As regards the market's competitive nature, however, strong growth of new micro-enterprises may mean at least two opposite things. Firstly, strong startup growth may point to a good competitive situation if the growth is based on intensive innovation aiming to challenge enterprises already in the market. This also incentivises innovation among non-startups. On the other hand, the higher survival rate of micro-enterprises combined with their strong growth may point to stricter regulation of market entry.

Figure 6.9 presents one more indicator: within-industry reallocation of jobs in non-startups, i.e. the percentage of new jobs and lost jobs of all non-startup jobs. In this context, non-startups mean enterprises that are not enterprises entering or exiting the market in the year examined. The figure shows that job reallocation has been at a rather high level in Finland compared with the group of reference countries, particularly in digital industries. It was found when examining individual industries (at SNA A38 level) that the only industries with lower reallocation of jobs in Finland than in the group of reference countries were 'Food products, beverages and tobacco', 'Media' and 'Accommodation and food service activities'. As is the case with the market entry of new enterprises, the job reallocation trend has also been declining since the very first years in Finland and the group of reference countries alike, with the exception of non-digital services.

Figure 6.9. Job reallocation in non-startups, %.



Source: OECD DynEmp project, http://oe.cd/dynemp, December 2021

6.7 Summary

In Finland, the market is significantly more concentrated than in the group of reference countries. On the other hand, this has not resulted in higher markups for enterprises. Since dynamic indicators also point to continuous regeneration of production activity at the enterprise level, the significant market concentration does not seem to provide as much cause for concern as might appear at first.

In Finland, the dispersion of total factor productivity across enterprises is lower than in the group of reference countries. Low productivity dispersion combined with low allocative efficiency (see e.g. Chapter 4) may be a sign of a market shortage of high-productivity enterprises to which resources could be allocated rather than a sign of there being a lot of low-productivity enterprises in the market. Chapter 5 also suggested that the electronics industry crisis has had the greatest negative effect specifically on more productive enterprises. In such a situation, even an efficient reallocation of labour inputs (referring in this regard to e.g. Figure 6.9) has limited capacity to improve productivity, as there are no high-productivity enterprises to which labour could move.

The survival and growth of new micro-enterprises in Finland are stronger than in the group of reference countries. Possible factors underlying the stronger growth might include stricter regulation of market entry or the fact that the protection of innovations by means of, for example, patents and copyrights is stronger in Finland than in many other countries. On the other hand, strict regulation of market entry usually reduces the number of new enterprises entering the market, which, however, does not appear to be the case according to Figure 6.5. Stronger protection of innovations may have resulted in the market also automatically becoming more concentrated, with Finland having been ranked among the leading countries in terms of protection of intellectual property rights (e.g. Property Rights Alliance, 2021).

As regards competition, the indicator time series analysed does not show any significant movement in a more unfavourable direction specifically around the financial crisis years. It therefore appears unlikely that lack of competition as such would be a distinguishing factor underlying Finland’s poorer productivity growth in the post-financial crisis years. Instead, more likely distinguishing factors have included, as already pointed out above in this report too, lower allocative efficiency, weakened competitiveness in the post-financial crisis years, and the number of negative demand shocks experienced by Finland (e.g. the electronics industry crisis, export shock, difficulties of paper manufacturing).

Overall, the results are therefore similar to those presented in the previous report of the Finnish Productivity Board (2021). However, we have now obtained further confirmation of the problems not lying in business dynamics. In addition, the relatively low markups of enterprises affirmed the view that a concentrated market as such does not appear to be a very great cause for concern from the competition perspective. Instead, potentially problematic issues include lower allocative efficiency and the possible lack of high-profitability enterprises or their too small a share of production inputs and outputs.

7 Effect of export shock on productivity[18]

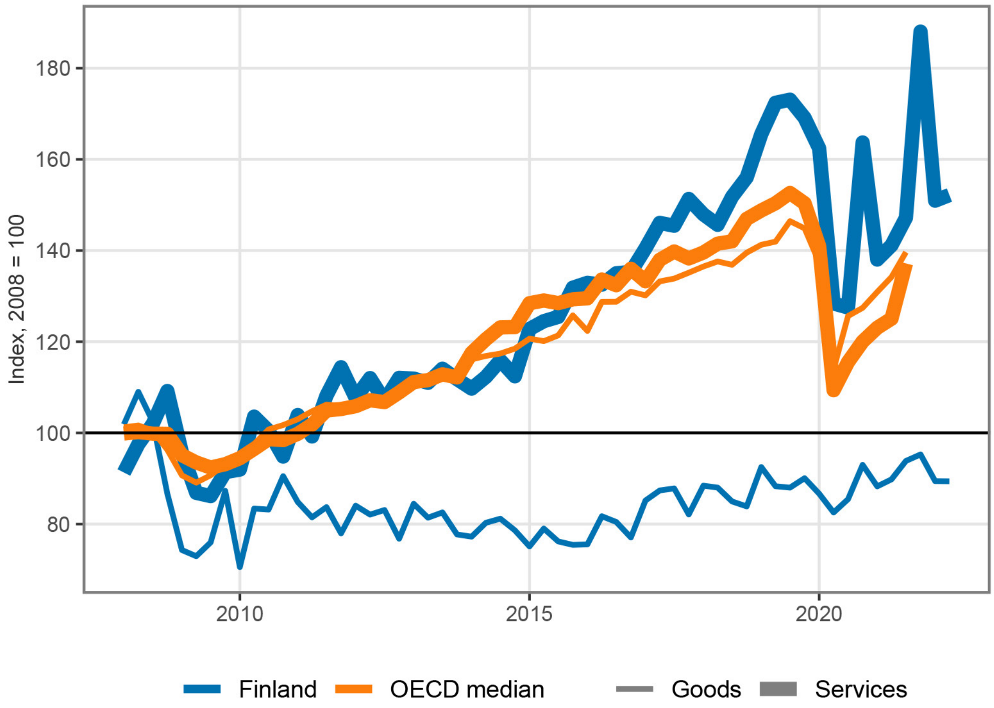
7.1 Introduction

In 2009, world trade experienced a sudden collapse. The common view is that this was a demand shock triggered by the financial crisis. The crisis spread at an unprecedented speed through global production and value chains (Baldwin, 2011).

As a small open economy, Finland is highly dependent on export performance. This meant that the collapse in global demand had significant implications on Finland. In 2009, exports of manufacturing industries declined by more than 25% and, unlike in OECD countries on average, they did not recover to the 2008 level by 2022, either (see Figure 7.1). This development was partly affected by the difficulties experienced by Nokia, but even they alone cannot explain the poor export development. In contrast, the decline in exports experienced by services was slighter, with service exports recovering rapidly in Finland and the OECD countries to the pre-crisis level.

[18] As was the case with the examination of the shock experienced by the electronics industry, this chapter is also based on a productivity analysis commissioned from the OECD by the Finnish Productivity Board, the Economic Policy Council and the Research Division on Business Subsidies. The analysis was conducted by the OECD Directorate for Science, Technology and Innovation (STI), which will also publish its own research paper on the topic in autumn 2022, presenting the analysis methods and results in considerably more detail than this chapter. (OECD, upcoming)

Figure 7.1. Exports of services and goods in Finland and OECD, 2008=100.



In the figure, the fine line indicates services and the thick line goods. The series representing Finland are marked in blue and the median for OECD countries in orange colour.

The purpose of the analysis is to assess whether such severe and sudden yet short-term global shock to demand creates a longer-term negative effect on productivity growth. In other words, the aim is to establish whether the export shock was a factor contributing to the persistent slowing of Finland's productivity growth after the financial crisis.

Previous reports of the Finnish Productivity Board have suggested that the export shock was one of the reasons for Finland's relatively slow measured productivity growth after the financial crisis. This was caused in part by lost export competitiveness. Exporters were unable to increase value added at the previous rate or the rate of reference countries even though the national economy maintained employment and hours worked reasonably well. The analysis presented in this chapter is, however, the first known occasion when the shock is examined on the basis of the network of value chains. This way the results also include indirect impacts channelled through networks.

7.2 Data and model

As was the case when analysing the shock experienced by the electronics industry, this analysis makes use of numerous OECD databases (STAN, ICIO, MultiProd, DynEmp) and covers the same 16 OECD countries to ensure a sufficient number of observations. The period (2000–2018), industries (21 private-sector industries) and dependent variables (value added, labour productivity, output and employment) are the same.

The basic idea of the analysis is the same as in the model used in Chapter5: the aim is to establish how the effects of the shock spread through value chains. Unlike in the model examining the electronics industry shock, this time the analysis does not only cover the decline in value added in the electronics industry. Instead, the aim is to establish how the shock affecting the external demand of all 21 industries spread domestically to other domestic industries. The model assumes that the shock itself, i.e. the change in exports, only lasts one year.

More detailed description of the model

To examine the effects of an external demand shock, economic literature often uses a so-called shift-share instrument. As the name implies, the instrument consists of two components. The first represents the size of the shock (shift), such as percentage of value-added growth in the destination country and industry $\Delta \log VA_{b,q,t}$. The second component represents a predetermined rule for the share and distribution of the shock in the economy (share). For this, the method usually uses the share of exports from country of origin c, industry s to destination country b, industry q of total global exports to the industry in the destination country at the start of the period examined. More specifically,

$$share_{c,s\to b,q} = \frac{X_{c,s\to b,q,2000}}{\sum_c \sum_s X_{c,s\to b,q,2000}}$$

Consequently, the shift-share instrument ($SSS_{c,s,t}$) is as follows:

$$SSS_{c,s,t} = \sum_b \sum_q share_{c,s\to b,q} * \Delta_{h=1} \log VA_{b,q,t}.$$

However, this instrument only takes account of direct input-output links between industries and therefore not the linkages across the entire value change. This is why the instrument is expanded by including the Leontief coefficient. This time the number of coefficients is considerably larger than in the model used for the electronics industry because, instead of examining the coefficients of other industries relative to the electronics industry, here all 21 industries are examined in relation to each other. The average of the Leontief coefficient is calculated for each industry pair as follows

$$\lambda_{s\to q} = \frac{\sum_{t=2000}^{2018} \sum_c \sum_b \lambda_{c,s\to b,q,t}}{T * N_c} .$$

When these coefficient averages are added to the instrument, we obtain the expanded shift-share instrument $(ASS_{c,s,t})$

$$ASS_{c,s,t} = \sum_b \sum_q \lambda_{s\to q} * share_{c,s\to b,q} * \Delta \log VA_{b,q,t}.$$

Next, the actual regression model can be written out

$$\Delta_h DV_{c,s,t} = \beta_h ASS_{c,s,t} + \gamma_{c,s} + \theta_{c,t} + X_h \delta + \varepsilon_{c,s,t},$$

where $\Delta_h DV_{c,s,t}$ is the dependent variable, $\gamma_{c,s}$ is the country-industry fixed effect, $\theta_{c,t}$ is the country-time fixed effect and X_h is the control variable selected in accordance with the dependent variable. In practice, it is often the value of the dependent variable at a time in the past h. As with the model in Chapter 5, the results are examined over three different timespans h: 1, 3 and 5 years after the shock.

It was tested during the analysis that the results for Finland did not differ statistically significantly from the results for the group of countries as a whole.

7.3 Results

Tables 7.1 and 7.2 present the effects of the export shock on the development of manufacturing and service industries. The effects are standardised to allow for better comparisons of the connections between the various independent variables and the dependent variable.

The tables show that the change in external demand has had effects in the same direction on value added, output and employment in both manufacturing and service industries. The effect on value added is strongest over the short timespan, whereas the effect on employment remains high also in the longer run. As a result of these, the effect on labour productivity wears off over the longer timespan. Consequently, the export shock does not appear to have caused the longer-term decline in productivity growth. In the short run (the first year), however, the export shock did have a significant effect on the productivity decline.

Table 7.1. Effect of export shock on development of manufacturing industries

		Change in value added	Change in output	Change in employment	Change in labour productivity
After one year	Effect of export shock on industries	0.0942*** (0.0230)	0.104*** (0.0224)	0.0666*** (0.0210)	0.0321* (0.0173)
	Number of observations	2,986	2,732	2,973	2,472
	R^2	0.672	0.726	0.329	0.543
After three years	Effect of export shock on industries	0.0169 (0.0109)	0.0160 (0.0151)	0.0609*** (0.0170)	-0.0222 (0.0140)
	Number of observations	2,635	2,409	2,616	2,164
	R^2	0.778	0.765	0.601	0.781
After five years	Effect of export shock on industries	0.00981 (0.00944)	0.0228* (0.0118)	0.0436*** (0.0131)	-0.0202* (0.0104)
	Number of observations	2,276	2,078	2,266	1,854
	R^2	0.862	0.827	0.757	0.867

The effects have been standardised, which means their interpretation is not as direct as with non-standardised coefficients. Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.001.

Table 7.2. Effect of export shock on development of service industries

		Change in value added	Change in output	Change in employment	Change in labour productivity
After one year	Effect of export shock on industries	0.117*** (0.0256)	0.113*** (0.0252)	0.0631** (0.0290)	0.0676** (0.0296)
	Number of observations	2,267	2,030	2,262	2,103
	R^2	0.839	0.870	0.373	0.573
After three years	Effect of export shock on industries	0.0158 (0.0173)	0.0195 (0.0179)	0.0713** (0.0291)	0.00362 (0.0281)
	Number of observations	2,001	1,794	1,996	1,851
	R^2	0.904	0.914	0.659	0.793
After five years	Effect of export shock on industries	0.0196 (0.0167)	0.0360** (0.0181)	0.104*** (0.0270)	-0.0194 (0.0320)
	Number of observations	1,733	1,556	1,728	1,597
	R^2	0.939	0.940	0.812	0.866

The effects have been standardised, which means their interpretation is not as direct as with non-standardised coefficients. Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.001.

As was the case with the electronics industry shock, these effects can be used to assess how the shock affected Finnish aggregate productivity. It is observed that the export difficulties and the spread of the shock through global and domestic value chains may explain more than 65% of the decline in Finnish aggregate productivity in 2009.

As before, the model only contains the effects channelled through value chains and does not take account of other channels (such as decline in investments and in market entry of enterprises) through which the shock may have affected productivity. In addition, it could be argued that, since Finland is a small open economy, the role played by exports for other domestic industries was also more significant in Finland than was the case on average in other countries. This, too, would make the results of this estimation cautious and, consequently, the effects of the shock on the national economy may, in reality, have been greater. That is why it was tested during the analysis whether the results for Finland differed from the results for the entire group of countries. It was observed that this was the case in the short run (one year after the shock), but there was no difference over the longer timespans. In the short run, the effect on Finland was greater than for the group of countries on average, so the 65% result can for this reason also be regarded as the lower limit for the effect.

Within-industry effects were not as significant as in the case of the shock experienced by the electronics industry. The results of the analysis (not included in Tables 7.1 and 7.2) indicate, however, that the effects of the export shock mostly affected the top half of the productivity distribution, i.e. the most productive enterprises. No effect from the shock was observed in the concentration or allocative efficiency of industries.

As labour productivity growth in Finnish manufacturing was weaker than in the reference countries after the 2009 export shock (Figure 7.2), the causes must be found in Finland rather than in the export shock. Based on the analysis discussed in Chapter 5, the electronics industry shock explains at least 30% of the labour productivity decline experienced in other manufacturing. For the remaining 70% or so, the causes lie elsewhere. Since no similar change occurred in the productivity of service industries (Figure 7.3), this points to causes concentrating on manufacturing, such as the cost competitiveness of manufacturing.

Figure 7.2. Labour productivity in manufacturing, 2007=100.

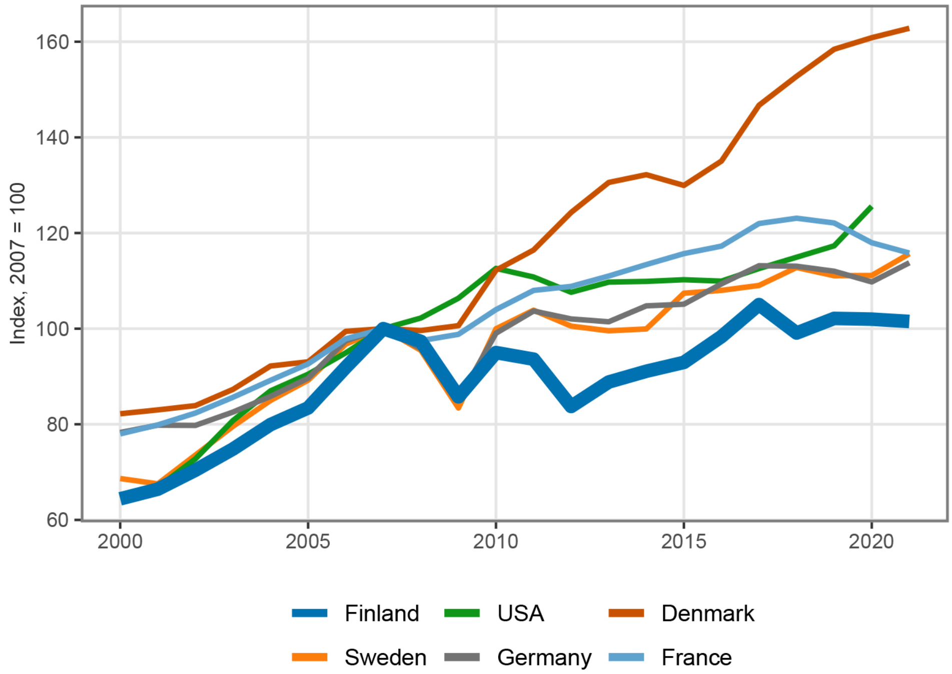
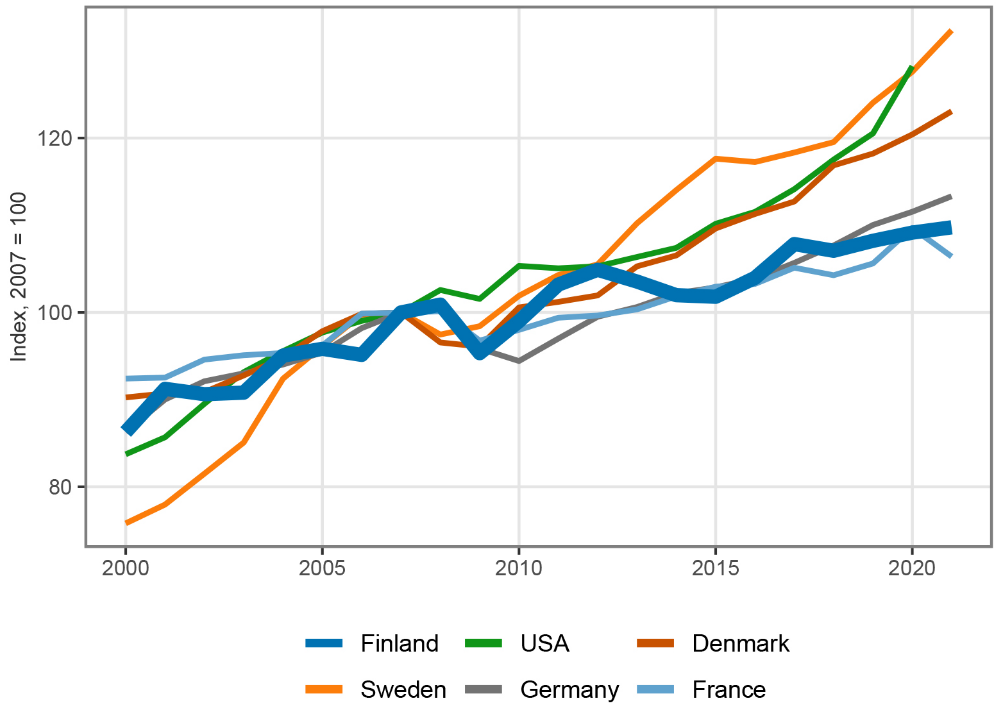


Figure 7.3. Labour productivity in services, 2007=100.



8 Innovation policy

Innovation policy refers to a broad set of policy measures that promotes innovation and the strengthening of R&D activity and the competence base that support innovation. It involves multilateral cooperation domestically and internationally, increases in the number of enterprises engaged in innovation, and regeneration of industries. The main aim of innovation policy is, by means of internationally successful innovations, new products, services and business models, to increase productivity, support sustainable economic and employment growth and increase citizens' prosperity and wellbeing. (Koski et al., 2019)

A key rationale for innovation policy is that innovations create externalities. There is research evidence of the societal benefits of innovations being significantly greater than their private returns. From society's perspective, the market alone does not invest enough in innovation, as knowledge relating to innovation "spills over" to competitors. This market failure slows the elevation of the standard of living in society and is at the same time regarded as a justification for public measures to promote innovations (Goolsbee & Jones, 2021).

The larger the difference between societal and private returns of innovation, the more justifiable it is to provide public support to innovation activity. According to Takalo (2014), economic literature estimates that externalities are greatest at the front end of the innovation process, such as in basic research and in sectors where the market mechanism functions poorly (e.g. education and training, national defence, healthcare and environmental technology)[19] and therefore, in innovation policy, public authorities should focus particularly on research as well as education and training relating to the early stages of the innovation process. Support for innovations has also been justified by financial market imperfections. It may be difficult for new enterprises based on intangible capital to access finance in the market due to informational asymmetries, high uncertainty, risk and lack of collateral.

In practice, innovation policy is a collection of approaches employed during different periods of time and based on different motives as well as related policy instruments. Traditional innovation policy directs public inputs at knowledge generation at

[19] Categorising research and innovation activity into different stages does not do justice to the modern research process. The various phases are often done at the same time and overlap in the same organisations. Depending on the funding provider and the objectives, the following four stages can, however, be distinguished: 1) Basic research 2) Applied research 3) Development activity 4) Commercialisation and other societal utilisation of scientific knowledge. (Working Group on Sustainable Growth)

universities and other public research organisations, at supporting enterprise R&D, and at strengthening the protection of intellectual property rights (IPR). According to systemic innovation policy, policy must also fix problems that hamper innovation activity and innovation spread (Halme & Niinikoski, 2019). Mission-oriented innovation policy seeks new solutions to specific challenges. It endeavours to take account of all the phases of the innovation process and the complementary measures (EC-DGRI, 2018; Gross & Sampat, 2021). The coordinated mobilisation of the US scientific community to develop solutions to win World War II is an example of this (Gross & Sampat, 2021). In recent years, burning societal problems such as climate change have led researchers to outlining transformative innovation policy based on the advancement of sustainable development. According to this approach, sustainable development problems cannot be solved exclusively by means of technological innovations. Instead, institutional and social innovations are also required (Lemola, 2021)

8.1 Challenges of innovation policy

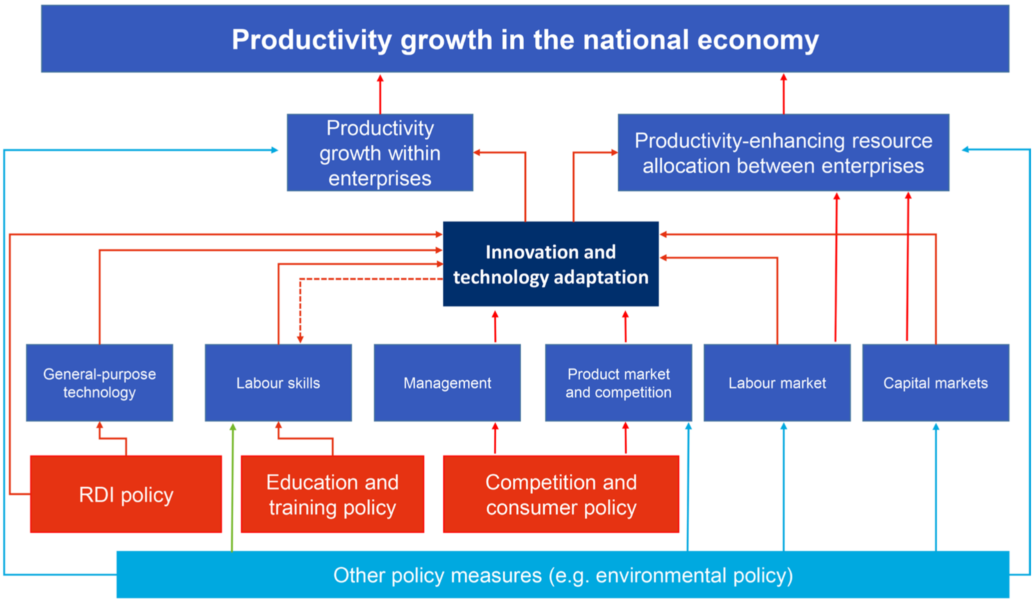
The usability of theories justifying innovation policy is not necessarily sufficient for the development of practical policy. Market failure theory does not provide an answer to the basic policy question of the societally optimal level of R&D investment. It has often proved to be challenging to coordinate the innovation system in a complex society (Halme & Niinikoski, 2019). Measures designed to correct a market failure or a system may have resulted in undesirable outcomes, such as public funding crowding out private innovation funding (so-called government failure). Path dependence may also present problems: National innovation systems evolve in interaction with a country’s economic system (dominant industries, etc.) as well as its political and institutional system, providing each country’s “knowledge infrastructure” with a distinct national flavour. This may be problematic if an innovation system or policy change is necessary due to economic shocks or disruptive market development. (Edler & Fagerberg, 2017)

Effective innovation policy provides direction for innovation efforts of enterprises, is credible and is not subject to frequent, unpredictable changes (Edler & Fagerberg, 2017). This may be difficult if, for societal, economic or political reasons, the focus is on acute or relatively short-term objectives (cf. Finnish R&D input cuts in the 2010s or the long-term wrangling over the allocation of business subsidies). Investments made on the basis of political passions and hype or the equality criterion may also lead to problems (such as the “biocluster for every region” thinking without taking account of the region’s scientific and other conditions) (Lerner, 2020). It is therefore important to ensure the independence of policy implementation and protect the implementing organisations against the pressures of day-to-day politics.

Attitude to risk is a key issue guiding innovation activity and also innovation policy. The principles and practices of the RDI funding system should at all levels provide sufficient incentives for risky innovative projects while at the same time controlling the risks at the system level. If the role of the organisations providing funding in relation to the directing ministry only remains an administrator role concerning policy formulated at the ministry level without access to active involvement in policy development, this may result in activity focusing on low-risk projects.

Over the past decade, many countries have seen increased interest among more ministries and stakeholders in innovation policy as a tool for addressing issues such as solving pressing societal problems. Reconciling views in a complementary manner may be difficult due to the structures, practices and routines of public administration. Many countries have established coordinating innovation councils for innovation policy debate. Figure 8.1 illustrates how, in addition to RDI policy, most policy sectors have an identifiable link to innovation and, consequently, to the productivity growth of the national economy.

Figure 8.1. Channels of influence of various policy sectors on innovation and economic productivity.



Source: Labour Institute for Economic Research (Labore)[20]

8.2 Innovation policy instruments

In Table 8.1, innovation policy instruments have been divided into supply- and demand-side instruments. The table shows how the instruments relate to the various innovation policy objectives, such as funding new knowledge or innovation, commercialising competence and innovations, and promoting interaction and learning. Increasing attention has been paid to demand-side instruments (9-15). Regulation and standardisation affect both the supply of and demand for innovations. Technology foresight seeks to increase understanding about technological trends and to develop policy measures to utilise them.

[20] A project entitled ‘Policy actions promoting productivity and the dynamics of the business sector’ examining the role of the various policy sectors and related challenges from the perspective of promoting productivity was launched in August 2022 and is coordinated by the Labour Institute for Economic Research (Labore) and ETLA Economic Research.

Bloom et al. (2019) and Teichgraeber and Van Reenen (2022) supplement these instruments by examining the effects of aspects such as patent boxes[21], increasing the number of students in STEM disciplines (science, technology, engineering and mathematics), increasing the number of inventors, encouraging entrepreneurship among researchers, facilitating the immigration of talent, increasing competition, trade openness, reforms concerning intangible assets, and mission-oriented policy. The effectiveness of R&D tax credits and direct R&D subsidies is emphasised in the short term, that of increases in intellectual capital (such increases in the number of university STEM students) in the long term, and the effectiveness of talent immigration in the short or medium term. The innovation effects of competition and trade policy are assessed to be lower than the effect of the above-mentioned measures but, as tools, these policies are economically advantageous. Teichgraeber and Van Reenen note that the assessment ignores interactions between instruments, an aspect that is important when designing mission-oriented programmes.

Table 8.1. Innovation policy instruments (adapted from Edler & Fagerberg, 2017).

Instruments	Overall orientation		Goals						
	Supply	Demand	Increase R&D	Skills	Access to expertise	Systemic capability and complementarity	Enhance demand for innovation	Improve framework	Improve discourse
Fiscal incentives for R&D	●●●		●●●	●○○					
Direct support to enterprise R&D	●●●		●●●						
Policies for skills and training	●●●			●●●					
Entrepreneurship policy	●●●				●●●				

[21] Patent boxes are tax regimes that apply a lower tax rate to revenues from patents relative to other commercial revenues. In 2015, these were used in 16 OECD countries. Patent boxes encourage the shifting of patent revenue to be taxed in such countries and have not been observed to have direct incentivising effects on R&D activities or their quality. This is why they can be regarded as tools for tax competition between countries.

Instruments	Overall orientation		Goals						
	Supply	Demand	Increase R&D	Skills	Access to expertise	Systemic capability and complementarity	Enhance demand for innovation	Improve framework	Improve discourse
Technical services and advice	●●●				●●●				
Cluster policy	●●●					●●●			
Policies to support collaboration	●●●		●○○		●○○	●●●			
Innovation network policies	●●●					●●●			
Private demand for innovation		●●●					●●●		
Public procurement policies		●●●	●●○				●●●		
Pre-commercial procurement	○●●	●●●	●●○				●●●		
Innovation inducement prizes	●●○	●●○	●●○				●●○		
Standards	●●○	●●○					●○○	●●●	
Regulation	●●○	●●○					●○○	●●●	
Technology foresight	●●○	●●○							●●●

Notes: Major relevance (●●●), moderate relevance (●●○), minor relevance (●○○) to the overall orientation and stated innovation policy goals.

New international comparative studies of leverage effects of R&D support

Published in 2020, the OECD microBERD report produced interesting new findings about R&D tax incentives for enterprises and the effects of direct public support. Tax incentives have become a key form of support for business R&D in the OECD and partner economies. Tax incentives accounted for around 50% of direct government support for business R&D in 2017, up from only 30% in the early 2000s.

The analysis shows that the input additionality yielded by R&D tax relief was around 1.4, i.e. one extra euro of R&D tax support translates into 1.4 extra euros of R&D. The effect on experimental development was around twice as large as on basic and applied research. The input additionality of tax relief yields the largest cross incrementality ratio (IR) for small enterprises (small 1.5; medium-sized 1.0; large 0.4). The results also reflect the fact that, relative to their size, smaller enterprises engage on average in less R&D than large ones. The input additionality was the lowest (0.3) for enterprises in highly R&D-intensive industries (pharmaceuticals, computer manufacturing, scientific R&D).

Direct R&D government funding yields a similar degree of input additionality as tax relief. The results show that one euro of R&D support translates to around 1.4 extra euros of R&D. Direct public R&D support is clearly more conducive to research (R) than to development (D). A positive combined effect was observed for R&D tax incentives and direct R&D support, but there is no data available on how strong it is. Overall, there is very little research data available on their combined effect.

In addition, it was observed that a lower corporate tax rate is associated with higher R&D investment, although its effect is smaller than that of more targeted R&D support measures. One unit of lost tax revenue was compensated for by an increase of 0.24 units in business R&D expenditure. (Husso, 2021; OECD, 2020a)

The following is a closer presentation of issues relating to some policy sectors and instruments.

Findings made in basic research are often decisive for the creation of practical innovations. For example, the business of the mobility service provider Uber is based on the GPS network, which is based on several scientific breakthroughs including Einstein’s general theory of relativity, which in turn is essentially based on the mathematical tools developed by Bernhard Riemann in 1854 (Goolsbee & Jones, 2021). Many fundamental enabling technologies have been developed with public funding in academic institutions and research laboratories. New small enterprises have often been the first to grab the commercial potential offered by them. The innovation role of small enterprises has been observed to be the largest in immature sectors where market power is not particularly concentrated. Entrepreneurs and small enterprises appear to play a key role in detecting where new technologies meet customer needs, and they are capable of responding to these faster than large enterprises (Lerner, 2020; Akcigit & Stantcheva, 2020).

Due to the nature of basic research, failures are common and it is difficult to predict potential applications. Benefits largely arise from unexpected externalities, which requires funding for basic research in a manner that tolerates failures. In science funding, the portfolio approach may be justified. In that, broad-based funding is allocated to independent research lines and the projects funded may, when viewed individually, be riskier than usual but, together, lead to better results (Franzoni et al., 2021; Azoulay & Li, 2020).

The role of education and training is emphasised, as the generation of new ideas relies on the intellectual capital of the labour force (Takalo, 2014). Innovation clusters are often created around top universities. Reserves of intellectual capital depend on factors including education and immigration policy. To increase the reserves, it is important that all talented persons are able, regardless of their background, to access education and training for innovative roles, including entrepreneurship (Van Reenen, 2021). Immigration policy can have a relatively quick effect on the supply of innovative labour. In the USA, immigrants have been found to be particularly innovative when measured by, for example, the number of patents and innovative entrepreneurship (Pekkala Kerr & Kerr, 2020). Development of education and training and increases in the number of talented researchers should be synchronised with the development of R&D support. Failing this, additional investments may merely increase researchers' pay without affecting R&D volume or quality. The different timespans of R&D activity and education and training may make it difficult to synchronise measures (Van Reenen, 2021).

Investments in intangible capital explain productivity dispersion

According to the OECD, since 2000, enterprise productivity dispersion has been more pronounced in intangible-intensive industries. Intangible capital includes R&D, software, databases, mineral exploration, entertainment, artistic and literary originals, other new product development (e.g. design originals, new financial products), brands, market research, and human and organisational capital. In industries that have experienced a strong increase in intangible capital, enterprise productivity dispersion has seen a sharper rise both at the top and at the bottom of the productivity dispersion. The results at the top appear to be associated with the scalability of intangible capital, which may disproportionally benefit high-productivity enterprises and incumbent enterprises. Increased dispersion at the bottom would appear to be linked to complementarities between intangible capital and factors such as digital intensity, trade openness and venture capital. Low-productivity enterprises operating in digital-intensive industries that are not capable of carrying out intangible investments fall behind others in productivity development.

The link between intangible capital and productivity dispersion varies significantly between sectors and countries. The findings apply particularly to the service sector, whereas in the manufacturing industry the link is on average clearly weaker. The business competencies of enterprises have been found to have a significant link to enterprise productivity dispersion. To improve productivity performance, it is important to promote the innovation activity of the most productive enterprises and strengthen the ability of as many enterprises as possible to adopt innovations. In digital-intensive industries, enterprises with the lowest productivity could benefit from practices where intangible assets could be used as collateral for finance. Competition policy can increase incentives for enterprises to improve management and efficiency, which will increase their organisational capital. IPR legislation has also been shown to be able to stimulate intangible investment by enterprises. (Corrado et al., 2021)

According to Takalo, public funding for private-sector innovation activity should also focus on projects with large externalities, such as early-stage R&D. Providers of funding should not try to determine funding priorities in advance. Instead, they should focus on evaluating projects on the basis of their societal benefits. Projects may be worth funding even when their commercial potential is small if their domestic externalities are large. Commercial potential may be a criterion when evaluating the societal returns gained from projects, but its evaluation should be left to private funding providers. Compared with tax relief, direct funding can be targeted at themes regarded as societally significant, such as climate change, health or digital transition.

Enterprises engaged in RDI in Finland

The European Commission's latest Community Innovation Survey (CIS) shows that already up to 69% of Finnish enterprises with 10–249 employees reported they had innovation activities in 2018–2020. It can be estimated on the basis of the CIS that, of the total of around 20,000 SMEs with at least 10 employees Finland, around 13,900 engage in in innovation activity, while the number of those engaging in R&D is just over 9,200. This means that at least a third of the innovation activity of such enterprises appears to be other than R&D. According to Statistics Finland's R&D statistics, around 3,100 enterprises in Finland reported that they had R&D activities in 2020. Of these, around 2,800 were SMEs and around 300 were large enterprises. Enterprises with fewer than 10 employees only include those that have received public product development funding. There is a significant difference between the number of SMEs engaged in R&D shown in the R&D statistics and the number those estimated to engage in R&D on the basis of the CIS. The R&D statistics may not be able to fully reflect what innovation activity currently means for enterprises. In particular, there is a lack of full understanding of RDI activity of enterprises with fewer than 10 employees (which account for 97% of Finnish enterprises). Business Finland has around 5,000 enterprise customers.

According to Takalo, early-stage public capital investments in high-tech enterprises are theoretically justified and should take place through private equity investors via, for example, funds of funds. Funding must be organised in a way that frees investment decisions from political pressures and links them with private funding to enable the efficient utilisation of the expertise of private venture capitalists. Direct public equity investments at later stages should be avoided. The venture capital market is highly cyclical and its downturns have a negative effect on innovations (Lerner, 2020). Public funds invested should be countercyclical (Takalo, 2014).

Funding received by Finnish startups increasing

The Market Review published by the Finnish Venture Capital Association on 23 June 2022 shows that the investments received by Finnish startups and early-stage growth companies have increased since 2013 and particularly strongly since 2018, with a new record seen in 2021 (around EUR 1.2 billion). Foreign investors accounted for as much as 71% of the total or EUR 855 million compared to the previous year's 57%. In European benchmarking, Finnish startups receive clearly the most venture capital (VC) funding in relation to GDP.

Although highly selective, VC funding has been observed to have a strong positive effect on innovation. VC funding has been estimated to increase patenting three to four times more than traditional R&D funding (Lerner, 2020). In Finland, an annual total of around 4,000–5,000 startups are established when defining a startup as a young, smallish, independent and private enterprise meeting the basic legal conditions for growth. Of startups defined in this way, 6–7% or around 300 enterprises reach reasonable growth in three years. According to ETLA Economic Research, the importance of startups is in their role in the regeneration of the economy and its market structures and in long-term productivity growth. (Ali-Yrkkö et al., 2017)

Tax incentives used in innovation policy. Most OECD countries use specific R&D tax incentives implemented in a variety of ways. In 2021, these were used in 31 of the 36 OECD Member States (up from 19 in 2000). It is common practice to allow "super-deductions" where enterprises can deduct more than 100% of the costs. Tax incentives have been found to increase enterprise R&D activity and patenting. According to Takalo (2014), tax incentives employed in innovation policy must be simple, transparent and industry-neutral and only support innovation activity. However, the OECD definition of innovation activities, for example, is rather loose: Business innovation activities include all developmental, financial and commercial activities that are intended to result in an innovation. According to Takalo, tax relief for business angel investments is also worthy of support.

Effects of personal and corporate income taxation on innovation activity

In addition to R&D tax incentives, general personal and corporate income taxation and other targeted tax incentives may impact innovation activity. Personal and corporate income taxation and tax subsidies based on training, place of residence or activity, starting up of enterprise, certain types of research and location may affect decisions that are important regarding innovation activities of various types of inventors and enterprises in various lifecycle stages. Inventors need to make decisions including whether or not to become an inventor in the first place (through self-employment or their own or another enterprise), where to live and carry out their trade, what kinds of knowledge- and skills-based capacities to obtain, and what to do with the inventions/innovations produced – whether to sell them or start up a business, which is when the innovation and related income can move from personal to corporate taxation. Enterprises need to make decisions including whether to enter a given market, remain in operation, or exit, select the location for their operations, including innovation, R&D inputs, employees, R&D teams and targeting of RDI activity. Taxation can affect all of these. At the micro level, the effect is targeted at enterprises or inventors, whereas at the macro level the effect may be on transitions from country to country.

Akcigit & Stantcheva (2020) found that both corporate and personal income tax hikes negatively affect the quantity and quality of innovation. Correspondingly, tax cuts would appear to increase innovation especially for credit-constrained enterprises. Taxation has the clearest effect on the location choices of superstar inventors. This applies particularly to inventors who work for large multinationals. The results show that lower taxation of VC-based startups may foster innovations. Small enterprises engaging in external research produce a disproportionately large share of radical innovations, and this is why their preferential tax treatment can further improve the quality of innovation and lead to breakthrough innovations. Taxation could be used to level out the conditions of competition of new market entrants if and when large incumbent enterprises have better opportunities to influence policy content (such as market entry) than small ones. Taxation may be able to affect the market exit of low-profitability enterprises, with enterprises that are good enough to survive despite taxes being selected for the market. Taxing polluting technology with, for example, carbon taxes may guide R&D towards clean technologies that make them competitive in the market (Akcigit & Stancheva, 2020).

From the societal perspective, intellectual property rights (IPR) policy should encourage innovation activity and, on the other hand, enable its results to be utilised with minimum constraints. The patent system should encourage the patenting of valuable inventions and rejection of poor-quality applications (Takalo, 2014).

There are, however, problems relating to the protection of intangible assets due to which it is possible that under-investment in innovation activity is a problem in many sectors. The diffusion of knowledge and technology from leading to lagging enterprises has been estimated to have decreased in many countries in recent decades. This may have been affected by patenting being increasingly concentrated on enterprises owning many patents and leading enterprises using the protection of intangible assets to restrict knowledge diffusion and strengthen their market power. In recent years, evidence has been obtained from the USA in particular that the patent system has been abused by predominantly large enterprises to block market entry by rivals. This takes place by patenting trivial patents and hiding rather than revealing useful knowledge in patent documents and spending a lot of money on defending these patents.

Patents can also be “designed around”, which is when they offer very little protection. In many industries, innovations cannot be formally protected as they are often tacit, difficult to codify and incremental. (Teichgraeber & Reenen, 2022)

Triadic patents

The number of most commercially important Finnish triadic patent families was 58 in 1985 but increased to 483 in 1999 and then deceased to 283 in 2019. In 2020, Finland accounted for around 0.48% of all such patent families, which was close to Denmark’s share (0.54%). Compared to these, shares of countries such as Sweden and the Netherlands were three times as large. Finland’s share has dropped by half since the late 1990s. The shares of almost all other countries have also decreased in the 2000s, whereas a strong rise can be seen for China. (OECD, Macrobond).

The purpose of competition policy is to ensure a level playing field for enterprises. Competition is usually assessed to have a positive impact on innovation activity. According to Takalo, at times competition policy has to take a stand on whether to promote competition in the market or competition for the market. Competition policy has traditionally emphasised competition in existing markets, but this contradiction often emerges in contexts such as the platform economy, standardisation and the interface of competition and IPR policy.

The trade policy objective of freer trade increases market size, which is when RDI costs can be allocated across broader markets. Trade boosts the quality of production inputs and the rate of knowledge diffusion and also increases competition. (Teichgraeber & Van Reenen, 2022). In this respect, the effects on innovation activity are similar to those of competition policy. From the innovation perspective, labour market policy should promote the channelling of competent labour to rising innovative industries. The quality of research teams plays a major role in innovation activity, and interactions with others is a way of improving inventor productivity. Inventor movement between enterprises may improve team quality and also facilitate the diffusion of technological knowledge. Terms and conditions of employment may include clauses that may prevent movement (Akcigit & Stantcheva, 2020).

8.3 Regulation

Regulation affects the conditions and incentives for innovation activity and its funding and, on the other hand, the utilisation of the results of innovation and the development of markets. Regulation of education, training and basic research, including increasing the number of engineering and natural sciences students, is a priority. Strengthening researchers' patent rights encourages the establishment of startups and the commercialisation of ideas generated in universities. Stronger industrial property rights may, however, also prevent innovation activity. Standardisation may weaken competition for markets and incentives for the development of new technological solutions that are not compatible with standards but strengthen competition in the market and innovations that are compatible with standards. Legislation protecting employees may slow resource allocation and spread of innovations but also encourage employees for innovation activity (Takalo & Toivanen, 2021).

A predictable and consistent regulatory environment creates conditions for innovation investments. According to Takalo and Toivanen, the need for regulation is greater the greater the externalities of innovation activity are. Regulation emphasising externalities means that there is a focus in public-sector funding on projects with large externalities (incl. early-stage R&D or new clean technologies). Regulation that is unnecessarily heavy, outdated with regard to technological transformations or insufficient in turn has a negative effect on innovation activity by creating uncertainty and hindering the market entry of innovations. Costs arising from regulatory compliance may weaken incentives for innovation activity or utilisation of innovations.

The benefits of innovation-friendly regulation are spread broadly and in part to beneficiaries that do not yet exist at the time of regulation. Disruptive innovations may create pressure to amend regulation and result in tensions between incumbents and new enterprises seeking market entry. According to Takalo and Toivanen, it may be more important for regulation to emphasise making efficient use of the results of innovation activity in Finland than strengthening innovation incentives.

Regulation can help to create demand and legitimacy for new innovations and build the foundation even for the creation of entire new markets or ecosystems. In extreme cases, changes in the regulatory environment may even influence the playing field of competition between entire nations and the direction of economic development. An example of this is the role played by the NMT/GSM standards for the rise of Nokia and the growth of the entire Finnish economy (Salminen et al., 2021). Since not all innovation activity promotes prosperity, one of the purposes of regulation is to attempt to curb harmful innovations. The challenge is to strike the right balance and harness innovation activity/innovation policy for the achievement of the various policy objectives.

8.4 Innovation policy in Finland in the 2000s

Finnish innovation policy is rather centralised in terms of national guidelines, strategies and funding, although the combination of national and local administration provides regions with autonomy in their own innovation policy. Parliament and Government are responsible for general policy outlines. Operationalisation and oversight of policy are carried out by ministries, implementation largely by funding organisations (Academy of Finland, Business Finland, etc.) and practical RDI activity by research organisations and the private sector.

The development of Finnish innovation policy in 2000–2019 can be divided into four periods: growth in globalisation and international trade (2000–2005), intensifying international competition and the financial crisis, difficulties of the ICT sector and forest industry (2005–2011), economic recession and questioning of the role and effectiveness of innovation activity (2012–2017) and efforts towards new RDI policy following economic adaptation (2017–2019). The situation of the operating environment during these periods was reflected in policy objectives, priorities, instruments and R&D funding volumes as well as in the ways in which policy development was managed. (Koski et al., 2019)

Innovation policy in the 2000s saw the implementation of significant reforms targeted at universities, universities of applied sciences and sectoral research institutes which affected RDI activity: the universities reform launched in the 2010s, the resulting reform of universities of applied sciences, the sectoral research institutes reform and the 2016 reform of the Research and Innovation Council (RIC). The reforms of the Finnish higher education system have been so broad and profound that it has taken several years to deploy them in practice and to adapt activities. They also lay the core foundation for the research activity of universities and other higher education institutions and especially for their research cooperation with enterprises. Structural reforms and budget cuts were directly reflected in the capacity of research institutes to carry out research cooperation with enterprises. The significance of the sectoral research institutes reform in public RDI funding was rather small as a whole, but the cuts made in the budget funding for individual research institutes were all the more significant. The largest cuts in terms of volume were experienced by VTT Technical Research Centre of Finland. (Halme et al., 2021.)

The 2016 reform of the RIC was a major reform relating to the formulation of innovation policy. The OECD has assessed that the reform weakened the RIC's opportunities for the horizontal development of innovation policy and, consequently, the effectiveness of its activities. (Deschryvere et al., 2021) The reform was also found problematic in the international evaluation of the Academy of Finland (Arnold et al., 2022). Another significant reform was the merger of Tekes, the Finnish Funding Agency for Innovation, and Finpro, the provider of internationalisation advisory services, resulting in the establishment of a new operator, Business Finland at the beginning of 2018.

Between 2014 and 2021, the GDP share of R&D expenses decreased from 3.4% to 2.88%. In 2021, the public sector accounted for around 1.0 percentage points of the GDP share of R&D. Although, as a whole, R&D inputs in Finland still remain rather high relative to GDP, the share of public funding in enterprise R&D in 2019 (2.5%) was clearly lower than the OECD average (4.4%). Most of the public funding is allocated to research carried out by universities, other higher education institutions and research institutes. In the past ten years, a split was seen in the development of central government RDI funding, with funding for universities and the Academy of Finland increasing and funding for central government sectoral research institutions and Tekes/Business Finland decreasing. After the lowest level seen in 2016, public R&D inputs again took an upturn. Competition for international RDI investments has in turn led to various types of R&D tax subsidies becoming more common. Finland, too, introduced an R&D tax incentive at the beginning of 2021. Funding from EU framework programmes and structural funding provides an increasingly important complement to national R&D funding from the SME perspective in particular. (Halme et al., 2021)

8.4.1 Innovation policy in the Programme of Prime Minister Sanna Marin's Government

The Programme of Prime Minister Sanna Marin's Government seeks solutions to global development challenges and sustainable economic growth on a broad front. There is an emphasis in industrial and innovation policy objectives on strengthening ecosystems[22], exports and internationalisation competences of enterprises as well as

[22] The literature contains many kinds of definitions of ecosystems. The definition used in an ecosystem evaluation of Business Finland regards the following as the key aspects of ecosystems: a motivated core of private organisations and supportive actors; open collaboration; a clear governance model in which all members are represented; a neutral orchestrator; a shared strategy of the members; and many types of formal and informal activities linked to the

growth orientation in certain industries. Adopted by the Government in spring 2020 and updated in late 2021, the National Roadmap for Research, Development and Innovation provides a set of measures to develop the RDI operating environment. The situation overview included in the roadmap draws attention to the fact that the projected development of private-sector R&D expenditure and central government R&D funding (General Government Fiscal Plan 2022–2025) is insufficient to achieve the 4% R&D intensity goal by 2030.

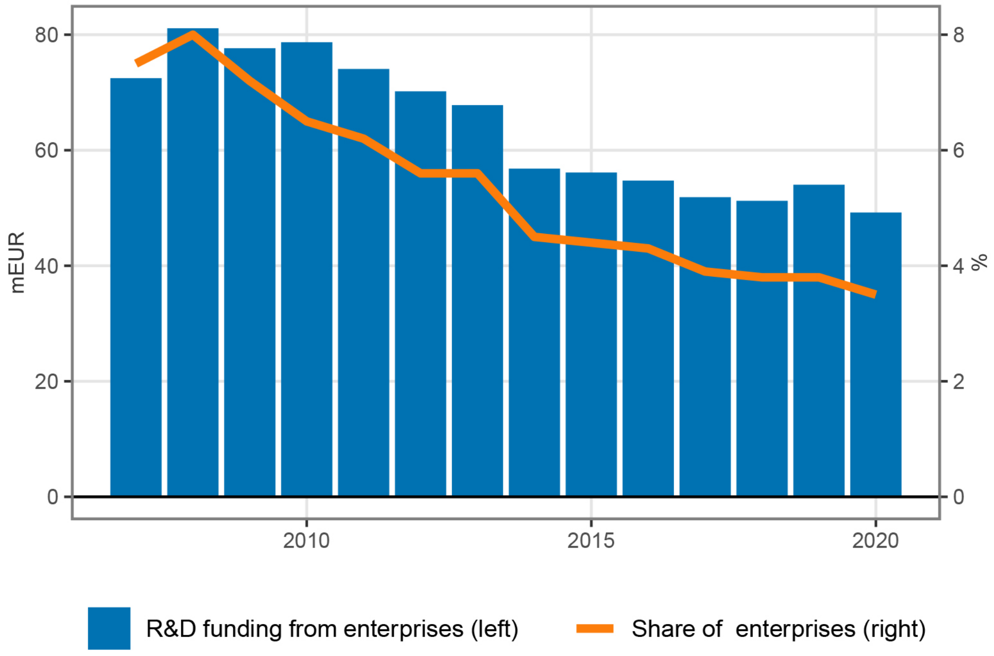
Unpredictability of public R&D funding is one of the key weaknesses of the Finnish R&D system. Direct funding provided by enterprises to universities has also been declining over the past 10 years (Figure 8.2), while at the same time changes in the operating environment and solutions to systemic problems call for broad, cross-sectoral cooperation and multidisciplinarity. Learning outcomes in basic education have declined and educational equality has not progressed. The rate of young adults (aged 25–34) in Finland completing a higher education degree is considerably lower than in the reference countries. Within the OECD, Finland has the highest shortage of employees with higher education qualifications and the number of foreign students and RDI professionals settling in Finland does not currently meet the targets. R&D in full-time equivalents in central government research institutes has been declining for a long time. Finland has only a relatively small number of fields where the level of research activity is among the world's best. Due to the funding system, the academic career of many researchers is fragmented, making a research career in Finland less attractive. The importance of this perspective is emphasised by the fact that access to competent R&D personnel is a key factor in enterprise RDI investments. (Ministry of Education and Culture, 2021)[23]

---

common challenges and, consequently, the strategy of the ecosystem. Ecosystems provide their members with external services relating to aspects including regeneration/entrepreneurship, new markets, suppliers/customers, market intelligence, marketing/visibility, capital, R&D and technologies, infrastructure and human capital. For more information, see: 2/2021 World-class ecosystems in the Finnish Economy (businessfinland.fi), pages 18–20.

[23] A Government resolution on technology policy was also published on 31 March 2022. The technology policy goal adopted in the resolution is that, in 2030, Finland will be the most successful and best-known country in the world that generates prosperity and wellbeing from the research, development and utilisation of technology. https://api.hankeikkuna.fi/asiakirjat/8ac0ab12-68e7-4be5-91a5-213f572e938f/83b738af-6c18-432a-8b34-49024c5edb75/PAATOS_20220420122054.PDF

Figure 8.2. Funding received by universities from enterprises (EUR million) and its share of universities' R&D expenditure.



Notes: Bars = R&D funding received by universities from enterprises (EUR million) Line = Share of R&D funding received by universities from enterprises of universities' R&D expenditure. Source: Kai Husso, Ministry of Economic Affairs and Employment.

The situation overview also stated that R&D activities in Finland depend on a narrow group of enterprises and that large enterprises are the driving forces behind R&D activity, with three industries accounting for 60% of enterprise R&D expenditure. Longer-term challenges include diversifying the enterprise structure in a more knowledge- and research-intensive direction, identifying high-growth enterprises and increasing the RDI capabilities of the SME sector. The internationalisation of enterprises has also extended to their R&D activities, which results in growth not necessarily being seen in Finland even if the R&D expenditure of Finnish-origin enterprises increases. The most significant factors for the location of R&D abroad are the cost and availability of R&D personnel and R&D subsidies. The measures set out in the updated roadmap are actions to be implemented or launched during the current government term that will support the roadmap's objectives for 2030. A number of measures included in the roadmap are expected to raise the level of R&D funding in the coming years. The strategic development priorities for the roadmap pertain to competence, a partnership model[24] and public sector innovativeness.[25]

Proposal of Parliamentary RDI Working Group

In its final report of 17 December 2021, the Parliamentary RDI Working Group proposed that the target of increasing public R&D funding to 4% of GDP. This target is to be met by enacting an R&D funding act that determines the annual level of central government R&D expenditure such that the public sector's R&D expenditure to GDP ratio increases to 1.33% by 2030 in relation to the projected trajectory of economic development.

The act is to state the importance of increasing private-sector R&D investments alongside public funding. Development of private-sector R&D funding will be monitored carefully and regular checkpoints will be set to assess development of enterprise R&D investments. When implementing the act, there should be a focus on encouraging and including the private sector.

The starting point for the act is for private-sector R&D investments to develop in line with the target so that the level of private and public R&D inputs will increase to a total of 4% of GDP by 2030. Alongside the act, a statutory plan for R&D funding that extends beyond the spending limits period and follows the R&D policy principles outlined by the Working Group will be formulated to strengthen commitment to the development of R&D funding and activity and to specify the use and content of funding in more detail. Each government will implement its own R&D policy for each government term within the framework provided by the R&D funding act and the long-term plan for R&D funding. Each government will decide how the increase in R&D expenditure under the R&D funding act will be financed. According to the Working Group, the R&D funding act will secure the increases in the level of funding and provide an actual guarantee for R&D funding being available for the long term and being predictable. (Parliamentary RDI Working Group, 2021)

[24] Partnerships will be supported through measures including Academy of Finland's Flagship Programme, Business Finland's funding for leading companies and ecosystems and the ecosystem agreements (Ministry of Economic Affairs and Employment (tem.fi/en)) between the State and university cities and towns.
[25] The May 2022 report of the expert working group appointed by Minister of Economic Affairs Lintilä also contained the key message that the RDI system must be made more efficient.

8.4.2 Innovation policy as part of growth policy at Ministry of Economic Affairs and Employment and its administrative branch

The following objectives of the Programme of Prime Minister Sanna Marin's Government have been defined as key shared strategic innovation and industry policy objectives of the administrative branch of the Ministry of Economic Affairs and Employment: attaining an employment rate of 75%, raising RDI funding to 4% of GDP and making Finland carbon neutral by 2035. Public funding allocated for RDI activity seeks to create billion-euro innovations and business ecosystems responding to global development challenges and regenerating industries and the national economy as well as leveraging enterprises' own inputs for regeneration and international growth. The entire Ministry of Economic Affairs and Employment Group promotes on a broad scale the development of the operating environment of enterprises in order to diversify the industrial structure and to increase investments, RDI activity, export revenue and employment (Ministry of Economic Affairs and Employment, 2021a).

Actors of the administrative branch implement measures, prepared in cooperation with key stakeholders, that promote the objectives of the government programme, such as the Entrepreneurship Strategy[26] , the Export and International Growth Programme[27], the sector-specific low-carbon roadmaps[28], the domestic ownership programme[29] and the National Roadmap for Research, Development and Innovation. The activities form part of the implementation of the Ministry's Agenda for Sustainable Growth[30] and the global sustainable development goals (2030 Agenda)[31]. The administrative branch takes part in the implementation of the Sustainable Growth Programme for Finland to make use of the EU's Recovery and Resilience Facility (RRF)[32]. Related national measures promote sustainable growth based on digitalisation and the green transition (Ministry of Economic Affairs and Employment, 2021a).

---

[26] https://julkaisut.valtioneuvosto.fi/handle/10024/164095
[27] https://tem.fi/viennin-ja-kansainvalisen-kasvun-ohjelma
[28] https://tem.fi/en/low-carbon-roadmaps-2035
[29] https://tem.fi/en/-/report-diverse-responsible-and-competent-domestic-ownership-needed-to-strengthen-investments-growth-and-wellbeing
[30] Agenda for Sustainable Growth - online service of Ministry of Economic Affairs and Employment (tem.fi/en)
[31] 2030 Agenda for Sustainable Development (kestavakehitys.fi/en)
[32] https://www.businessfinland.fi/en/campaign-sites/sustainable-growth-program-for-finland

In addition to this, the Ministry implements strategies, programmes and roadmaps relating to intellectual property rights[33], research and innovation activity in the health sector[34], tourism[35], artificial intelligence[36], innovative public procurement[37], creative industries[38], retail sector[39], circular economy[40], bioeconomy[41] and batteries[42]. The 2022 operating year will also see the formulation of a growth strategy for medium-sized enterprises, which will aim to increase the critical mass of high-growth enterprises with capacity for scaling up and seeking internationalisation. To boost investments, the “fast track for investments” operating model will also be ramped up. In addition, an outlook will be formed concerning policy measures and funding supporting the green transition[43] [44] . By influencing EU industrial policy, efforts will be made to ensure that changes in EU state aid and competition policy will not have adverse effects on Finland. Finnvera’s funding and risk management will be developed to promote enterprise growth, exports and the digital green transition (Ministry of Economic Affairs and Employment, 2022b).

In November 2021, an internal survey addressed to the departments and units of the Ministry of Economic Affairs and Employment probed how they saw the role of their own policy sector in promoting productivity. Although the policy sectors of the Ministry have objectives based on a variety of starting points, in practice all of the respondents mentioned that their policy sector is linked to innovation and, consequently, to promoting productivity. In principle, it might be possible to sharpen the joint role of the Ministry’s policy sectors, such as competition policy, regulatory policy, labour policy,

---

[33] Government adopts resolution on national IPR strategy - online service of Ministry of Economic Affairs and Employment (tem.fi/en)
[34] https://julkaisut.valtioneuvosto.fi/handle/10024/162564
[35] Finland’s tourism strategy for 2019–2028 - online service of Ministry of Economic Affairs and Employment (tem.f/en)
[36] Artificial Intelligence 4.0 programme - online service of Ministry of Economic Affairs and Employment (tem.fi/en)
[37] Public procurements as an instrument in implementing society’s important development objective: Action plan for increasing the use of innovative public procurement, developing services and promoting sustainable growth - Valto (valtioneuvosto.fi)
[38] Roadmap for creative economy - online service of Ministry of Economic Affairs and Employment (tem.fi/en)
[39] Government report on the future of the retail sector - online service of Ministry of Economic Affairs and Employment (tem.fi/en)
[40] Government resolution on the Strategic Programme for Circular Economy
[41] The Finnish Bioeconomy Strategy. Sustainably towards higher value added - Valto (valtioneuvosto.fi)
[42] National Battery Strategy 2025 - Valto (valtioneuvosto.fi)
[43] Report evaluates green transition funding as part of growth policy - online service of Ministry of Economic Affairs and Employment (tem.fi/en)
[44] Government proposes act to permit state aid for projects promoting carbon neutrality - online service of Ministry of Economic Affairs and Employment (tem.fi)

regional policy and migration policy, in innovation policy and, consequently, in promoting productivity.

"The 2022 operating year will also see the formulation of a growth strategy for medium-sized enterprises, which will aim to increase the critical mass of high-growth enterprises with capacity for scaling up and seeking internationalisation."

The ETLA Economic Research Brief 'What is a Scalable Business?' defines the business of an enterprise as scalable if its turnover is able to grow significantly without its costs increasing in the same proportion. According to the report, scalability should be seen as a characteristic of the business model rather than as achieved growth. It follows from the definition that not all high-growth companies are scalable. Scalable business commonly occurs in ICT, financial and insurance services and commerce, but not all business even in ICT is scalable. In manufacturing, scalable business is most common in process industries, such as the chemical industry and manufacture of machinery. Digitality and international market orientation strongly increase opportunities for business scalability. Ownership of digital platforms was regarded as enabling major economies of scale for enterprises. Scalable business creates good conditions for productivity growth. (Ali-Yrkkö et al., 2022) Innovation policy documents have so far paid relatively little attention to scalability as a phenomenon or policy objective.

8.4.3 Business Finland as innovation policy implementer

Business Finland is a key public actor in research, development and innovation funding as well as in the promotion of the internationalisation of export and enterprises, foreign investments and inbound tourism. It was created at the beginning of 2018 through the merger of Tekes, the Finnish Funding Agency for Innovation, and Finpro, the provider of internationalisation advisory services. Business Finland's statutory duties are broad (for details, see https://www.finlex.fi/en/laki/kaannokset/2017/en20171146). Business Finland performs its duties by providing research, development and innovation funding and internationalisation services as well as promoting tourism and efforts to attract foreign investments and talent to Finland. The purpose of Business Finland stated in its strategy for 2021–2025 is to generate prosperity and wellbeing for Finland by accelerating its customers' sustainable growth globally. The Ministry of Economic Affairs and Employment guides and supervises Business Finland's activities. Its performance-based management is related to objectives set in the government programme and the Budget as well as the strategic objectives of the Ministry of

Economic Affairs and Employment. Progress made towards the achievement of Business Finland's societal objectives is evaluated primarily by means of independent external reports. The key performance indicator targets set by the Ministry emphasise 1) the development of customers' competitiveness and, consequently, economic growth, 2) the promotion of sustainable development through the development of customers' solutions and activities, and 3) the bold regeneration of customers' business. Business Finland focuses particularly on strong internationalisation-related capabilities and investments, significant investments in research, development and innovation activity, digital transformation, new business models and value-adding networks and partnerships (Ministry of Economic Affairs and Employment, 2021a).

According to an evaluation of Business Finland (Halme et al., 2021), compared with Tekes, Business Finland has moved towards shorter-term actions closer to the market. On the other hand, compared with Finpro, the trend has been in the opposite direction. Since 2015, funding provided by Business Finland has been targeted increasingly at enterprises at the expense of the share received by research organisations. R&D funding allocated for university cooperation is estimated to have decreased by more than 40% in the 2010s. The focus of incentives aimed at enterprises has been shifted from traditional R&D activity to more mature projects seeking growth materialising faster than before, considerable revenues as well as exports and internationalisation. A trend partially contradictory to this has been the partial shift towards a narrower focus and longer-term RDI funding when the Growth Engines and Leading Companies funding instruments have been used in efforts to fund the creation of 'world-class' ecosystems. A shift has taken place from R&D funding for research organisations to co-creation and co-innovation projects.[45] The number and relative share of micro-enterprises among enterprises that used internationalisation services in 2015–2020 increased significantly in the final years of the period examined. The increase in service use is primarily due to the increase in the number of micro-enterprises as Business Finland's internationalisation service customers. SMEs received around two thirds and large enterprises around a third of enterprise funding (excl. Covid-19 funding) in 2010–2021. In 2015–2020, the majority of enterprise funding (just over a half) was allocated to young enterprises aged less than 6 years, around 10% to enterprises aged 6–10 years and around 30% to

---

[45] Ecosystems: https://www.businessfinland.fi/en/for-finnish-customers/services/ecosystems
Growth Engines: https://www.businessfinland.fi/en/for-finnish-customers/services/funding/growth-engines
Leading Companies challenge competitions: https://www.businessfinland.fi/en/for-finnish-customers/services/funding/funding-for-leading-companies-and-ecosystems
Co-creation and co-innovation: https://www.businessfinland.fi/en/for-finnish-customers/services/funding/cooperation-between-companies-and-research-organizations/co-creation

enterprises older than that. In 2010–2020, on average 50–60% of enterprise funding was allocated to enterprises operating in the Uusimaa region including the Greater Helsinki area. The enterprise funding shares of the Finnish regions are very close to the respective shares of the R&D volumes of their non-financial corporations of the total R&D volume of the Finnish non-financial corporations sector.

In the evaluation, views on the role and positioning of Business Finland vary particularly in relation to how close to the market Business Finland should operate and how extensively it should serve the enterprise field. Representatives of industries, large enterprises, research organisations and higher education institutions feared that activities will move away from longer-term objectives emphasising regeneration and RDI activity and that the trend will result in a decline in technological novelty and risk levels and in development activity moving from novel ideas to incremental development. On the other hand, some stakeholder representatives considered it good that, compared with Tekes, Business Finland is “more in touch with market needs” and that “there is a better view of market needs”, as Business Finland has moved from Tekes’ strategic research initiatives and programmes towards more enterprise-oriented ecosystem programmes. Representatives of startups and high-growth enterprises found funding provided by Business Finland as highly important and reported that it generally functions very well.

Incremental, disruptive and radical innovations

Disruptive (discontinuous) innovations with the most significant novelty value and broadest impacts often make use of essentially new technology or are aimed at new markets, market segments and customer groups or based on a new business concept. When entering the market, a disruptive innovation activates innovation in the industry and reduces demand for existing products and services and may ultimately force them out of the market. Radical innovations are those that are discontinuous in terms of both technology and target market. (Berg et al., 2014.) The bulk of innovations are incremental or sustaining, i.e. involve making a series of improvements to products, services or related processes. The development of disruptive innovations requires new kinds of competences, breaking away from familiar patterns of thought and action and employing more experimental and learning processes. Their development involves considerable uncertainty and major risks. (Dillner & Kaufmann 2015) The duration of projects aiming for incremental innovations is typically short (6 months to 2 years), but the process to create radical innovations may take several years or even a decade.

According to the National Roadmap for Research, Development and Innovation, enterprises must be encouraged to engage in bolder RDI activities. The final report of the Parliamentary RDI Working Group states that “radical innovations and systemic solutions creating new growing markets and prosperity and wellbeing for citizens are based on RDI activity.” Shortage of disruptive and radical innovations is regarded as a weakness of the innovation system by the Agenda for Sustainable Growth (Ministry of Economic Affairs and Employment, 2018) and the Outlook for Finland’s Innovation Policy (Koski et al., 2019) published by the Ministry of Economic Affairs and Employment. Also the Working Group on Sustainable Growth appointed by Minister of Economic Affairs Lintilä mentioned the lack of radical innovation as a problem in the Finnish RDI system. The Finnish Productivity Board mentions in its previous report that exceptionally high productivity is often associated with radical innovation and suggests that enterprises in Finland might have invested less in ambitious innovation projects than enterprises in other countries.

A key challenge pointed out by the evaluation is cooperation between Business Finland and the Academy of Finland and the constriction that has emerged between their funding provision due to a decline in Business Finland funding targeted at research organisations. This was also identified as a problem in the evaluation of the Academy of Finland, which stated that, in addition to funding for basic research, the government also needs to ensure that research can be done in applied, strategic and technological areas that depend on the findings and opportunities created by basic research and that on the other hand generate knowledge and skills for use in economic and societal innovation. The evaluation of the Academy of Finland states that Business Finland should have an explicit goal of funding technology programmes and other research and innovation programmes, such as those needed to address societal challenges.

8.5 Summary

Innovations play a key role in the development of society and productivity in the economy. Although business innovations are made in enterprises, public policy plays a key role in developing the foundation for innovation activity. The cornerstones of this foundation are knowledge and competence, with an emphasis on the importance of education, training, research and development activity. In addition to these, most other policy sectors are connected with innovation and introduction of technologies and further with productivity in the national economy. Gaining a better understanding of this whole is important for the development of policy effectiveness.

To increase productivity, it is important to both promote the innovation activity of the most productive enterprises and strengthen the capacity of all enterprises for intangible investment and adoption of new technologies. R&D is a key component of total factor productivity, but the decisive point is how well it is interlinked with other intangible investments.

The nature of innovations and innovation processing has been and will be transformed by the servitisation of the economy, increased prevalence of open innovation activity and digitalisation. Digitalisation affects the entire economy through business dynamics, market structures and resource reallocation. Data has become the core factor for innovations. Such changes also have impacts on innovation policy.

Scalable business models provide opportunities for productivity development. Innovation activity and intangible investments create opportunities for this type of business. The significance of startups is to do with the regeneration of the economy and its market structures and with long-term productivity growth.

Foresight and management of disruptive circumstances is a strategic challenge for enterprises and innovation policy. The path-dependence of the innovation system may turn out to be a problem, which is when a system or policy change is necessary in response to economic shocks or disruptive market development. The fall of Nokia's mobile phone business is an example of this. Processes aiming for disruptive innovations are demanding, long and risky. If society expects an increase in disruptive and radical innovations in the economy, it must be understood what creating them requires from policy in terms of, for example, competence development, funding and risk management.

The Programme of Prime Minister Sanna Marin's Government seeks solutions to global development challenges and sustainable economic growth on a broad front. The ambitious objectives of the National Roadmap for Research, Development and Innovation extend to 2030. It is decisive whether commitment to long-term development is also included in the programme of the next government.

Compared with Tekes, Business Finland's activities have moved closer to the market and towards activities seeking shorter-term effects. The research literature associates the justification of innovation policy to its externalities, which are assessed as being the largest at the front end of innovation processes and in sectors where the market mechanism functions poorly.

Innovations are not produced exclusively by enterprises. Innovation and utilisation of innovations also taking place in the public sector and elsewhere in society is important for productivity development. It is another matter how reliably productivity outside the market sector can be measured.

The crises seen in recent years have strongly changed the global operating environment. In critical times, the pressing nature of problems often acts as a strong motivating factor that activates innovation to find solutions. Solutions-oriented policy combines several different tools to solve a pressing issue. The climate crisis and other sustainable development challenges are problems that are likely to require not only technological innovations but also institutional and social innovations.

9 Conclusions and policy recommendations

9.1 Introduction

Growth in prosperity that is sustainable in terms of social and environmental aspects as well as general government finances is based, above all, on productivity growth**.**

Russia's war in Ukraine threatens to slow economic growth not only for Finland but also extensively for our trading partners. Moreover, even before the crises caused by the pandemic and the war, productivity growth had been slowing in practically every advanced economy.

We need a transition away from technologies as well as from production and consumption methods that emit greenhouse gases and threaten biodiversity. Investments in new, clean technology increase growth only if productivity improves at the same time. For the returns of such investments to be enjoyed in Finland, our cost competitiveness also needs to be in good shape. The need for investments required for clean technology appears to be very high, but it may provide an opportunity for Finland to step up the creation of sustainable value added.

Productivity growth has slowed extensively in advanced economies, but in Finland the turn for slower productivity has been very significant. Based on this and our previous reports, the following sums up our notions of Finland's exceptionally poor productivity development.

The financial crisis caused a sudden decline in global demand in 2009. The collapse of demand led to a contraction of value added, due to both lower prices and reduced volumes. For various reasons, the number of hours worked did not contract in the same proportion as value added, which resulted in a drop in productivity. The 2009 collapse of exports was greater in Finland than in most OECD countries.

With the exception of 2009, the financial crisis cannot, however, be regarded as the cause of Finland's poor productivity growth. Access to finance or interest rates levels did not reduce investment or other enterprise activity any more than in other countries. Finnish productivity development differs from most countries in that labour productivity took another downturn in 2012–2014. Post-2009 productivity was weaker in Finland than in the reference countries, regardless of whether comparing Finland's and OECD countries' market sectors as a whole or their market sectors excluding the electronics industry.

Factors that could explain the poor productivity development do not appear to be identifiable in the functioning of the commodity markets or business dynamics, either.

Alongside the financial crisis, Finland also experienced another shock at the same time: the technology that used to mean high productivity and rapid productivity growth for the electronics industry was outcompeted by its new alternatives. The shock had a direct effect on the electronics industry but also an indirect effect above all to its subcontractors. The paper industry also suffered from digitalisation as the global demand for some high value added paper products declined. A large number of jobs that used to create high value added per hour worked were lost permanently in Finland.

In addition to the above factors, our export industry was also suffering from a third problem around the same time: cost competitiveness eroded and profitability collapsed in manufacturing. This resulted in poor export performance. It was not until 2021 that the volume of goods exports in manufacturing, excluding the electronics and paper industries, rose back to the 2008 level. The poor cost competitiveness and profitability contributed to low productive and intangible investments, which in turn slowed the recovery of productivity growth.

By contrast, Finnish service exports bounced back from the post-financial crisis recession roughly as well as those of the other OECD countries. For Finland, the most important service export industry is ICT services, which appears to be less sensitive to fluctuations in cost competitiveness, with its export performance being affected more by other factors.

The fourth issue that weakened and is still weakening productivity and growth in Finland is misallocation of resources. This involves three aspects. Firstly, Finnish enterprises appear to be operating on a lower labour input than could be expected for profit maximisation. Reasons for this may include availability of skilled labour, labour market frictions or risks related to hiring labour that are not visible in analyses examining marginal costs and marginal products. On the other hand, inter-enterprise labour mobility and business dynamics have been high in international comparison. Studies show that the reallocation of labour has generally boosted productivity in Finland (Maliranta, Rouvinen and Ylä-Anttila, 2010). The early 2000s appear to be somewhat of an exception to this, as has been described in contexts such as the 2019 report of the Finnish Productivity Board.

In addition, many enterprises appear to be operating too capital intensively. Here, too, there may be underlying issues that are not visible in analyses examining marginal costs and marginal products. Thirdly, in Finland high-productivity enterprises do not receive a large enough share of the labour force, whereas low-productivity enterprises receive too large a share of it. This means that lowering the risks of employing people and improving the functioning of the labour market could promote growth and profitability.

Productivity growth is necessary not only for standard of living and quality of life but also for general government finances. In Finland, general government finances have been in deficit for a long time and the problem appears to be structural. That is why the public debt-to-GDP ratio threatens to grow indefinitely unless major new decisions balancing revenue and expenditure can be made. A productive and competitive market sector contributes to the solution to this problem, too, as it strengthens GDP growth. In addition, this would need to be coupled with progress in the productivity and effectiveness of public services, too – otherwise private-sector productivity growth threatens to a considerable extent to only be reflected in the costs of public services.

Finland has also been plagued by a low level of productive and intangible investments. In addition to new investments, we need competent people to make use of them; the shortage of skilled labour is already a significant obstacle to growth. As pointed out above, the misallocation of labour results in a significant decline in productivity in Finland. This may also be a factor contributing to the lack of investments. The problem may stem from the shortage of skilled labour, labour market frictions and details in regulation. An improved understanding of the phenomenon would require further research.

Cost competitiveness is an “easy” problem. In short, solving the problem would require on the one hand balancing the open sector’s capacity to compete in the global market and generate domestic value added and on the other hand the domestic sector’s capacity to improve earnings. In this respect, the Finnish labour market appears to function better than it is reputed to do: the earnings of the labour force increase in line with enterprise productivity and profitability.

Productivity, on the other hand, is a more difficult policy problem. The connection of productivity to “levers” that can be adjusted through policy is more remote, complex and uncertain. In enterprises, productivity can be boosted through innovation and imitation. At the national economy level, productivity is boosted by the spread of improved technology and competence and better allocation of resources. Effective competition encourages enterprises to innovate and to imitate innovations developed by others.

On the other hand, it is not simple to continuously manage cost competitiveness by means of pay moderation alone. Productivity in part determines cost competitiveness, especially over the long term, so these cannot be separated fully from each other. Productivity growth also increases capacity to pay wages and salaries. Policy measures boosting productivity growth and eliminating its bottlenecks also boost competitiveness and earnings growth.

A high competence level, or human capital, facilitates innovation and imitation – broader education and training, investments in research and development and immigration of talent are part of the solution. Another way of boosting productivity is by improving resource allocation – here we need to look at not only immigration of talent but also at improving the functioning of the labour market.

Next, we will provide a more detailed summary of some of the key observations and recommendations of this report.

9.2 Shortcomings in competition or business dynamics are not causes of poor productivity development

A possible cause of Finland's poor productivity growth could be found in changes that have taken place in the competitive situation of the markets and in business dynamics. According to endogenous growth theory, competition and market dynamics are key factors for productivity growth. The analyses based on static and dynamic growth indicators discussed in this report strengthened our previous conclusion that the problem with Finland's productivity growth does not lie in competition or in low market dynamics.

Nevertheless, the development of competition policy and regulation should not be overlooked, as new technologies and aspects such as the platform economy and other network effects may give rise to new kinds of competition or market problems. Competition policy and regulation are developed efficiently first and foremost at the EU or broader levels, as the problems often extend beyond the Finnish market.

9.3 The permanent negative shock experienced by the electronics industry was a larger factor contributing to poor productivity development than previously thought

The weakening of electronics industry dynamics was a major factor contributing to the productivity decline. The shock experienced by the electronics industry entailed Symbian technology being outcompeted by iOS and Android technologies, with the Symbian-based business and its subcontracting chains swept away by creative destruction. Although at the global level this was about a reallocation of demand, for the Finnish economy and policy this was a permanent negative technology shock.

The effects of the shock were examined by analysing how the shock experienced by one industry affected its subcontractors and their industries. According to empirical results, the negative technology shock explains at least 30% of the decline in the (non-electronics industry) private-sector productivity in 2009–2013. This result is the lower limit for the effects of the shock, as the empirical model does not take account of other possible channels of the effect of the shock, such as a decline in investments and innovation or effects on users of electronics industry products and services. The biggest effect was seen in the manufacturing and digital-intensive services industries with the closest links to the electronics industry. The result is interesting, as it is specifically in these sectors that productivity growth has been the weakest (Finnish Productivity Board, 2021, Figures 3.3 and 3.4).

This means that the shock experienced by the electronics industry removed supply and potential production from Finland and this resulted in the destruction of previously profitable, high profitability-growth technology. Although the effect looks like a recession, providing demand stimulus does not help at all in a shock like this. Demand stimulus measures may even slow recovery from the effects of the shock by slowing the transfer of resources and other adaptation to the new situation. Unfortunately, the national economy usually experiences multiple shocks with effects in different directions – it may be difficult to take a fiscal stance appropriate to the combined effects of such shocks.

Instead, a policy targeted at the problem itself might work. For example, retraining people affected by a negative shock might promote the labour market access of people whose skills level in itself is already high. Supporting and developing new substitute technologies might improve productivity over the longer term. Innovation, however, requires competence and significant R&D investments, and there is a long time lag before their impacts can be seen. After this, enough new enterprises and their market trials are still needed and, after that, it will still take time to allocate resources between new and old enterprises. Knowing that resource allocation is less efficient in Finland than in the reference countries, it is very possible that the time lag between R&D investments and effects is even longer than usual.

9.4 Productivity was also weakened by export difficulties

As a small open economy, Finland is highly dependent on export performance. The collapse in global demand had significant implications on Finland. In 2009, exports of manufacturing industries declined by more than 25% and, unlike in OECD countries on average, they did not recover to the 2008 level by 2022, either. This development was partly affected by the electronics industry shock described above, but even that alone does not explain the poor export development. In contrast, the decline in exports experienced by services was slighter, with service exports recovering rapidly in Finland and the OECD countries to the pre-crisis level.

The effects of the global demand shock were assessed in the same way as the shock experienced by the electronics industry discussed above, i.e. by analysing the effects channelled through value chains. This does not take account of other channels (such as decline in investments and in market entry of enterprises) through which the shock may have affected productivity. The results indicate that the export difficulties and the spread of the shock through global and domestic value chains may explain more than 65% of the decline in Finnish aggregate productivity in 2009. The effect on value added is strongest over the short-term, whereas the effect on employment remains high also in the longer run. As a result of these, the effect on labour productivity already wears off over the medium timespan. Consequently, the global demand shock does not appear to have caused the longer-term decline in productivity growth.

The fact that the productivity and exports of Finnish manufacturing recovered more slowly than it took for the effects of the global demand shock to dissipate implies that the weakening of Finland’s cost competitiveness might be a factor contributing to the poor productivity development.

9.5 Misallocation of labour and capital is a significant factor lowering productivity in Finland

In this report, we continued our examination of the role played by resource misallocation for productivity from the 2021 report. While the previous report used Business Register data to examine the entire enterprise field in Finland, in this report we take a separate look at certain industries. Previous observations show that resource allocation from the productivity perspective has been less efficient in Finland than in the reference countries and, at least in 2018, allocation still remained less efficient than in 2000 as far as productivity is concerned.

As regards labour allocation, the results show that enterprises employ fewer people than could be expected from the perspective of profit maximisation. Possible reasons for the under-use of labour input may include shortage of skilled labour, various frictions and mismatch problems in the labour market, and issues related to labour market regulation. Are resources not allocated well enough in the labour market? Analyses of causes and effects would require further research into the topic. In any case, the development of labour market regulation should take account of the conditions for more efficient allocation and productivity.

On the other hand, the examination of capital allocation revealed that a significant share of the enterprises examined have invested more in capital inputs than could be expected with a view to profit maximisation. In small, entrepreneur-driven enterprises, the high capital intensity may be partly explained by the more advantageous tax treatment of capital income compared with earned income. This observation implies potential development of corporate income taxation, for example the introduction of the so-called normal return model.

How big a problem is misallocation, then? The answer to this question requires the definition of the counterfactual of what constitutes realistic reallocation. If, for example, low- and high-productivity enterprises are so different from each other that it is not realistically possible to reallocate resources from low-productivity to high-productivity enterprises, the potential for productivity-improving reallocation is lower than if the allocation of resources could be freer.

Even if the reallocation of resources can only take place between enterprises operating in the same productivity distribution decile, the allocation is relatively inefficient for most manufacturing industries in most years. The value added generated by the observed allocation is as low as less than half of what the optimal allocation could generate with the same resources and at the same productivity level. The problem is clearly smaller in service industries. In a scenario where resources could be reallocated more freely, the efficiency loss is greater and is increasing especially in service industries.

It would be particularly important to gain a better understanding of how policy measures could help to stimulate and guide market actors to achieve better allocation of labour and capital inputs in order to improve total factor productivity. In a market economy, the most important allocative tool is competition, and this is why competition policy plays an essential role. In addition, the details of support or regulation may create bottlenecks or friction for reallocation of resources or incentives for sticking to the old and avoiding regeneration.

9.6 Finland's cost competitiveness has been preserved

Finland's nominal cost competitiveness has remained more or less close to the 2000s average since 2017. In the reference countries, the increase in real unit labour costs has exceeded the increase in nominal unit labour costs, which means Finland's competitiveness is at a better level than on average in the 2000s. The rise in employee compensation has been slower than in the reference countries following efforts in Finland to recover the competitiveness lost in the early 2000s by means of moderate pay settlements and later by means of the Competitiveness Pact. After the signing of the Competitiveness Pact, in 2016–2017 earnings growth slowed and in 2018–2021 grow bounced back close to 2%. Future earnings development is currently exceptionally difficult to forecast, as the current high inflation may ramp up pay demands in a manner that is difficult to anticipate.

9.7 Flexibility in pay formation has bolstered competitiveness and earnings development

Alongside aggregate-level statistics, in this report we also examine competitiveness and earnings in the light of register data. When interpreting cost-competitiveness indicators based on aggregate-level statistics, it is important to take account of the underlying microeconomic structural changes. Otherwise, interpretations of economic development and economic policy conclusions may be skewed. It is necessary to assess cost competitiveness and its components not only at the level of the national economy, sector or industry but also at two micro levels: the enterprise level and the wage and salary earner level.

The cost competitiveness of the national economy can be broken down into four components: 1) labour productivity, 2) price of value added in the common currency (euro), 3) exchange rate and 4) price of labour (wages, salaries and employers' contributions) in the country's own currency. This breakdown provides valuable additional information as regards to which extent macro-level development on the one hand directly reflects within-enterprise cost competitiveness and to which extent it on the other hand depends on the creative destruction process taking place in the market and on the development of profitability differences between enterprises.

The profitability of hiring labour is measured by value added relative to the sum of wages and salaries. This ratio indicates how much margin is generated in the activity for each euro paid for an hour worked. The profitability of hiring labour can be seen to correlate positively with the number of hours worked in the national economy with a time lag of a few years.

By examining these four factors, we observed that the 2008–2013 decline in cost competitiveness was primarily due to a decline in labour productivity that was clearly more drastic than in other countries. In recent years, improvements in competitiveness have in turn been boosted mainly by the moderate increase in the price of labour, but labour productivity has also recovered to some extent from its 2008–2013 collapse.

The breakdown also shows that enterprise productivity growth may remain continuously slower within all enterprises than in the national economy as a whole. Economic dynamics result in the market entry of new, more productive enterprises and the exit of less productive ones, with the most productive enterprises being able to grab larger market shares. Correspondingly, it is possible that the wages and salaries of all individual employees increase more rapidly that the average wages and salaries in the national economy, as new employees, whose pay level is lower than that of older employees already in or retiring from the labour market, enter the labour market.

Closer profitability examinations show that, in 2008–2013, the profitability of the national economy declined slightly less than within-enterprise profitability, as creative destruction and other dynamics increased the significance of enterprises with above-average profitability in the economy. Both labour productivity and the price of labour at the level of the national economy as a whole during this period primarily reflect within-enterprise development despite also being affected by structural changes in enterprise profitability dispersion and between components that had effects in opposite directions.

In 2014–2019, in turn, the slight improvement in the profitability of the entire non-financial corporations sector conceals the fact that within-enterprise profitability did not improve at all. Instead, the real unit labour costs of the national economy decreased, i.e. enterprise profitability improved for two reasons: 1) high-profitability enterprises have increased their lead over low-profitability enterprises, which widens the profitability gap between enterprises; 2) enterprises with below-average profitability exited the market and the share of enterprises with above-average profitability grew.

For the same reasons, in recent years labour productivity growth has been much brisker in the national economy as a whole than within enterprises. By contrast, in recent years the increase in the price of labour has been lower in the national economy than within enterprises, as the number of jobs created has been proportionally higher within enterprises where the price of labour is below average.

One conclusion from this examination is that wages and salaries within enterprises typically increase more rapidly than the average wages and salaries within the economy. In addition, they increase more rapidly than enterprise profitability. All this creates constant pressure for dynamics improving productivity in the national economy and for employee mobility between jobs.

Another key finding is that Finnish pay formation is more market-based than has been thought. Research findings show that wages and salaries react not only to cyclical fluctuations but also to differences between productivity and profitability. Pay flexibility is about how pay development reacts to the labour market situation. Flexibility may even out the consequences of fluctuations and differences in labour demand. This creates conditions for stable economic development.

Pay flexibility may also contribute towards a lower risk of exclusion from the labour market. These observations are important when considering needs and tools relating to labour market reforms.

9.8 Innovation policy can boost productivity

The justification of innovation policy arises from the observation that often the value of innovations for society is greater than their value for the innovators themselves. For example, the benefit created by an innovation for the innovator is diluted when other enterprises start to imitate the new innovation and manage, through competition, to spread the new technology and competence and to lower the prices paid by users. From the perspective of society and productivity, imitation, knowledge spillover and competition are highly beneficial. This being the case, enterprises are investing too little in innovation and the capabilities required for it. This means that enterprise innovation and imitation capabilities should be supported.

Innovation is much more than R&D activity and its expenses. To put it playfully, innovation can be regarded as the opposite of R&D activity: R&D uses money (and other resources) to generate knowledge and competence, whereas innovation uses knowledge and competence to generate money (and/or other benefits).

Even though R&D support is a key component of innovation promotion, a successful innovation policy should be broader in scale than mere support for R&D activity. For example, only a small group of enterprises operating in Finland engage in R&D. The remaining (often small) enterprises may still be innovative by, for example, adopting technologies as well as planning, design, production, distribution, management and other methods developed elsewhere. This kind of innovation also requires competence just like R&D activity.

In this report, we have described the features, problems and characteristics of innovation policy. The innovation policy toolkit and the effects of the measures selected should be examined further and policy measures should be developed in the light of new information.

References

Acemoglu, D., Akcigit, U., & Kerr, W. (2016). Networks and the Macroeconomy: An Empirical Exploration. *NBER Macroeconomics Annual*, *30*, 273–335. https://doi.org/10.1086/685961

Acemoglu, D., He, A., & le Maire, D. (2022). Eclipse of Rent-Sharing: The Effects of Managers' Business Education on Wages and the Labor Share in the US and Denmark. *National Bureau of Economic Research Working Paper Series, No. 29874*. https://doi.org/10.3386/w29874

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

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

Akcigit, U., & Stantcheva, S. (2020). Taxation and Innovation: What Do We Know? In A. Goolsbee, *Innovation and Public Policy* (pp. 189–212). University of Chicago Press. http://www.nber.org/chapters/c14428

Alasalmi, J., Busk, H., Holappa, V., Huovari, J., & Vaahtoniemi, S. (2022). Osaajapula vai työvoimapula – Mistä avointen työpaikkojen määrän kasvu kertoo? [*Shortage of Talent or Labour? What does the Increase in Vacancies Tell Us?*] *Akava Works report*, *2022*(2).

Ali-Yrkkö, J. (2010). *Nokia and Finland in a Sea of Change*. Etla.

Ali-Yrkkö, J., Hyytinen, A., Pajarinen, M., & Rouvinen, P. (2022). Millaista on skaalautuva liiketoiminta? [*What is Scalable Business Like?*] *ETLA Brief*, *2022*(109).

Ali-Yrkkö, J., Kotiranta, A., & Ylhäinen, I. (2017). Katsaus yritysten kasvuun ja sitä koskeviin politiikkatoimiin [*Policy Implications on Company Growth – A Review*]. *ETLA Reports*, *79*.

Arnold, E., Warta, K., Halme, K., Evers, G., van der Graaf, A., Haila, K., Järvelin, A.-M., Kettinen, J., Kolarz, P., Krismer, R., Piirainen, K., & Sutinen, L. (2022). Evaluation of the Academy of Finland. *Publications of the Ministry of Education and Culture*, *2022*(7).

Azoulay, P., & Li, D. (2020). Scientific Grant Funding. *National Bureau of Economic Research Working Paper Series*, *No. 26889* (published as Pierre Azoulay, Danielle Li “Scientific Grant Funding,” in Austan Goolsbee and Benjamin Jones, editors, "Innovation and Public Policy" University of Chicago Press (2021)). https://doi.org/10.3386/w26889

Baldwin, R. E. (ed.) (2011). *The great trade collapse: Causes, consequences and prospects*. Centre for Economic Policy Research.

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

Barth, E., Heyman, F., Hyytinen, A., & Maliranta, M. (2019). *Decomposition of macro- and micro-sources of competitiveness*.

Berg, P., Elfvengren, K., Kevätsalo, J.-P., Patana, A., Pihlajamaa, J., Pihlajamaa, M., Poskela, J., Valiauga, P., Vanharanta, O., & Vänskä, J. (2014). Johdatus uutta liiketoimintaa luovien innovaatioiden maailmaan: Apuvälineitä innovaatiotoiminnan kehittämiseen [*Introduction to the World of Innovations Creating New Business: Tools for Innovation Development*] (p. 156). School of Science. http://urn.fi/URN:ISBN:978-952-60-3674-8

Bils, M., Klenow, P. J., & Ruane, C. (2021). Misallocation or Mismeasurement? *The Real Interest Rate and the MarginalProduct of Capital in the XXIst CenturyOctober 15-16, 2020*, *124*, pp. 39–S56. https://doi.org/10.1016/j.jmoneco.2021.09.004

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

Busso, M., Madrigal, L., & Pagés, C. (2013). *Productivity and resource misallocation in Latin America*. *13*(1), 903–932. https://doi.org/10.1515/bejm-2012-0087

Böckerman, P., & Maliranta, M. (2003). Tehoton mikrotason dynamiikka. Uusi näkökulma aluetalouksien ongelmiin [*Inefficient Micro-Level Dynamics. A New Perspective on Problems of Regional Economies*]. *Kansantaloudellinen aikakauskirja*, *99*(2), pp. 138–147.

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

Calligaris, S., Del Gatto, M., Hassan, F., Ottaviano, G. I. P., & Schivardi, F. (2016). *Italy's productivity conundrum: A study on resource misallocation in Italy.* Publications Office. https://data.europa.eu/doi/10.2765/970192

Calvino, F., Criscuolo, C., Marcolin, L., & Squicciarini, M. (2018). *A taxonomy of digital intensive sectors*. https://www.oecd-ilibrary.org/content/paper/f404736a-en

Calvino, F., Criscuolo, C., & Verlhac, R. (2020). *Declining business dynamism: Structural and policy determinants* (OECD Science, Technology and Industry Policy Papers 94; OECD Science, Technology and Industry Policy Papers, Vol. 94). https://doi.org/10.1787/77b92072-en

Chuah, L. L., Loayza, N. V., & Nguyen, H. (2018). *Resource Misallocation and Productivity Gaps in Malaysia* (No 8368; Policy Research Working Paper, p. 8368). World Bank.

Cirera, X., Fattal-Jaef, R., & Gonne, N. (2017). *High-growth firms and misallocation in low-income countries: Evidence from Côte d'Ivoire.*

Cirera, X., Fattal-Jaef, R., & Maemir, H. (2020). Taxing the Good? Distortions, Misallocation, and Productivity in Sub-Saharan Africa. *The World Bank Economic Review*, *34*(1), 75–100. https://doi.org/10.1093/wber/lhy018

Corrado, C., Criscuolo, C., Haskel, J., Himbert, A., & Jona-Lasinio, C. (2021). *New evidence on intangibles, diffusion and productivity*. https://doi.org/10.1787/de0378f3-en

Criscuolo, C., Gal, P. N., & Menon, C. (2017). Do micro start-ups fuel job creation? Cross-country evidence from the DynEmp Express database. *Small Business Economics*, *48*(2), 393–412. https://doi.org/10.1007/s11187-016-9778-x

Dai, S., Kuosmanen, T., & Liesiö, J. (2022). Optimal resource allocation: A quantile approach. In T. Kuosmanen (ed.), *Misallocation of labor and capital in Finland's business sector* (Vol. 2022).

De Loecker, J., & Warzynski, F. (2012). Markups and Firm-Level Export Status. *American Economic Review*, *102*(6), 2437–2471. https://doi.org/10.1257/aer.102.6.2437

Deschryvere, M., Husso, K., & Suominen, A. (2021). Targeting R&D intensity in Finnish innovation policy. *ECD Science, Technology and Industry Working Papers*, *2021*(08). https://doi.org/10.1787/51c767c9-en

Dias, D. A., Robalo Marques, C., & Richmond, C. (2016). Misallocation and productivity in the lead up to the Eurozone crisis. *Journal of Macroeconomics*, *49*, 46–70. https://doi.org/10.1016/j.jmacro.2016.04.009

Dillner, U., & Kaufmann, C. (2015). *Leading and Organizing for Radical Innovation. A qualitative benchmarking study of how SKF could stimulate radical innovation* [Master's Degree Project]. University of Gothenburg/Graduate School.

EC-DGRI (European Commission Directorate-General for Research and Innovation). (2018). *Mission-oriented research and innovation policy: A RISE perspective*. European Commission Publications Office. https://doi.org/10.2777/426921

Edler, J., & Fagerberg, J. (2017). Innovation policy: What, why, and how. *Oxford Review of Economic Policy*, *33*(1), 2–23. https://doi.org/10.1093/oxrep/grx001

Elsby, M. W. L., Hobijn, B., & Sahin, A. (2013). The Decline of the U.S. Labor Share. *Brookings Papers on Economic Activity*, 1–52. JSTOR.

Fornaro, P., & Maliranta, M. (2022). *Liukumat suomalaisen palkanmuodostuksen joustotekijänä* [*Wage Drifts as Flexibility Factors in Finnish Wage Formation*] (Working Paper No. 334). Labour Institute for Economic Research (Labore).

Franzoni, C., Stephan, P., & Veugelers, R. (2021). Funding Risky Research. *National Bureau of Economic Research Working Paper Series*, *No. 28905*(published as Chiara Franzoni, Paula Stephan, Reinhilde Veugelers. "Funding Risky Research," in Josh Lerner and Scott Stern, editors, "Entrepreneurship and Innovation Policy and the Economy, volume 1" University of Chicago Press (2022)). https://doi.org/10.3386/w28905

Goolsbee, A., & Jones, B. (2021). *Innovation and Public Policy*. University of Chicago Press. https://www.nber.org/books-and-chapters/innovation-and-public-policy

Gross, D. P., & Sampat, B. N. (2021). Crisis Innovation Policy from World War II to COVID-19. *National Bureau of Economic Research Working Paper Series*, *No. 28915* (published as Daniel P. Gross, Bhaven N. Sampat. "Crisis Innovation Policy from World War II to COVID-19," in Josh Lerner and Scott Stern, editors, "Entrepreneurship and Innovation Policy and the Economy, volume 1" University of Chicago Press (2022)). https://doi.org/10.3386/w28915

Grossman, G. M., Helpman, E., Oberfield, E., & Sampson, T. (2017). The Productivity Slowdown and the Declining Labor Share: A Neoclassical Exploration. *National Bureau of Economic Research Working Paper Series*, *No.* 23853. https://doi.org/10.3386/w23853

Grossman, G. M., & Oberfield, E. (2022). The Elusive Explanation for the Declining Labor Share. *Annual Review of Economics*, *14*(1), 93–124. https://doi.org/10.1146/annurev-economics-080921-103046

Halme, K., & Niinikoski, M.-L. (2019). Taloutta ja yhteiskuntaa uudistava innovaatiopolitiikka [*Innovation Policy Reforming Economy and Society*]. *Publications of the Ministry of Employment and the Economy*, *2019*(7).

Halme, K., Salminen, V., Kettinen, J., Lahtinen, H., Smolander, A., Ljungman, J., Holmberg, D., Vingre, A., Beckers, D., & Khalaf, G. (2021). Business Finlandin arviointi: Innovaatioita, kasvua ja kansainvälistymistä [*Evaluation of Business Finland: Innovations, growth and internationalisation;* in Finnish, abstract in English]. *Publications of the Ministry of Employment and the Economy*, *2021*(46).

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

Haltiwanger, J., Kulick, R., & Syverson, C. (2018). Misallocation Measures: The Distortion That Ate the Residual. *National Bureau of Economic Research Working Paper Series*, *No.* 24199. https://doi.org/10.3386/w24199

Hang, J. (2022). Capacity utilization and the measurement of misallocation. *Economics Letters*, *214*, 110410. https://doi.org/10.1016/j.econlet.2022.110410

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

Hukkinen, J., Kajanoja, L., Kerola, E., Mäki-Fränti, P., & Pylkkönen, P. (2015). *Mistä investointien vaimeus johtuu? [Why is Investment Subdued?]* Bank of Finland.

Husso, K. (2021). *Todistettua vaikuttavuutta T&K-toiminnasta* [*Proven Effectiveness from R&D activity*].

Ilmakunnas, P., & Maliranta, M. (2016). How does the age structure of worker flows affect firm performance? *Journal of Productivity Analysis*, *46*(1), 43–62. https://doi.org/10.1007/s11123-016-0471-5

Jones, C. I. (2016). Chapter 1—The Facts of Economic Growth. In J. B. Taylor & H. Uhlig (eds.), *Handbook of Macroeconomics* (Vol. 2, pp. 3–69). Elsevier. https://doi.org/10.1016/bs.hesmac.2016.03.002

Kajanoja, L. (2012). Finland’s competitiveness and its measurement. Bank of Finland Bulletin, 20(5), 85–95.

Kajanoja, L. (2015). Paljonko kustannuskilpailukyvyn pitäisi parantua? [*How much should cost competitiveness improve?]* Kansantaloudellinen aikakauskirja, 111(3), 361–372.

Kajanoja, L. (2016). Suomen kustannuskilpailukyky: Lisää hyödyllisiä mittareita ja vastauksia kysymyksiin [*Finland’s cost competitiveness: More useful indicators and answers to questions*]. Bank of Finland Bulletin.

Kajanoja, L. (2017). Measuring cost-competitiveness in Finland. Bank of Finland Bulletin.

Kauhanen, A., & Maliranta, M. (2019). The Roles of Job and Worker Restructuring in Aggregate Wage Growth Dynamics1. *Review of Income and Wealth*, *65*(1), 99–118. https://doi.org/10.1111/roiw.12315

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

Kokkinen, A., Obstbaum, M., & Mäki-Fränti, P. (2021). *Bank of Finland’s long-run forecast framework with human capital*. BoF Economics Review.

Koski, O., Husso, K., Kutinlahti, P., Huuskonen, M., & Nissinen, S. (2019). Innovaatiopolitiikan lähtökohdat [*Outlook for Finland’s Innovation Policy;* in Finnish, abstract in English*]. Publications of the Ministry of Employment and the Economy*, *2019*(18).

Kuosmanen, T. (ed.) (2022). *Misallocation of labor and capital in Finland's business sector*. *2022*(44).

Kuosmanen, T., & Maczulskij, T. (2022). Kasvuyrittäjyys, yritysten uudistuminen ja työvoiman liikkuvuus tukemaan tuottavuuskasvua [*High-growth entrepreneurship, business regeneration and labour mobility to boost productivity growth*. *Policy Brief of the Government's analysis, assessment and research activities*, *2022*(18).

Kuosmanen, T., & Zhou, X. (2021). Shadow prices and marginal abatement costs: Convex quantile regression approach. *European Journal of Operational Research*, *289*(2), 666–675. https://doi.org/10.1016/j.ejor.2020.07.036

Kyyrä, T., & Maliranta, M. (2008). The micro-level dynamics of declining labour share: Lessons from the Finnish great leap*. *Industrial and Corporate Change*, *17*(6), 1147–1172. https://doi.org/10.1093/icc/dtn006

Lemola, T. (2021). Transformatiivinen innovaatiopolitiikka: Tiede-, teknologia- ja innovaatiopolitiikan uusi paradigma [*Transformative innovation policy: New paradigm for science, technology and innovation policy]*. *Yhteiskuntapolitiikka*, *86*(2021:(4)).

Lerner, J. (2020). Government Incentives for Entrepreneurship. In *Innovation and Public Policy* (pp. 213–235). University of Chicago Press. http://www.nber.org/chapters/c14426

Li, N., & Wang, Y. (2021). Estimating resource misallocation: Distinguishing factor market distortions from variable markups. *Economics Letters*, *207*, 110027. https://doi.org/10.1016/j.econlet.2021.110027

Maliranta, M. (2014a). Luovan tuhon tie kilpailukykyyn. Miten innovointi vaikuttaa yrityksiin, kansantalouteen ja kansalaisiin [*The Creative Destruction Path to Competitiveness. How Does Innovation Affect Enterprises, National Economy and Citizens?*] *Tehokkaan Tuotannon Tutkumussäätiö*.

Maliranta, M. (2014b). *Kustannuskilpailukyky kasvumenestyksen ehtona* [*Cost competitiveness as a condition for growth performance;* in Finnish, abstract in English].

Maliranta, M., & Hurri, P. (2017). Kasvuyritykset ja talouskasvu: Empiirinen analyysi kasvuyritysten työllisyyden ja tuottavuuden dynamiikasta [*High-growth enterprises and economic growth: Empirical analysis of employment and productivity dynamics of high-growth enterprises*]. *Kansantaloudellinen aikakauskirja*, *113*(1), Article 1.

http://www.taloustieteellinenyhdistys.fi/wp-content/uploads/2017/03/kak-1-2017-MalirantaHurri.pdf

Maliranta, M., & Määttänen, N. (2018). Toimialojen kannattavuus, työpaikkavirrat ja luova tuho Suomen tehdasteollisuudessa [*Profitability of Industries, Labour Market Flows, and Creative Destruction in Finnish Manufacturing*; in Finnish, abstract in English]. *ETLA Brief*, *74*, 9.

Maliranta, M., Rouvinen, P., & Ylä-Anttila, P. (2010). Finland's Path to the Global Productivity Frontier through Creative Destruction. *International Productivity Monitor*, *20*, 68–84.

Mankinen, R., Nikula, N., & Rantala, O. (2012). Kustannuskilpailukyvyn mittausmenetelmien uudistaminen [*Reform of Cost Competitiveness Metrics*]. Prime Minister's Office Reports, 2012(3).

Nguyen, H., Taskin, T., & Yilmaz, A. (2016). Resource misallocation in Turkey. *World Bank Policy Research Working Paper*, *7780*.

OECD. (2020a). *The effects of R&D tax incentives and their role in the innovation policy mix*. 92. https://doi.org/10.1787/65234003-en

OECD. (2020b). *OECD Economic Surveys: Finland 2020*. OECD. https://doi.org/10.1787/673aeb7f-en

OECD (upcoming). *The Slowdown in Finnish Productivity Growth: Causes and Consequences*.

Ministry of Education and Culture. (2021). *Updated National Roadmap for Research, Development and Innovation*. Ministry of Education and Culture.

Parliamentary Working Group on Research, Development and Innovation. (2021). Parlamentaarisen TKI-työryhmän loppuraportti [*Final Report of the Parliamentary Working Group on Research, Development and Innovation*; in Finnish, abstract in English] . *Publications of the Finnish Government*, *2021*(95).

Pekkala Kerr, S., & Kerr, W. R. (2020). Immigration Policy Levers for US Innovation and Startups. *National Bureau of Economic Research Working Paper Series*, *No. 27040* (published as Sari Pekkala Kerr and William R. Kerr. "Immigration Policy Levers for US Innovation and Start-Ups," in Austan Goolsbee and Benjamin Jones, editors, "Innovation and Public Policy" University of Chicago Press (2021)). https://doi.org/10.3386/w27040

Property Rights Alliance. (2021). *International property rights index*. https://www.internationalpropertyrightsindex.org/.

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

Ryzhenkov, M. (2016). Resource misallocation and manufacturing productivity: The case of Ukraine. *Ukraine\: Escape from Post-Soviet Legacy*, *44*(1), 41–55. https://doi.org/10.1016/j.jce.2015.12.003

Salminen, V., Halme, K., Piirainen, K., Roiha, U., Laasonen, V., Talvitie, J., Valtakari, M., Fängström, T., Bengston Jallow, A., Äimä, K., Isokangas, E., Kokko, A., Takalo, T., & Toivanen, O. (2020). Innovaatiomyönteinen sääntely: Nykytila ja hyvät käytännöt [*Innovation-friendly regulation: Current state and good practices*; in Finnish, executive summary in English]. *Publications of the Government's analysis, assessment and research activities,* 2020(27).

Suni, P., & Vihriälä, V. (2016). Finland and Its Northern Peers in the Great Recession. ETLA Reports, 49.

Syverson, C. (2011). What Determines Productivity? *Journal of Economic Literature*, *49*(2), 326–365. https://doi.org/10.1257/jel.49.2.326

Takalo, T. (2014). Innovaatiopolitiikan haasteet [*Challenges of Innovation Policy*]. *Kansantaloudellinen aikakauskirja*, *110*(3).

Takalo, T., & Toivanen, O. (2021). Sääntelyn vaikutukset innovaatiotoimintaan ja innovaatiotoimintaa edistävä sääntely [*Effects of Regulation on Innovation Activity and Regulation Promoting Innovation*]. *Kansantaloudellinen aikakauskirja*, *117*(1), 28.

Teichgraeber, A., & Van Reenen, J. (2022). *A policy toolkit to increase research and innovation in the European Union*. Centre for Economic Performance, LSE.

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*, *2019*(21), Article 21. http://urn.fi/URN:ISBN:978-952-367-291-8

Finnish Productivity Board. (2020). Productivity and competitiveness in Finland. Which factors affect competitiveness? Why do we need it? *Publications of the Ministry of Finance*, *2020*(81), Article 81. http://urn.fi/URN:ISBN:978-952-367-485-1

Finnish Productivity Board. (2021). Productivity and resource allocation – Weak level and growth of productivity in Finland's digital services. *Publications of the Ministry of Finance*, *58*.

Ministry of Economic Affairs and Employment. (2018). Agenda for Sustainable Growth. MEAE guides and other publications, 2018(14).

Ministry of Economic Affairs and Employment. (2021a). Innovaatiorahoituskeskus Business Finlandin tulostavoiteasiakirja vuosille 2022-2025 [*Performance target document for the Innovation Funding Centre Business Finland for 2022–2025*] . Ministry of Economic Affairs and Employment; VN/13762/2021.

Ministry of Economic Affairs and Employment. (2022a). Occupational Barometer: Number of occupations suffering from labour shortage has risen to pre-COVID level.

Ministry of Economic Affairs and Employment. (2022b). Innovations ja enterprise funding -osaston tulossopimus vuodelle 2022 [*Performance agreement for the Innovations and Enterprise Financing Department for 2022*]. Ministry of Economic Affairs and Employment.

Van Reenen, J. (2021). Innovation and Human Capital Policy. *National Bureau of Economic Research Working Paper Series*, *No. 28713*(published as John Van Reenen. "Innovation and Human Capital Policy," in Austan Goolsbee and Benjamin Jones, editors, "Innovation and Public Policy" University of Chicago Press (2021)). https://doi.org/10.3386/w28713

Varian, H. R. (1984). The Nonparametric Approach to Production Analysis. *Econometrica*, *52*(3), 579–597. JSTOR. https://doi.org/10.2307/1913466

Wang, Y., Wang, S., Dang, C., & Ge, W. (2014). Nonparametric quantile frontier estimation under shape restriction. *European Journal of Operational Research*, *232*(3), 671–678. https://doi.org/10.1016/j.ejor.2013.06.049

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 978-952-367-213-0 (pdf)

December 2022