MINISTRY OF FINANCE

The State of Productivity in Finland
Why did its growth stop? Will it start again?

Economic Policy

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The State of Productivity in Finland

Why did its growth stop? Will it start again?

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Abstract

Economic growth is still important source of improving living standards and, in the long term, labour productivity growth is the most important factor behind it. Productivity grows as a result of better utilisation of better technologies. In this, its first report, the Finnish Productivity Board examines the development of productivity in Finland from diverse perspectives, making use of national accounts, growth accounting and corporation-level productivity decompositions.

The financial crisis put an end to Finland's fast productivity growth, turning it into a decline. The main causes for the fall in measured productivity were the shock faced by the electronics industry and decline in the competitiveness of the Finnish national economy, which resulted in negative or weak productivity growth, even if employment stayed at quite a high level considering the poor economic cycle.

In Finland the drop in labour productivity was more severe and recovery was slower than in the reference countries. Total factor productivity started to fall as well. Total factor productivity is often considered as a measure of technologies and expertise, but this is only partially true. Total factor productivity measures the change in productivity in total that is not explained by other factors. Part of the decline in productivity is due to weak demand and competitiveness.

There are considerable differences between corporations in terms of productivity. In creative destruction labour force moves from low-productivity activities to activities where productivity is higher. At the level of the national economy this is a key source of productivity. Corporate dynamics featuring creative destruction has for its part maintained productivity growth.

Policy actions only have an indirect and uncertain impact on productivity. In policy interventions it is better to focus on maintaining and strengthening general conditions for productivity growth.

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Tiivistelmä

Talouden kasvu on edelleen keskeinen hyvinvoinnin kasvun lähde ja työn tuottavuus on pitkällä aikavälillä sen tärkein tekijä. Tuottavuus kasvaa paremman teknologian paremman käytön myötä. Tuottavuuslautakunnan ensimmäisessä raportissa Suomen tuottavuuskehitystä tarkastellaan monipuolisesti kansantalouden tilinpitoa, kasvulaskentaa ja yritystason tuottavuushajotelmia apuna käyttäen.

Suomen nopea tuottavuuskasvu pysähtyi finanssikriisin aikoihin ja kääntyi laskuun. Merkittävät syyt mitatun tuottavuuden alenemiseen ovat elektroniikkateollisuutta kohdannut shokki ja kansantalouden heikentynyt kilpailukyky, jotka pitivät tuotannon kasvun pitkään negatiivisena tai heikkona, vaikka työllisyys säilyi suhdanteisiin nähden hyvänä.

Suomessa työn tuottavuuden pudotus oli syvempi ja toipuminen heikompaa kuin vertailumaissa. Myös kokonaistuottavuus kääntyi laskuun. Kokonaistuottavuutta ajatellaan usein teknologian ja osaamisen mittana.

Tulkinta on puutteellinen. Kokonaistuottavuus mittaa kaikkea sitä tuottavuuden muutosta, jota muut tekijät eivät selitä. Osa kokonaistuottavuuden laskusta selittyy heikolla kysynnällä ja kilpailukyvyllä.

Tuottavuudessa on merkittävää hajontaa yritysten välillä. Luovassa tuhossa työvoimaa siirtyy alemman tuottavuuden tuotantotoiminnasta korkeamman tuottavuuden tuotantoon. Se on kansantalouden tasolla keskeinen tuottavuuden lähde. Luovaa tuhoa sisältänyt yritysdynamiikka on osaltaan ylläpitänyt tuottavuuden kasvua.

Politiikkatoimilla on vain epäsuora ja epävarma vaikutus tuottavuuteen. Tärkeintä olisi keskittyä tuottavuuskasvun edellytysten ylläpitämiseen ja vahvistamiseen.

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Referat

Den ekonomiska tillväxten är fortfarande en betydande källa till välfärdstillväxt och arbetsproduktiviteten på lång sikt dess viktigaste faktor. Produktiviteten ökar i takt med en bättre användning av bättre teknik. I produktivitetsnämndens första rapport undersöks Finlands produktivitetsutveckling på ett mångsidigt sätt med hjälp av nationalräkenskaper, tillväxtberäkning och produktivitetsdekompositioner på företagsnivå.

Den snabba produktivitetstillväxten i Finland avstannade under finanskrisen och började minska. Betydande orsaker till att den uppmätta produktiviteten minskade är den chock som drabbade elektronikindustrin och den försvagade nationalekonomiska konkurrenskraften som länge ledde till att produktivitetstillväxten var negativ eller svag, fastän sysselsättningen i förhållande till konjunkturerna förblev god.

I Finland var minskningen av produktiviteten kraftigare och återhämtningen svagare än i jämförelseländerna. Även totalproduktiviteten började minska. Totalproduktivitet uppfattas ofta som ett mått på teknik och kunnande. Tolkningen är bristfällig. Totalproduktiviteten mäter all den förändring i produktiviteten som andra faktorer inte förklarar. En del av nedgången i produktiviteten förklaras av svag efterfrågan och konkurrenskraft.

I fråga om produktiviteten finns det en betydande spridning mellan företag. Kreativ förstörelse innebär att arbetskraft övergår från uppgifter med lägre produktivitet till uppgifter med högre produktivitet. Detta är på nationalekonomisk nivå en viktig källa till produktivitet. Företagsdynamik som inkluderat kreativ förstörelse har för sin del upprätthållit produktivitetsökningen.

Politiska åtgärder har bara en indirekt och osäker effekt på produktiviteten. Det viktigaste vore att fokusera på upprätthållandet och förstärkandet av förutsättningarna för produktivitetstillväxt.

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Contents

1 Introduction

The impacts of policy actions on productivity are indirect and uncertain

The growth of the economy is the foremost source of the improving of wellbeing. In the long run, labour productivity is the most important source of growth. The foremost individual factors affecting the growth of productivity are better technology and especially the better use of technology.

Investments into research and product development (R&D) provide support for productivity development but with a certain delay. However, the advantages to be obtained from the R&D results of a small open economy like that of Finland may, for the most part, be lost to globally active corporations and consumers. More than 99% of the R&D investments by OECD countries are made outside Finland. More essential would be better utilization the results of these foreign investments.

The better utilisation of the results of global R&D investments is promoted by the high and wide-in-scope level of expertise of companies' management and labour force. The best employees' chances are often global. Productivity could be indirectly enhanced by Finland's ability to attract and to hold skilled personnel and to provide them with incentives to improve their know-how.

The level of the productivity varies markedly among the corporations and their various workplaces. The wider adopting and adapting of best practices would improve the productivity of the national economy. For example, broader interaction internationally or between established and small growth-seeking corporations could help in this. Internationally active corporations are above-average in productivity and their more active presence in Finland would improve productivity. Finland's ability to attract international investments and business activity characterised by high productivity could promote growth of productivity, e.g. through know-how and best practices spilling over into the country's national economy.

The foremost factor at the level of the national economy in the background of productivity growth is the so-called creative destruction whereby labor and capital move from workplaces characterised by poor productivity to more productive workplaces. This means that productivity could be indirectly promoted by increasing the regional, vocational and other mobility of the labour force. Ensuring healthy competition between corporations is also important. From this point of view, a matter of fundamental importance is to promote market access for entrants and the departure of old corporations. For example, the departure of non-productive corporations from the marketplace could be accelerated through reforms promoting restructuring. Digitalisation, platforms, artificial intelligence and other instruments accompanying the on-going industrial revolution may lead to an increasingly large number of "winner-takes-it-all" markets. This challenges competition regulatory policy to see to it that success in the marketplace is based on merit and not, for example, by preventing new potential competitors' from challenging past winners

Corporate structures have in many cases evolved as a consequence of history of long standing. Investments have been made in under uncertainty and some of them have proved to be less productive than was initially expected. Demand may have been hit by shocks, and consequently a corporation's production lines and labour force may no longer fulfill their purpose. The capital and labour force may be misallocated from the point of view of productivity. The recent literature on misallocation emphasises the significance of various frictions being bottlenecks for productivity.

Thus, productivity is extremely important for the foundation of the material standard of living in a society. At the same time, promoting it by policy actions is difficult and the chains of effect are long and indirect. Thus, the first report by the Productivity Board endeavours to shed light on the recent development of productivity in Finland and in selected benchmark countries, and to discuss matters such as the possibilities of policy making to promote productivity and remove obstacles to growth. However, it is necessary first to examine a framework which facilitates the examination of the significance of productivity growth and its factors.

Economic growth can be examined in the short and long run and on the macro and the micro level

It is useful to examine economic growth from two directions (from the short-term and long-term points of view) and on two levels (the macro level and the micro level). These four points of view are not alternatives; instead, they supplement one another. Bundled together, they offer a versatile and uniform general idea of the different aspects of economic growth. This general idea is necessary to gain a proper understanding of the development of the economy, the reasons for economic growth, and the phenomena associated with economic growth. Figure 1.1 illustrates this framework.

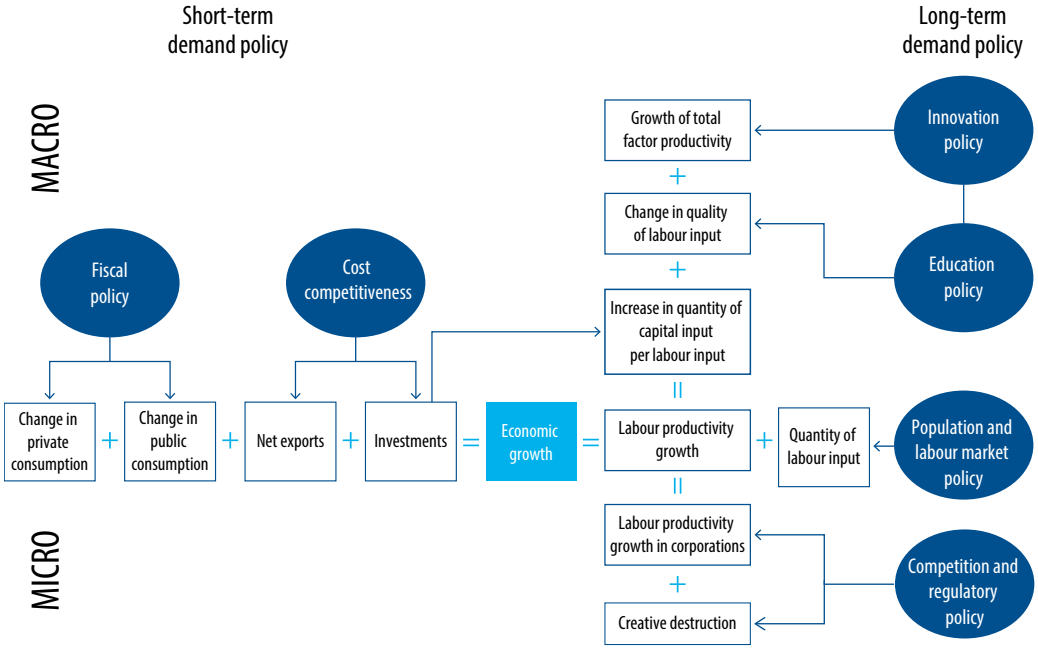


Figure 1.1 Economic growth and productivity
Source: Maliranta (coming)

Short-term macro factors

Economic growth is presented in the dark box in the middle of the figure. The various items of demand are described on left side of the figure: change in private consumption, change in public consumption, net exports (export-import), and investments. These changes in demand explain the short-term, a few years' time span, changes in gross domestic product.

These demand items can be influenced through business cycle policy. They are presented at the left top of the figure. Fiscal policy can be used to regulate public demand and (in part) private demand, and thereby short-term economic activity and growth. Furthermore, for a small open economy, a significant demand item, such as of Finland, is the difference of exports and imports. It is impacted by cost competitiveness which affects the market shares of export corporations on the international marketplace. On the other hand, corporations active on the domestic market and competing with imports are also of major significance.

The competitiveness of corporations also affects their willingness to expand their production capacity through investments. Monetary policy impacts especially on private consumption and investments, and thereby on the GDP.

Long-term macroeconomic factors

Factors affecting long-term economic growth are described at the top and middle of Figure 1.1. Algebraically, economic growth is the sum of the change in the growth of labour productivity and the number of hours of work.

The crucial factor of long-term economic growth is the development of labour productivity. The growth of labour productivity can be divided into components from two points of view. The "macro factors" of the growth of labour productivity can be measured by the so-called growth accounting. These factors are described at the top right of Figure 1.1.

The first one of these is capital. The idea is that the more machines, devices and other capital goods an employee has available to him, the more output in an hour he will achieve; i.e. the capital intensity is higher. Thus, labour productivity can be increased by investing in (i.e. by increasing) the stock of capital. However, the stock of capital is subject to what so-called diminishing marginal product. The more capital stock there is already, the less a certain amount of additional capital increases labour productivity percentage vice. Because of diminishing marginal product, an increase in investments cannot bring about lasting economic growth and growth of labour productivity.

The second growth accounting factor is the quality of labour input. The idea here is that by improving his know-how, the employee can achieve more output in an hour. Investment in education and training is of foremost importance here. Labour productivity cannot be improved endlessly by increasing investments in education and training. This is prevented simply by the limited length of human life and particularly of the individual's effective working age.

The third growth accounting factor is a residual term, which known as total factor productivity. It is that part of the growth of labour productivity which cannot be explained by investments in fixed capital (machinery, plant, and buildings) or in human capital (know-how). Economists often refer to it by using the term technology.

However, because it is a residual term, the term technology must be interpreted broadly. It includes the technological knowledge produced at universities and research institutions with the help of which corporations are able to achieve hitherto greater output following a specific labour and capital input, inter alia. But a residual term can also grow for the reason that corporations reduce inefficiencies in the use of their production capacity (Leibenstein, 1966). A residual term can also grow for the reason that knowledge is being accumulated within a corporation and causes an increase in productivity as experience accumulates in production (David, 1973). This is an interesting source of growth of labour productivity for the reason that it does not require investments by corporations.

Long-term corporate-level factors

Efficiency at the level of the entire national economy, sector or branch can improve and the residual term of growth accounting can increase for the reason that the labour input and capital input are allocated to the more efficient corporations rather than inefficient corporations. This is a matter of the so-called "creative destruction" mechanism. This viewpoint indicates that it is useful to examine economic growth and the development of labour productivity in the economy also from the corporation level, i.e., from the micro level. The micro-level labour productivity growth factors are measured using so-called micro-level decomposition (Maliranta and Ylä-Anttila, 2007).

Micro-level labour productivity growth factors are presented at the bottom right of Figure 1.1. Part of the growth of labour productivity within the economy is explained by each on-going corporation (and government agency, organisation etc.) achieving more output per hour than during the preceding year, i.e. growth of labour productivity has occurred "within" the corporations. This component is referred to as the "within component".

Productivity can rise even if it does not increase within any corporation

The rate of growth of labour productivity within the economy (or within a sector or branch) is not necessarily the same as the average productivity growth of its corporations. The productivity of the economy can rise even if there is no improvement in the productivity of even a single corporation. The productivity of the national economy can also increase through the entry of new corporations whose level of productivity is higher than the average productivity level of old corporations operating on the market. After all, by definition, new corporations cannot have a productivity growth rate. On the other hand, the productivity of the economy can also increase following the departure of corporations with productivity levels lower than those of corporations that continue to operate on the market. Correspondingly, by definition, corporations that departied the market cannot have growth of productivity.

From the point of view of the national economy's labour productivity, it is a matter of fundamental significance how the labour force moves between the corporations that continue to operate, and how the corporations' shares of the labour force change. The shifts in the labour force shares of corporations continuing to operate on the market have a positive impact on the national economy's labour productivity when corporations having higher labour productivity enlarge their shares of the labour force at the expense of corporations characterised by lower labour productivity. This happens when employees move from corporations with lower productivities to corporations with higher productivities. This is referred to as the "between component" of labour productivity.

In this way, the change in corporation structures and workplace structures, which elevate the productivity of the national economy (or of a sector or branch of manufacturing), is composed of the effects of between components taking place between new corporations, departing corporations, and corporations continuing to operate on the market. These are referred to as "creative destruction" in Figure 1.1. Creative destruction is addressed in more detail in Chapter 5.

To the right of Figure 1.1, there are factors which have long-term impacts on the growth of the national economy and on which of the growth mechanisms serve in conveying the impacts. The innovation policy and education policy are connected, and they affect technological development and quality of the work contribution. Labour market policy affects the volume of the labour input and in the long run so does population policy. The growth effects of competition policy and regulation policy are conveyed significantly via the micro factors of the growth of labour productivity. Increasing competition and the elimination of inflexibilities slowing down the reallocation of the labour force accelerate "creative destruction" and thereby the growth of productivity and of the economy. Maliranta (forthcoming)

There are linkages between the various parts of the figure

It should be noted that many interconnections and channels of impact between the various matters have not been pointed out separately; this has been done in order to enhance the readability of the figure. This applies to the possible linkages between the left and right sides of the figure. For example: the short-term changes in consumer demand can impact on both the quality and quantity of the labour input in the long term due to the hysteresis effect. The weakening of demand can lead to increased unemployment. Particularly lengthy unemployment periods can lead to impaired level of know-how, which then impairs the individual's productivity and can even lead to the person being excluded from the labour force.

There are also significant interconnections between the top and the bottom parts of Figure 1.1, but they are not shown in the figure. For example: the intensity of competition can impact on the innovation willingness of corporations. In other words, competition policy can impact on both creative destruction as well as technological development.

Figure 1.2 illustrates how the this report focuses on examining productivity and on reporting on productivity development.

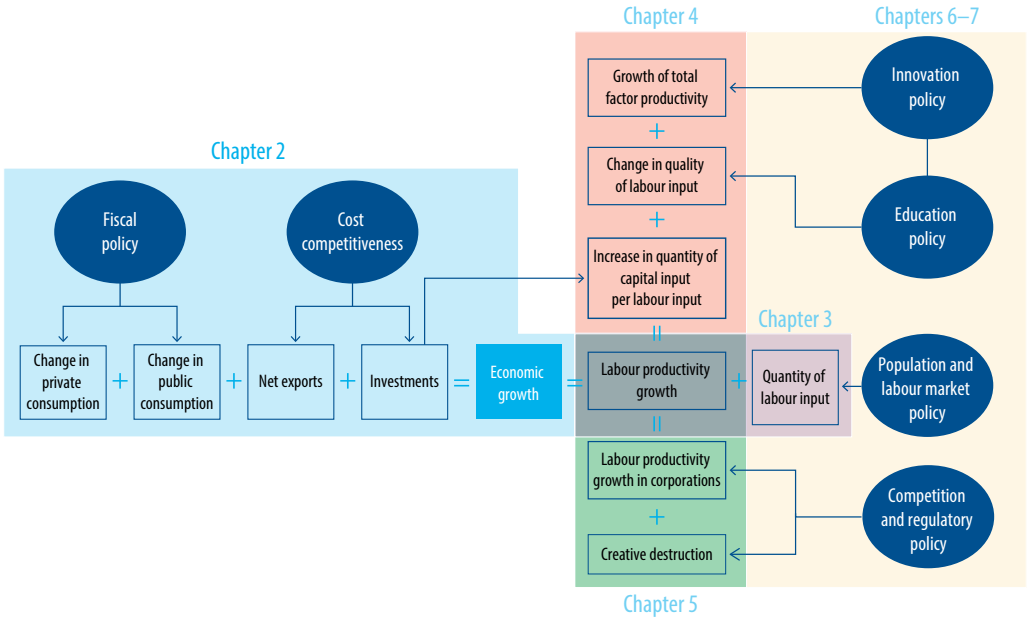


Figure 1.2 The structure of this report
Source: Maliranta (coming)

Chapter 2 focuses on the section on the left-hand side of the figure. The emphasis there is on demand and on the competitiveness of the economy. Chapter 3 examines the central section of the figure and especially labour productivity. Chapter 4 focuses on the top central part of the figure, and Chapter 5 focuses on the bottom part. Chapter 4 draws attention to examining total factor productivity and Chapter 5 to creative destruction. Chapters 6 and 7 provide a synthesis of the various findings and discuss the possibilities of the various policies.

2 Economic growth and labour productivity

First we examine the development of the measured productivity by resorting mainly to national accounts. This provides a bird's eye view for the productivity. In the later Chapters we proceed to explain the development of measured productivity and we endeavour to provide a more detailed answer to the observation of the halt of productivity growth and its becoming negative. This chapter underscores demand and competitiveness (Figure 2.1).

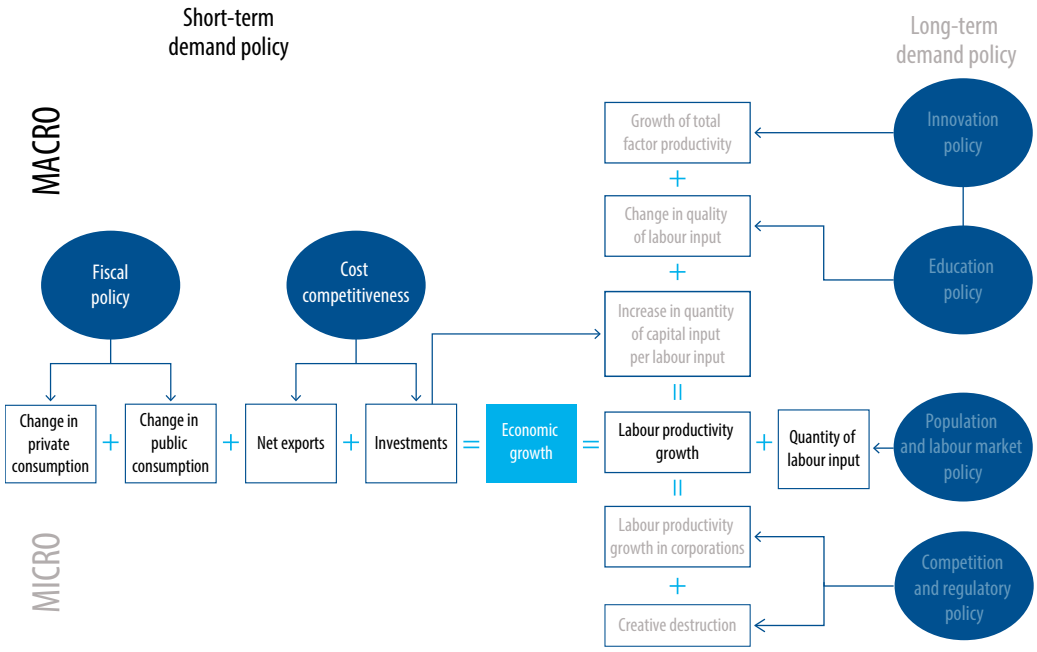


Figure 2.1 Productivity measured over a short period of time reflects demand and competitiveness
Source: Maliranta (coming)

In the long run, productivity is of primary importance

The growth of the economy is the foremost source of the improving of wellbeing. Productivity is not everything, but the ability of the national economy to improve the standard of living and the quality of life in the long run depends almost only on labour productivity, because employees' average number of work hours cannot be infinitely large (Krugman 1994).

Gross domestic product (hereafter: GDP) is comprised roughly of the working hours multiplied by labour productivity. In an ageing society, with the numbers of those of working age no longer increasing, economic growth is created mainly through labour productivity.

Productivity does not mean that Jack uses his shovel at an increasingly faster pace. First and foremost, productivity is the result of the shovel being replaced by a mechanised tractor-mounted digger (use of more capital and better technology), the use of tractors being well organised (better know-how, practices and management are implemented) and of the labour force moving to where tractor operation has been organised in the best way (creative destruction).

Labour productivity – output, GDP or value added divided by hours of work – can then, in principle, increase without limit thanks, above all, to technological development, better ways of doing things, and better know-how and management. It is often more sensible to concentrate on value added than the GDP or output, because value added is that which is used to pay wages, taxes and profits. Value added (gross) means the value produced by the unit participating in the production. It is calculated in the market production by deducting the intermediate products (goods and services) and in non-market production by adding together the employee compensations, the depreciation of fixed capital, and any taxes on production and imports.

The examination of productivity is in measuring

This report deals with the examination of labour productivity, first and foremost, through measurements. To measure productivity, one needs to measure the result (output, GDP or value added) and the input (hours or number of employees) used. Productivity is the relationship between the results and the inputs.

In the case of non-market production, measuring value added, and thereby productivity, is problematic. Consequently, most of this report focuses on market production. In some market sectors, too, the measurement of productivity is problematic (see Chapter 3.1 and Annex 1), and at several points we concentrate on a limited market sector from which these few problematic fields have been removed.

Focus on productivity, not profitability

Productivity is totally different from profitability, even though there is confusion regarding them in informal debate. Profitability refers to the difference or relationship between revenues and expenses. At the level of the national economy, operating surplus (net) is the closest term to profitability. It is obtained when employee compensations, taxes on production and imports, and the wear-and-tear of the fixed capital are deducted from the value added, and when subsidies are added to it. Figure 2.2 shows time series of the development of Finland's output, GDP, value added and operating surplus and Figure 2.3 shows the corresponding productivity time series (there is no sensible interpretation of the operating surplus/work hours series, and consequently it has been omitted from the latter figure).

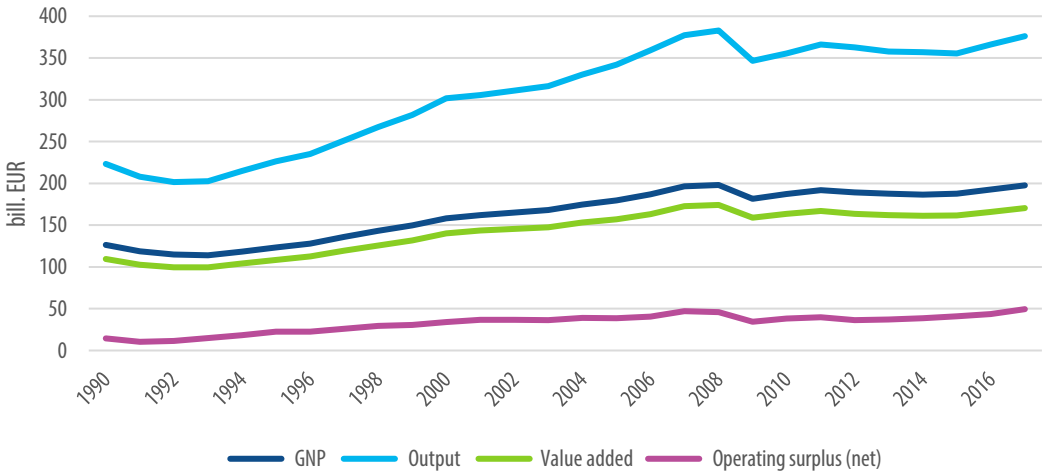


Figure 2.2 Finland's fixed-price output, GNP, value added, and operating surplus

Source: Statistics Finland, Finnish Productivity Board

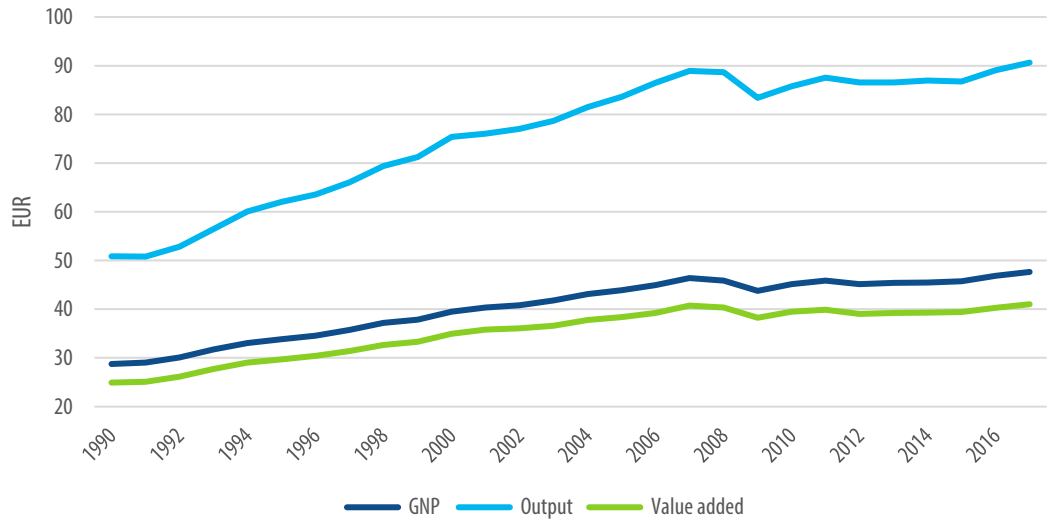


Figure 2.3 Output, GNP, and value added per hour

Source: Statistics Finland, Finnish Productivity Board

Finland's rapid productivity growth came to a halt after the financial crisis

In Figures 2.4 and 2.5 we present comparisons of productivity development between Finland and some other by means purchasing-power-adjusted GDP per hour of work. It becomes evident from the figures that productivity in Finland grew very rapidly despite the recession of the 1990's. The growth of productivity in Finland was the fastest of the countries chosen to be included in the figure until the financial crisis; in Figure 2.4 the slope of the graph representing Finland remains steepest of all until 2008. Finland succeeded in catching up on some of the headway of countries having higher productivity, but this development came to a halt at the time of the financial crisis and the difference has subsequently increased again. A significant part of the report is dedicated to examining the coming to a halt of Finland's productivity growth and the difference in growth rate with respect to the reference countries.

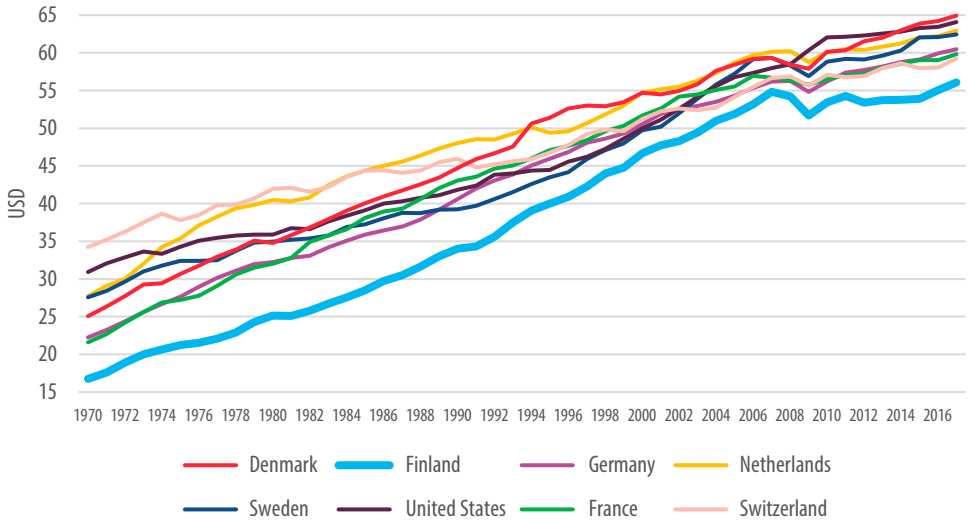


Figure 2.4 Volume of GNP per work hour, purchasing-power-adjusted 2010, USD
Source: OECD LAMA, Macrobond, Finnish Productivity Board

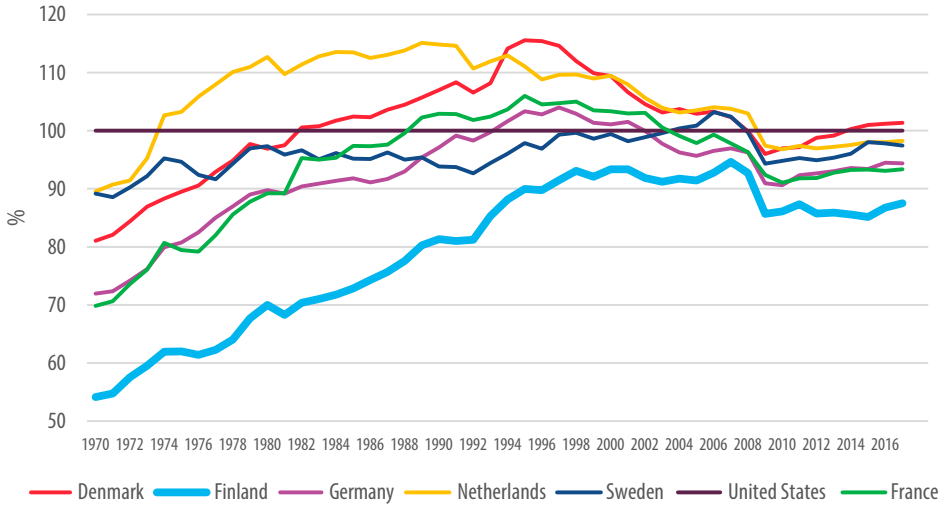


Figure 2.5 Volume of GNP per work hour, in relation to the United States, %
Source: OECD LAMA, Macrobond, Finnish Productivity Board

In order to better understand the development of productivity and of the factors affecting it, economics is also needed in addition to time series and mere measurement.

The foremost component in labour productivity is total factor productivity

Examples of how the factors of productivity can be divided include per change in labour force quality and quantity of capital per employee. However, these explain only a small part of the growth of productivity. The foremost factor of productivity is total factor productivity (TFP) or multifactor productivity (MFP). Total factor productivity is that part of the development of productivity which these other factors do not explain. It is often interpreted, for example, as development of technology, but sometimes also as development of know-how and management; however, this interpretation is too narrow in scope. Total factor productivity always includes all those effects which have not been explained by other used factors. Figure 2.6 shows one breakdown based of the cumulative factors of productivity since 1985. The emphasised significance of total factor productivity is clearly to be seen here. More thought is given to this in Chapter 4 where growth calculation is discussed.

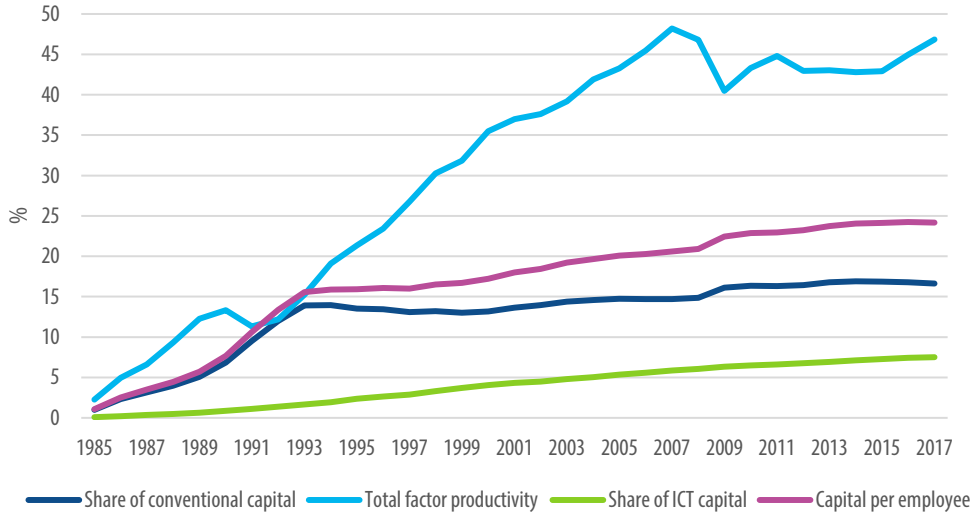


Figure 2.6 One way to break down labour productivity's growth contributions in Finland since 1985
Source: OECD LAMA, Macrobond, Finnish Productivity Board

Demand and competitiveness also affect the measured productivity

In principle, productivity is purely a phenomenon of the supply side: productivity depends on what the corporate sector and the public sector are able to produce with the quantity of labour and other inputs they have at their disposal. Productivity will improve when better technology, the best ways of action and practices are brought into use, and when capital and labour move from lower productivity workplaces to higher productivity workplaces. Improving the quality of goods and services is also part of productivity growth, but this sometimes difficult to measure. In practice, however, demand and competitiveness affect measured productivity. Labour productivity is, by definition, the ratio of value added to the number of hours worked, and demand also affects how great the measured value added is.

In Figure 2.7 we show the growth of labour productivity and total factor productivity in the Finland, Sweden, Germany and Denmark, and these are compared with the capacity utilization rate in manufacturing. Capacity utilization rate can be thought of as depicting the demand on a country's manufacturing sector, which depends not only on the quantity and structure global demand, but also on the competitiveness of the country to respond to demand.

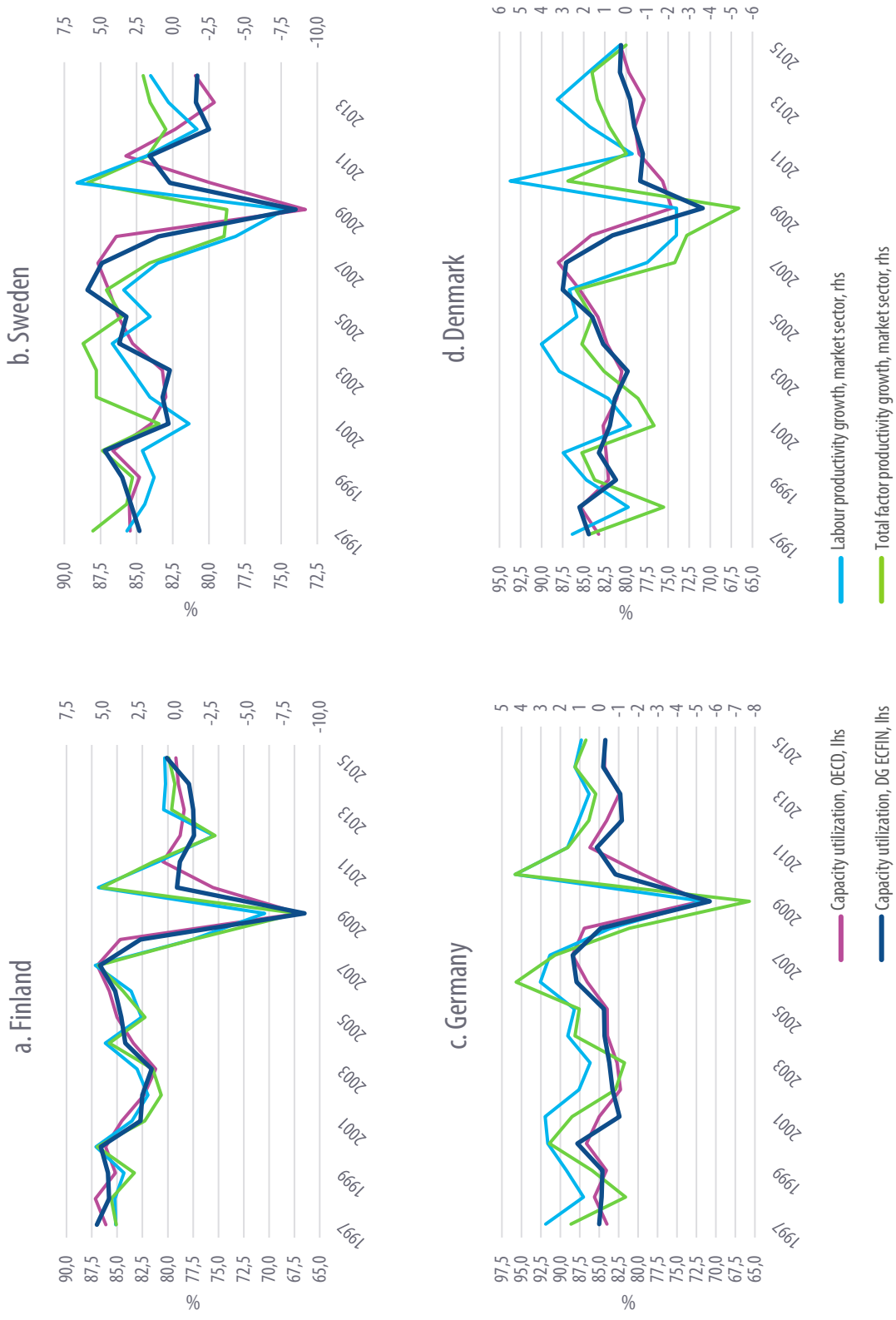


Figure 2.7 Capacity utilization rate and productivity of manufacturing in the market sector

Source: OECD, DG ECFIN, EU KLEMS, Macrobond, Finnish Productivity Board

The first thing to be noted on looking at the figures is the clear correlation between capacity utilization rate and the various productivity concepts. Measured productivity development follows demand and business cycle.

The second thing to be noted is the negative productivity growth over several years following the demand shock caused by the financial crisis. Moreover, the growth in total factor productivity was negative. The supply side explanation, such as decline of technology or vanishing of know-how, is not a rational interpretation of this phenomenon; rather, this is, first and foremost, a question of the combined impact of the demand side factors on the measured productivity. During the financial crisis, the collapse of demand led to a reduction of the value added, due to both lower prices and reduced volumes. Due to various reasons, the number of working hours did not diminish in the same proportion as the value added. In the short run, of even a few years, demand may determine the measured growth in productivity.

Increase in productivity may slow down for several years due to the impact of demand and competitiveness

The third thing to be noted is the extremely slow recovery of Finland, in terms of both capacity utilization rate and measured productivity. In the three other countries, productivity growths returned to the pre-crisis speeds, but Finland's productivity growths in 2012-2015 stayed about 3 percentage points below the pre-crisis rate. This phenomenon is especially clearly visible in Figure 2.8 where productivity growth and capacity utilization rate are compared with a median of the years 1997-2007.

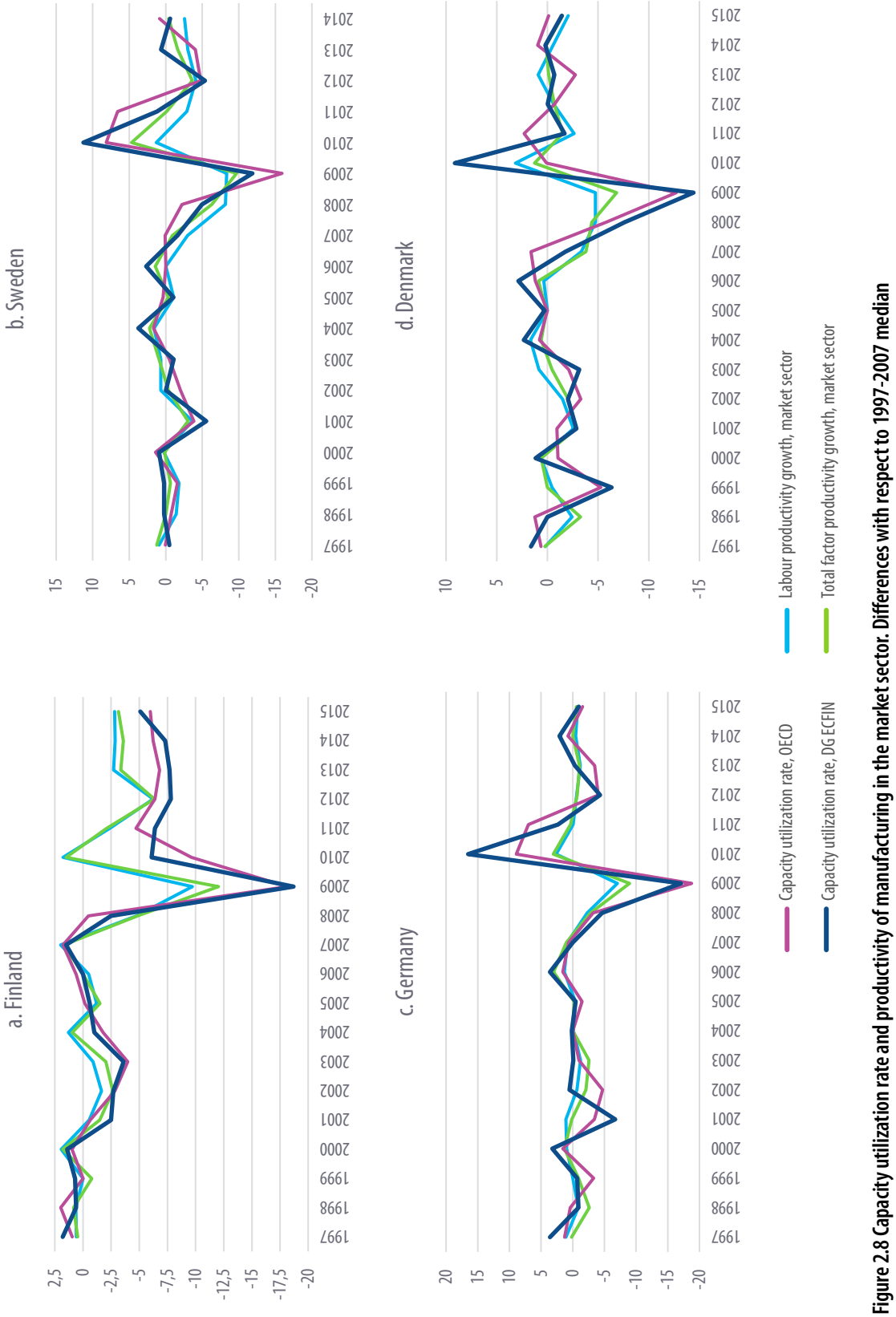


Figure 2.8 Capacity utilization rate and productivity of manufacturing in the market sector. Differences with respect to 1997-2007 median

Source: OECD, DG ECFIN, EU KLEMS, Macrobond, Finnish Productivity Board

Price-and-cost competitiveness can also be seen in measured productivity

Furthermore, Finland's volumes of exports of goods and services in relation to the world's imports and to the exports of some benchmark countries are compared in Figure 2.9. The time series have been scaled so that the pre-crisis year of 2007 gets the value 100 because 2007 was an epoch-making year in many respects. The figure shows that Finland's graph is the steepest one prior to the financial crisis. During the period 1995-2008 Finland did better in international trade than the benchmark countries.

Furthermore, the figure suggests that one reason for Finland's relatively slow measured post-crisis productivity growth may have been Finland's lack of export success, which in part was caused by Finland's loss of export competitiveness. Exporters were not able to grow their value added at the earlier rate or at the rate of benchmark countries even though the national economy was able to maintain employment and working hours at quite good levels.

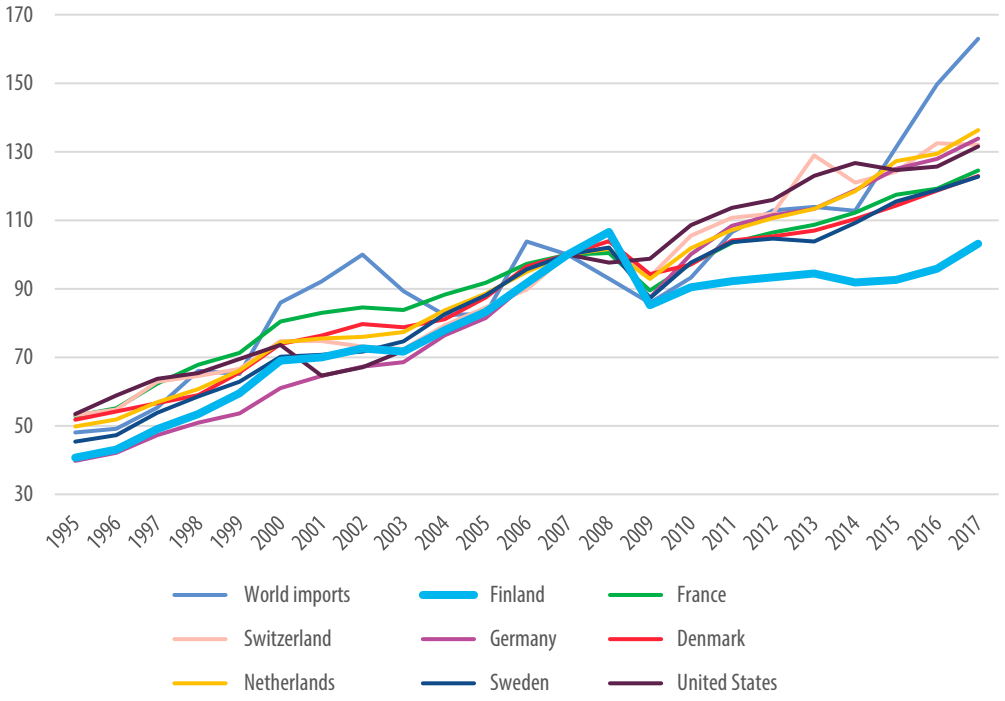


Figure 2.9 Volumes of world exports of goods and services, and export volumes of certain countries, 2007=100

Source: World Bank, Eurostat, US BEA, Macrobond, Finnish Productivity Board

The difficulties of Nokia and the electronics industry have been occasionally put forward as reasons for Finland's slow post-2008 recovery. During the period 2008-2015 the constant price value added of the electronics industry diminished by a total of EUR 5.6 billion while for the entire national economy it diminished by a total of EUR 12.4 billion. In other branches of manufacturing, too, there were long-term problems in the recovery of value added and thereby of productivity.

The above presents an examination and comparison mainly of value added, working hours and some other national accounts time series. Finland's development is examined more systematically using a method called synthetic control. The chapter compares Finland's development with that of “synthetic Finland". This method was used to construct a synthetic country that is as close as possible to pre-financial-crisis Finland in its development of productivity.

Later, in Chapter 5, we proceed to use corporate data to examine productivity within corporations and so-called creative destruction in which resources move from one corporation to another. This examination sheds more light on the long-term slowing down of Finland's measured labour productivity and total factor productivity.

3 Labour productivity

3.1 The data and the branches of the corporate sector examined

The following continues to examine the development of labour productivity in Finland. In this Chapter we move from the level of the entire national economy to examine productivity of various branches (see Figure 3.1). In doing so, we focus on that part of the economy that yields good comparative data on labour productivity. Those branches in which the public sector is a significant actor, i.e. public administration, education, and health services and social services, were excluded from this examination in order to achieve uniformity and to improve the reliability of the comparisons between the countries. A large part of the production of these fields is non-market, which means that measurement of value added is not reliable. Furthermore, primary production, financial, insurance, and real estate branches, and personal-service branches were excluded from this examination.

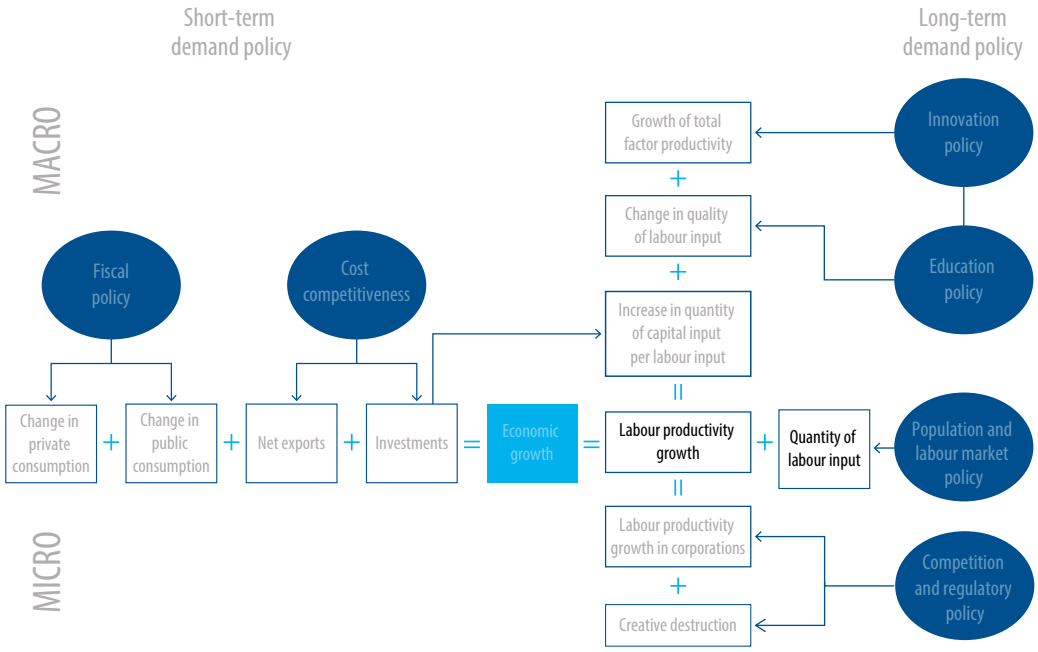


Figure 3.1 Labour productivity
Source: Maliranta (coming)

The branches excluded from this examination are no less important in any way. However, there are problems associated with their statistics and measurement of labour productivity because of which the development of labour productivity cannot be properly and comparably estimated with either other branches or countries. We address the problems and the development of these branches in Annex 1.

The branches examined are the following:

- Manufacturing ("C" in Standard Industrial Classification 2008)
- Construction ("F")
- Wholesale and retail trade ("G")
- Transportation and storage ("H")
- Accommodation and food service activities ("I")
- Information and communication ("J")
- Professional, scientific and technical activities ("M")
- Administrative and support service activities ("N")

In 2017, these branches covered 59% of the entire national economy's and 89% of the corporate sector's working hours.

The development of labour productivity of Finland's corporate sector is compared with the development in other countries. A topic of particular interest is development since the financial crisis of 2008. The comparison has been performed in two ways: 1) By comparing to countries' labour productivity index series by setting the year 2007 as the index base year for all (the year preceding the financial crisis) and 2) by comparing Finland's development with the synthetic so-called control economy.

The year 2007 used as the point of comparison is a clear turning point both in Finland and in nearly all of the other countries examined here. The index comparison covers the Netherlands, Great Britain, Italy, Norway, France, Sweden, Germany, Denmark, and the United States. Furthermore, the aggregate of the EU15 countries is included.[1]

The synthetic control economy was generated using data covering the period 1996-2007. A greater number of countries was used when estimating synthetic control (see description of the method in Box 2). The data used in both was comprised of Eurostat statistics, which were supplemented, where necessary, by data from the OECD's STAN database. In the analysis, we compare Finland's post-2007 development to the generated synthetic control economy. The results are based on the work of Anttonen's and Maliranta (2019).

1 EU15 -countries are those countries, which were EU member states prior to 1.5.2004. They are as follows: Netherlands, Belgium, Spain, Ireland, Great Britain, Italy, Austria, Greece, Luxembourg, Portugal, France, Sweden, Germany, Finland and Denmark.

BOX 1: LABOUR PRODUCTIVITY IN THE CORPORATE SECTOR

The aggregate productivities of the corporate sector and its individual branches are defined in the following as the ratio of value added and the number of working hours. Productivity defined in this way shows how much value added has been produced on average per hour of work.

Labour productivity is directly connected to *cost competitiveness*. The ratio cost of labour per average hour of work and labour productivity is referred to as *nominal unit labour cost*, and to illustrate it we can think of it as expressing how much "one unit of value added" costs on average as labour costs.

When entire national economies or their corporate sectors are compared, the examination of the ratios (value added/hours of work) describing labour productivity is neither very sensible, e.g. because the ratios also depend on the different industrial branch structures of the countries and not only on their ability to produce a lot of value added with a small amount of work within each branch of manufacturing.

Indeed, the graphic presentations comparing productivity development in different countries are generally based on index values similar to those used in this report: the productivity value of 100 is given to a certain year in all of the examined countries and the productivities of the other years are then compared to the level of that base year. In this report, the year 2007 which preceded the global financial crisis launched by the sub-prime crisis in the United States was chosen to be used as the base year.

The productivity development illustrated by Figures 3.3 and 3.4, in which Finland's economy looks inferior to those of the competing countries after 2007, was not accompanied by labour costs growing slower than those in the benchmark countries. This being so, competitiveness measured using nominal unit labour costs weakened during the said period of time when compared to the foremost competitor countries. The parlance types manifested in public debates following the financial crisis, according to which some kind of well-defined and measurable "difference in cost levels" (Borg – Vartiainen, 2015, p. 18) or competitive gap was supposed to prevail between Finland and its competitors, were based on the pre-financial-crisis situation having been chosen as the basis for the comparisons.

Figures 3.3 and 3.4 also indicate that the growth of productivity in the corporate sector was exceptionally pronounced in Finland during the period. **Figure 3.2** illustrates labour productivity development by setting the year 2000 as the base year for the index numbers and against this background Finland's productivity development looks mediocre when compared to the competitor countries shown in the figure. In the same way, the estimates concerning cost competitiveness depend on the choice of the base year.

Volume of production and new products

Productivity calculations are based on value added measured in *volume units* and not the market value of value added. This means that in the aim in the calculations has been made to take into account the changes in the prices of products. It is often said that there the prices of a certain base year (e.g. of the year 2000) are used in volume numbers, but this kind of parlance is imprecise. In the accountancy system of the national economy of Europe, which Finland's national statistics bureau Statistics Finland also uses, the volume numbers are based on the linked Laspeyres indices of the base year, which is always the first of the two years when estimating the volume change between two consecutive years. The changes in volumes over longer periods of time are calculated only at the next stage on the basis of the numbers depicting the changes between such consecutive years. And so, to take an example, the corporate sector's value added change between the years 2000 and 2008 (and the change in productivity obtained from that) depends indirectly on the price levels of each year up to 2007.

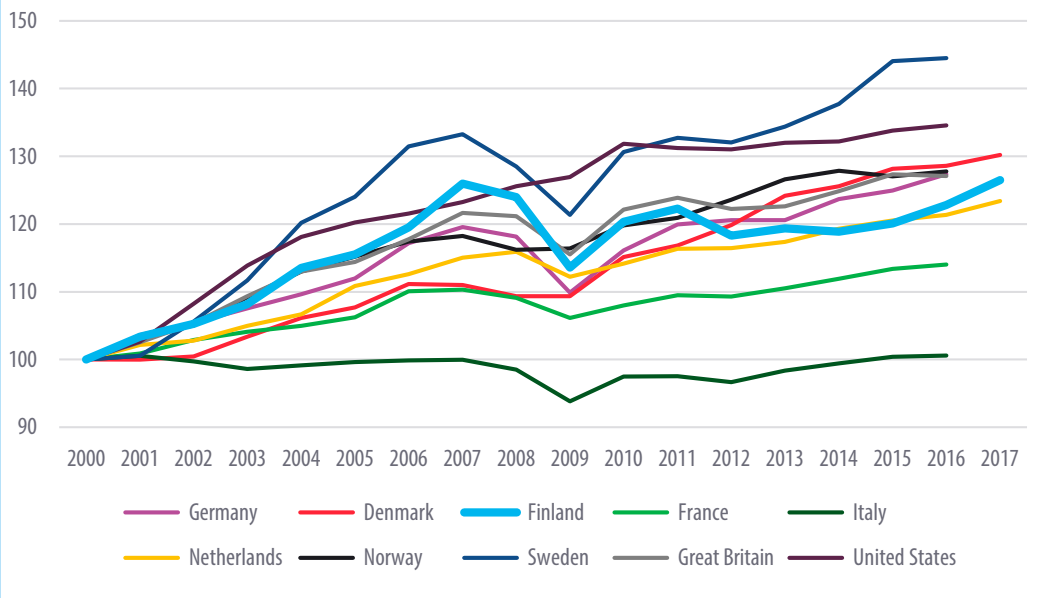


Figure 3.2 Real aggregate labour productivity in the private sector, year 2000=100
Source: Eurostat, OECD.

The improvement in product quality and totally new types of products constitute a problem when calculating volume numbers: after all, a product cannot have a previous year's price if it has become available only this year. The accountancy system of the national economy of Europe is comprised of several (more or less satisfactory) methods using which with the previous year's accounting price of new and quality-wise improved products can be fixed (Eurostat 2016, p. 21-24). The choice of the method used affects the value added expressed as a volume number and through it also the measured productivity

BOX 2: METHOD DESCRIPTION, ABOUT SYNTHETIC CONTROL[1]

1 This section is based on the research by Anttonen and Maliranta (2019).

Economic development is often examined by comparing it with development in other countries or in other regions. In this way, one gains a better understanding of the relative development of the national economy and one can endeavour to answer the questions such as the following: How might the national economy in question have grown without certain political decisions having been made or without the economic shocks that impacted only on the national economy in question. When the development of the national economy in another country is used in addressing "what if" questions such as those in the above, that other country's development is referred to as contrafactual to what has happened in the country that is the object of the examination. Sweden is often used as a country of comparison in studies focusing on Finland. Using individual countries as contrafactuals is always problematic, because no single national economy is the same as another, and because the national economy serving the purpose of being a benchmark economy can encounter shocks which further hinder the comparison.

Abadie and Gardeazabal (2003) proposed a statistical approach to constructing a synthetic contrafactual as a solution to this problem. This synthetic contrafactual is often referred to as a synthetic control. Two examples of the use of synthetic controls are the assessment of the effects of tobacco legislation and of the economic effects of the merger of East Germany and West Germany (Abadie et al., 2010, 2015). Moreover, Born et al. (2018) used the method for measuring the economic impacts of the Brexit voting results, and Anttonen et al.(2019) constructed a synthetic control in order to examine the relatively slow recovery of Finland's national economy after the international financial crisis.

A synthetic control is built by seeking out the optimal country weights which are then used to form a linear combination of the various national economies. The purpose is to minimise the mean square error between the variable that is the subject of the examination and the linear combination formed of the other countries during the time period used in the estimation. A detailed presentation of the optimisation problem to be solved to form the synthetic control is provided, among others,. by Abadie and Gardeazabal (2003).

In this case, the synthetic control is such a weighted average obtained of the other national economies as will provide the best possible correspondence to the development of labour productivity in Finland before the year 2007. Extra explanatory variables are often used to find the country weights extra, the objective being to increase the reliability of the synthetic control beyond the estimation data, i.e. during time period of time that is the subject of interest. However, the choice of extra explanatory variables is not a straightforward matter and in this report it was decided to form a synthetic control without extra explanatory variables. This adds to the need to examine the reliability of the synthetic control.

To examine the reliability of the synthetic control a, the control can be formed several times removing one country at a time from

among the countries used in the estimation. This reveals the synthetic control's possible sensitivity to the individual national economies used in the estimation. If the synthetic control that has been formed is considerably different following the exclusion of an individual country, the difference between the synthetic control and the national economy being examined more probably reflects changes in the national economy of the excluded country than in the national economy of the country that is the subject of the examination. Then the excluded country should be excluded from among the countries that are being used for the estimation and the sensitivity analysis should be repeated using a new land restricted number of countries.

The country weights used by the synthetic control do not necessarily possess any economic interpretation value and they should not be used to draw any far-reaching conclusions regarding the national economy of the country that is the subject of the examination and the national economies of the countries with significant country weights. The reason for this cautionary note is that a linear combination of very different national economies may have more in common with the dynamics of the national economy that is the subject of the examination than that of a neighbouring economy held to be very similar. Neither should the synthetic control in the case of this report be held to be a real alternative in the sense that labour productivity of labour in Finland would have necessarily reached the level of the synthetic control were it not for the events that occurred after the estimation period.

Since fixing of synthetic control means selecting the other countries' weights so that Finland's productivity development during the estimation period is as similar. as possible to that of the control group, any similarity between the development of Finland and the control prior to the estimation period does not provide grounds for concluding that productivity development in Finland during the estimation period would have been mediocre. And even though post-estimation productivity development in Finland was inferior to the productivity of the synthetic control group, this alone is not enough to indicate that Finland had fallen behind the average growth of productivity in the other countries. However, we can state that productivity growth in Finland was weak compared to those countries in which productivity had been most similar when compared to Finland.

The same also holds true vice versa. Were productivity growth to appear to have been fast after the estimation period when compared to the control group, we could not conclude that productivity growth had been fast when compared to the average of the other countries. Another explanation for this result could also be that earlier weak growth had caused countries with weak productivity growth to have been selected for inclusion in the synthetic control.

In this case, the synthetic control is more likely to be a statistically justifiable description of the development of Finland and of the rest of the world as regards labour productivity, and this helps to clarify the point in time when Finland's development began to deviate from the development that was expected in the light of Finland's earlier history. In addition to this, the branch-specific examination sheds light on the extent to which the various factors may have served as drivers of this exceptional development.

3.2 Development in the corporate sector and in its various branches

3.2.1 The entire corporate sector

Productivity fell in the corporate sector not only during the financial crisis, but also after it

Labour productivity in Finland's corporate sector (excl. the above mentioned branches which are difficult to measure) fell during the financial crisis in the years 2008 and 2009 altogether by about 10% (Figure 3.3). The labour productivity recovered during 2010 and 2011, but more slowly than in the benchmark countries or when compared to the synthetic control economy formed of the benchmark countries. In Finland, the fall in labour productivity was far more severe and recovery was considerably weaker than in the "synthetic Finland" formed of the benchmark group. Labour productivity fell again in 2012 in Finland, but hardly at all in the other countries. Then, until 2015, productivity remained pretty well unchanged. Cumulatively, the difference between labour productivity and the synthetic control economy increased to more than 10%.

Following the recovery of economic growth after 2015, the growth of labour productivity in the corporate sector has been a little faster in Finland than in its competitor countries. In 2017, labour productivity in Finland was, however, still only at the level it had been 10 years earlier. Thus, the development of labour productivity in Finland has been distinctly weaker in the corporate sector after financial crisis than in the benchmark countries or in the synthetic control economy as estimated using the benchmark countries.

Development subsequent to the financial crisis deviates significantly from prior development

Development subsequent to the financial crisis deviates significantly from the development prior to the year 2007 when growth was very rapid in Finland. In 2000, labour productivity was 80% of its 2007 level, i.e. productivity increased about 25% in the space of seven years. This means an average annual growth of 3.3%.

The growth of labour productivity in Finland's corporate sector in 2000-2007 was second only to that of Sweden in the group of benchmark countries, but then during the years 2007-2016 it was clearly the slowest. Labour productivity the growth during the period 2007-2016 was at its peak in Denmark had been a country of relatively slow productivity growth in the years 2000-2007. In the United States and Sweden, too, the growth of productivity has been relatively good since 2007 when compared to the other countries.

However, the growth of productivity in Finland's corporate sector, which was distinctly weaker than that of the benchmark countries, varied depending on the corporation and branch of activity. In manufacturing and services, productivity has developed differently. The obvious diminished role of the electronics industry is also a significant feature. The following is a presentation of the development of labour productivity in more detail by breaking down the corporate sector into smaller components.

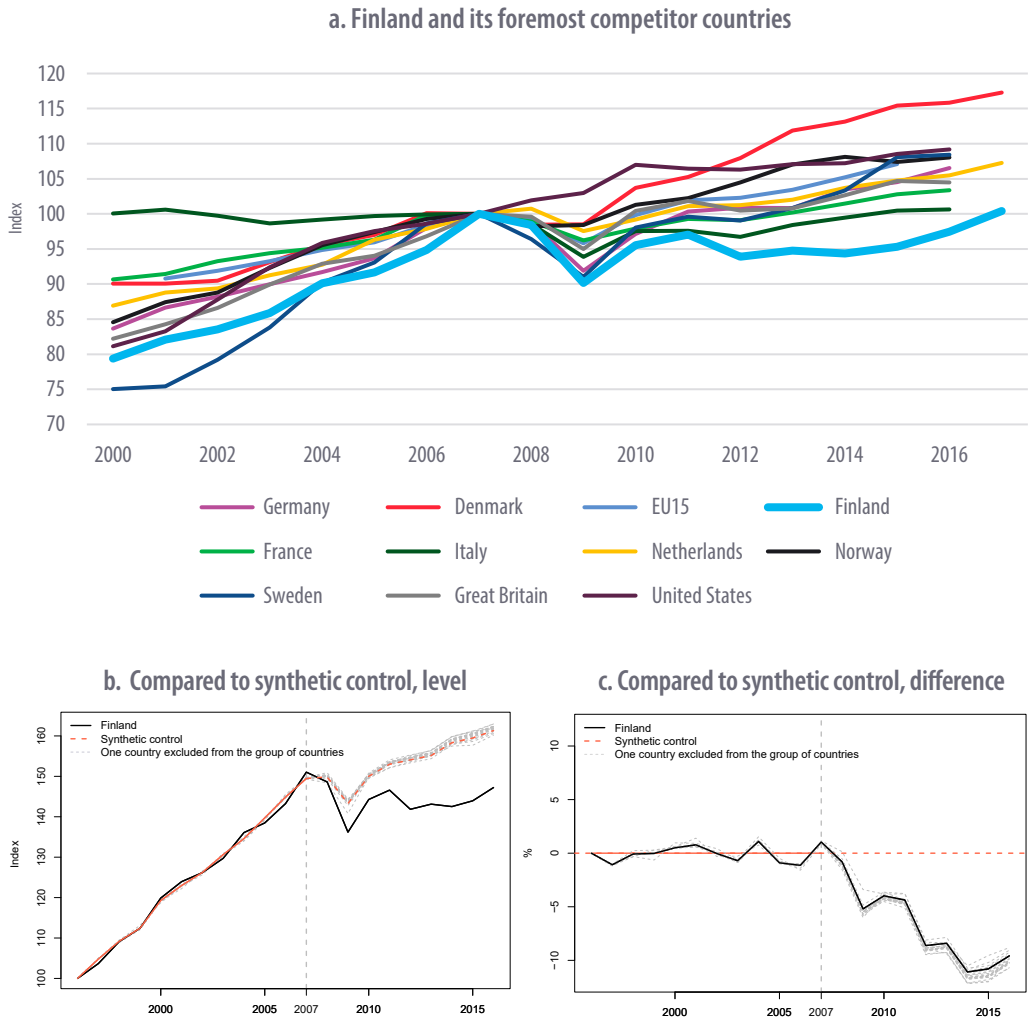


Figure 3.3 Real aggregate labour productivity in the corporate sector, year 2007=100

Source: Eurostat and OECD.

N.B. The fields problematic from the point of view of the measuring of the productivity (see text) have been excluded from the examination

3.2.2 The corporate sector, excl. electronics

The corporate sector , excl. electronics, reduces the gradients of both earlier productivity growth and alleviates the post-crisis drop

The effect of Nokia on the growth of Finland's productivity has been significant. To estimate the effect of the comparisons of figure 3.4 the electronics industry (so Nokia belongs to which) has been omitted. Because Nokia has encountered some major difficulties in recent years, it is interesting to look separately at what the development has been like within the other branches and to see whether the other branches been able to make up for the slowing down of productivity caused by Nokia's difficulties.

When comparing Figures 3.3 and 3.4, it becomes apparent that part of Finland's more severe slowing down of productivity is explained Nokia's difficulties: if the electronics

industry is excluded, Finland's productivity does fall short of the other countries by as much since 2007. On the other hand, Finland's development was not quite as good during the period 2000-2007 as that of the other countries. In Sweden, United States and Great Britain, for example, growth was then stronger, and this is demonstrated by the steepness of the graph of their development. Thus Nokia explains both the strong growth of productivity in the beginning of the 2000's and the post-2007 exceptionally weak growth.

Without the electronics industry, the growth of labour productivity in Finland was only of a good mediocre level before the financial crisis whereas after the financial crisis the fall in productivity was steep but not exceptionally weak. Up until 2012, the development of labour productivity in Finland was very similar to that of Sweden, for example. However, without the electronics industry, Finland differs from most other countries in that Finland's labour productivity fell again during the period 2012-2014.

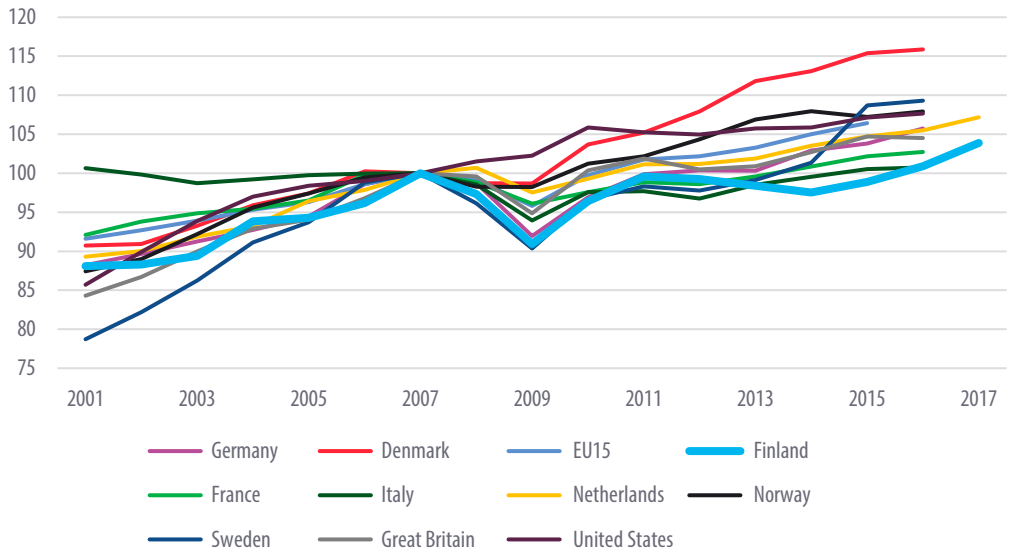


Figure 3.4 Aggregate labour productivity in the corporate sector, excl. electronics

Source: Eurostat and OECD. N.B. The problematic fields (see the text) have been left outside the examination from the point of view of the measuring of productivity

3.2.3 The corporate sector without branch structure differences

As became apparent in the above, an individual branch can have a significant impact on the productivity development of an entire country. More generally, too, differences in branch structures can explain the differences in productivity growth between countries. For example, growth of productivity can be fast for the reason that a significant proportion of the labour force is employed in branches where the growth of productivity is fast. This matter needs to be noted for at least two reasons. Firstly, branch structures are the result of long development and they are explained by differences in natural resources and societal factors. This means that they be thought of as predestined factors, at least in the short and medium term.

Still another more important reason to take the significance of the branch structure into consideration is connected to the fact that the growth of the productivity can overestimate preconditions (Maliranta 2014) for the development of the external balance's and citizens' welfare in some situations. This is due to fast productivity growth of a branch being often connected to slowly rising or even falling prices of products of the branch in question. This is of significance to the development of the prosperity of the national economy where a significant proportion of production being exported. In such a situation, fast growth of productivity is offset by weakening terms of trade. In this kind of a situation it is the citizens of the other countries that get to enjoy the fruits of productivity growth. This is why it is useful to take the development of the terms of trade into consideration when calculating cost competitiveness, for example.

When the effect of branch structure is removed from the productivity development of the entire national economy…

Due to the reasons presented in the above, it is interesting to eliminate the effect of the differences in branch structures in productivity comparisons between countries. Then the examination focuses on what the development of the productivity has been like "within the branches". In Figure 3.5, the effect of branch structures has been eliminated by determining what the development of productivity would have been in each country if all of the countries had a similar branch structure. In these calculations, the corporate sector has been divided into 20 branches with 12 of them in manufacturing and 8 in private services. The average employment shares of the branches during the period 2000-2015 in the EU15 countries have been used as the branch structure here. In other words, this examination has been done by erasing the effects of changes in both differences in branch structures and changes in branch structures.

…the differences between the countries become less

As can be seen from Figure 3.5, the differences between the countries as regards the development of productivity become significantly less when the effect of the differences in branch structures is taken into consideration. It is seen that Finland's development was fairly typical during the period 2007-2011. The fall in labour productivity of labour caused by the financial crisis was major, but no longer the greatest, and recovery from it was a little quicker than on average. In 2011, the labour productivity erased from Finland's branch structure of labour when compared to the year preceding the financial crisis was quite average.

Finland sank again in 2012-2014 when compared to others. Indeed, taking into account the branch differences, Finland differs from the benchmark countries only in regard to this latter productivity dip.

From Figure 3.6 it can be seen that the picture does not basically change even though the electronics industry is excluded from the examination. Figures 3.5 and 3.6 also show that Finland's development was fairly mediocre in 2000-2007 when taking into account the differences of the branch structures. On the other hand, the figures show that Finland's productivity growth has strengthened since 2014.

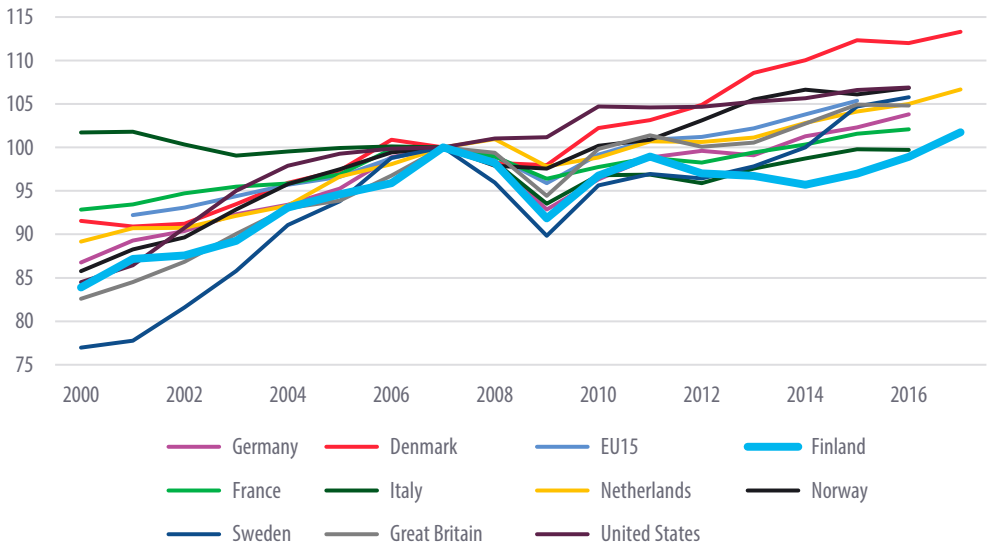


Figure 3.5 Development of labour productivity within the corporate sector's branches, 2007 = 100

Source: Eurostat and OECD.

Note 1: The fields problematic from the point of view of the measuring of productivity (see text) have been excluded from the examination

Note 2: These calculations have been conducted so that all countries have been given the same branch structure, which corresponds to employees' average branch shares in the EU15 countries during the period 2000-2015.

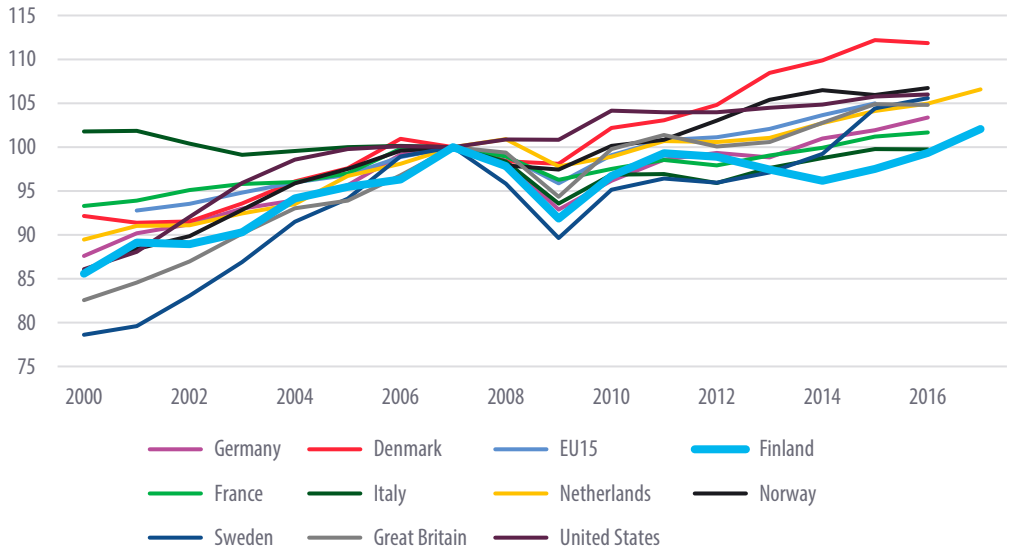


Figure 3.6 Development of labour productivity within the corporate sector's branches, excl. electronics industry, with 2007 = 100

Source: Eurostat and OECD.

Note 1: The fields problematic from the point of view of the measuring of productivity (see text) have been excluded from the examination

Note 2: These calculations have been conducted so that all countries have been given the same branch structure, which corresponds to employees' average branch shares in the EU15 countries during the period 2000-2015.

3.2.4 Manufacturing

The development of labour productivity within Finland's entire manufacturing sector was the quickest before 2007, sharing first place with Sweden, and thereafter it was clearly the slowest of all in the given group of countries (Figure 3.7). The fall, together with Sweden, during the financial crisis was the biggest, about 15%. After the fall, Finland's development was clearly weaker than that of others distinctly, all the way to 2012.

A similar picture is obtained by examining the development of manufacturing in Finland compared to the synthetic control economy. Figure 3.7 shows that Finland fell behind at an even and strong pace in relation to the synthetic control economy, right up to 2012, at which point the difference was about 30%. Post-2012, the growth of Finland's labour productivity has been faster than that of the benchmark countries and the synthetic control economy. The difference with regard to other countries is becoming less. In relation to the synthetic control, the difference has been about 20% over the past few years.

The significance of the electronics industry has been especially important the development of labour productivity in manufacturing. Labour productivity in manufacturing has also been examined without the electronics industry and by controlling the effect of branch structure.

When comparing the aggregate development of labour productivity in manufacturing with the synthetic control economy, with the electronics industry being excluded, it can be noticed that the difference with respect to the synthetic control economy increases more slowly than with respect to manufacturing as a whole (Figure 3.8). Indeed, the electronics industry explains roughly half of the relative fall in labour productivity in Finland when compared to the synthetic control economy up to 2012.

But without the electronics industry, the difference continues to grow, however, for a longer time, and in 2016 the difference with respect to the synthetic control economy is nearly as much for manufacturing as a whole and without the electronics industry. This is due to the fact that without the electronics industry the synthetic control economy is formed with different weights and from different countries the synthetic control economy formed than with the electronics industry. The growth of labour productivity in the synthetic control economy after the financial crisis has continued and at a rate only slightly slower than before the financial crisis; i.e. the global weakening of productivity development in manufacturing is significantly explained by the slowing down of the growth of productivity in the electronics industry.

Figure 3.9 shows controlled effect of the branch structures, i.e. the development of productivity is examined within the various branches of manufacturing. This shows that the differences with respect to the other countries are reduced by 2007, and especially after it. Still the growth of Finland's productivity has been the slowest in this group of countries since 2007.

It should be noted that the effect of the electronics industry has been made reasonable in Figure 3.9, because the weighting of the various branches has been done using the EU15 countries' average employee shares during the period 2000-2015. Also the effect of change in the branch structures has been eliminated here. When the electronics industry is excluded, i.e. when development of productivity is looked at within the other branches its waste, the difference between Finland and the other countries is reduced further (see Figure 3.10). It is becomes evident that Sweden's productivity development was more rapid than that of Finland before 2007, but thereafter it is fairly similar, at least until 2013. In Sweden, too, very significant slowing of growth of productivity took place as did in Finland.

If the same examination (standardised branch structure, excl. the electronics industry) is made by comparing Finland with the synthetic control economy (the lower part of Figure 3.10), the difference increases to nearly 30% by 2014. The figure reinforces the view that the weak productivity development of Finland's manufacturing industry is not explained merely by Nokia or by the disadvantageous branch structure. However, this figure, too, shows signs of the improving of the state of productivity in Finnish manufacturing industry.

The development of labour productivity in manufacturing as a whole deviates from the development of nearby benchmark subject countries such as Sweden when manufacturing is examined without the electronics industry with the branch structure standardised. When Finland is examined in relation to the synthetic control economy, the difference in both cases is nearly as big until 2016. Thus the growth of labour productivity industry excluding the electronics industry has not been very much slower when compared to countries like Sweden, but when compared to countries like Finland without electronics industry then the growth of industry excluding the electronics industry was also distinctly slower.

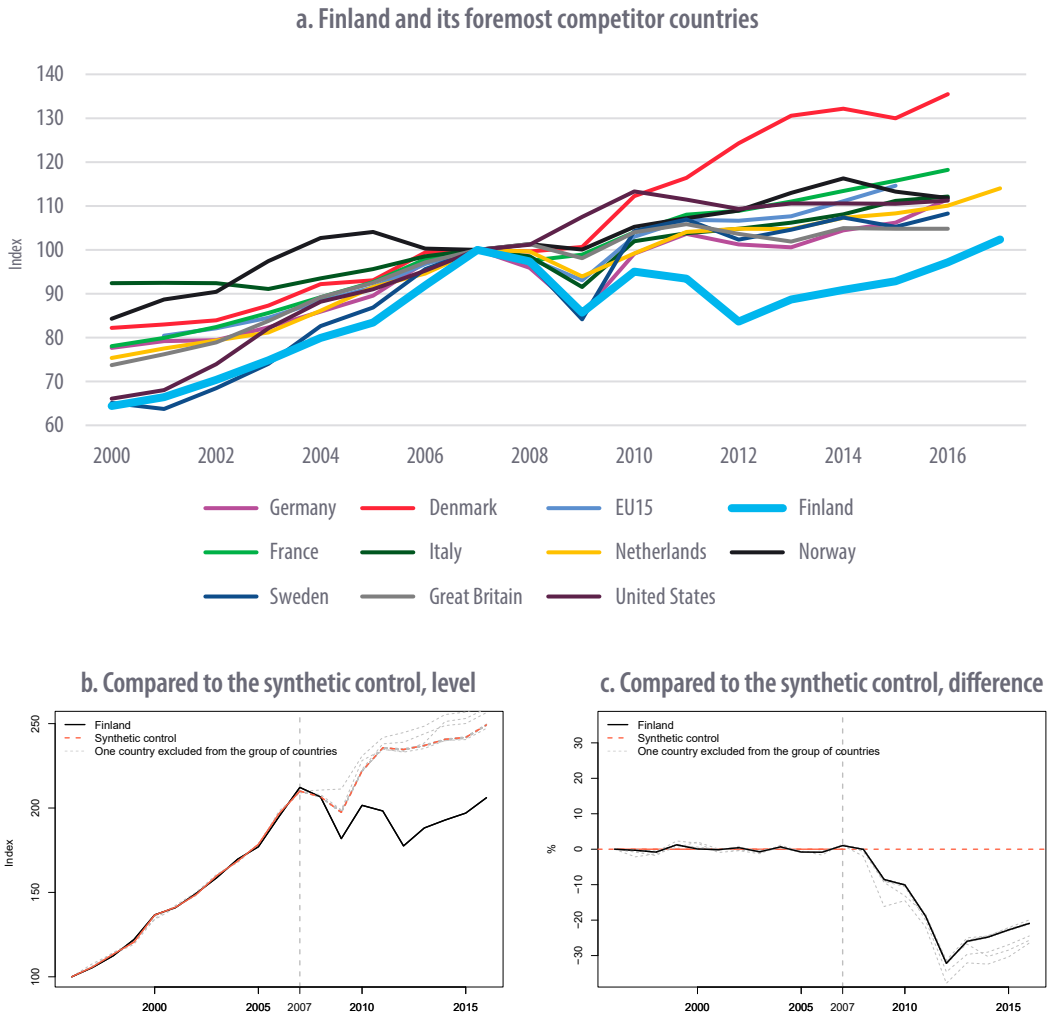


Figure 3.7 Aggregate development of labour productivity in the manufacturing industry, 2007 = 100

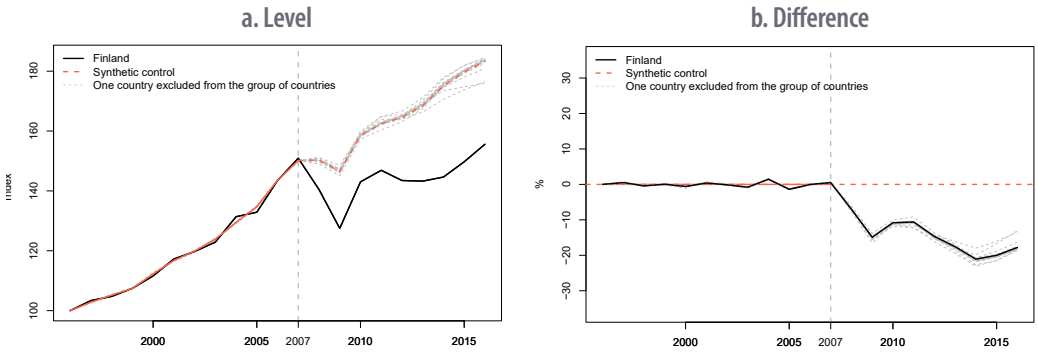


Figure 3.8 Development of labour productivity within the manufacturing industry branches, excl. electronics industry, 2007 = 100

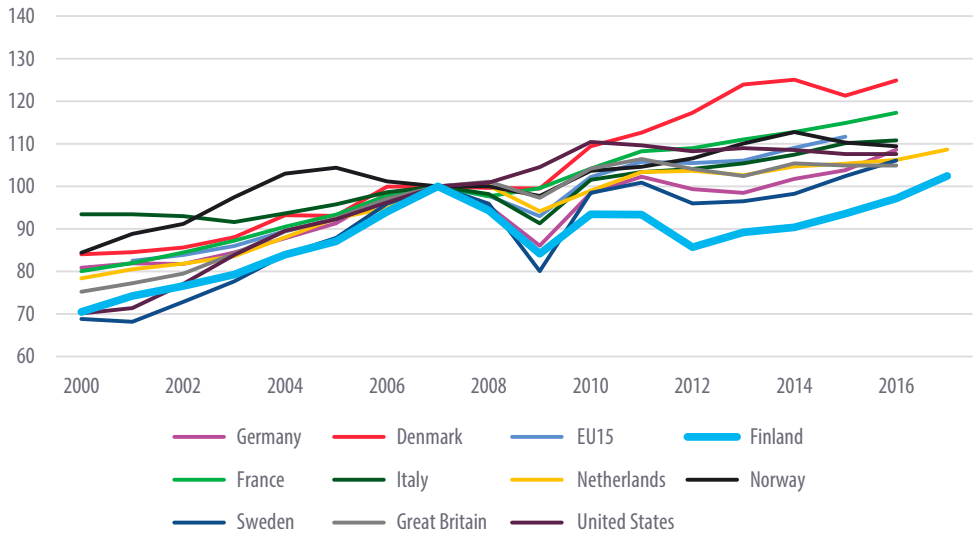


Figure 3.9 Development of labour productivity within the manufacturing industry branches, 2007 = 100

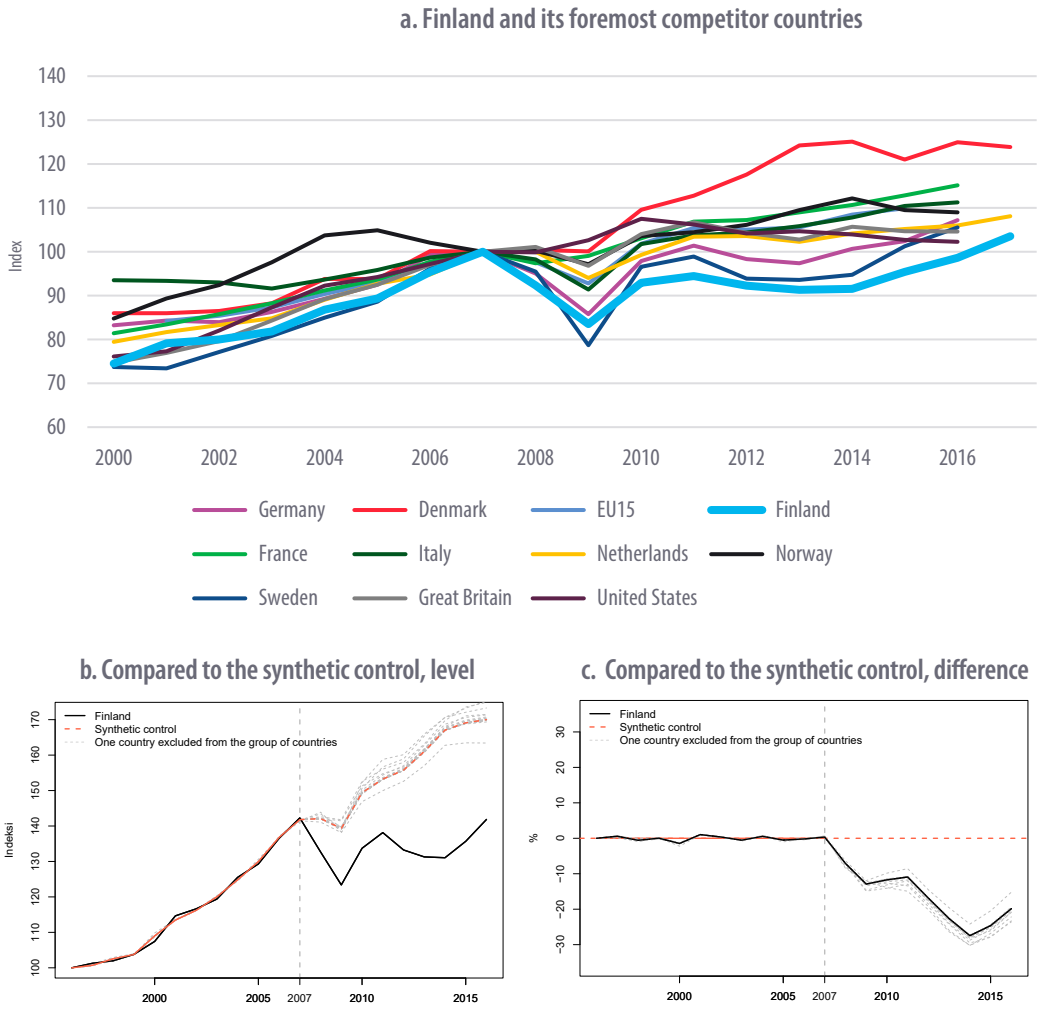


Figure 3.10 Development of labour productivity within the manufacturing industry branches, excl. electronics industry, 2007 = 100

3.2.5 Private services

The development of labour productivity at the aggregate level of Finland's private services was fairly average during the period 2000-2012 (Figure 3.11). The fall in labour productivity during the financial crisis was big, but not exceptional. Thereafter the growth in labour productivity was quicker than even in the benchmark countries. By the year 2012 labour productivity within Finland's private services had recovered more than in most of the benchmark countries. Also, in regard to the synthetic control economy[2], the growth of labour productivity in the private services was distinctly quicker in Finland after the financial crisis. Since then, there was a distinct downward swing in productivity

2 Ireland has been excluded from these calculations because it proved to be a highly exceptional case, which also impacted significantly on the results.

development within Finland's private services and productivity weakened again. This did not happen in the benchmark countries or in the synthetic control economy. After 2014, productivity in private services developed an upward trend again, however, and as a whole productivity increased after the financial crisis on average by as much as in the benchmark countries or in the synthetic control economy.

By controlling differences and changes in branch structures, i.e. by examining the development of productivity within the private service branches, the growth of labour productivity looks a little weaker with respect to the benchmark countries and the synthetic control economy. Generally, the differences between the countries in regard to development diminished a little. Finland's development was fairly similar to that of the synthetic control economy until 2012, but since then labour productivity in Finland dropped by over 5% from that of the benchmark group. Both of the Figures 3.11 and 3.12 show that Finland's productivity development has recovered in recent years. It is also evident that the growth of productivity in Sweden was stronger than in the other countries before 2007 and particularly after 2009.

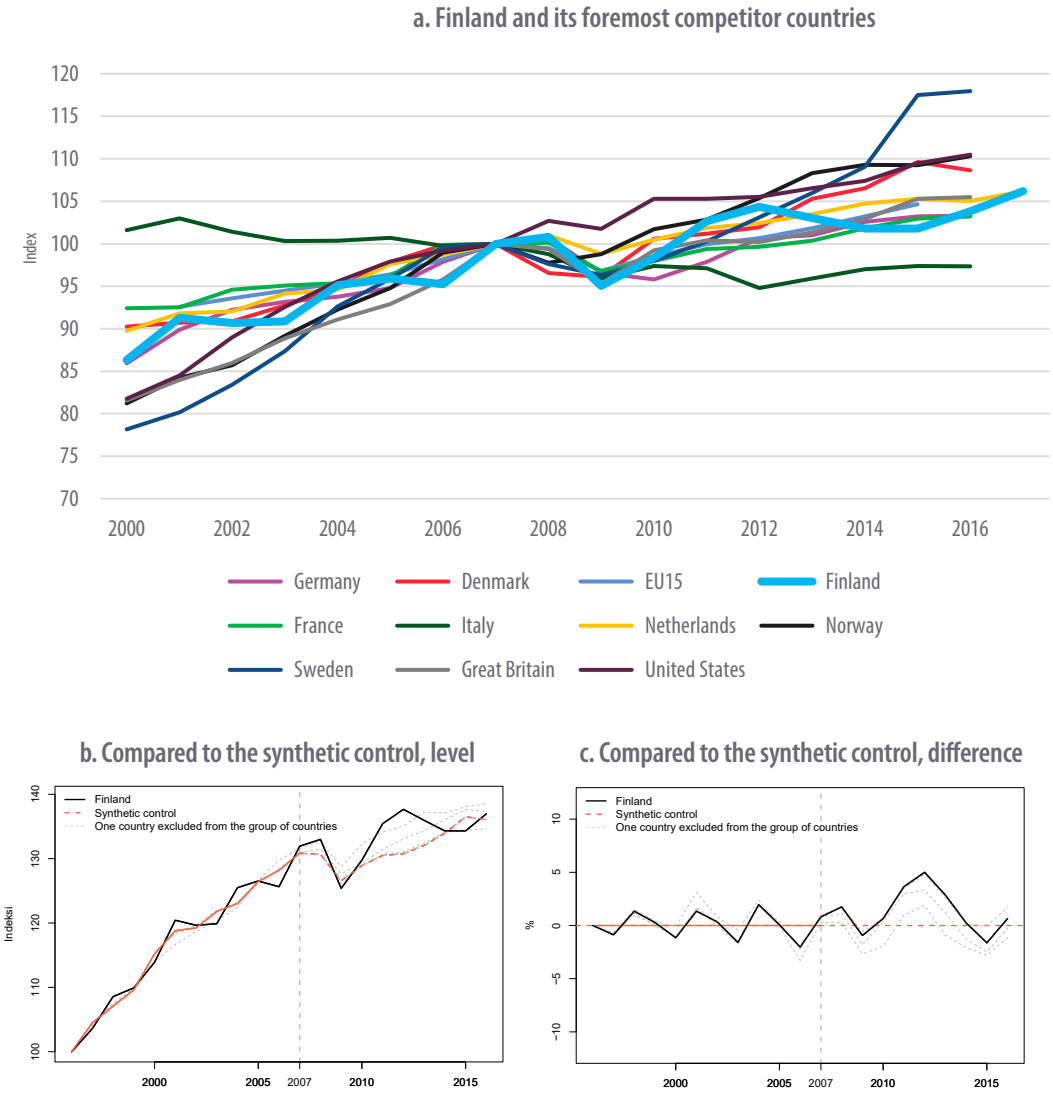


Figure 3.11 Development of labour productivity in private services, 2007=100

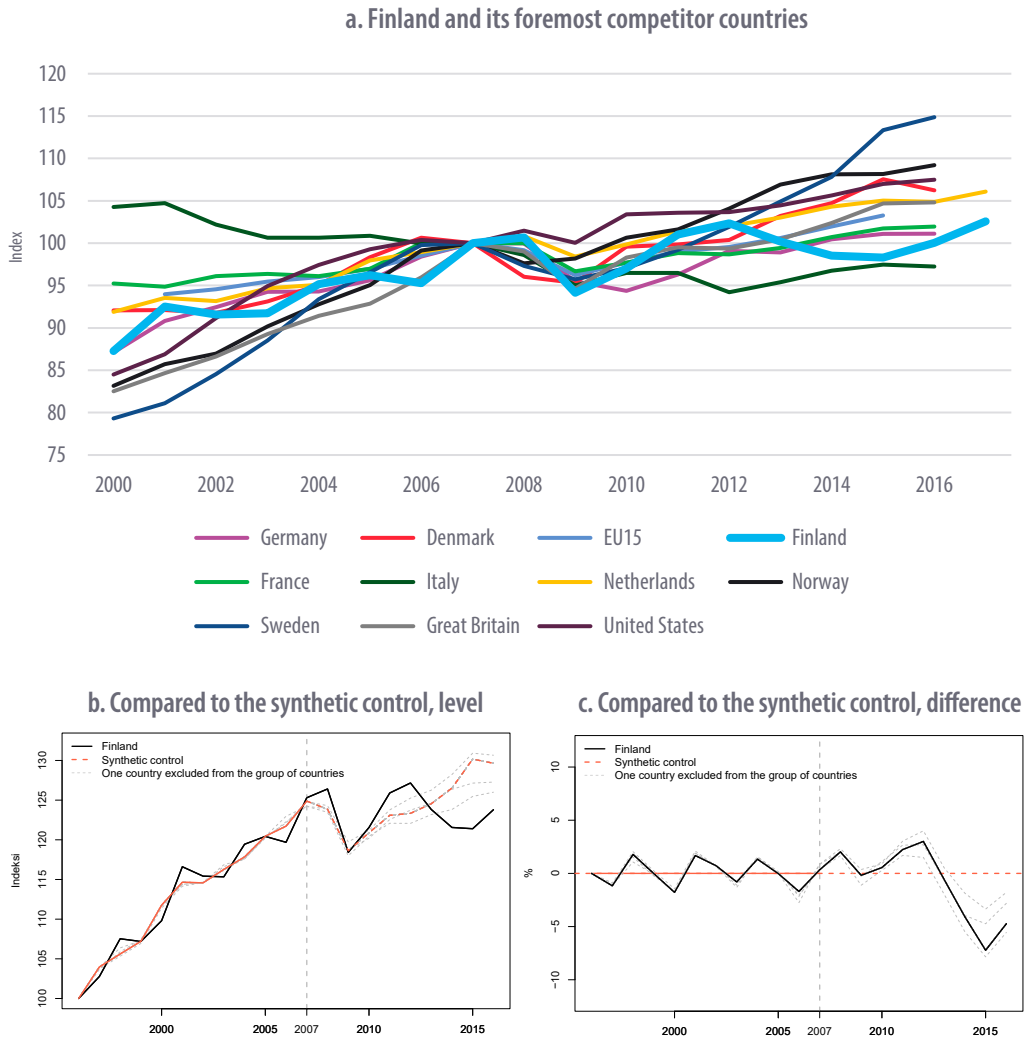


Figure 3.12 Development of labour productivity within the branches of private services, 2007 = 100

The development of productivity in manufacturing and in services with respect to the benchmark countries has been quite different in Finland. The fall in productivity in the manufacturing industry during the financial crisis was extremely severe and the growth of productivity was slower than in the benchmark countries even during the years after the financial crisis. Since 2012, the growth of productivity in manufacturing has been quicker than in the benchmark countries at the aggregate level.

The immediate decrease in the productivity caused by the financial crisis was not especially bad in private services with respect to the benchmark countries. During the years following the financial crisis, the growth in productivity was quicker than in the other countries. However, productivity in private services developed a clear downward trend after 2012, so that the growth of productivity in private services has been average at the aggregate level during the entire period following to the financial crisis and when taking the branch structure into account it has been weak.

The fall in productivity in private services during the period 2012-2015 applies only to some of the service branches (Figure 3.13). The fall is evident mainly in retail, accommodation and catering, and transport and storage. Within these branches, the development of productivity was better than in the benchmark countries until 2012. This was followed by a distinct fall lasting three years after which productivity quickly improved again. Such a fall did not occur in the other branches of private services after 2012. The development of productivity within the branches in question is very similar to the situation in manufacturing.

Wholesale and retail trade, transport, and accommodation and food service activities are branches where majority of the demand originates from domestic households. These branches' years of falling productivity coincide with the point in time when households' purchasing power was at exceptionally low level. The real purchasing power of households did not increase at all during the period 2012-2014, and the growth of private consumption was also extremely weak then.

Demand has a major impact on the measured short-term growth of productivity (see Chapter 2 and section 6.2). Indeed, it is probable that the productivity of private services mainly serving households suffered from the lack of domestic demand when the weakening of external competitiveness was accompanied by increasing unemployment.

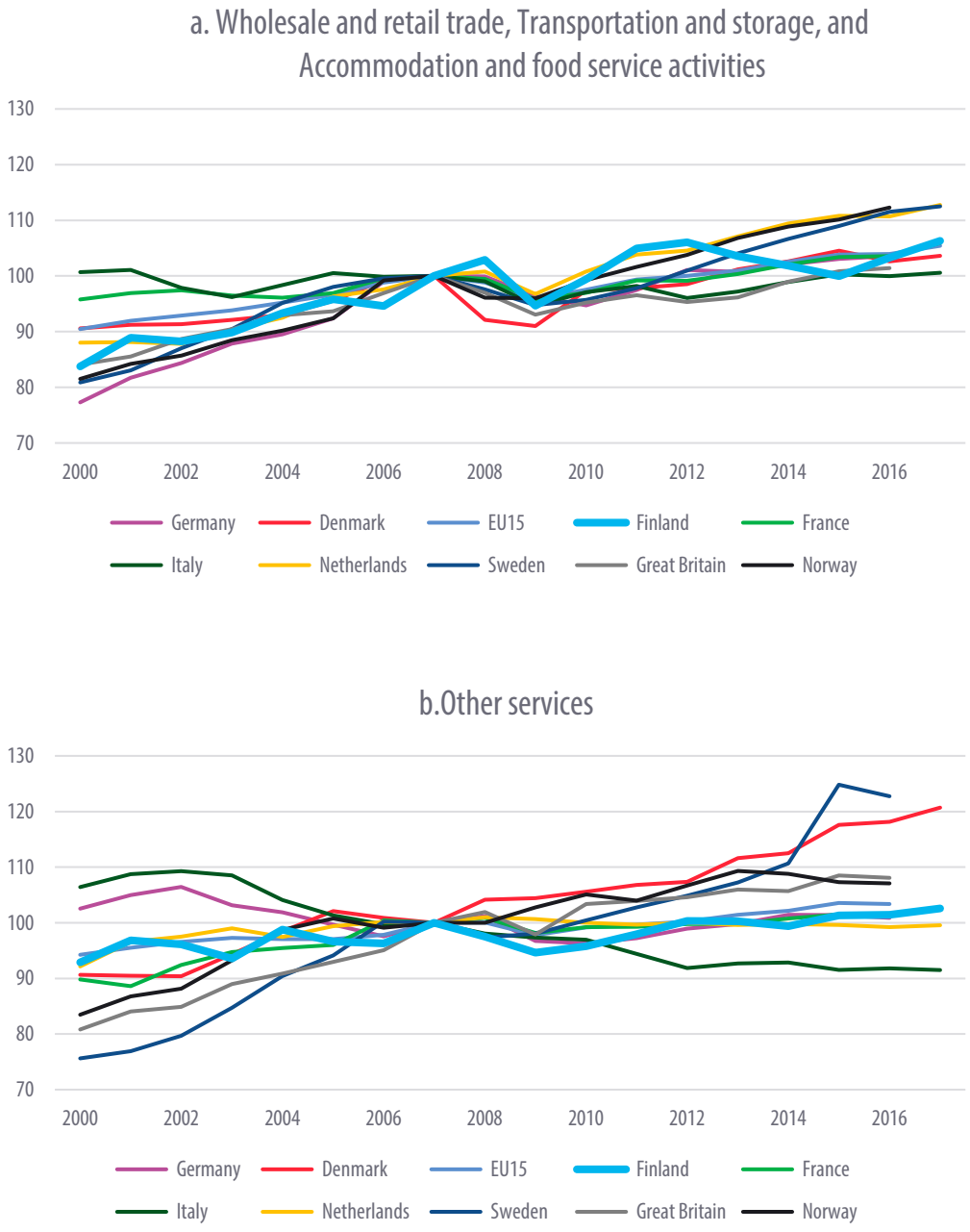


Figure 3.13 Development of labour productivity in (a) branches of private services Wholesale and retail trade (G),Transportation and storage (H) and Accommodation and food services activities (I) in aggregate and (b) within the other branches of private services, 2007 = 100

Source: Eurostat

4 The macro factors of labour productivity: Growth accounting

This chapter addresses the foremost components of labour productivity factors involved in economic growth. In addition, the chapter presents an assessment of the various components with regard to labour productivity by making use of growth accounting.

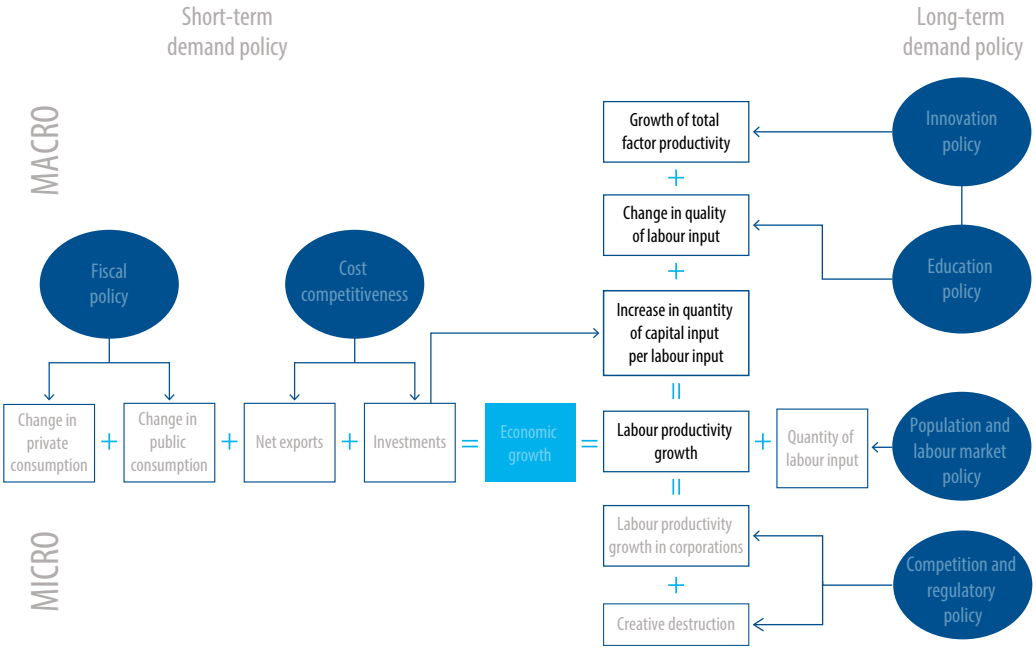


Figure 4.1 Growth accounting can be used in determining the components involved in labour productivity
Source: Maliranta (coming)

4.1 Growth accounting

Growth accounting is commonly used method in examining the structure of growth in studies focusing on economic growth and productivity. When using this method, growth is broken down into its various components based on a theory, and then the significance of these components is determined by calculating their growth contributions. Causality cannot be presented on the basis of the growth accounting conclusions, however; instead, the method can only be used to estimate the significance of the various components in the background of growth. If the objective is to study the factors in the background of growth of productivity and innovations, the results of the method need to be supplemented by further research (OECD, 2001).

This report concentrates on the examination of labour productivity, and then the components of growth are change in labour structure, growth of capital intensity, and growth of total factor productivity (Timmer et al., 2007). Thus growth of productivity can be calculated as follows:

Growth of labour productivity = Change in labour force structure + Change in capital intensity + Change in total factor productivity

In accordance with the above, labour productivity is made up of the sum of three components, whose significance for the growth of labour productivity is estimated with the help of the growth contributions calculated for them. The contributions are calculated by weighting the annual change of the production inputs, i.e. labour and capital, with the average shares of costs. The contribution of total factor productivity is calculated as a residual term of the equation, i.e. by deducting the production inputs' contributions from the growth of labour productivity. Interpretation of the contributions presupposes understanding what they refer to.

Change in labour force structure means that the number of the hours worked by competent, i.e. highly trained or experienced, labour force changes (Timmer et al., 2010). This is measured as the growth in the share of the hours worked by the highest-paid labour force. A change in the labour force structure can, indeed, be interpreted as being a sign of quality in working hours. For example: the change in the structure of the labour force in Finland has, in the new millennium, made, on average, a positive contribution, which can be interpreted as meaning that the labour force has become more talented as a consequence of new (and on average better trained) employees entering the labour market (Timmer et al., 2010).

Capital intensity tells about the working-hour-specific amount of capital and its growth is a consequence of either increase in the amount of the capital or improvement in quality (OECD, 2001). The amount of capital increases as investments are made and quality improves through new or better capital commodities. In other words, growth in capital intensity indicates that employees become more and more productive if they have at their disposal more and more capital or if the available capital is of enhanced quality (Jorgenson et al., 2008). In this report, capital intensity has further been divided according to the source data: ICT and non-ICT capital intensity. ICT capital covers computers, communication devices, and software and databases, which means that non-ICT capital is made up of the remaining assets, e.g. machinery and plant, and R&D development investments (Timmer et al., 2007).

However, total factor productivity becomes the most interesting of all these components, because theoretically growth of labour productivity slows down if there is no change in the technology in the background of its growth and without improvement in effectiveness, and eventually it stops, and at the same time it stops the development of economic growth (Oulton, 2016; North, 2017.) When certain assumptions become full, one can interpret directly from the change (Timmer et al., 2010) in the reporting immaterial technology the growth of total factor productivity. Change in the immaterial technology refers to the technological development which is not materially manifested in new capital commodities here. This kind of a change in technology is represented for example by the effects of networking or external effects associated with investment inputs, e.g. organisational changes improving effectiveness or reallocation of inputs for more productive use, either at the corporate or branch level (OECD, 2001; Oulton, 2016).

However, the simplifying assumptions related to the method cannot be deemed to be fulfilled in reality, which means that the contribution of total factor productivity also includes all the deviations from these assumptions (O'Mahony & Timmer, 2009.) As above was pointed out, the contribution of total factor productivity is calculated as a residual term, which means it also contains other factors, e.g. impacts associated with economic trade cycles, variables left unmeasured, and to the possible measurement errors (OECD, 2001). Thus the growth of total factor productivity cannot be directly interpreted as change in technology, instead, by generalising, it can be interpreted, for example, as a component indicating improving effectiveness or about the capacity of the utilisation of technology in a specific branch (Timmer et al., 2010).

BOX 3: GROWTH ACCOUNTING

The theoretical basis for growth accounting is in the growth models of the neoclassical economic theory. The data of the EU KLEMS database are based on the KLEMS growth calculation developed by Jorgenson et al. (1987). When applying this method, each branch has its own production function according to which the production happens through the use of inputs::

$$Y_j = f_j(K_j, L_j, X_j, T)$$

Y in the production function signifies production of branch j, which is produced in accordance with capital K, labour L, intermediate products X, and time-wise indexed technology T (Timmer et al., 2007).

Assumptions which simplify the functioning of the economy are also connected to the method. In accordance with the assumptions, the production process can be described with the help of the production function, the corporations operate efficiently, and the market is competitive, which means that the corporations take the prices as given (OECD, 2001). Furthermore, it is assumed that there is perfect utilisation of inputs and standard scale yields (Timmer et al., 2007). When these assumptions are valid, the growth of production can be indicated as growths that have been weighted with the costs portions of inputs and as change in technology (Timmer et al., 2007).

In the case of labour productivity of labour, however, there is interest in hour-of-work-specific value added instead of hour-of-work-specific production (Timmer et al., 2007). This requires a value-added function according to which value added consists of a work contribution and capital input plus technology:

$$Z_j = g_j(K_j, L_j, T)$$

Thus branch-specific value added is comprised of capital K, labour L, and technology T; i.e. compared to the production function, the intermediate product input X is missing. This is due to value added Z being specified as the difference between production Y and intermediate product use X, in which case the aforementioned production inputs and technology are the value added inputs. (Timmer et al., 2007).

The equation for growth of labour productivity can be derived from the value added function by reducing the increase in working hours H from both sides of the equation, and then labour productivity if formed the ratio of value added and working hours (Timmer et al., 2010). The result from the above is this report's basis for growth calculation in the form of an equation:

$$\Delta \ln z_j = \bar{v}^Z_{ICT,j} \Delta \ln k^{ICT}_j + \bar{v}^Z_{N,j} \Delta \ln k^N_j + \bar{v}^Z_{L,j} \Delta \ln LC_j + \Delta \ln T^Z_j$$

On the basis of the diagram, it can be seen that branch-specific growth of labour productivity, i.e. the logarithmic change z in the working-hour-specific value added went through z, is formed as the sum of the weighted logarithmic changes in production inputs and the change in technology. The equation's first two terms depict capital intensity, i.e. growth of working-hour-specific capital. The first of these terms depicts growth and the other ICT capital intensity's klCT growth and the other the non-ICT capital intensity's kN growth. The third term of the equation depicts labour structure's LC change. Each input's average share of the value added of branch serve as the weights of the changes in the inputs. The change in total factor productivity T depicting change in technology is obtained as the equation's residual term by subtracting the growth in the aforementioned inputs from the growth of labour productivity. (Timmer et al., 2010).

Branch-specific growth of labour productivity is defined in the manner described above. Branch-specific calculations function also as the basis for calculating the growth of the market sector's labour productivity. The market sector's growth of labour productivity is derived from branch-specific growth equations using the average shares of branches of the value added of the market sector as weights (Jäger, 2017).

Thus the growth of labour productivity is formed as the contributions of the production inputs, i.e. of growth capital intensities and labour force structure change, and total factor productivity. As is pointed out in the above, the total factor productivity contribution calculated from the components to total productivity is simply calculated as the residual time of the equation by reducing the contribution of labour productivity growth to inputs, the change in the structure of the labour force and the increase in capital intensity.

As regards the contributions related to production inputs to calculate the contribution of the change in labour force structure, the labour force is divided, based on labour force queries, according to gender (female, male), age (15-29, 30-49, 50+) and education and training (high, medium, low) (Timmer et al., 2007). Based on this, each group's annual shares of branch-specific working hours and wages are then calculated. These shares can be used to calculate the increase in annual working hours of specific groups, which is then weighted with the group's average share of the wages paid within the branch. (Timmer et al., 2007).

The wages paid to the employees are deemed to reflect their limit output and thus the contribution of the labour force's structural change is positive as the labour force's proportion of highly-paid employees and their share of the working hours increase (Hulten, 2009).

As was pointed out in the above, based on the data, the contribution of the growth of capital intensity is further divided into two parts in this report: growth of ICT capital intensity and growth of non-ICT capital intensity. Both of these are comprised of the growth of the capital stocks of the asset classes constituting the same type of assets, and they are weighted with their respective branch-specific average cost shares (Timmer et al., 2007). The portion of costs is obtained from capital compensation, which is calculated as the difference between the branch's value added and labour force compensation, i.e. wages. The productive capital stock is calculated by weighting the growth of assets items at the calculatory rental price of each item, which is comprised of the nominal return on capital, degree of wear-and-tear, and capital gains. (Timmer et al., 2007). Because the contribution of capital intensity growth is calculated based on the growth of productive capital stock, it takes into account changes in both the quantity and quality of the capital (Pohjola, 2017). Thus the growth of capital intensity can, indeed, be consequence of the improvement in the quantity or quality of capital, which takes place either through capital commodities of higher quality or totally new capital commodities (OECD, 2001).

4.2 The data and the branches of the corporate sector to be examined

The EU KLEMS database is used as a source in the examination of macro factors. The data in this database is comprised of data based on national accounts and covering the various branches. The data to be used are based on the 2017 publication of the database with the data generally extending to 2015. Thus the data in the database limit the period of the examination of macro factors such that the most recent years are excluded. However, growth of productivity between countries can be reliably compared by applying the uniformly implemented growth accounting based on the EU KLEMS database.

At the centre of the examination is Finland's growth of labour productivity during the new millennium with benchmark countries being the following: the Netherlands, Great Britain, France, Sweden, Germany, Denmark, and the United States. The examination focuses on the market sector from which the following branches have been excluded because of their special nature or problems in their measurement: Agriculture. Forestry and fishing (A), Mining and quarrying (B), Financial and insurance activities (K), Real estate activities (L), Arts, entertainment and recreation (R), Other service activities (S) and the public sector.

Thus the market sector examined here covers the following branches: Manufacturing (C), Electricity, gas, steam and air conditioning supply and Water supply, sewerage, waste management and remediation (D-E), Construction (F), Wholesale and retail trade (G), Transportation and storage (H), Accommodation and food service activities (I), Information and communication (J), Professional, scientific and technical activities (M), and Administrative and support service activities (N). The market sector defined in this way covered an average of 58% of the value added of the entire national economies included in this examination during the new millennium.

In addition to the market sector, the growth of labour productivity and the development of total factor productivity are also examined by dividing the market sector into three parts with the focus on manufacturing and private services. Manufacturing consists directly of industry whereas private services include Wholesale and retail trade, Transportation and storage, Accommodation and food service activities, Information and communication, and Administrative and support service activities. Thus other production of the market sector consists of Electricity, gas, steam and air conditioning supply and Water supply, sewerage, waste management and remediation, and Construction.

4.3 The growth of labour productivity and of total factor productivity

This section depicts the development of labour productivity and total factor productivity based on the data of the EU KLEMS database. The figures show that the growth of labour productivity based on the EU KLEMS database data is very similar to the previous chapter's growth based on Eurostat and OECD data. Thus it can be concluded that the data used as the source does not appear have significant impact on what the development of productivity has looked like during the new millennium.

4.3.1 The market sector

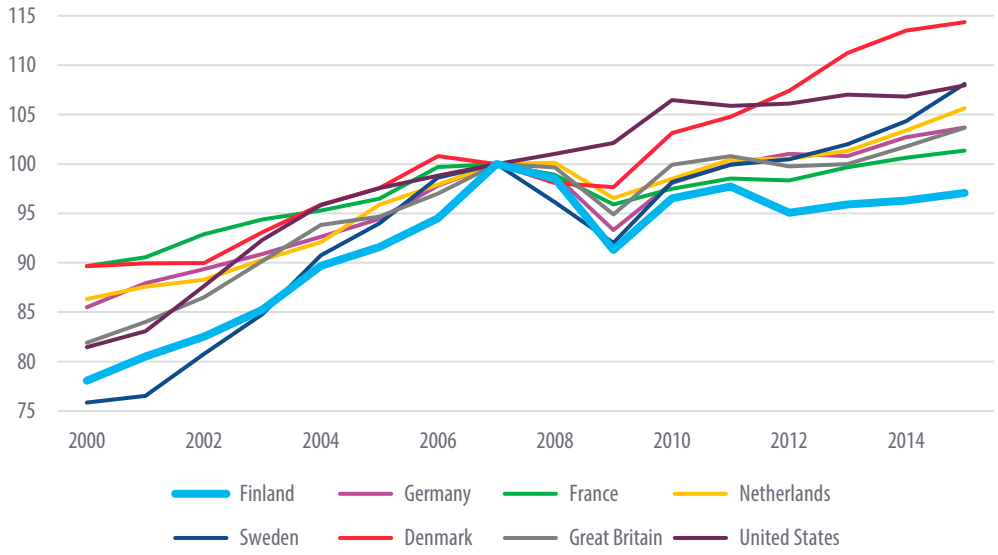


Figure 4.2 Development of labour productivity in the market sector, 2007=100

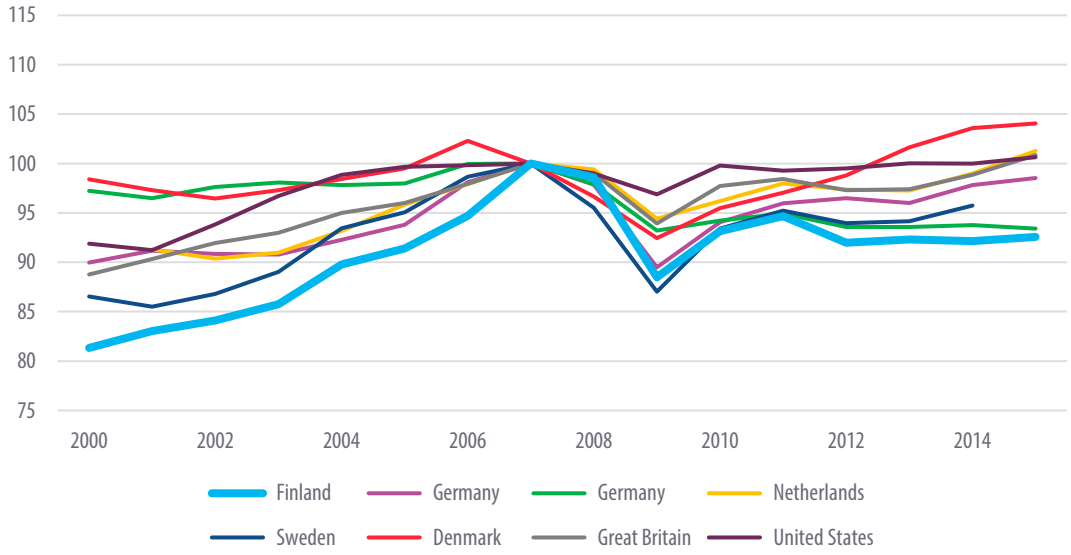


Figure 4.3 Development of total factor productivity in the market sector, 2007=100
Source: EU KLEMS

Figures 4.2 and 4.3 examine the development of labour productivity and total factor productivity in the market sector during the new millennium. Labour productivity and total factor productivity have developed in the same way in Finland. Like labour productivity, total factor productivity in Finland grew strongly during the period preceding the financial crisis, whereas in the most recent years of this series, its growth seems to have almost stopped. This can be seen as being worrying trend because the growth of total factor productivity is a significant factor in the growth of labour productivity and thereby acting in background of economic growth as such..

The figures presented in the above demonstrate as do the figures in Chapter 3 that the growth of labour productivity in Finland was very powerful prior to the financial crisis and then post-crisis it was fairly modest compared to the other countries included in this study. A similar conclusion can be made also in regard to total factor productivity because total factor productivity in Finland was the most powerful of all the countries prior to the financial crisis, but then post-crisis growth has been significantly slower. In addition to Finland, the growth of total factor productivity was relatively powerful also in Sweden also and in the United States, as two other examples, during the period preceding the financial crisis. In the United States, however, growth slowed in 2004, several years before the financial crisis. As regards European countries, especially in Germany and the Netherlands, the growth of total factor productivity seems to have accelerated midway through the first decade of the new millennium.

Following the financial crisis, labour productivity increased particularly in Denmark and (after the euro crisis) also in Sweden. However, the growth of total factor productivity seems to have remained fairly modest in these countries, especially in Sweden. Growth appears to have levelled out during the recent years also in Denmark. However, the growth of total factor productivity appears to have picked up especially in the Netherlands and in Great Britain along with Denmark following the euro crisis.

On the basis of Figure 4.2, one can indeed conclude that the dying out of the growth total factor productivity is not restricted merely to Finland. In the United States, for example, the growth of total factor productivity has been at practical standstill since the beginning of the millennium and in France it has been slowing down continuously. However, the development in Finland' differs especially from that of France in that in Finland the growth of total factor productivity was very marked in the period preceding the financial crisis whereas in France its growth has been very modest since the beginning of the new millennium.

4.3.2 Manufacturing

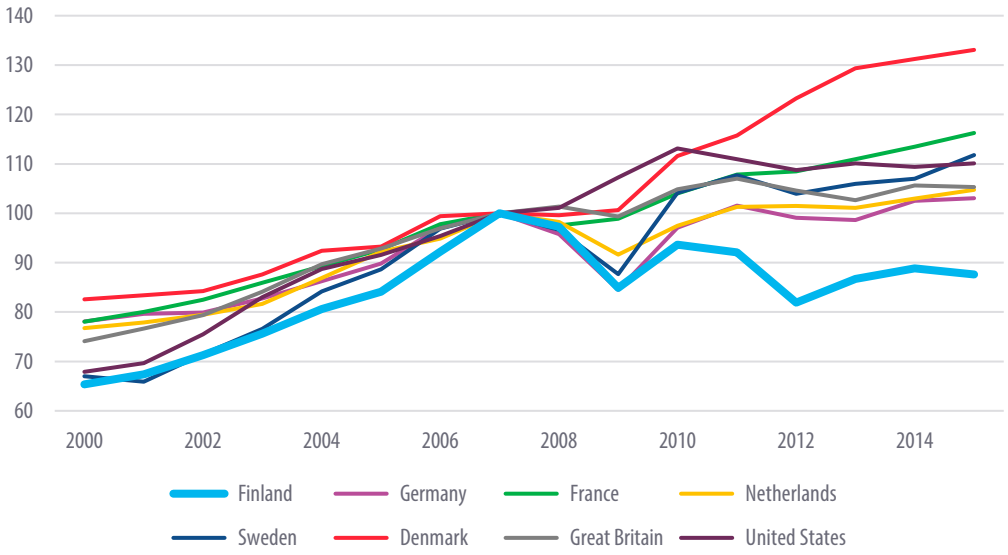


Figure 4.4 Development of labour productivity in manufacturing, 2007=100

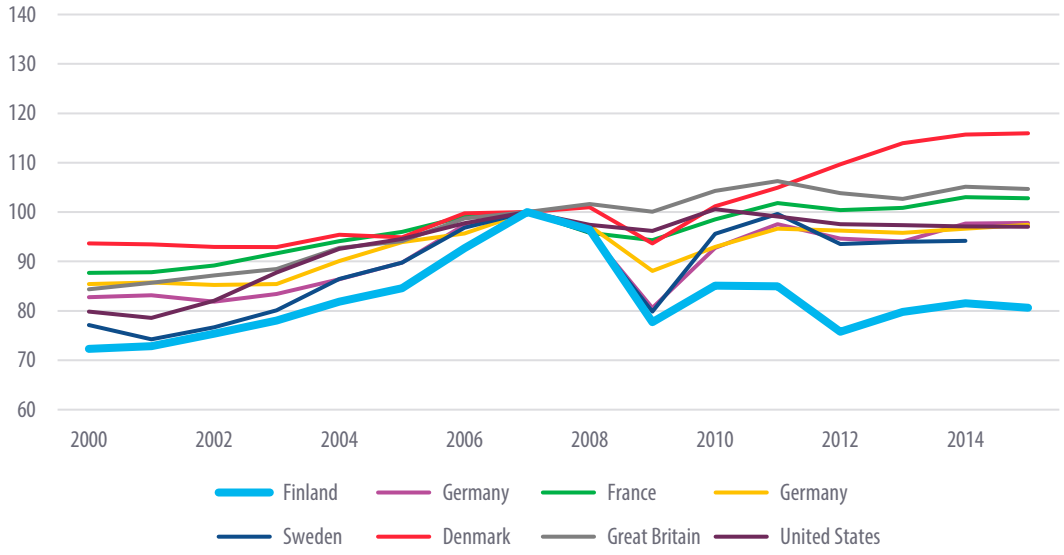


Figure 4.5 Development of total factor productivity in manufacturing, 2007=100
Source: EU KLEMS

Figures 4.4 and 4.5 illustrate the development of labour productivity and total factor productivity in manufacturing. The development of labour productivity and total factor productivity were very similar also in manufacturing in Finland. Furthermore, development in manufacturing corresponded to a large degree to development in the entire market sector: growth of both labour productivity and total factor productivity was very pronounced before the financial crisis in Finland, but after the crisis this growth seems to have slowed down. However, the slowing down subsequent to the financial crisis is still clearer in manufacturing and on the basis of the figures the euro crisis which followed the financial crisis also had a big impact on the development of productivity.

Once again, the growth of labour productivity corresponds largely to the development shown in the figures of Chapter 3. Prior to the financial crisis, growth was strong in Finland, Sweden, and United States, but after the crisis, growth of labour productivity slowed down, especially in Finland. During the period preceding the crisis, total factor productivity also increased strongly as did labour the former especially in Finland and Sweden, gaining momentum especially in the middle of the first decade of the new millennium, prior to the financial crisis. In this regard, the development of total factor productivity has been very similar in manufacturing as it has been throughout the market sector.

After the financial crisis, labour productivity and total factor productivity in manufacturing have increased strongly in Denmark, but in other countries growth of labour productivity and especially of total factor productivity seem to have slowed down significantly. In the case of Finland, the euro crisis had a considerable impact on the development of productivity in manufacturing, as is shown by the figures, but a corresponding drop did not happen in the other countries. On the whole, especially the growth of total factor productivity seems to have slowed down or come to halt even during the years following the financial crisis and the euro crisis in nearly all of the countries included in this examination. The point of strongest growth seems to have been passed in Denmark, too, after 2013.

In addition to international crises, the collapse of Nokia also in part explains the weak development of labour productivity and total factor productivity in Finland's manufacturing sector. It was noted in the previous chapter of this report when examining the growth of labour productivity that Nokia has had a major influence on manufacturing in Finland, and thereby also on the development of productivity in the market sector. Nokia belongs in the branch of manufacturing of electronic and optical devices, and the development of labour productivity and total factor productivity in this branch is illustrated in Figures 4.6 and 4.7.

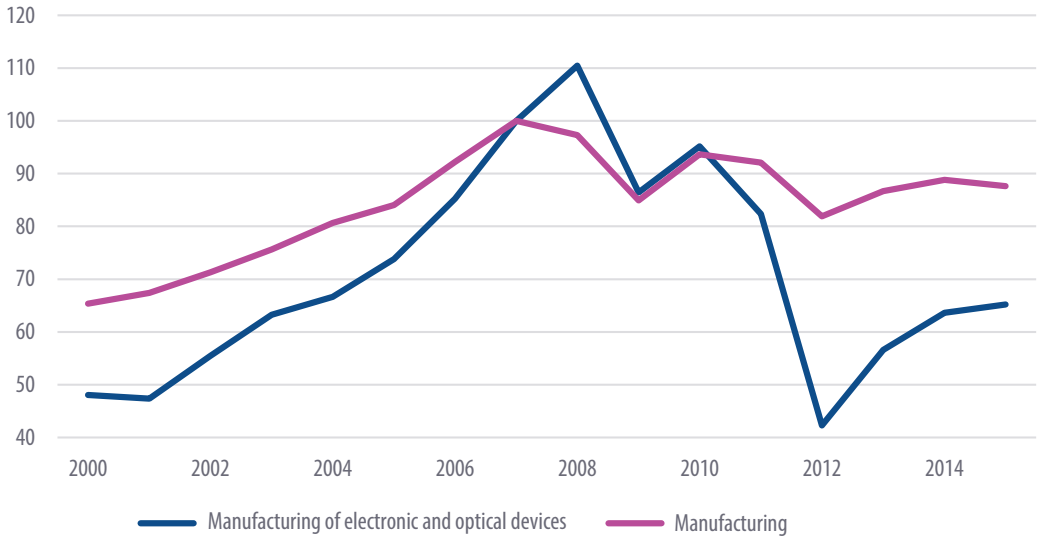


Figure 4.6 Development of labour productivity in manufacturing of electronic and optical devices in Finland, 2007=100

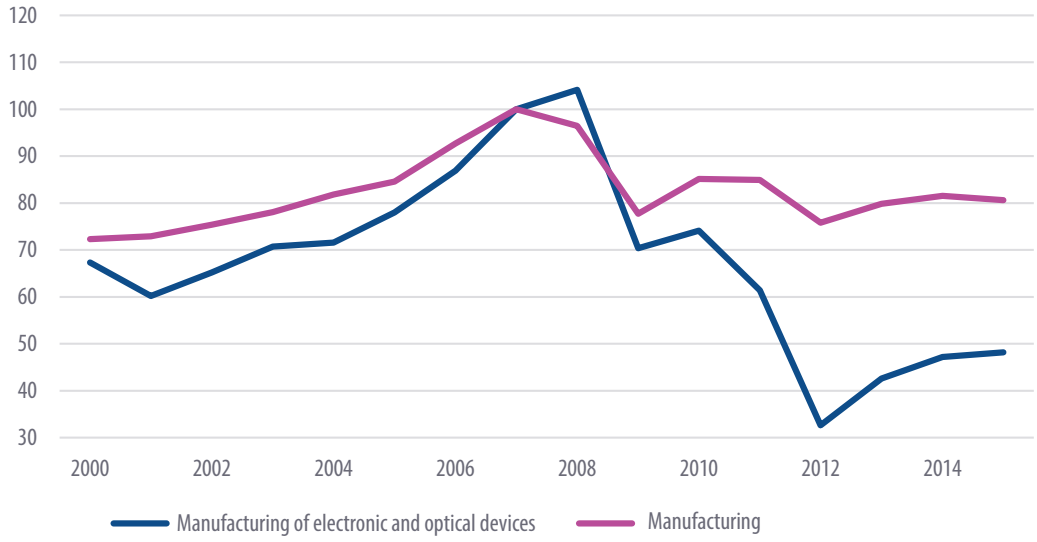


Figure 4.7 Development of total factor productivity in manufacturing of electronic and optical devices in Finland, 2007=100
Source: EU KLEMS

Figures 4.6 and 4.7 show that the electronic and optical devices branch's labour productivity and total factor productivity increased strongly during the early years of the new millennium. After the financial crisis, however, labour productivity and total factor productivity in this dropped significantly right up to 2012. Total factor productivity dropped particularly severely. On the basis of these figures, labour productivity and total factor productivity in the electronic and optical devices branch appear to have truly collapsed after the financial and euro crises.

The significance of this branch for the development of labour productivity in manufacturing and in the market sector can be estimated by means of the value added share, for example. Throughout the first decade of the new millennium, manufacturing electronic and optical devices amounted to an average of roughly 25% of manufacturing as a whole. During the period preceding the financial crisis, this share was close to 30% and after the crisis the average value added share has stayed at about 25%. Manufacturing's share of the value added of the market sector since the beginning of the new millennium has averaged about 35%. Based on these shares and the above figures, it can be said that Nokia has had a significant impact on the development of labour productivity and total factor productivity and (due to manufacturing's central position) also on the growth of productivity in the market sector as a whole.

4.3.3 Private services

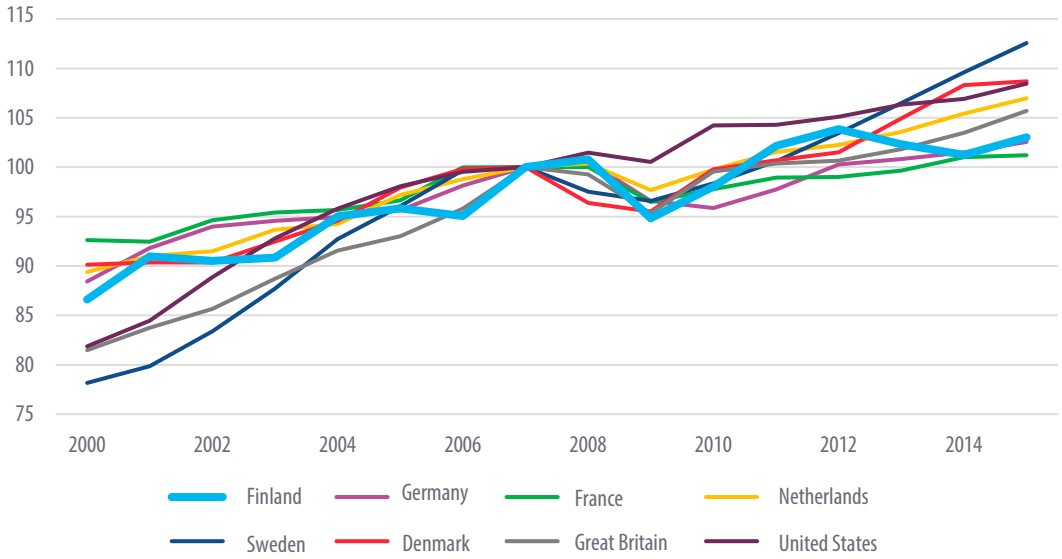


Figure 4.8 Development of the labour productivity in private services, 2007=100

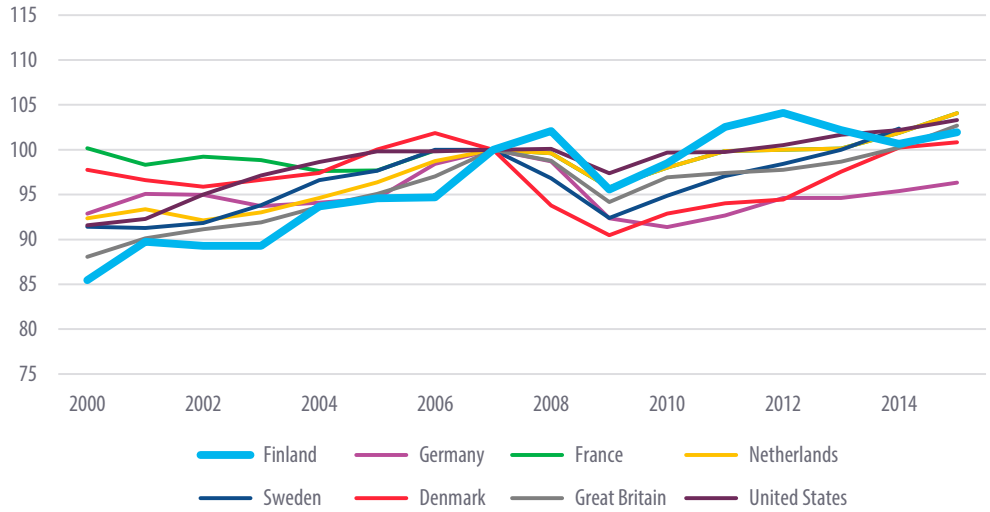


Figure 4.9 Development of total factor productivity in private services, 2007=100

Source: EU KLEMS

Figures 4.8 and 4.9 illustrate the development of labour productivity and total factor productivity in private services. The development of labour productivity and total factor productivity in private services in Finland differs from the development in manufacturing and in the market sector especially during the period that preceded the financial crisis. In private services particularly the growth of labour productivity did not place Finland at the head of the examined group of countries during the period preceding the financial crisis. Based on these figures, it can be said that the development of labour productivity and the development of total factor productivity in private services have been very similar in Finland.

As is the case with market sector and manufacturing, the development of labour productivity in private services is largely in compliance with the figures in Chapter 3. Where the growth of labour productivity in Finland prior to the financial crisis does not appear to be doing equally well with growth in manufacturing, growth of total factor productivity has been, nonetheless, powerful in Finland when compared to the benchmark countries. Total factor productivity increased relatively strongly during the years prior to the financial crisis also in Great Britain, Sweden and the Netherlands whereas in the United States its growth slowed down as had been noted in earlier examinations in the middle of the first decade of the new millennium.

Following the financial crisis, labour productivity in private services has increased most of all in Sweden whereas in Finland the growth which began after the financial crisis appears to have slowed down after the euro crisis. At the same time, but even more powerfully, total factor productivity strengthened in Finland, but it, too, appears to have slowed down subsequent to the euro crisis in the same way as labour productivity. The growth of total factor productivity in private services went through hard times during the financial crisis, especially in Germany and Denmark. However, the growth which followed the collapse of the crisis has been clearly more pronounced in Denmark than in Germany.

4.4 Labour productivity's growth components

As was pointed out at the beginning of this chapter, the growth accounting method can be used to examine the structure of growth by breaking it down to its factors. The components making up growth of labour productivity are change in labour force structure and growth of capital intensity and the growth of total factor productivity, which is calculated as a residual term. The contribution of each component to the growth of labour productivity is expressed in percentage points, which together form the labour productivity percentage value.

The results of the growth accounting are given in the following sub-chapters for the market sector, manufacturing and private services. In addition to the average value for the entire period of examination, 2001-2015, results are also presented for shorter periods: the period 2001-2007 preceding the financial crisis, for the period 2008-2011 covering the financial crisis, and for the period 2012-2015 following the financial crisis.

4.4.1 Growth of labour productivity in the market sector and its components

Country	2001 - 2015	2001 - 2007	2008 - 2011	2012 - 2015
Sweden	2,36	4,05	0,08	1,45
United States	1,91	2,99	1,45	0,49
Denmark	1,65	1,59	1,22	2,21
Great Britain	1,61	2,90	0,26	0,71
Finland	1,52	3,61	-0,46	-0,16
Netherlands	1,37	2,13	0,13	1,28
Germany	1,32	2,27	0,07	0,92
France	0,83	1,58	-0,36	0,71

Table 4.1 Growth of labour productivity in the market sector, %
Source: EU KLEMS

Table 4.1 shows the average growth figures for labour productivity obtained as results of growth accounting, for both the entire examination period (2001-2015) and the aforementioned shorter periods. The results are presented as arithmetical averages of the annual growth of labour productivity in the market sector. In the case of Sweden, it should be noted that the averages for the entire examination period (2001-2015) and the last period (2012-2015) have been calculated up to 2014 because of missing data. This note applies both to the market sector as well manufacturing and private services growth calculation presented later.

Finland's average growth of labour productivity in the market sector for the entire examination period (2001-2015) places it in the middle. However, the average growth of labour productivity in Finland during the pre-crisis years (2001-2007) second only to Sweden. The market sector's growth of labour productivity in Finland was severely impacted during the financial crisis (2008-2011) and it turned negative. The recovery of growth of labour productivity subsequent to the financial crisis (2012-2015) has been fairly weak in Finland, and on average the growth in the market sector has been negative. However, the slowing down of growth of productivity during the last period is explained partly by the impacts of the euro crisis.

However, Table 4.1 provides only a superficial picture of the growth of labour productivity. In the following, the growth of labour productivity in the market sector is assessed in more detail utilising the growth accounting method.

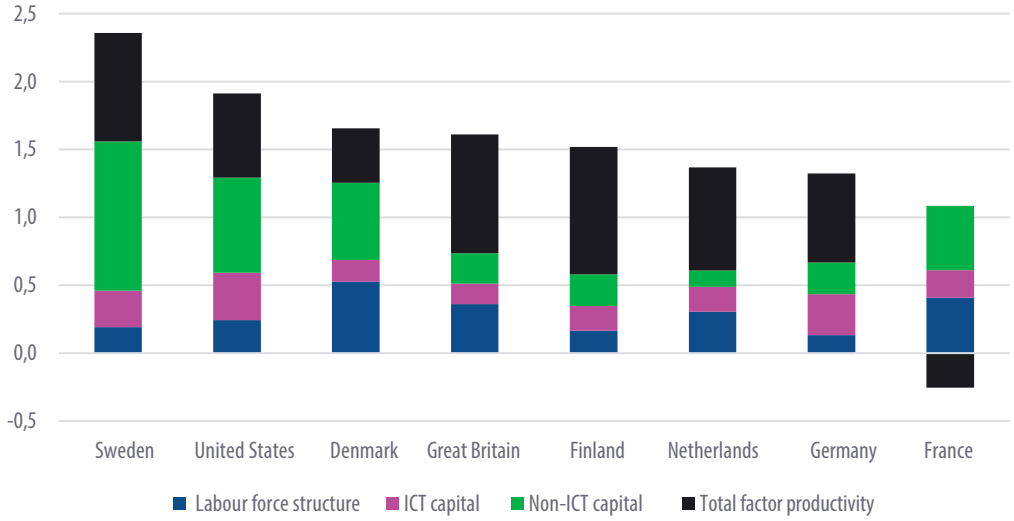


Figure 4.10 Growth of labour productivity (%) and the growth contributions of the components (percentage points) in the market sector on average during the period 2001-2015
Source: EU KLEMS

In Figure 4.10, the average growth of labour productivity in the market sector covering the entire examination period (2001-2015) has been divided into the growth contributions of the change in the structure of the labour force, ICT and non-ICT capital intensities, and total factor productivity. The main source of growth in the average labour productivity in Finland's market sector during the entire examination period (2001-2015) has been the growth of total factor productivity (its contribution of 0.9 percentage points corresponded to about 60% of the average growth of labour productivity. The remaining growth of labour productivity was divided fairly evenly between the three other components

The structure of the growth of labour productivity in Finland's market sector seems to be similar in the Netherlands, Great Britain, and Germany. However, in the case of the Netherlands and Great Britain, the contribution of the change in labour force structure is more significant than Finland's growth structure. In Germany, in addition to growth of total factor productivity, the growth of labour productivity has been supported by growth in ICT capital intensity. However, in Sweden, Denmark, and the United States, the growth contribution of total factor productivity has not been as significant, and in France this contribution has actually been in the negative territory throughout the examination period.

The structure of growth of labour productivity varies from country to country. In Finland the primary source of the average growth has been growth of total factor productivity, which tells of improvement in efficiency whereas, when looking at the average growth of labour productivity, Sweden and the United States have been the best in this comparison, and their growth in labour productivity has been significantly supported by growth in capital intensity. In other words, investments in both ICT capital and non-ICT capital have been important from the point of view of growth of labour productivity in these countries. In Finland the total growth contribution of capital intensities has been smaller than average, and this indicates that investments are below average.

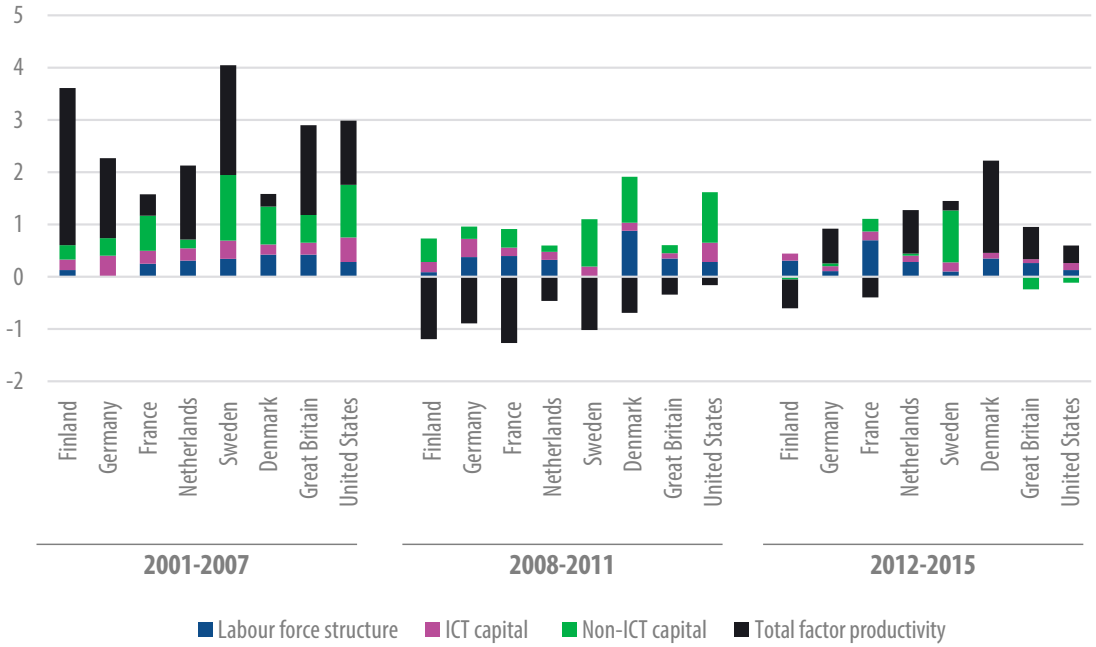


Figure 4.11 Growth of labour productivity (%) and the growth contributions of the components (percentage points) in the market sector during the period 2001-2015
Source: EU KLEMS

In Figure 4.11, the average growth of labour productivity in the market sector has been divided like the preceding figure to the contributions of the components of growth. The calculations are for three time periods: 2001-2007, 2008-2011, and 2012-2015.

During the period (2001-2007) preceding the financial crisis, the growth of total factor productivity was an extremely significant source of growth for labour productivity in Finland's market sector: then the contribution of total factor productivity can be estimated to be more than 80% of this growth. The growth of total factor productivity was a significant source of growth of labour productivity during the period in nearly all of the countries included in this examination. In Sweden and the United States, another

important source of growth was the growth of capital intensity. The growth of labour productivity in the market sector was markedly based on the aggregate contribution of capital intensity also in France and Denmark, whereas the growth contribution of total factor productivity remained relatively modest in these countries.

During the crisis years (2008-2011) the average growth of labour productivity in Finland sunk into negative territory in the market sector along with the significantly negative contribution of total factor productivity. During the period, the growth contribution of total factor productivity has, indeed, negative in all the countries examined, albeit its contribution the United States remained very minor. Were total factor productivity multiplied only by the change in technology, its negative growth contribution would indicate decline in technology. In this case, one can, indeed, interpret the contribution of generally negative total factor productivity to indicate firmly in the direction that factors associated with economic trade cycles are also significantly having their impact in the background of total factor productivity (OECD, 2001).

During the last period (2012-2015), the average growth of labour productivity was negative only in Finland. As was the case during the preceding period, the significant negative contribution of the total factor productivity has manifested itself as slower growth of labour productivity. However, Finland's slower growth is explained partly by the euro crisis which happened during the last period and the factors associated with it may have been in the background of the negative growth contribution of total factor productivity.

As regards the other countries, the contribution of total factor productivity has been negative only in France, whereas especially the Netherlands, Germany and Denmark are three countries where it has been the foremost source of the growth of labour productivity. Sweden stands out from among the other countries included in this assessment as a country where the growth contribution of total factor productivity was very small and the growth of productivity was almost totally based on the growth of capital intensities, i.e. on concerted investments. Especially the contribution of the non-ICT capital intensity in Sweden has been very significant, because it has been the foremost individual source of growth for labour productivity during the period. In other words it seems that the growth of labour productivity in Sweden has been promoted especially by strong investments in non-ICT capital, i.e. machinery and plant and in R&D activity. In the other countries, total factor productivity's positive growth contribution was accompanied especially by labour force structure's change, which tells about increase in work hours by a skilled labour force.

The branch-specific data of the EU KLEMS database makes the examining of labour productivity in the market sector possible also as contributions by the sectors. The average growth of labour productivity including the entire examined period (2001-2015) of the market sector is presented in Figure 4.12 as the growth contributions of manufacturing, private services and other production. It is possible to assess the significance of each sector for the growth of labour productivity within the entire market sector in this way.

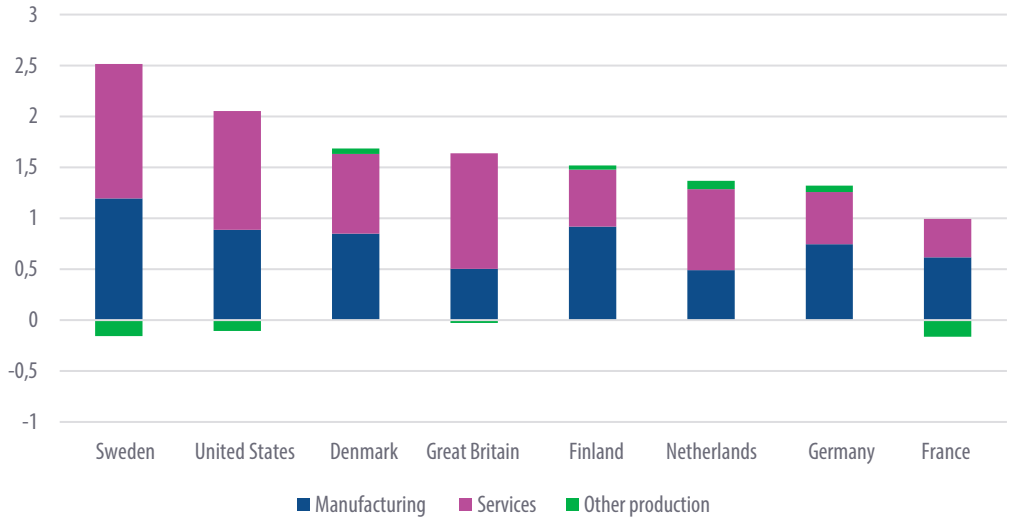


Figure 4.12 Average growth of labour productivity in the market sector during the period 2001-2015, %
Source: EU KLEMS

As can be seen from Figure 4.12, the market sector's average growth of labour productivity covering the entire examination seems to have been nearly totally based on the contributions of manufacturing and private services. Because of this, we focus primarily on the division of the market sector's growth of labour productivity between these two sectors.

Where the division between manufacturing and private services has been quite even, e.g. in Sweden and the United States, the leader of these two sectors in Finland is manufacturing. Manufacturing's growth contribution has been greater than that of private services in Finland, France and Germany, whereas in the Netherlands and Great Britain the growth contribution of private services has been greater than that of manufacturing. As with the structure of growth, the significance of the different sectors in the background of growth of labour productivity in the market sector vary between the countries.

Figure 4.13 Growth of labour productivity in the market sector during the period 2001-2015, %
Source: EU KLEMS

Figure 4.13 illustrates the contributions of manufacturing, private services and other production during different time periods to the growth of labour productivity of the market sector. In the case of Finland it can be seen that prior to the financial crisis (2001-2007) manufacturing possessed a considerably large growth contribution when compared internationally: then manufacturing produced about 70% of the growth of labour productivity in the market sector. This share was bigger than in any other country included in this report. In connection with this, it necessary to note the above impact of Nokia on labour productivity of manufacturing, which was very significant and especially during the period preceding the financial crisis.

In the case of Finland, the major impact of the financial crisis (2008-2011) on manufacturing's growth contribution is reflected the development of the sector's labour productivity. Indeed, it was only in Finland that manufacturing had a negative contribution to the market sector's growth of labour productivity. This can be seen as indicating that in Finland the labour productivity in manufacturing was impacted relatively more severely during the financial crisis more than in the other countries included in this report. One reason for the negative contribution of the industry has been indeed probably a collapse of Nokia which has been timed to the areas of the financial crisis. In the cases of the other countries, negative influence is reflected especially in the contribution of Other production, whereas the contribution of Private services has been positive in all other countries but not in France and Germany.

After the financial crisis (2012-2015) the average productivity of labour of Finland's market sector is still negative. Especially manufacturing, with its labour productivity having suffered considerably also during the euro crisis, seems to have been a fundamental factor once again. The growth contribution of private services has in turn been positive still, but it has diminished with respect to the preceding period. This deviates from the general development of the last period, because in the other countries it is the positive contribution of private services which comes to the fore. The growth of labour productivity in the market sector in countries such as Great Britain, Sweden and the United States originated almost entirely in private services.

Indeed, the significance of private services in the background of the growth of labour productivity in the market sector has strengthened and especially so in the last period (2012-2015) in nearly all of the countries covered by this report. However, Finland deviates significantly from the other countries in this case because in Finland the growth contribution of manufacturing has been constantly more significant than the contribution of private services.

4.4.2 The growth of labour productivity in manufacturing and its components

Country	2001-2015	2001-2007	2008-2011	2012-2015
Sweden	3,62	5,96	2,39	-0,19
United States	3,33	5,72	2,68	-0,19
Denmark	3,28	2,80	3,81	3,58
France	2,71	3,61	1,94	1,90
Great Britain	2,41	4,38	1,74	-0,38
Finland	2,20	6,28	-1,70	-1,04
Netherlands	2,15	3,87	0,44	0,85
Germany	2,03	3,62	0,86	0,40

Table 4.2 Growth of labour productivity in manufacturing, %
Source: EU KLEMS

The average growth figures of labour productivity in manufacturing are listed in Table 4.2 for the entire examination period (2001-2015) and for the three shorter periods. When assessing the average growth of labour productivity during the first decade of the new millennium, Finland is placed at the bottom of the list with Germany and the Netherlands. This is explained by an examination of the growth of labour productivity during the shorter periods. Before the financial crisis, Finland's growth of labour productivity was greater than in any of the other countries, but the crises which erupted around the end of the first decade of the new millennium caused it to go into negative territory during the

last two periods. Whereas Finland was the only country during the financial crisis period (2008-2011) among those included in this examination to have negative growth of labour productivity, the same thing happened also to Sweden, the United States, and Great Britain during the period following the financial crisis (2012-2015). In other words, the growth of labour productivity in manufacturing seems to have slowed down in Finland as well as in other countries.

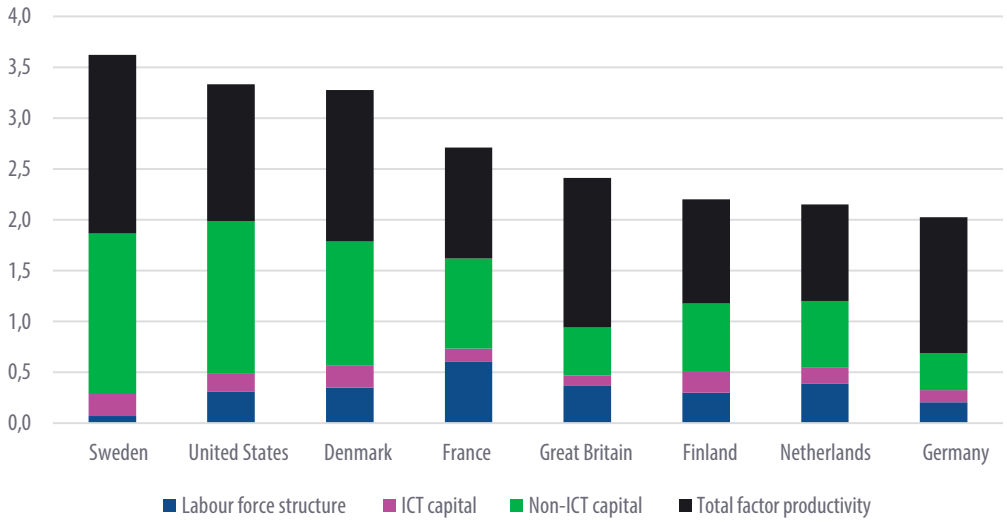


Figure 4.14 Average growth of labour productivity (%) and its components' growth contributions (percentage points) in manufacturing during the period 2001-2015
Source: EU KLEMS

Figure 4.14 shows the average growth of labour productivity and the structure of growth in manufacturing covering the entire examination period (2001-2015). It does seem that the average growth of labour productivity in Finland when compared to the market sector was divided more evenly during the first decade of the new millennium to total factor productivity contribution as well as capital intensities' and change in labour force structure contributions. The change in labour force structure contribution has been relatively modest as is the custom in the market sector, but capital intensities' contribution in manufacturing was close to the average of the selected countries, and differed in this way from that of the market sector.

The growth contribution of total factor productivity in the sector has been more significant than Finland on average, e.g. in Great Britain and Germany. The growth of capital intensities' and especially the growth of ICT capital intensities in Sweden, Denmark, and the United States have emerged as central components in the background of growth. The examination of the structure of average growth of labour productivity over the entire period (2001-2015) does, indeed, give indications that growth in manufacturing Finland has been supported by capital investments enlarging capital intensity as well as promoting total factor productivity more strongly than the market sector.

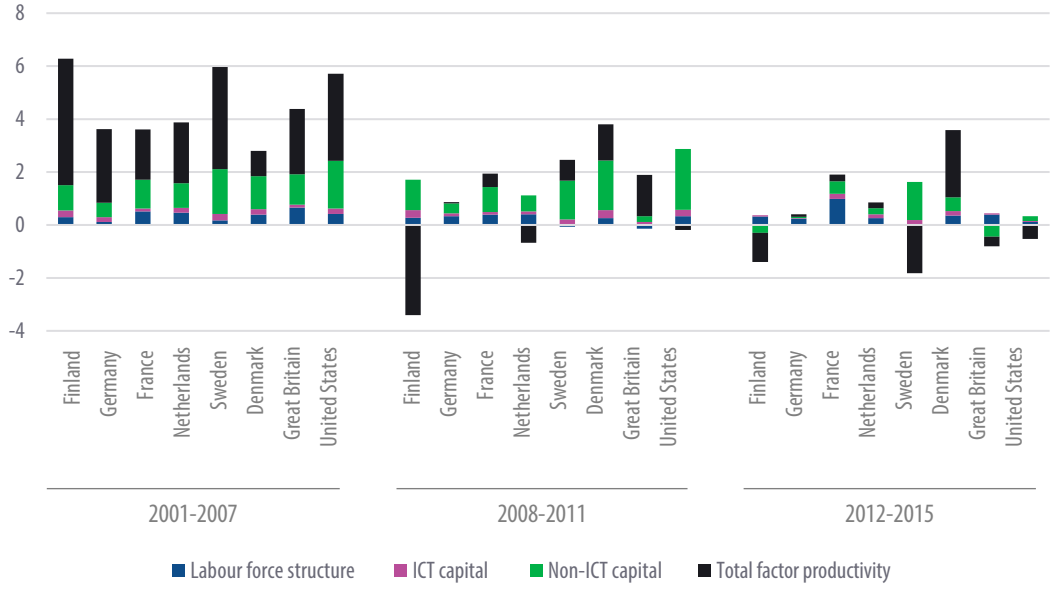


Figure 4.15 Growth of labour productivity (%) and the growth contributions of the components (percentage points) in manufacturing during the period 2001-2015
Source: EU KLEMS

When examining the structure of the growth of labour productivity in manufacturing in Finland as per Figure 4.15 and its shorter periods, the conclusion can be drawn in the case of Finland corresponding to that of the market sector regarding the fundamental significance of the growth contribution of total factor productivity. In the period (2001-2007) which preceded the financial crisis, the growth of labour productivity in manufacturing in Finland was almost entirely based on the contribution of total factor productivity as was the case with the market sector. Then the contribution of total factor productivity accounted for about 75 % of the growth of labour productivity in manufacturing. On the basis of the figure it can, indeed, be seen that the growth of total factor productivity was a significant source of growth in nearly all of the countries included in this examination. The only noteworthy exception was Denmark where the growth contribution of total factor productivity remained considerably smaller than the aggregate contributions of change in structure of capital intensities and labour force structure.

The negative growth of labour productivity in manufacturing in Finland during the crisis years (2008-2011) was markedly influenced by the negative contribution of total factor productivity. As was pointed out in connection with the market sector's growth structure, this can be seen to be partly explained by the factors related to the trade cycles in the economy influencing matters in the background of total factor productivity. However, the figure does show that, in addition to Finland, the contribution of total factor productivity was negative only in the Netherlands and United States despite the financial crisis. Had

only factors related to the trade cycles of the economy powerfully influenced matters in the background of total factor productivity during only this period, it can be assumed that the growth contribution of total factor productivity would have been negative also in the other countries as was the case with the market sector, because this was a global economic crisis. In other words, it can be assumed that the significant negative contribution of the total factor productivity of manufacturing in Finland was probably also influenced by other factors impacting especially on Finland, e.g. the collapse of Nokia.

After the financial crisis (2012-2015) the growth of labour productivity in manufacturing is still negative in Finland. Especially the negative contribution of total factor productivity is in the background of the slow growth. In addition to Finland, the growth contribution of total factor productivity was significantly negative during the last period of examination also in Great Britain, Sweden, and the United States where the sector's growth of labour productivity went negative as it did in Finland. In Denmark, however, total factor productivity has had a very significant positive contribution on the strong growth of labour productivity in the sector. During the period following the financial crisis, the growth of labour productivity in manufacturing was strongest in Denmark, because the growth in the other countries was very modest when compared to the period preceding the financial crisis.

On examination of the structure of growth during the last period (2012-2015), it also becomes evident that the growth contribution of capital intensity also seems to have become significantly smaller when compared to the preceding periods' growth. Sweden is the only country among those examined here where the non-ICT capital intensity had a significant positive contribution during the last period on the growth of labour productivity. In other words, the growth of capital intensity seems to have lost its significance as a source of growth for labour productivity in nearly all of the countries. This can also be interpreted as indicating that investments in nearly all of the countries have diminished in manufacturing during the last period when compared to the previous periods.

4.4.3 The growth of labour productivity in private services and its components

Country	2001-2015	2001-2007	2008-2011	2012-2015
Sweden	2,47	3,60	0,17	2,90
United States	1,91	2,91	1,07	0,99
Great Britain	1,77	2,97	0,13	1,31
Denmark	1,28	1,50	0,21	1,94
Netherlands	1,21	1,62	0,40	1,32
Finland	1,21	2,11	0,61	0,22
Germany	1,01	1,78	-0,55	1,22
France	0,60	1,11	-0,24	0,57

Table 4.3 Growth of labour productivity in private services, %
Source: EU KLEMS

Table 4.3 shows the growth figures for labour productivity in private services during different periods. The list of the growth of average labour productivity during the entire examination period (2001-2015) shows that Finland is at the tail end of the group of countries whereas especially Sweden stands out from the other countries with its strong average growth of labour productivity. In the light of the period-specific examination, the growth of labour productivity in private services in Finland was fairly compared to other countries during the period (2001-2007) preceding the financial crisis and during the crisis (2008-2011) Finland was placed immediately second after the United States. Following the crises (2012-2015), the average growth of labour productivity in the sector seems, however, to have slowed down in Finland when compared to the previous periods; growth in Finland during the last period was the lowest of all.

The growth of labour productivity in every one in the countries on has been considerably slower, on average, than in manufacturing throughout the examination period (2001-2015); e.g. the average growth in Sweden's for the entire examination period reached about 3.5%. However, the average growth of labour productivity in private services has been stronger than the growth in manufacturing in all of the countries during the last period (2012-2015) except in Denmark. The emphasis of the position of private services in the background of growth of labour productivity in the market sector could be seen already in connection with the sector-specific examination of the market sector in Figure 4.13.

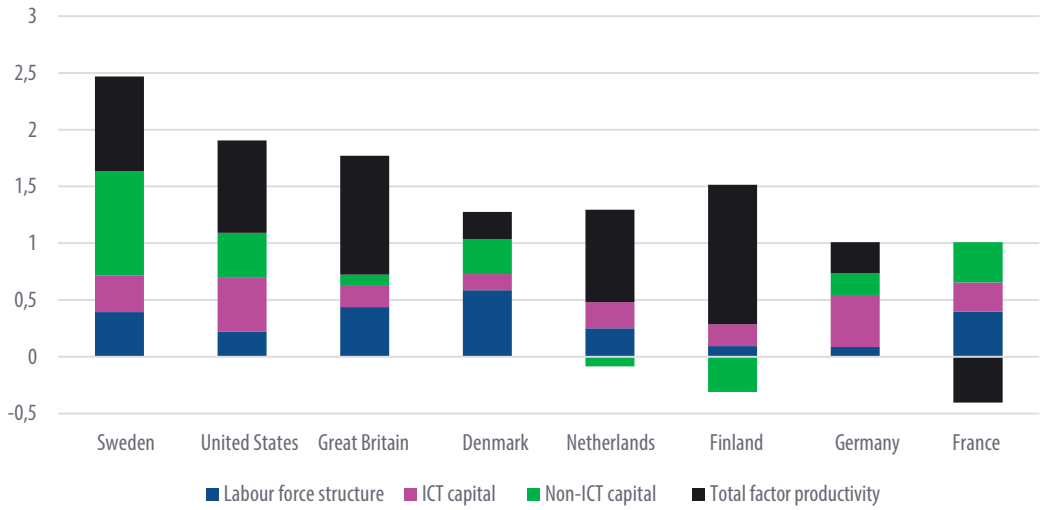


Figure 4.16 Average growth of labour productivity (%) and its components' growth contributions (percentage point) in private services during the period 2001-2015
Source: EU KLEMS

Figure 4.16 illustrates the structure of the growth of average labour productivity over the entire examination period (200120012015) in private services. The figure shows in Finland the growth contribution of total factor productivity has been even more significant in private services than in manufacturing. It also shows that the contribution of non-ICT capital intensity has been negative on average, unlike in manufacturing. Likewise, the contribution of the ICT capital intensity has remained relatively fairly minor in Finland and that the total growth contribution of capital intensity has been negative. In other words, the negative contribution of non-ICT capital intensity indicating diminishing investments has cancelled out the positive contribution of ICT capital intensity, and thus the contribution of capital intensity in total has slowed down the average growth of labour productivity in private services in Finland. At the same time, these observations indicate that investments in Finland in private services as opposed to manufacturing, would have been less than in the group of countries on average.

In addition to Finland, the significance of the growth of total factor productivity in the background of the growth of average labour productivity in private services was emphasised in the Netherlands and in Great Britain. In Sweden and the United States, the growth contribution of capital intensity, in addition to total factor productivity, came to the fore. In Germany and Denmark, on the other hand, the importance of total productivity growth has been very minor, and in Germany the foremost growth component was the increase in ICT capital intensity, while in Denmark the change in labour force structure was particularly pronounced. As distinct from the other countries, the contribution of total factor productivity was negative on average in private services in France, as had been the case earlier in the market sector.

The average structure of the growth of labour productivity over the entire examination period (2001-2015) in private services does indeed deviate somewhat from the aforementioned and structure of growth in manufacturing. Compared to manufacturing, especially the contribution of ICT capital intensity in private services was emphasised in several countries, whereas in manufacturing non-ICT capital intensity was the most important capital intensity. In addition, based on the previous examination, the positive contribution of total factor productivity was generally emphasized in manufacturing, while in private services its contribution has been very minor or even negative in a few of the countries. In addition to this, it seems that the average structure of growth in private services differs more from one country to the next than in manufacturing.

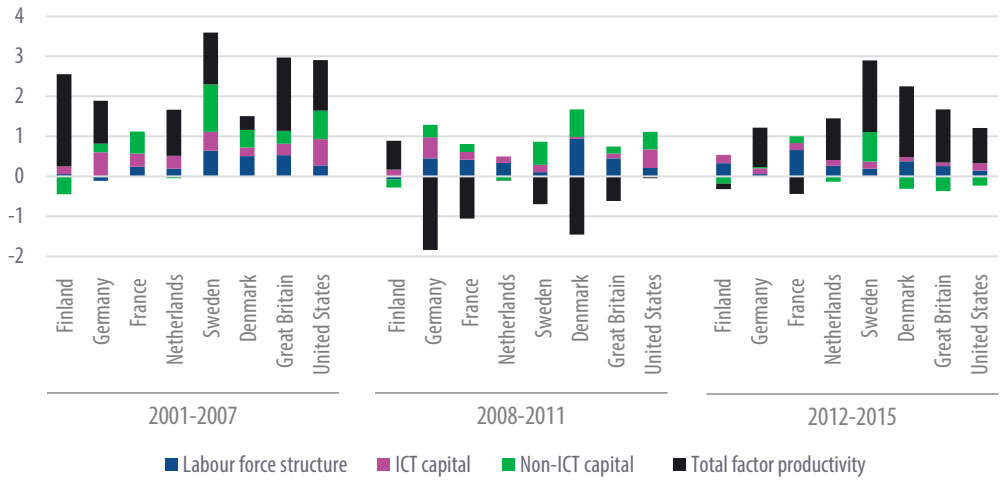


Figure 4.17 Growth of labour productivity (%) and its components' growth contributions (percentage points) in private services during the period 2001-2015
Source: EU KLEMS

As before, Figure 4.17 depicts the growth of labour productivity and its components in private services over three periods. The figure shows that during the period which preceding the financial crisis (2001-2007) the average growth of the productivity of labour in private services in Finland, as when dealing with manufacturing, was almost entirely based on the growth of total factor productivity. Unlike in manufacturing, ICT capital intensity had a significant negative contribution during the period. With the exception of France and Denmark, the period generally emphasised the significant positive contribution of total factor productivity. The figure also clearly shows that, in addition to total factor productivity, ICT capital intensity also had a significant positive contribution in several countries as regards the growth of labour productivity within the sector.

During the financial crisis (2008-2011) the structure of the growth of labour productivity in Finland's private services differed considerably from that of the other countries and from the structure of the growth of manufacturing in Finland. Even though the growth

of labour productivity was reduced during the financial crisis when compared to the preceding period, it remained positive in Finland where growth was still firmly based on the positive contribution of total factor productivity. In most of the countries included in this examination, the contribution of total factor productivity was significantly in the negative territory, however, and the situation was almost entirely opposite to that in manufacturing: Finland was the only country where the contribution of total factor productivity and the growth of labour productivity were negative during the financial crisis. In Finland, the development of the growth of labour productivity dating from the time of the financial crisis of the sectors can, however, be to some extent explained by demand factors: where the increase in the domestic demand supported the growth of labour productivity of private services, growth was held down especially by export problems (Anttonen et al., 2019) in manufacturing.

During the last period (2012-2015) in the examination, the growth of labour productivity in private services was still reduced in Finland when compared to the preceding periods and the contribution of total factor productivity turned negative during the period. Furthermore, the contribution of ICT capital intensity remained negative as it did in the preceding periods and the figure shows that the sector's weak growth in Finland during the last period were maintained by the contributions of the change in the labour force structure and of ICT capital intensity. In addition to Finland, the growth contribution of total factor productivity was negative during the last period only in France; in the other countries it provided a significant positive contribution to the growth of labour productivity. However, the ICT capital intensity's contribution seems to have been negative also in the Netherlands, Great Britain, Denmark, and the United States as well as in Finland. Indeed, the figure shows that the aggregate growth contribution of capital intensities had diminished significantly like in manufacturing in all other countries except in Sweden when compared to the preceding periods.

On the basis of period-specific examination of the structure of the growth of labour productivity in private services, one can, indeed, state that the significance of the growth of total factor productivity in the background of the growth of labour productivity was emphasised during every period. At the same time, growth has been slowed down by the constantly negative contribution of non-ICT capital intensity indicating diminishing investments. The development of private services in Finland differed fundamentally from that in the other countries, and especially so during the last period (2012-2015) because the growth of labour productivity in the sector was very modest during the last period. In addition to this, the contribution of total factor productivity turned negative and at the same time lost its significance as a background growth factor when compared to the preceding periods. However, the weakened growth of private services in Finland is probably largely explained by problems in domestic demand (see the discussion in item 3.2.5).

5 The micro factors of labour productivity: Productivity decomposition using corporate data

Chapter 3 dealt with the growth of labour productivity in the corporate sector and within its various branches. Next, we take yet another step deeper in the examination – to the level of corporations within the various branches.

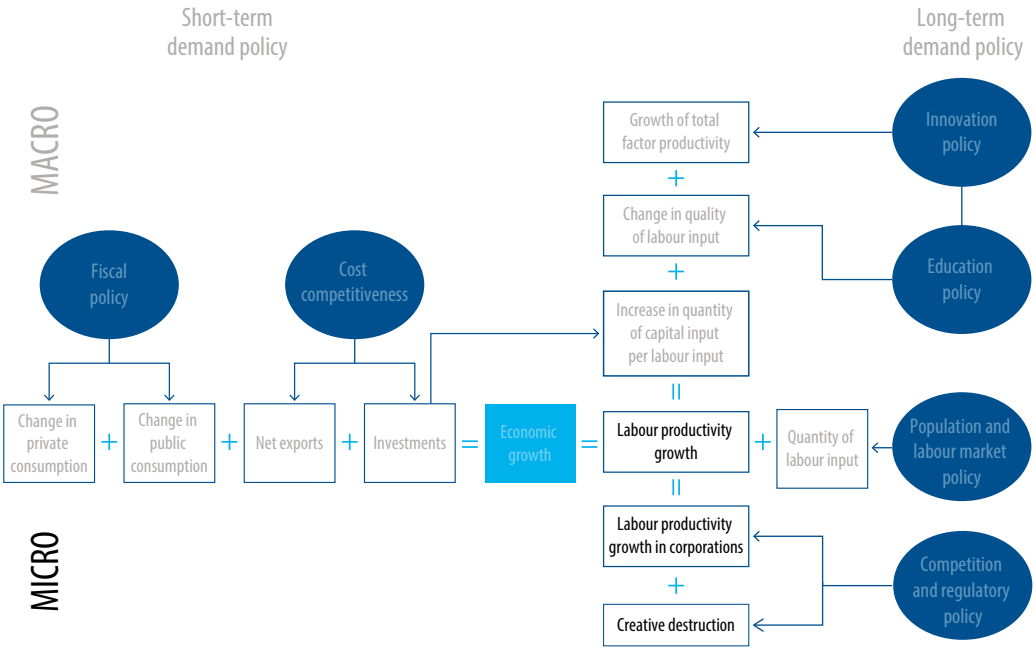


Figure 5.1 Creative destruction as the driver of productivity
Source: Maliranta (coming)

5.1 Corporate-level factors of labour productivity and their measurement

Figure 5.2 illustrates how the growth of (aggregate) productivity of a branch, the growth of productivity of corporations, and changes in corporation structure and workplace structure are interconnected. The steepness of the graph depicts the force of the growth of productivity. For the sake of simplicity, it is assumed that the growth rate of productivity in all corporations is the same. The size of the circle depicts the magnitude of inputs (e.g. number of working hours) in the corporation. The development of the branch is depicted by the thick dashed line.

The figure shows four different corporations:

- Corporation A: A departing corporation, which is present on the market in year t-1 but has departed by the year t.
- Corporation B: A low-productivity corporation in which the labour input has diminished between year t-1 and year t.
- Corporation C: A high-productivity corporation in which the labour input has Increased between year t-1 and year t.
- Corporation D: A new corporation, which was not present on the market in year t-1, but is present inyear t.

Corporations B and C influence the growth of aggregate productivity through their own productivity growth: the steeper the thin solid graphs depicting the development of their productivity, the steeper the thick dashed graph depicting the productivity development of the branch. The assumption here, for the sake of simplicity, is that that the corporations' growth rate of productivity is the same in both. These could, of course, be different, but then we would be considering the weighted average productivity rate of these corporations. The weights used would be the corporations' shares of employment.

In addition to this, both corporations have influenced the productivity of the branch positively through the mechanism of creative destruction. Corporation B because its productivity is lower than that of corporation C and its share of employment has diminished (the circle depicting its size has become smaller in relation to the circle depicting the size of corporation C). Corporation C has influenced creative destruction, but due to the opposite reason: its productivity is high and its size has increased in relation to corporation B. Corporation A has also influenced the productivity of the branch had through the mechanism of creative destruction. Its productivity was slower in year t-1 than in corporations which continued until year t. Consequently, if it had not departed, the productivity of the branch in year t would have been lower than now, and the branch's growth of productivity would have been lower Corporation D influenced creative destruction by entering the market at a productivity level, which was higher

than the average productivity of corporations B and C. Had it not entered the market, the productivity of the branch in year t would be lower and the growth of productivity between the years t-1 and t would be lower than it is here.

Creative destruction, i.e. the entry to the market of the new corporation D, the departure of the old corporation A and the structural change between corporations B and C have in aggregate raised the branch's productivity. Without creative destruction the branch's productivity growth would be lower. This growth stage is depicted by the thin dashed line. The difference between the thick and the thin dashed lines indicates the significance of creative destruction between years t-1 and t.

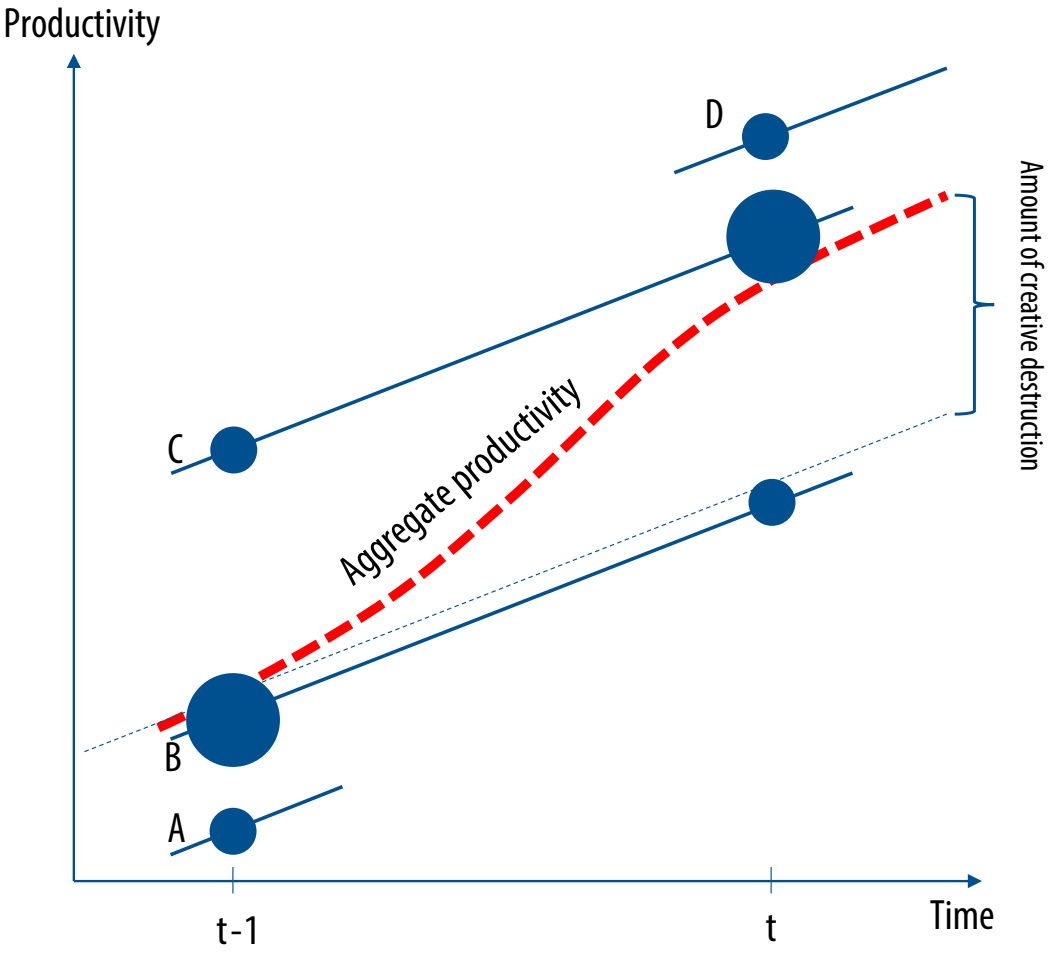


Figure 5.2. Illustration of aggregate productivity and corporate productivity
Source: Adapted from research by Hyytinen and Maliranta (2013)

Figure 5.2 illustrates some of the mechanisms of corporate-level growth of labour productivity within a branch and these can be measured using data on corporations' labour input, value added, and covering several years of branch history, and such that it is possible to monitor each corporation. Productivity decomposition adapted to the purpose is the method used (Böckerman and Maliranta, 2012; Hyytinen and Maliranta, 2013.)

5.2 Labour productivity growth factors at the corporate level in Finland and Sweden

Figures 5.3 and 5.4 present results concerning Finland and Sweden obtained in a study conducted by Barth, Heyman, Hyytinen and Maliranta (2019). The starting point for the calculations is the same as in Figures 3.10 and 3.12: the decomposition was conducted separately for each of the branches examined. The branch-specific results were then aggregated to branch level by weighting each branch using its average labour input share during the period 2000-2015 in the EU15 countries. The annual changes thus obtained by using the decomposition were linked to form index such that the base year selected to be 2007. Thus the results are basically comparable with the results of Figures 3.10 and 3.12[3] In Figures 5.3 and 5.4, the productivity growth of the branches has been divided into the two corporate-level mechanisms: to growth of labour productivity within corporations and to creative destruction.[4]

Figure 5.3 shows the change in productivity that has taken place in the corporation. Thus it corresponds to the average productivity development of corporations B and C shown in Figure 5.2. It becomes apparent that when the branch structures in Finland and in Sweden are standardised to be the same (the average employment shares of the branches in the EU15 countries during the years 2000-2015) and the effect of creative destruction is eliminated from the branches' productivity growth, the remaining development of labour productivity within the corporations has been simply stunningly similar in these countries. This is evident in both manufacturing (excl. electronics) and private services, but excluding Finland's weak development in private services during the period 2013-2015.

3 The numbers in Figures 3.10 and 3.12 originate from the national accounts data, but the calculations for Figures 5.3 and 5.4 were conducted using corporate data. Similarly, the national accounts data rely significantly on the same corporate data, but due to the requirements of the national accounts those data had to be supplemented by using other sources. Some of the decomposition calculations making use of corporate data have had to be left aside due to the major deviation of the data or lack of data. The productivity series that have been calculated based on national accounts and corporate data are compared in Annex 2. Generally, both data sets provide relatively similar pictures of the development of productivity in Finland and Sweden since the early years of the new millennium. The most significant exceptions are that the national accounts data yield significantly higher growth of productivity values for Sweden's manufacturing in 2010 and 2011 than do the corporate data, and for Finland's private services in 2011.

4 Creative destruction here is the difference between change in aggregate productivity and changes in corporate productivity. It includes the impact on aggregate productivity of the change in employment shares which has taken place between the new corporations, the departing corporations, and the continuing corporations.

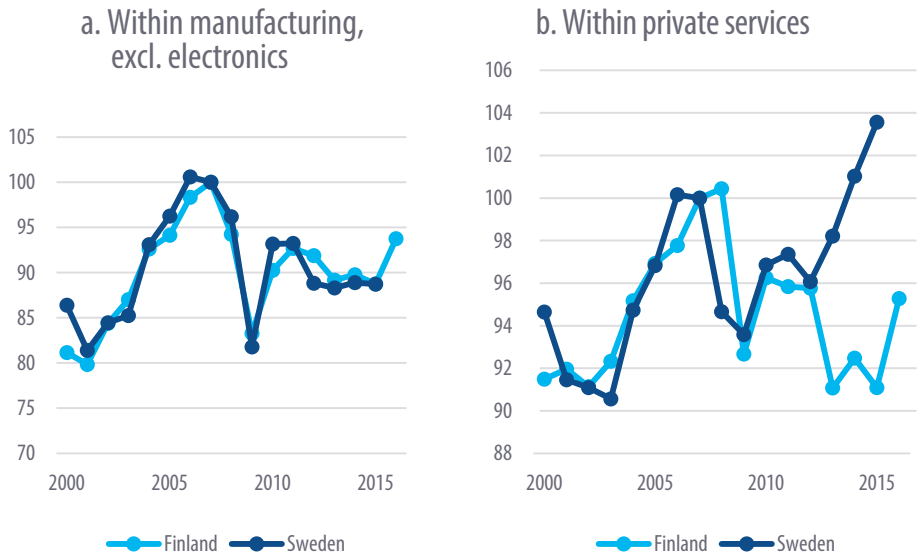


Figure 5.3 Growth of labour productivity within branches and corporations, 2007 = 100
Source: Barth et al. (2019)

Figure 5.4 shows the effect of within-corporation and within-workplace structural changes, the effect of creative destruction. It also is seen that creative destruction in Finland strengthened after the year 2007 both in manufacturing and in private services. It can be seen that prior to 2007, creative destruction was stronger in Sweden than in Finland in both manufacturing and private services. In Finland, creative destruction increased after 2007 in both manufacturing and private services. Creative destruction within manufacturing in Sweden seems to have diminished a little after 2007 and in private services after 2010.

The decomposition of corporate-level growth of labour productivity offers at least a partial explanation for why the growth of productivity was relatively slow in manufacturing in Sweden during the period 2007-2013; this becomes apparent from Figure 3.10. On the other hand, the results show that at least up to 2010 creative destruction has maintained for its part the strong productivity development of Sweden's private service branches as is shown in Figure 3.12. The turning point in the creative destruction trend after 2010, particularly Finland's private services, can be seen as an encouraging sign of strengthening of the dynamics at the corporation level.

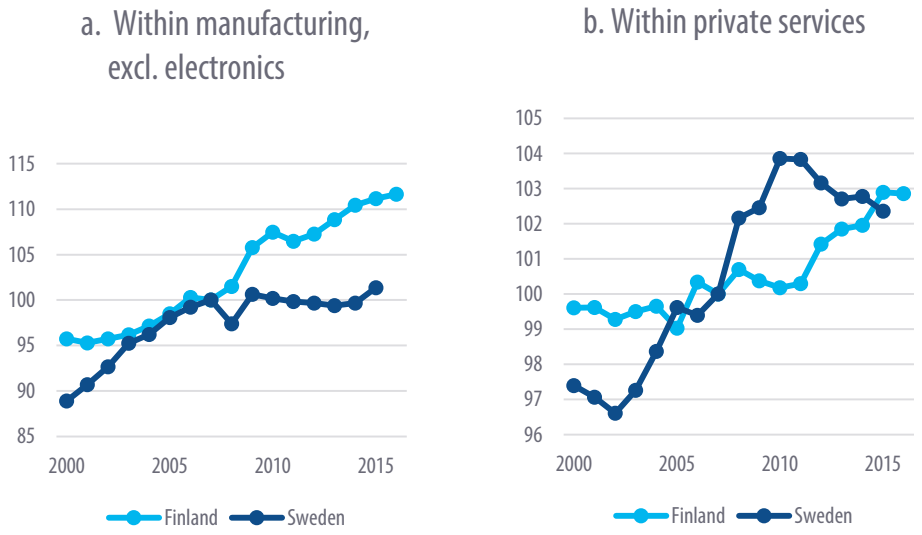
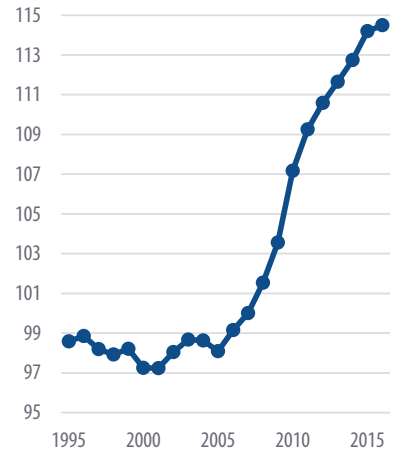


Figure 5.4. Impact of creative destruction on labour productivity within branches, 2007 = 100

In the results of individual branches more uncertainty and rush than to the sector level are included in the productivity effects caused by the new corporations and departing of old corporations in the aggregated results. For this reason it is concentrated on the effects of the change in the job structures which have taken place (in other words to the corporations that have been illustrated in figure 5.2 B and c) between the continuing corporations in the following branch-specific comparisons. This is a steadier part of the creative destruction and it can be therefore used as an indicator of the well creative destruction within individual branches.

The examination of branch-specific results uncovers that the cuff in the creative destruction has been especially clear in the following four manufacturing branches: Manufacture of paper and paper products (branch "17" in the Standard Industrial Classification 2008), Manufacture of coke and refined petroleum products, chemicals and chemical products, basic pharmaceutical products and pharmaceutical preparations, rubber and plastic products, and other non-metallic mineral products (branches "19" - "23"), Manufacture of basic metals, fabricated metal products, except machinery and equipment, computer, electronic and optical products, and electrical equipment ("24" - "25"), and Manufacture of machinery and equipment ("28") (see Figure 5.5)". As regards private services, there was a distinct turnaround in Professional, scientific and technical activities and Administrative and support service activities (“69”-”82”). It should be noted that this group of branches includes a great number of services. It also includes a very significant part of the employment in private services in these calculations, i.e. its weight in the calculations is quite large (18.9%). The results are presented in Figure 5.6.

a. Manufacture of machinery and equipment (28)



b. Manufacture of coke and refined petroleum products, chemicals and chemical products, basic pharmaceutical products and pharmaceutical preparations, rubber and plastic products, and other non-metallic mineral products (19-23)

c. Paper and paper products (17)

d. Manufacture of basic metals, fabricated metal products, except machinery and equipment, computer, electronic and optical products, and electrical equipment (24-25)

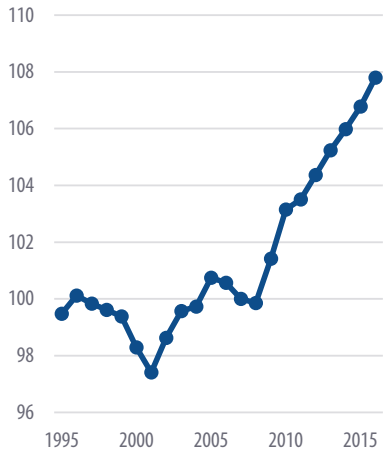


Figure 5.5 Manufacturing branches where significant turnarounds took place in inter-corporate "creative destruction" during the period 2005-2010, 2007=100

Source: Maliranta (2018)

Figure 5.6 Services group of branches where significant turnarounds took place in inter-corporate "creative destruction" during the period 2005-2010, 2007=100

5.3 Distribution of labour productivity between corporations within the various branches

As can be concluded from Figure 5.2, the essential precondition for creative destruction strengthening the productivity within the branch is that there are productivity differences between the corporations, i.e. the corporations A, B, C, and D are on different levels with respect to one another.

Figure 5.7 shows the distribution of labour productivity between the corporations within manufacturing and private services. The distribution of productivity has been measured using logarithmized labour productivity's labour force-weighted standard deviation. It describes the average distribution of productivity from the point of view of the corporations' employees. Here, too, the calculations have been made in the same way as above: the calculation has been made every year separately to each branch and the results have been aggregated after that by using the average employment shares of branches as weights in 2000-2015 in the EU15 countries to the sector level.

It becomes evident that the distribution increased during the first few years of the new millennium within the branches of Finland's and Sweden's manufacturing and in Sweden's private services. One interpretation to this development is that the corporations with weak productivity have not been able to keep with the best corporations, e.g. productive corporations have not spread information to the corporations with weak productivities. Another interpretation is that there has been innovation within the branches, and this

innovation has promoted the productivity of only some of the corporations, but despite this corporations with weak productivities have still been able to survive.

In any case, it seems that in all these three cases the distribution of productivity has begun to diminish in later years. The distribution of productivity within Finland's private services has been less than in Sweden and in addition it has been fairly steady during the first decade of the new millennium.

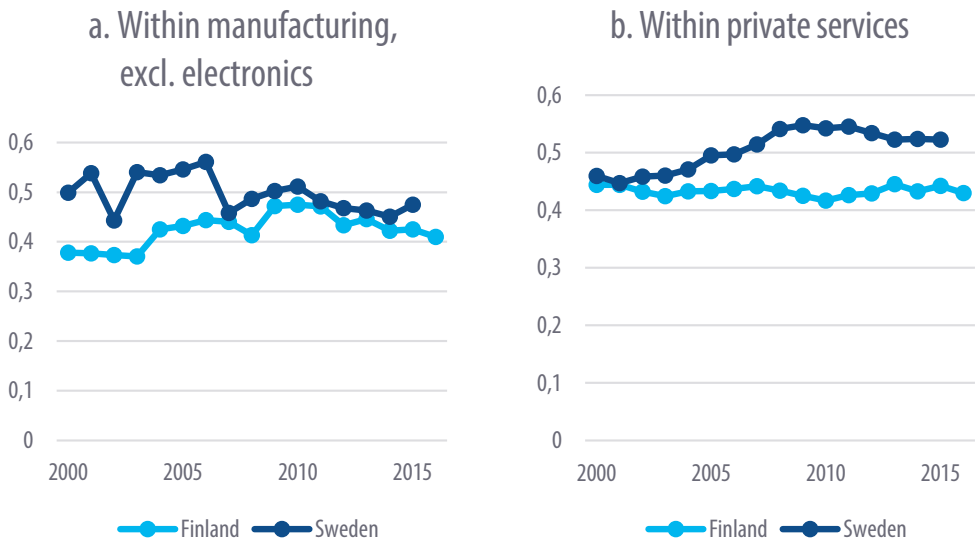


Figure 5.7 Distribution of productivity between corporations within the branches, logarithmized labour productivity's labour force-weighted standard deviation
Source: Barth et al., (2019)

5.4 Quality of management

It was noted in the above that there is a lot of variation in productivity between corporations, even within the same branch. Recent productivity literature in the field of economics has focused more than before on the quality of management as an explanatory variable of productivity (Bloom, Lemos Scur and Satu's Van Reenen 2014). Research has repeatedly found that there is a strong positive statistical link between management quality and productivity (and profitability) both in country-to-country and business-to-business comparisons. There is also evidence that better management quality has a causal positive impact on productivity (Bloom, Eifert, Mahajan, McKenzie, and Roberts, 2013). Similarly, there is evidence that a high standard of management quality is connected to a good level of job satisfaction (Bloom, Kretschmer, and Van Reenan, 2009).

On the other hand, research conducted in various countries and focusing of various branches has repeatedly noted that the quality of management practices varies greatly among corporations. Research has shown that a corporation's high standard of management is explained by variables such as high level of managers' education. It seems that a significant other factor is ownership. It has been noticed the world over that corporations with foreign ownership are managed better than locally owned corporations. It has also been noticed that family businesses are typically poorly managed, but mainly when the managing director is the member of the family.

Research has also produced diverse evidence competition having an improving influence on the quality of management practices. This result is an interesting one, but also quite expected. Indeed, it can be surmised that the competition compels, as it were, the managers of poorly managed corporations to develop management practices even when personally undesirable matters are associated with it. However, if there is no improvement, competition rids the market of poorly managed corporations of low productivity.

In other words, it seems that both the quality of the management and productivity can be improved by increasing competition in the national economy. These effects are produced, at least in part, through the mechanism of creative destruction. Poorly managed corporations become smaller and then disappear. If corporation dynamics functions properly, employees will choose to move to corporations that are better managed. This has the effect of improving the "management services" received by employees on average in the national economy. And at the same time the productivity of the national economy improves.

Recent studies conducted in Finland on the quality of management practices have been such that based on their analyses it is possible to assess the level of management of Finland against an international setting. These analyses have been conducted at both manufacturing workplaces (Maliranta and Ohlsbom, 2017) and at vocational basic education institutions (Jokinen, Sieppi and Maliranta, 2018). The results obtained indicate that, generally speaking, the quality of management practices is quite good, on average, in both (see Maliranta, Jokinen and Sieppi, 2018) . On the other hand, as has been repeatedly observed in studies conducted in other countries that the quality of management practices varies widely in both manufacturing workplaces and in vocational basic education institutions. Significant numbers of poorly managed units have been found in both of these sectors. The observations indicate that there are possibilities to improve the quality and productivity of management in the economy.

6 Theory and interpretation of the development of productivity

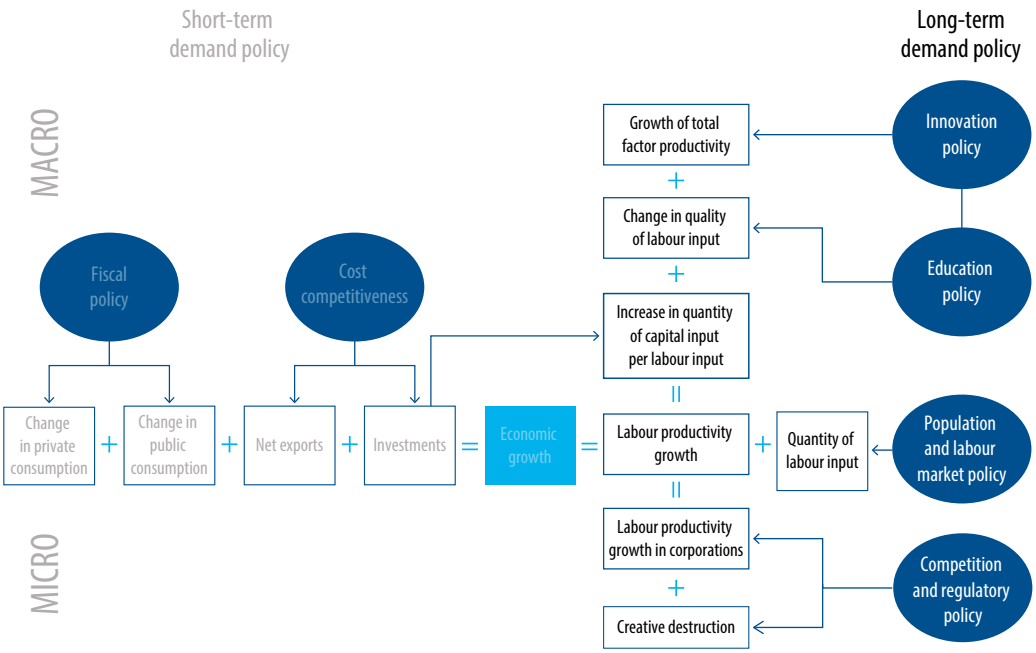


Figure 6.1 On the potential of policies to influence productivity development
Source: Maliranta (coming)

6.1 Innovation, changes in workplace structures and growth of productivity

A fundamental factor influencing the growth of labour productivity is technological development. It encourages corporations to make investments. It can also add to the yields of education and training, offering employees with incentives to participate in

education and training. In other words, investments are not basically a source of economic growth or growth of labour productivity; instead, they are essentially a mechanism through which technological development is transformed into growth of productivity and of the national economy. These are matters which must be borne in mind when interpreting the results, e.g. of growth calculations based on the neoclassical growth theory (Aghion and Howitt, 2007).

Innovation-based growth theories focus on the most fundamental factors of economic growth, i.e. innovations and the factors influencing innovations (Aghion and Howitt, 2009). Schumpeter's growth theory belongs to this group. According to the theory, corporations struggle on the market endeavouring to make a profit and to achieve the preconditions for surviving on the market, i.e. by developing new products and new ways of production. Those corporations which achieve success with their innovations win over market shares from the other corporations. They create new production and new jobs. At the same time, other corporations lose market shares and jobs in such corporations are destroyed. For this reason the theory is often characterised by the "creative destruction" concept made famous by Joseph Schumpeter (1942).

The theory emphasises the significance of competition (or rather struggle) between the corporations on the product market. It predicts that in several situations increasing competition between the corporations accelerates willingness among corporations to engage in innovation activity desires of companies.[5] This in turn accelerates the dynamics at the corporation level as corporations successful in their innovation activities win market shares from others. This is why the growth of productivity originating from corporations' innovations takes place partly through change in corporation structures and workplace structures, i.e. through creative destruction. Schumpeter's growth theory offers the explanation to the observations reported in Chapter 4 for total factor productivity explaining the growth of labour productivity and turnarounds in growth trends and to the observations in Chapter 5 for significant part of the growth of productivity in branches taking place through the mediation of changes in corporation structures and workplace structures.

Schumpeter's growth theory and the associated productivity research examining corporation-level dynamics also offer an explanation to why the results of innovation activity have a delayed impact on productivity in the national economy: the full realisation of the productivity effects of innovation activity requires that the labour force and other

5 The theory emphasises that the connection between competition and innovations depends on the situation. This can explain why empirical proof on the relationship between competition and innovations is somewhat conflicting (Aghion, Bloom, Blundell, Griffith and Howitt 2005; Gustavsson Tingvall and Poldahl 2006; Peneder 2012; Hashmi 2013).

factors of production focus on corporations that have succeeded in their innovation activities. There a number of reasons for why this happens gradually. The analyses by Hyytinen and Maliranta (2013) concerning the lifespans of corporations and the corporation dynamics of productivity demonstrate that changes of this kind can easily take a decade to materialise.

Schumpeter's growth theory states that the functioning of the labour market is not important merely from the point of view of employment; it is important also from the point of view of growth of productivity. Because productivity increases partly through the labour force moving from inefficient corporations to more efficient ones, the inflexibilities of the labour market can act as brakes to the growth of productivity. This may well be the situation especially during major technological turning points when above normal numbers of innovations and reforming of production structures and workplace structures are needed.[6]

More concrete reasons whereby job security, for example, which has been found to be part of the inflexibility of the labour market, reduces the growth of productivity, are the corporations' reduced incentives to invest in physical capital, the corporations reduced incentives to dismiss inefficient employees, and the employees' reduced labour input (caused by the reduced risk of being dismissed). On the other hand, security against dismissal can promote productivity for several different reasons: better job security can encourage corporations to invest more in the training of its employees and encourage employees to invest in adding to corporation-specific human capital. According to the theory of economics, the impact of job security on labour productivity is unclear, because job security can have both positive and negative effects on labour productivity through a variety of mechanisms (cf. Kauhanen and Kauhanen, 2018). Empirical research, too, has produced conflicting effects (cf. Cingano et al., 2016). According to both theory and empirical research, the effect of job security on corporations' innovation activity is unclear (Blind, 2012).

The so-called "models of search" in labour economics tell about the functioning of the labour market in connection with change in workplace structures (Mortensen and Pissarides, 1999). In these models, the corporation creates a new workplace and searches for a suitable employee for the workplace. At the same time, the employee is searching for a new workplace for to himself, e.g. because jobs in the service of the previous corporation have been destroyed. It is to the advantage of the employee, the corporation, and ultimately of the entire national economy that the employee finds a job in which he is able to apply his skills efficiently and that the corporation is able find an employee well

6 Martin and Scarpetta (2012) provide a review of this literature.

suited for the task. Finding one another can be a demanding task and consequently it can take time. The "models of search" provide the explanation for why there unemployment in the national economy. There are unemployed people in the labour market looking for new jobs but at the same time there are vacancies with employers searching for suitable employees.The "models of search" also help to understand why it takes time for the labour market to adapt, particularly after major turning points which require changes in production structures at corporation level and employee level.

Schumpeter's growth theory and the labour market search theory offer explanations for why the development of the productivity has been weak in Finland for such a long time. The economy of Finland has experienced several negative shocks, among them Nokia's fall from the position of globally leading manufacturer of mobile phones, the global fall in demand for capital goods after the financial crisis, and the demand-related difficulties of the forestry industries. Such setbacks have led to the permanent loss of preconditions for economically profitable operation for a significant part of Finnish industry. Recovery from all this requires reformation all the way to corporate level and workplace level, and this in turn requires the emergence of new jobs and the destruction of old jobs. This is why the reform is time-consuming and requires patience and causes pain. The analyses presented in Chapter 5 show that the reformation of corporation structures and job structures, which reinforce productivity, i.e. creative destruction, began to accelerate some ten years ago in many branches. Chapter 3 shows at least some signs of growth of productivity having recovered significantly in Finland. However, this happened later than in several other countries. The delay in Finland's recovery may be caused by politics and the functioning of institutions, but it may also be due Finland having encountered greater negative shocks than the other countries.

6.2 Trade cycles of the economy, growth of productivity, and creative destruction

It has often been observed that the growth of productivity varies in a procyclical manner, i.e. growth of productivity accelerates during a boom and slows down during a recession. One explanation for this is that during corporations' production during a recession falls because of diminishing demand. However, corporations do not make corresponding cuts in their labour force. Corporations may be unwilling to dismiss employees, because recruiting of new competent employees can be difficult when the next boom begins. In other words, corporations temporarily keep their inactive labour force labour on their payrolls. During a recession corporations are not able to utilise the advantages of economies of scale in production to the same extent as during a boom (Basu and Fernald, 2001).

The literature on the growth of economies has addressed the issue of whether there is benefit or harm from recessions from the point of view of long-term productivity and economic growth. Productivity studies have pointed out that recessions rid the economy, as it were, of poorly-productive corporations and as a result the average productivity of the remaining corporations improves. Certainly, recessions accelerate destruction, but from the point of view of long-term productivity development the essential question is this: How do recessions impact on creativity and reviving of economic structures? Research results indicate that the cumulative overall effect of recessions on changes in corporation structures and workplace structures is more likely to be negative than positive (Caballero and Hammour, 2005). It has also been noticed that R&D inputs by corporations diminish during recessions (Barlevy, 2007).

Even though the most significant thing ultimately about the development of productivity is its long-term development, it is important to take into account the significance of trade cycles when analysing productivity and interpreting results. The decomposition at the corporation level of productivity development within a branch has proven to be extremely useful in this.

Simple regression analyses have been performed to examine this matter; the growth of productivity component at the corporation level has been explained by growth of production in the sector . As is noted in the above, productivity decomposition is used here and it has been done separately for each branch, and then the branch-specific results have been aggregated by using the average branch-specific labour force structures of the EU15 countries as weights.

There are a total of four regression models: two sectors (manufacturing, excl. electronics, and private services) and two components (growth of productivity in corporations and creative destruction). The change in trade cycles is measured by measuring the change in the real value-added in the sector.

The analysis shows that there is a strong positive connection between growth in labour productivity within corporations and growth in production. According to the results, a 1.0 percentage point increment in the change in real value added corresponds to growth in labour productivity, which amounts to 0.57 percentage points in manufacturing corporations (excl. electronics) and to 0.59 percentage points in private services corporations. It is also evident that the variation in production explains very well the variation in growth of productivity among corporations: in manufacturing (excl. electronics) the coefficient of determination is 71.8% and in private services it is 55.2%.

Figure 6.2 shows the actual growth of labour productivity in corporations and the growth of productivity predicted on the basis of the growth of production. It becomes evident that particularly in manufacturing (excl. electronics) the growth of productivity during the

past few years has been quite precisely that which was to be expected on the basis of the changes in real value added. In private services, however, this connection is not as clear. In 2013, for example, the growth of labour productivity in private services corporations was clearly less than predicted, but in 2014 and 2016 it was considerably stronger.

	Growth of productivity in corporations		Creative destruction	
	Manufacturing, excl. electronics	Private services	Manufacturing, excl. electronics	Private services
Standard term	0,597	-0,857	1,012***	0,205
	(0,694)	(0,601)	(0,204)	(0,154)
Change ln real value-added	0,574***	0,586***	-0,100***	-0,004
	(0,093)	(0,136)	(0,027)	(0,035)
Number of observations	17	17	17	17
R2	71,8 %	55,2 %	47,2 %	0,1 %
Mean errors are shown in parentheses. *** p<0.01				

Table 6.1 Trade cycle based comparison of productivity growth's corporate-level components

The last two columns of Table 6.1 focus on the economic cycle fluctuation of the creative destruction component. In manufacturing (excl. electronics) there is a statistically extremely significant connection between creative destruction and real value-added. An increment of 1.0 percentage point in the growth of real value-added corresponds to creative destruction that is 0.1 percentage points smaller. However, no connection is evident between creative destruction and economic cycles in private services.

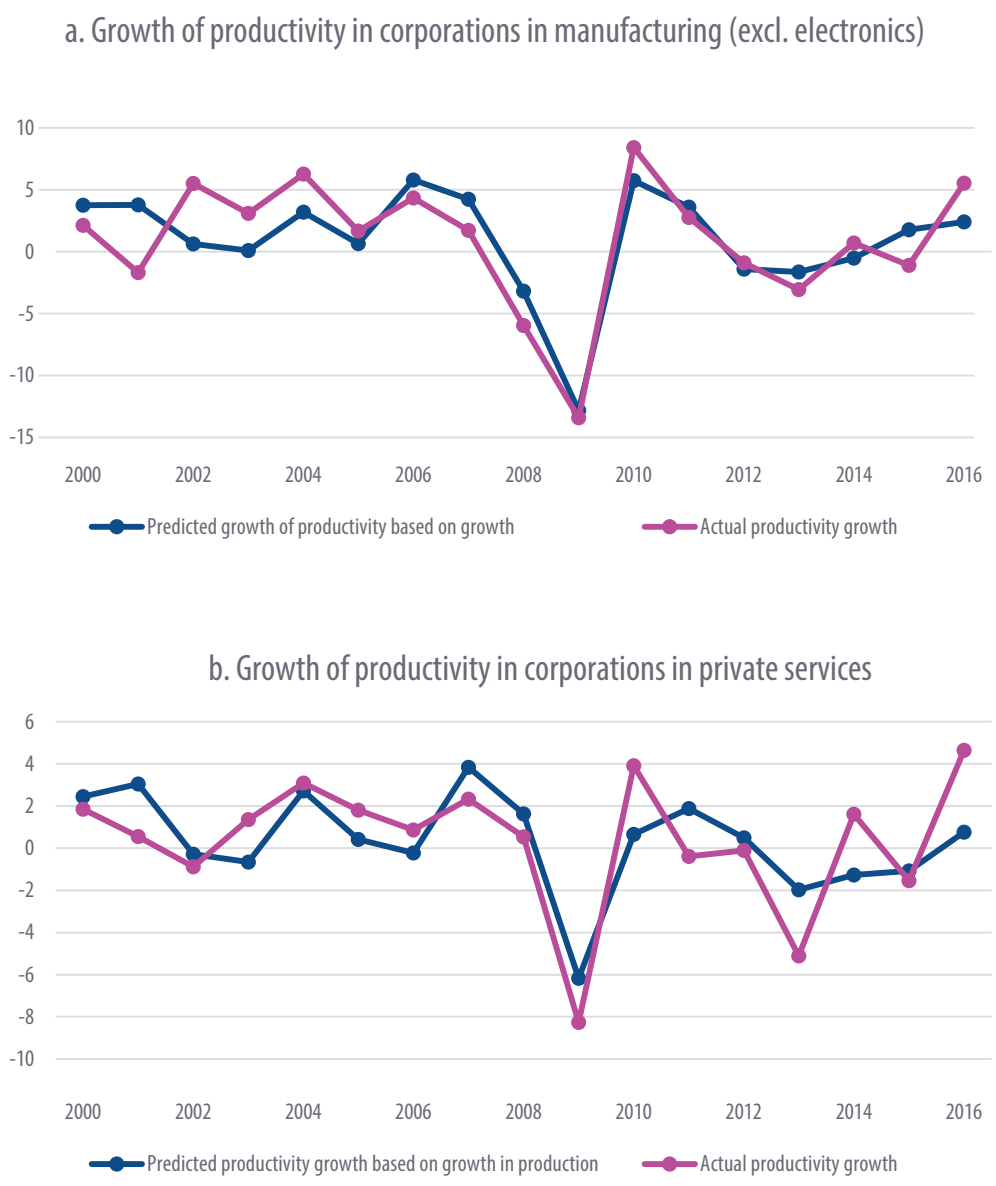


Figure 6.2 Actual and predicted growth of labour productivity in corporations, %

Figure 6.3 provides a comparison of actual creative destruction and creative destruction predicted based on real value-added in manufacturing (excl. electronics) and in private services. It becomes evident that creative destruction in manufacturing (excl. electronics) accelerated after the first few years of the new millennium, and particularly so when compared to what could have been predicted on the basis of development of production. During the past few years, creative destruction has complied with the economic cycle situation. It becomes also evident that there has been a significant amount of creative destruction within private services, particularly during the past few years, but there has not been a link to the economic cycles.

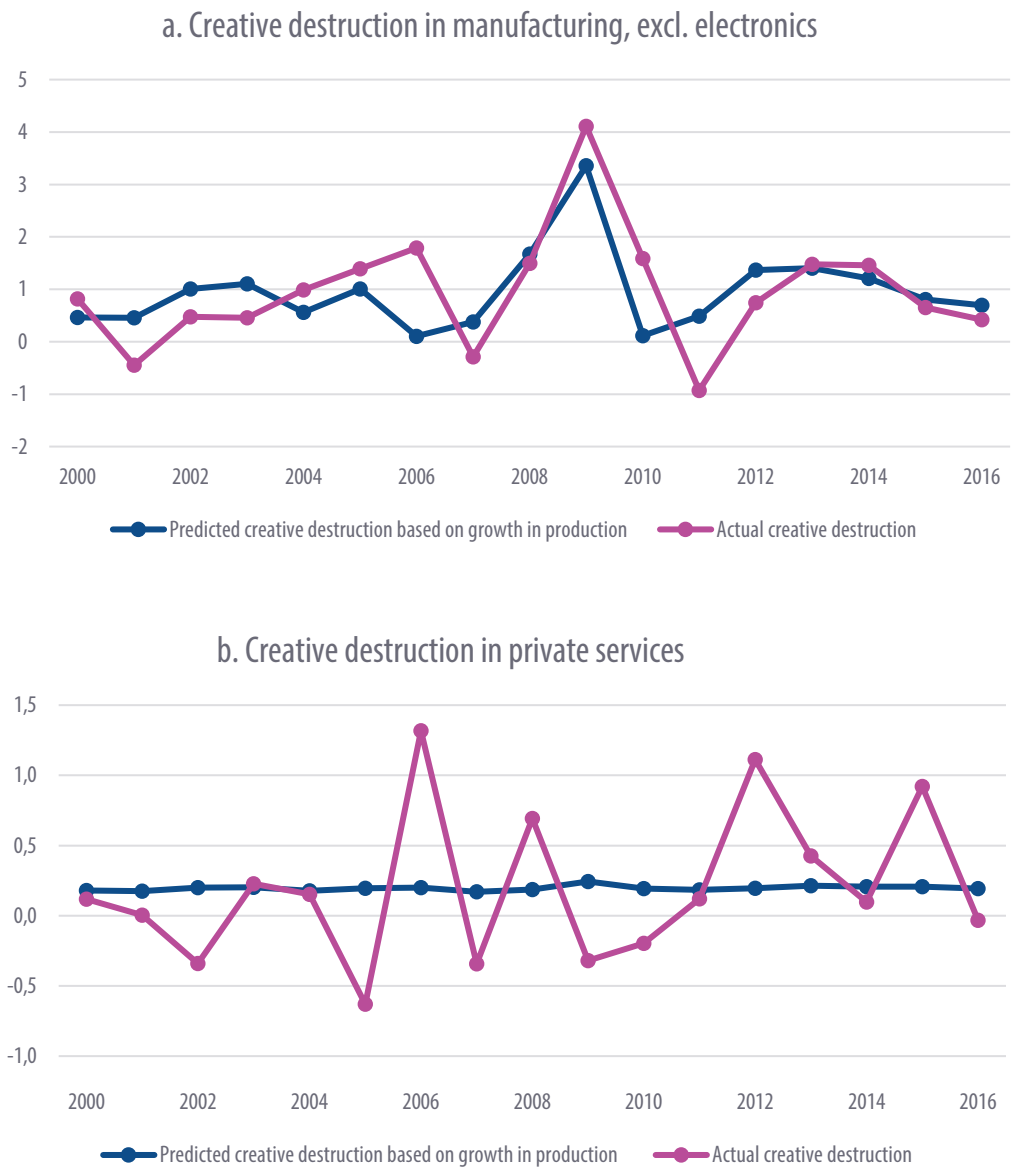


Figure 6.3 Actual and predicted creative destruction, %

6.3 Research and development inputs

Next we proceed to examine corporations' innovation activity, which according to Schumpeter's growth theory is fundamental factor of creative destruction and growth of productivity. The inputs of corporations into innovations is measured by means of corporations' real R&D expenses. The nominal expenses have been deflated using the GNP price index.

Figure 6.4 shows that in manufacturing the real R&D expenses fell by close to 50% during the period 2008-2017. The bulk of this fall is explained by the difficulties of the electronics branch, i.e. Nokia. On examining the rest of manufacturing, the fall is considerably less. Since 2014, the inputs have remained steady in the other branches of manufacturing. However, growth in private services has been pronounced. During the period 2008-2017, the real inputs into R&D increased by 16%. The increase in inputs has been especially strong in what are called ICT services; the real R&D inputs increased in them by 38% during the same period of time.

On the whole, Figure 6.4 demonstrates the powerful branch-specific structural change in Finnish corporations' R&D inputs. The focus is moving to services and there especially to ICT services. This kind of a focus shift is to be expected to be reflected also the branch-specific structure of productivity growth. On the other hand, the production of new technological knowledge and the utilising of this new knowledge in ways that strengthen productivity can take years, and so the effects can be seen in productivity development over long delay.

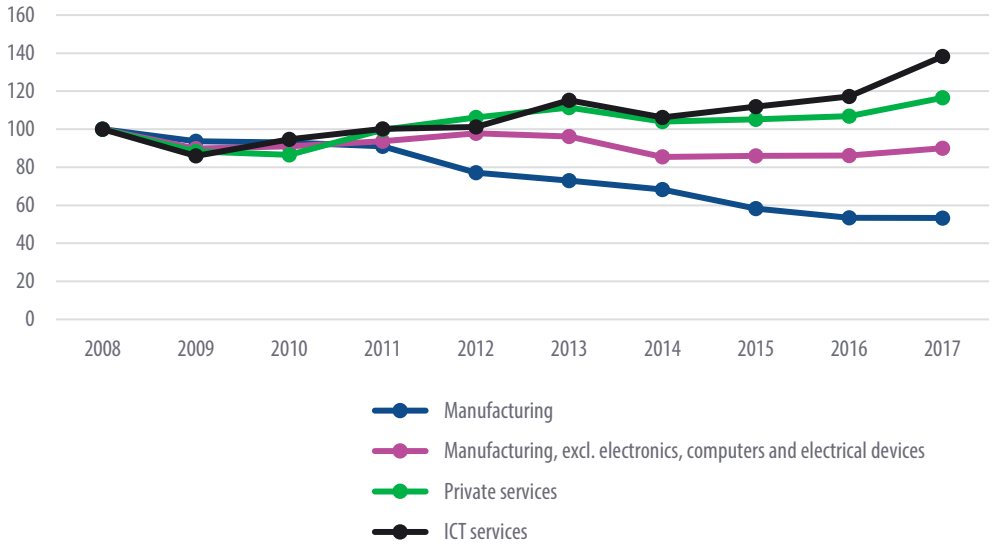


Figure 6.4 Corporations' real research and development spending, 2008=100

Source: Statistics Finland. Private services consist of the following fields: wholesale and agency activity; transportation and storage; ADP, software, consultation; other information and communication; financing and insurance industry; architectural and other such services, research and development. ICT services consist of the following branches: ADP, software, consultation; other information and communication

7 Conclusions and policy considerations

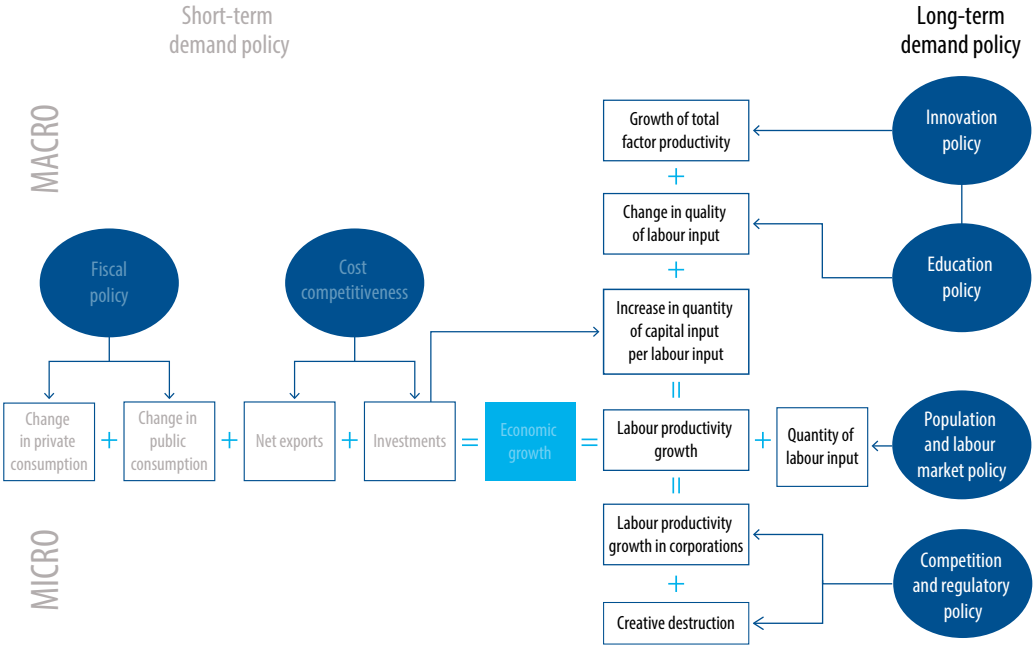


Figure 7.1 Growth of labour productivity and potential policy actions
Source: Maliranta (coming)

The comparisons presented in Chapter 3 show that after 2008 labour productivity in Finland's corporate sector fell in relation to both the situation preceding the financial crisis and in relation to the benchmark countries. The fall was about 10% in relation to the foremost benchmark countries. It was particularly significant in manufacturing. Depending on the measurement method, the fall was of the order of 20-30%. The significance of electronics was major in this. On the other hand, while the electronics industry is excluded from the review and the impact of manufacturing structures is being eliminated by using the so-called standardized manufacturing structures in the comparisons (averages of the EU-15 average industry-specific labour shares in 2000-2015), the productivity development of Finnish manufacturing has been significantly weaker than in the comparison countries. Instead the development of the productivity of

Finland's labour within the branches of private services has been relatively good. Quite recently, the development of labour productivity has recovered both in the relation to the one which had gone and to the control subject countries, in manufacturing as well as private services.

Growth accounting reveals that the force of and changes in development of labour productivity are explained first and foremost by total factor productivity. Total factor productivity is that part of the growth of labour productivity that cannot be explained by addition of capital or by change in the quality of labour input. It is a residual term which tells about all the other factors impacting on productivity.

In manufacturing in Finland, the development of total factor productivity was extremely good prior to 2008, but then extremely poor thereafter, also with respect to the benchmark countries. The electronics branch of manufacturing explains both of these developments. But the development of total factor productivity has been relatively good in private services.

The decomposition of productivity done using corporate data also separate from one another the productivity growth happening through creative destruction and productivity development happening within corporations (i.e. growth of productivity of corporations already present on the market and remaining there). In addition to the consequences of the emerging of new corporations and the departing of old corporations, creative destruction in them includes changes in productivity caused by changes in the relative size of the corporations.

The decompositions tell us that creative destruction has been an important factor impacting on the productivity development of various branches. Creative destruction within the branches of manufacturing and private services in Finland was distinctly weaker than in Sweden during the early years of the first decade of the new millennium. However, creative destruction particularly in private services has strengthened significantly during the past few years.

When assessing the development of productivity, it is important to take into account the significance of economic fluctuations. Particularly the growth of labour productivity occurring within the corporations is very much procyclical, i.e. fast during a boom period and slow during a recession. In manufacturing, however, creative destruction has been anticyclical. During recessions, productivity has increased partly through productionally weakest corporations becoming smaller in size or departing from the market, which has meant that the aggregate productivity of the corporations remaining on the market has increased. This is why the growth of productivity at the level of the entire manufacturing is bigger than the growth of productivity of the corporations already on the market and staying there; this applies particularly to periods of recessions.

The country comparisons of the productivity development of the various branches and the analyses of the micro-dynamics of productivity development are based on corporate data show signs of promise that the growth of productivity in manufacturing will be significantly stronger in the coming years than it has been during the past recent years. However, this presupposes that the development of the international economy continues in a favourable direction and that corporations succeed on the export markets so well that the growth of production remains strong. The slowing down of production growth would be negatively reflected within corporations in the growth of their productivity. If the cost competitiveness of export corporations is not enough, these corporations will have to make cuts in their production. This in turn will lead to the weakening of their capacity utilization rate and measured productivity. Similarly, there are positive signs in the development of labour productivity in private services post-2014. The analysis based on corporate data shows that the strengthening of growth of productivity within the corporations has had a significant effect. This would appear to be partly the result of increase in demand. The acceleration of the growth of productivity is, therefore, partly affected by trade cycles. Creative destruction, too, has strengthened in private services.

Figure 6.4 offers one possible explanation for the strengthened growth of productivity in private services and for greater creative destruction. The figure shows that the inputs in research and development input have increased significantly in private services. Inputs into ICT services have increased particularly. This may be important from the point of view of productivity development in the entire national economy because ICT services are also engaged in developing intermediate inputs which are used in many branches of the economy.

Creative destruction is also of central importance from the point of view of productivity development. If even if the labour force and other factors of production were initially favourably allocated from the point of view of productivity, changes in technological development and in international trade ultimately cause the allocation to be misplaced, unless it is constantly adjusted through the mechanism of creative destruction. On the other hand, taxation and business subsidies can cause distortions in the allocation of factors of production that are negative from the point of view of productivity, and these need to be taken into consideration in the implementation of economic policy.

The range of measures for strengthening creative destruction is very wide. It includes having an innovation policy providing the preconditions for productivity improvements within corporations and for the dissemination of information and know-how strengthening productivity within the national economy. Successful competition policies can encourage willingness within corporations to engage in innovations and accelerate the allocation of labour force and other factors of production to corporations characterised by their high productivity. Education and training policy can be used to improve the efficiency of both the creation of new technological knowledge and the productive utilization of the technological knowledge spreading between corporations.

Because the mobility of the labour force is one central element of creative destruction, the policy solutions affect it need to be taken into account. Mobility can be promoted through housing policy, for example. The elimination of asset transfer tax is an example of the actions via which the regional mobility of the labour force can be promoted. Other methods include labour policy and increasing of flexibility of the labour market. From the point of view of growth of productivity, it is important for capital to be focused on the most productive corporations. Not only does this require well-functioning and versatile capital markets (Aghion et al., 2013), it also requires a taxation system and corporate subsidy system which do not distort the allocation of investments between the corporations in a way that would hinder creative destruction.

In other words, the government can promote the development of productivity in many ways, some of which have indirectly effect and possibly involved a significant delay. Furthermore, productivity improvements can be achieved by doing away with the distortions resulting from earlier policy decisions.

Sources

Abadie, A., Diamond, A. and Hainmueller, J. (2010). "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program", Journal of the American Statistical Association, vol 105, issue 490, 493-505.
Abadie, A., Diamond, A., and Hainmueller, J. (2015). "Comparative Politics and the Synthetic Control Method", American Journal of Political Science, Vol 59, no 2, 495-510
Abadie, A. ja Gardeazabal, J. (2003). "The Economic Costs of Conflict: A Case Study of the Basque Country", American Economic Review, Vol 93, no 1.
Aghion, P., Bloom, N., Blundell, R., Griffith, R. and Howitt, P. (2005). Competition and innovation: An inverted-u relationship. Quarterly Journal of Economics, 120(2), 701-728.
Aghion, P. and Howitt, P. (2007). Capital, innovation, and growth accounting. Oxford Review of Economic Policy, 23(1), 79-93.
Aghion, P. and Howitt, P. (2009). The economics of growth. The MIT Press.
Aghion, P., Van Reenen, J. and Zingales, L. (2013). Innovation and institutional ownership. American Economic Review, 103(1), 277-304.doi: 10.1257/Aer.103.1.277.
Anttonen, J., Kuusi, T., Lehmus, M. & Orjasniemi, S. (2019). 2013 – The Finnish Divergence, ETLA Brief 76.
Anttonen, J. and Maliranta, M. (2019). Labour productivity in the Finnish business sector - synthetic control
approach. Unpublished manuscript, 18.2.2019, Helsinki.
Barlevy, G. (2007). "On the cyclicality of research and development", American Economic Review, 97(4), 11311164.
Barth, E., Heyman, F., Hyytinen, A. and Maliranta, M. (2019). "Decomposition of macro and microsources of competitiveness", Unpublished manuscript.
Basu, S. and Fernald, J. (2001). Why is productivity procyclical? Why do we care? In publication: C. R. Hulten, E. R. Dean ja M. J. Harper (Eds.), New developments in productivity analysis. Chicago: University of Chicago Press (for NBER).
Blind, K. (2012). "The Impact of Regulation on Innovation", Nesta Working Paper No. 12/02
Bloom, N., Eifert, B., Mahajan, A., McKenzie, D. and Roberts, J. (2013). "Does management matter? Evidence from India". The Quarterly Journal of Economics, 128(1), 1-51.
Bloom, N., Kretschmer, T. and Van Reenan, J. (2009). Work-life balance, management practices and productivity. In the publication International differences in the business practices and productivity of firms (s. 15-54). University of Chicago Press.
Bloom, N., Lemos, R., Sadun, R., Scur, D. and Van Reenen, J. (2014). "Jeea-fbbva lecture 2013: The new empirical economics of management". Journal of the European Economic Association, 12(4), 835-876.10.1111/ jeea.12094
Borg, A. – Vartianen, J. (2015). Strategia Suomelle, Valtioneuvoston kanslian julkaisusarja 5/2015.
Born, Mueller, Schularick and Sedlacek, (2018). "The Costs of Economic Nationalism: Evidence from the Brexit Experiment", London, Centre for Economic Policy Research.
Böckerman, P. and Maliranta, M. (2012). "Globalization, creative destruction, and labour share change: Evidence on the determinants and mechanisms from longitudinal plant-level data", Oxford Economic Papers, 64(2), 259-280.
Caballero, R. J. and Hammour, M. L. (2005). "The cost of recessions revisited: A reverse-liquidationist view", Review of Economic Studies, 72(251), 313-341.
Cingano, F, Leonardi, M., Messina, J. and Pica, G. (2016). "Employment protection legislation, capital investment and access to credit: Evidence from Italy", Economic Journal 126, 1798–1822.
Eurostat (2016).Handbook on prices and volume measures in national accounts, 2016 edition..
Gustavsson Tingvall, P. and Poldahl, A. (2006). "Is there really an inverted u-shaped relation between competition and r&d?", Economics of Innovation and New Technology, 15(2), 101-118.
Hashmi, A. R. (2013). "Competition and innovation: The inverted-u relationship revisited", Review of Economics and Statistics, 95(5), 1653-1668.
Hulten, C. (2009). "Growth Accounting", NBER Working Paper Series, p. 15341.
Hyytinen, A. ja Maliranta, M. (2013). "Firm lifecycles and evolution of industry productivity", Research Policy, 42(5), 1080-1098.http://dx.doi.org/10.1016/j.respol.2013.01.008

Jokinen, J., Sieppi, A. and Maliranta, M. (2018). Johtamiskäytäntöjen laatu suomen ammatillisessa peruskoulutuksessa. Kansantaloudellinen aikakausikirja, 114(2).Jorgenson D., Gollop, F. & Fraumeni, B. (1987). Productivity and U.S. Economic Growth, Harvard Economic Studies, Cambridge.
Jorgenson, D., Ho, M. & Stiroh, K. (2008). "A Retrospective Look at the U.S. Productivity Growth Resurgence", The Journal of Economic Perspectives, 22 (1), 3-24.
Jäger, K. (2017). EU KLEMS Growth and Productivity Accounts 2017 Release, Statistical Module.
Kauhanen, M. Kauhanen, A. (2018). "Irtisanomissuojan taloudelliset vaikutukset", Työpoliittinen aikakauskirja 4/2018, 11-20.
Krugman, P. (1994). The Age of Diminished Expectations, The MIT Press.
Maliranta, M. (2014). Kustannuskilpailukyky kasvumenestyksen ehtona. Helsinki: Taloustieto (ETLA B264). Maliranta, M. (2018). "Laskelmia tuottavuuden yritystason lähteistä ja niiden kehityksestä", Unpublished manuscript.
Syksy 2018.
Maliranta, M. (coming). Mistä tekijöistä talouskasvu rakentuu? Teoksessa H. Seppo and V. Vihriälä (Eds.), Suomen kasvu. Mikä määrää tahdin muuttuvassa maailmassa? (s. 35-55). Helsinki: Taloustieto Oy.
Maliranta, M., Jokinen, J. and Sieppi, A. (2018). "Johtamiskäytäntöjen tutkimus: Havaintoja suomen ammatillisen peruskoulutuksen oppilaitoksista ja teollisuuden toimipaikoilta", Talous & Yhteiskunta (2/2018), 18-23.
Maliranta, M. and Ohlsbom, R. (2017). Suomen tehdasteollisuuden johtamiskäytäntöjen laatu. Elinkeinoelämän tutkimuslaitos, ETLA raportit No. 73.
Martin, J. P. ja Scarpetta, S. (2012). "Setting it right: Employment protection, labour reallocation and productivity", De Economist, 160(2), 89-116.
Mortensen, D. T. ja Pissarides, C. A. (1999). New developments in models of search in the labor market. Handbook of labor economics, 3, 2567-2627.
OECD (2001). OECD Productivity Manual: A Guide to the Measurement of Industry-level and Aggregate Productivity Growth, OECD.
Oulton, N. (2016). "The Mystery of TFP", International Productivity Monitor, 31, 68-87.
Peneder, M. (2012). "Competition and innovation: Revisiting the inverted-u relationship. Journal of Industry", Competition and Trade, 12(1), 1-5.
Schumpeter , J. (1942). Capitalism, socialism and democracy. New York: Harper Torchbooks.
Timmer, M., Inklaar, R., O'Mahony, M. & van Ark, B. (2010). Economic Growth in Europe: A Comparative Industry Perspective. Cambridge University Press.
Timmer, M., van Moergastel, T., Stuivenwold, E., Ypma, G., O'Mahony, M. & Kangasniemi, M. (2007). EU KLEMS Growth and Productivity Accounts Version 1.0, Part 1 Methodology.

ANNEXES

Annex 1: Labour productivity in problematic sub-sectors

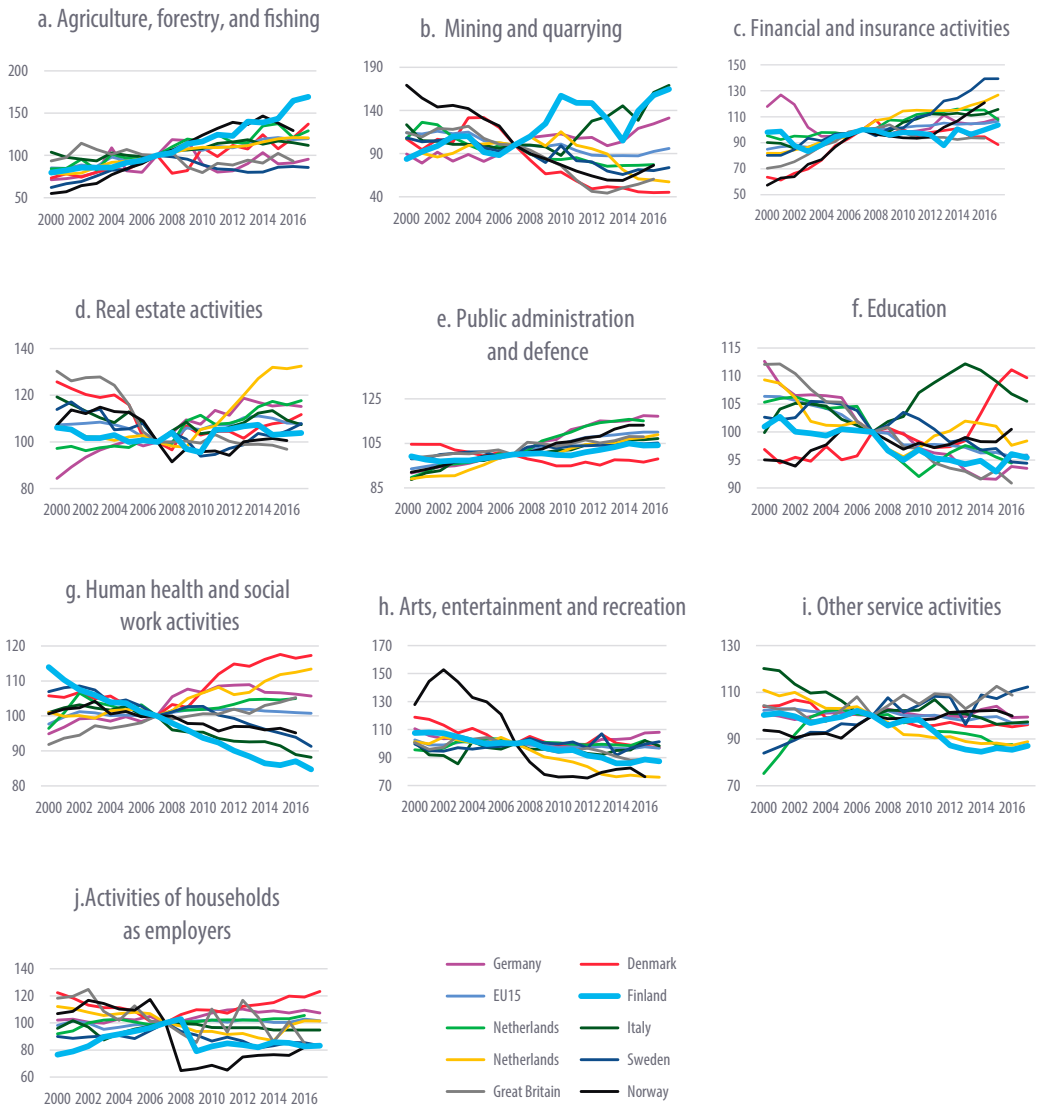
This report excludes those parts of the economy that are too difficult to measure as regards their labour productivity. These are branches where the public sector is a significant player, i.e. Public administration and defence (O), Education (P), and Human health and social work activities (Q), and Primary production (Agriculture, forestry and fishing, and Mining and quarrying) (A, B), Financial and insurance activities and Real estate activities (K, L), and some of the service branches, Arts, entertainment and recreation (R), Other service activities (S), Activities of households as employers (T), and Activities of extraterritorial organisations and bodies (U).

The branches excluded from this examination are by no means insignificant from the point of view of the functioning of the economy. They, too, are significant employers. Those branches on which the role of the public sector is significant employed about 28% of all employed persons in 2017 while all the branches excluded from this examination employed about 41% of all employed persons.

Even though the branches excluded from this examination form a significant part of Finland's economy, excluding them provides a better picture of productivity development than if they were included. These branches are associated with several problems associated with the measurement of labour productivity, which impair their comparability with other branches or with other countries. As becomes apparent from Figures L1.1-L1.10, the distribution in the development of labour productivity between the countries is extremely large in the branches that are problematic from the point of view of measurement. It is probable that measurement problems and different solutions in different countries have bearing on these large differences. This is why such branches are best left outside the examination. The following is a more detailed examination of these branches' measurement problems.

The public sector

Most of the production of the branches Public administration and defence (O), Education (P), and Human health and social work activities (Q) is public sector production. Public sector production is not sold on the market and due to this there are two difficult issues from the point of view of productivity analysis. Firstly, we do not know what the nominal value of the output of the public sector is for users. Secondly, we do not know what the change in the prices of the public sector's output is. Thus, the volume of the value added of the public sector cannot be calculated in the same way as is done in the market sector.



Figures A1.1 Measured labour productivity in problematic branches from the point of view of measurement, index 2007 = 100.
Source: Eurostat

The volume of production in market production which is used as an output in the calculation of labour productivity is obtained by deflating the nominal value-added with the price index. However, there is no direct price index available for the output of the public sector because this output is not sold on the market. Indeed, alternative methods are used to measure the public sector's volume.

The national accounts approach to calculating the nominal gross value-added of the public sector is to base it on public sector's employees' employee compensations and the wear-and-tear on the capital, i.e. based on the costs. This underestimates return on capital in the public sector.

To measure the volume of services produced by the public sector one can mainly use either direct services-produced numbers or use the price indexes of the corresponding market services as the price index. The methods used, the sources of information, and the structure of public production differ a great deal between the countries, and so the comparability between the countries is not very good.

Indicators taking into account improvement in quality cannot be used within the EU in measuring the volume of public sector production (Eurostat 2016). This significantly weakens the comparability of the development of productivity with respect to private sector because the improvement of quality in market products has a significant effect on the growth of production volume and thus on labour productivity.

Agriculture, forestry, and mining and quarrying

Natural resources and their growth are of great significance in primary production. This means that value added comes largely from somewhere else other than labour, and so labour productivity is not a very good indicator. There are also measurement problems associated with the growth of natural resources and their value. Furthermore, agriculture and forestry are a dominated by small companies and self-employed persons, and consequently there are measurement problems associated especially with the number of work hours.

Furthermore, subsidies play a major role especially in agriculture. Subsidies can be quite complex and they are manifested at many points along the production chain. All this means that the calculation of basis prices of the products is challenging and affects comparability.

Financial and insurance activities and Real estate activities

The output in financing and insurance originates largely from the output of capital, and this means that labour productivity is problematic as an indicator. Furthermore, the output includes many calculatory items, e.g. Financial Intermediation Services Indirectly Measured (a.k.a. FISIM).

Accommodation services produced for the occupants by housing form most of the output of real estate activities, and these are calculated based on the actual rents or (in the case

of owner-occupied accommodation) based on calculatory rents. In addition to a large part of the output being calculatory, the labour input in real estate activities is only indirectly linked to or is only in a small part of the production of housing services. Because a large proportion of the calculatory output of real estate activities is mainly produced by capital, labour productivity is not a very informative indicator in real estate activities.

Minor services

Measurement problems are connected also to some services. They are Arts, entertainment and recreation (R), Other service activities (S), Activities of households as employers (T), and Activities of extraterritorial organisations and bodies (U). The roles of small companies and self-employed persons dominate here. Firstly, the availability and quality of the source data of small companies is not so good compared large corporations. Secondly, defining the service unit to be sold is often difficult and consequently it is difficult to measure the price or volume. Also, the direct measurement of quality is difficult because in a significant number of these services the sense of pleasure is of great significance. Furthermore, NGOs provide a significant part of the service production, and the measurement of their productivity involves the same problems as in the public sector. (Eurostat 2016), (Tilastokeskus 2016).

Sources

Eurostat (2016), Handbook on prices and volume measures in national accounts. Publications Office of the European Union, Luxembourg.
Tilastokeskus (2016), Suomen BKTL-menetelmäkuvaus. Tilastokeskus.

Annex 2: Comparison of labour productivity series that have been calculated using national accounts and corporate data

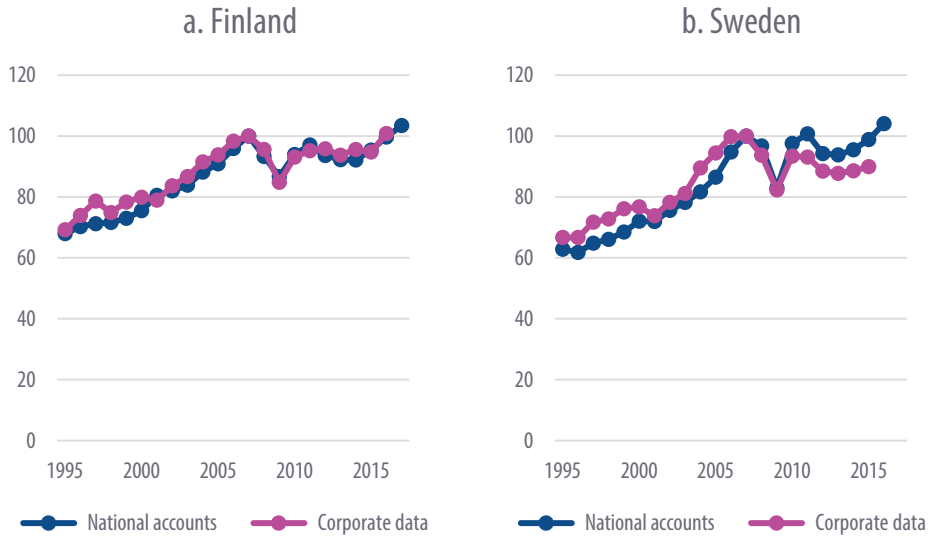


Figure A2.1 Manufacturing branches (excl. electronics industry), normalised branch structures

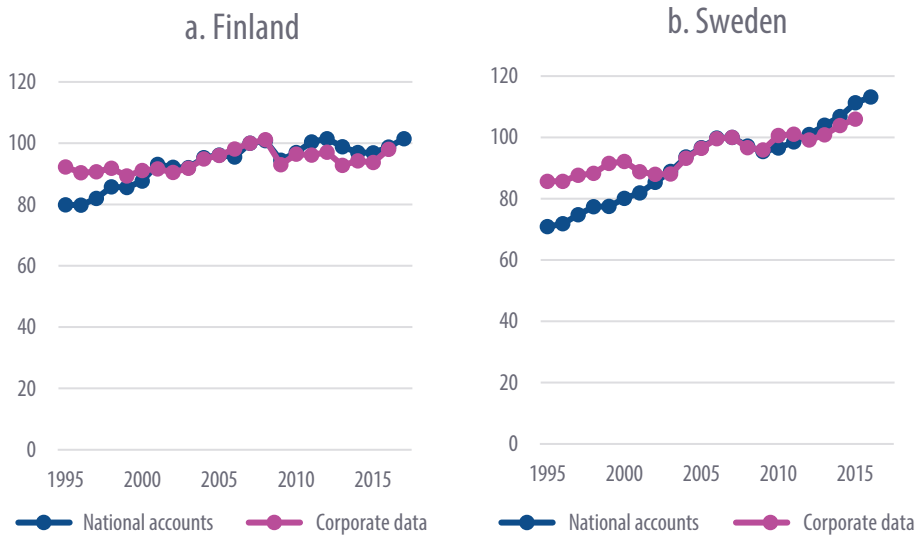


Figure A2.2 Private services branches, normalised branch structures

Annex 3: The countries making up the control economy and their weights

Table A3.1 Aggregate development of labour productivity in the corporate sector

Cyprus:	0.10
Czech Republic:	0.03
Estonia:	0.11
Greece:	0.02
Netherlands:	0.51
Slovakia:	0.08
Great Britain:	0.15

Table A3.2 Aggregate development of labour in manufacturing

Austria:	0.21
Belgium:	0.24
Czech Republic:	0.14
Estonia:	0.01
Greece:	0.03
Sweden:	0.37

Table A3.3 Aggregate development of labour productivity in manufacturing (excl. electronics industry)

Austria:	0.16
Czech Republic:	0.06
Denmark:	0.03
Greece:	0.05
Spain:	0.32
Italy:	0.07
Portugal:	0.21
Slovakia:	0.07
United States:	0.02

Table A3.4 Development of labour productivity with standardised branch structure in manufacturing (excl. electronics industry)

Austria:	0.20
Cyprus:	0.03
Czech Republic:	0.01
Spain:	0.51
Norway:	0.13
Romania:	0.07
Slovakia:	0.05
Czech Republic:	0.15
Italy:	0.20
Netherlands:	0.64

Table A3.6. Development of labour productivity with standardised branch structure in private services

Czech Republic:	0.22
Italy:	0.24
Netherlands:	0.54

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