# Productivity Growth in Denmark – Summary

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## INTRODUCTION

Productivity refers to the efficiency of a production process. In simplified terms, the concept reflects value added generated by the production process relative to the amount of input. For example, *hourly productivity*, which is one of the most frequently used measures of productivity, is an expression of the average output per hour worked.

An increase in hourly productivity implies more output for a given input of labour. Accordingly, higher hourly productivity enables a higher level of economic welfare and higher standards of living at the national level. Higher economic welfare can also be achieved by other means, e.g. by improving the terms of trade or by raising the average number of hours worked per person. In the longer term, however, the scope for raising the number of hours worked per person is limited, and it is not realistic to assume that the terms of trade can be improved indefinitely. Sustained improvements in welfare require sustained productivity growth.

Productivity growth has been weak in recent years, however – not only in Denmark, but also in most other western countries. But the decline in productivity growth has been particularly pronounced in Denmark, which has seen weaker productivity growth than its neighbouring countries since the mid-1990s.

In September 2011, Danmarks Nationalbank and the International Monetary Fund, IMF, held a conference on Danish productivity growth viewed in an international perspective. In Part 2 of this Monetary Review we present and extend the insights obtained at the conference. This article summarises the most important points and conclusions.

It is difficult to pinpoint the exact reason why, since the mid-1990s, Denmark has seen weaker productivity growth than most of its neighbouring countries. In terms of structural parameters that are normally considered to be of importance to productivity and growth – such as accumulation of capital, education, research and development and labour-market flexibility – Denmark is in a good position relative to other advanced economies.

Consequently, it is more natural to focus on what it would take to improve productivity growth in Denmark in future. But productivity can be influenced by many different factors, and this article does not leave scope to treat all the relevant ones. We have therefore chosen to focus on the topics discussed at the conference held by Danmarks Nationalbank and the IMF. Based on the conference as well as the existing economic literature, we argue that increased competition and openness to other countries may be means of improving productivity in Denmark, especially in the service sector. In terms of the education sector, added emphasis on specific disciplines, especially in the social and natural sciences, may contribute to higher productivity. Another contributing factor could be restructuring of the tax system.

Finally, it is important to focus on the mobility and flexibility in the Danish economy. Much of the aggregate productivity growth may thus be attributed to the free mobility of economic resources, including labour, towards activities with high value added. It is therefore important to avoid measures retaining an undue amount of resources in less productive activities. A case in point is the construction sector, which grew excessively during the overheating of the Danish economy in the years prior to the financial crisis.

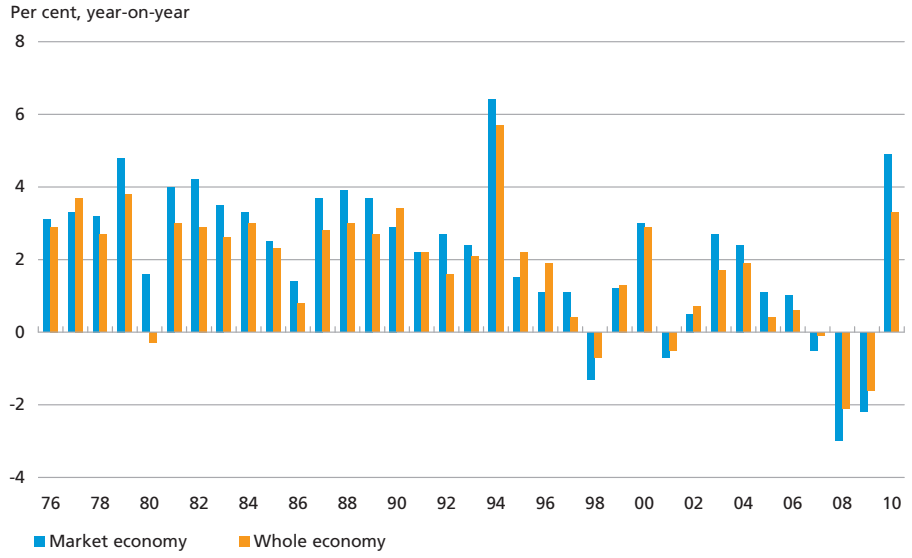
## GROWTH IN DANISH PRODUCTIVITY 1975-2010

Output per hour worked in the Danish economy, measured by the gross domestic product, GDP, at factor cost, nearly doubled in the period 1975-2010, equivalent to an average annual growth rate of 1.8 per cent for the period as a whole. However, this figure covers both the private and public sectors taken as one. This is problematic, since value added in the public sector is measured on a cost basis in the national accounts. Accordingly, productivity growth in the public sector is not taken into account. If, instead, the market economy is considered, the average annual growth rate for output per hour worked was 2.1 per cent in the period 1975-2010.[1]

Hourly productivity fluctuates strongly from year to year, however, cf. Chart 1. For example, productivity fell markedly in both 2008 and 2009, but rose substantially in 2010. These annual fluctuations should be viewed against the backdrop of the cyclical position. Output tends to fall at the beginning of a downturn, because firms' production falls, whereas employment typically reacts with a certain lag. Firms will gradually adjust their demand for labour to the new conditions, so productivity rises.

[1] There are also significant challenges in measuring productivity in the market economy. They are described in more detail in our article in Part 2 of this Monetary Review.

ANNUAL GROWTH IN HOURLY PRODUCTIVITY, 1975-2010 Chart 1



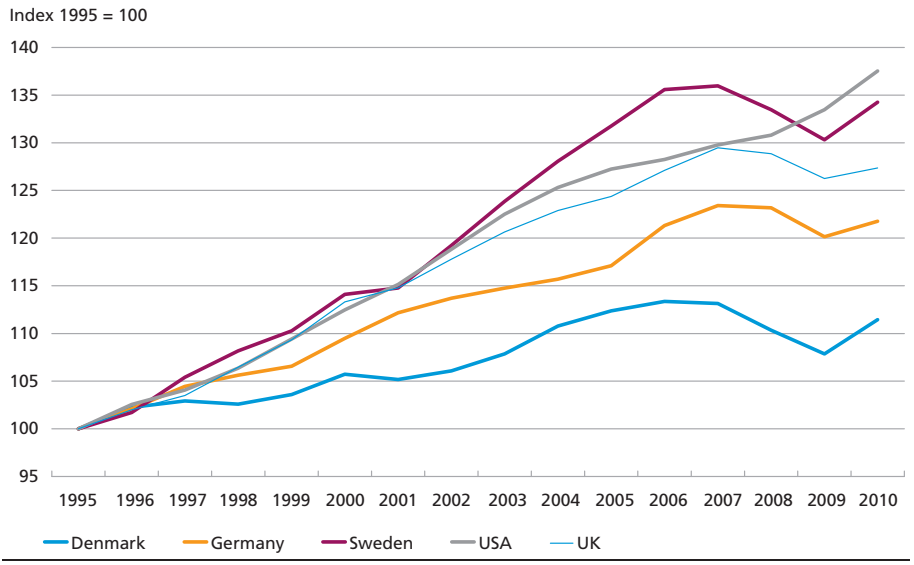

Note: The Chart shows the annual growth rates of GDP at factor cost per hour worked, 2005-prices, chained values. Market economy refers to the economy as a whole, excluding the general government sector.
Source: Statistics Denmark.

The evolution of productivity is also characterised by movements that are not directly attributable to the economic cycle. In the years 1975-95 average annual growth in hourly productivity in the market based economy was 3.2 per cent, while the figure was only 0.7 per cent in the years 1995-2010. Thus, productivity growth has been considerably lower since the mid-1990s than in the previous decades.

A comparison with productivity growth in some of our neighbouring countries shows a similar picture of weak Danish performance in recent years. Since 1995, labour productivity in Denmark, measured by GDP per hour worked, has increased by 11 per cent in total, cf. Chart 2. During the same period, productivity in Germany has risen by 22 per cent, while Sweden and the USA have seen productivity growth of 34 and 38 per cent, respectively. The same overall pattern is seen when choosing another starting year, e.g. 1990.

In summary, productivity growth in Denmark has been weak since the mid-1990s, compared to both the preceding years and to a number of comparable countries. After many years of catching up with the USA, Denmark, like virtually all other Western European countries, has seen a widening of the gap between its productivity level and that of the USA. The slowdown in productivity growth has been particularly pronounced in Denmark, however, where growth in GDP per hour worked since 1995

GDP PER HOUR WORKED, ECONOMY AS A WHOLE, 1995-2010 Chart 2



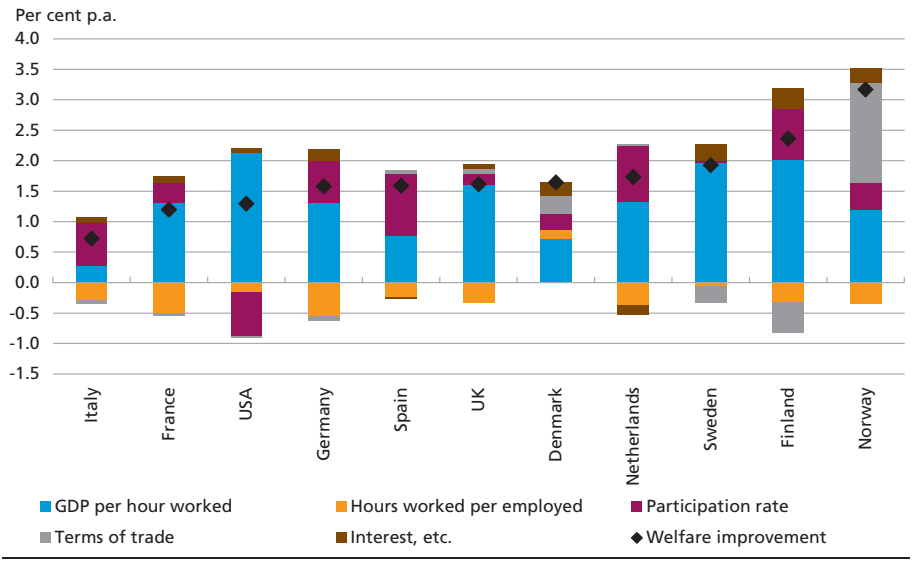

Source: OECD.

has been weaker than in other countries with the same initial level of income.

The weak Danish productivity growth has attracted considerable political focus. Productivity growth was thus one of the key focus areas for both the Globalisation Council and the Danish Growth Forum, which were established by the government at the time in 2005 and 2009, respectively. In the Danish Government Platform of 2011, the new government states that it will set up a productivity commission with the mandate to identify the causes of the low productivity growth and on this basis make specific recommendations to enhance productivity, cf. Danish Government (2011).

Productivity is not the only factor that impacts the level of economic welfare in Denmark. As initially mentioned, the number of hours worked per person, the terms of trade and income from abroad are also of key importance. The weak growth of productivity since the mid-1990s has coincided with a marked improvement of the terms of trade, an increase in the number of hours worked per employed and higher interest and investment income from abroad. Taking these factors into account, the improvement in economic welfare in Denmark since the mid-1990s appears less weak in an international context than implied by the growth of productivity. Adjusted for terms of trade effects, the average annual growth rate in the gross national product, GNP, per person in Denmark is thus on a par with the equivalent growth rates in

ECONOMIC WELFARE, AVERAGE ANNUAL INCREASE 1995-2010 Chart 3




Note: The growth rate of economic welfare has been calculated as the average annual growth rate for GNP per person of working age, adjusted for terms-of-trade effects. For a more detailed account of the adjustments made for terms of trade, see Ølgaard (2006).
Source: OECD, Eurostat, IMF and own calculations.

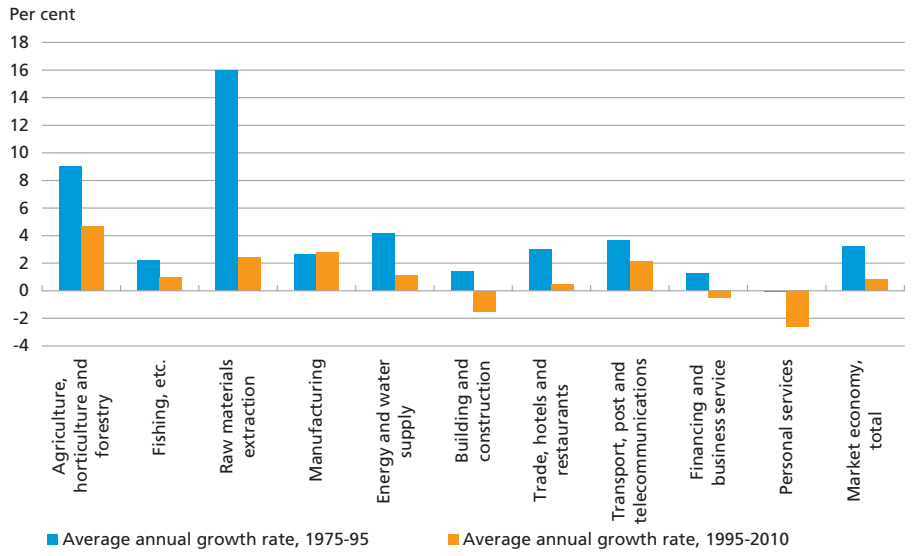
countries such as Germany, Spain, the UK and the Netherlands, cf. Chart 3.[1] Sweden, Finland and Norway are at a somewhat higher level. For Sweden and Finland, this is a consequence of choosing 1995 as the starting year. If 1990 is chosen as the starting year instead, Denmark is at the same level as both Sweden and Finland, while Norway remains higher.

However, it is not likely that improvements of the terms of trade and higher income from abroad will be able to compensate fully for continued weak productivity growth in the future. If productivity growth in Denmark remains lower than in its neighbouring countries, this will cause the level of economic welfare in Denmark to drop relative to those countries.

Declining productivity growth has affected almost all industries in the Danish economy, cf. Chart 4. Only in manufacturing was productivity growth in the years 1995-2010 the same as in the preceding 20 years. Construction and the service sector, on the other hand, have seen a marked fall in growth. Particularly the service sector has played a key role in aggregate productivity growth. The weaker productivity growth

[1] The relationship between weak productivity growth and improved terms of trade is not necessarily a coincidence. In export statistics, it may be difficult to determine the extent to which a higher product price of an export article reflects a quality improvement (and thus higher real value added) or a higher price level. In the former case, the quality improvement will be registered as an increase in productivity, while it will be registered as a terms-of-trade improvement in the latter case.

GROWTH IN LABOUR PRODUCTIVITY BY INDUSTRY, 1975-2010 Chart 4




Note: The Chart shows the average annual growth rates for GVA per hour worked, 2000-prices, chained values. The calculations are based on the market economy, i.e. the economy as a whole, excluding the general government sector. Comparisons of productivity growth across industries are complicated by the fact that it may be harder to measure productivity development in some industries than in others. In some industries, for example, it may be difficult to take the effect of quality improvements into account. Higher product quality makes it possible to sell the product at a higher price. In output statistics it may be difficult to determine whether such increases should be treated as increases in real value creation, and thus in productivity, or in the price level. These difficulties are probably substantial in the service and construction sectors, whereas output in volume terms is easier to calculate in, say, the agricultural sector.

Source: Statistics Denmark and own calculations.

in the service sector can thus explain almost half of the drop in productivity growth in the Danish economy relative to 1975-95. The growth of productivity in the Danish service sector since the mid-1990s also appears to be relatively weak compared with other countries, especially the USA.

## CAN DENMARK'S WEAK PRODUCTIVITY GROWTH BE EXPLAINED?

Capital accumulation is a key source of growth in hourly productivity, as increased use of capital equipment, such as machinery and buildings, enables higher output per hour worked. Lower capital accumulation will thus, all else equal, result in weaker productivity growth. Calculations based on figures from Statistics Denmark show that this can explain part of the decline in productivity growth in the period since 1995 relative to the years 1975-95. However, most of this decline is attributable to lower growth in total factor productivity, TFP, which is an overall expression of how efficiently production factors are used in the production process. A comparison of the experience since 1995 with that of other countries

shows a similar pattern. The relatively low Danish productivity growth in this period should thus be attributed to weak TFP growth, while capital accumulation has not been slower than in our neighbouring countries.

Investment in research and development is often highlighted as a key source of productivity growth. Research and development leads to the generation of new knowledge that may enhance both labour and capital productivity. In 2009, Danish firms' total expenditure for research and development constituted 2.08 per cent of GDP, cf. Table 1. This is considerably more than in the euro area. But there are pronounced differences within the group of euro area member states, and the research expenditure of firms in Germany is almost similar to that of Danish firms. When including research conducted in the education sector and the rest of the economy, Denmark's expenditure, at 3.06 per cent of GDP, is also substantially higher than that of the euro area. So there are no indications that investment in accumulation of knowledge is lower in Denmark than in comparable countries.

A third important source of productivity growth is the population's level of education. In terms of the proportion of the population of working age with higher education, Denmark is in line with most comparable countries. Among employed persons, the proportion with higher education has been showing a rising trend over many years, while the proportion with basic general education only has been decreasing, cf. Chart 5. Overall, this does not give grounds for concluding that developments in education levels in Denmark can account for the weak productivity growth.

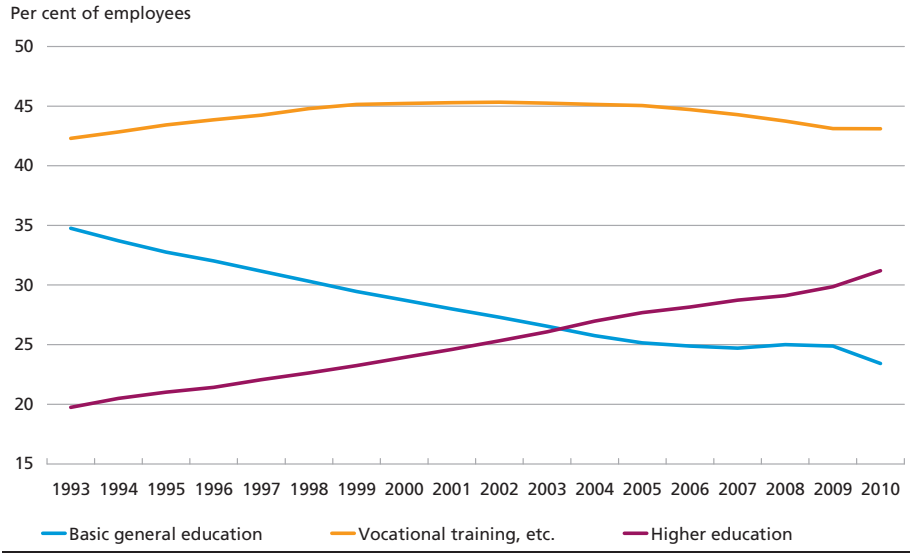
Calculations made by the European Commission, however, indicate that the contribution to productivity growth from improvement of the education level of employed persons has decreased considerably since the mid-1990s, cf. McMorrow (2011). The reason may be the marked reduction in unemployment during the same period. The decline in

EXPENDITURE FOR RESEARCH AND DEVELOPMENT AS A PERCENTAGE OF GDP, 2009 Table 1

| Unit | Private firms | Private non-profit sector | Education sector | Other public sector | Total |
|---|---|---|---|---|---|
| Denmark | 2.08 | 0.01 | 0.90 | 0.06 | 3.06 |
| France | 1.39 | 0.03 | 0.47 | 0.37 | 2.26 |
| Norway | 0.93 | - | 0.58 | 0.29 | 1.80 |
| Sweden | 2.54 | 0.00 | 0.91 | 0.16 | 3.61 |
| Germany | 1.91 | - | 0.50 | 0.42 | 2.82 |
| UK | 1.12 | 0.05 | 0.52 | 0.17 | 1.86 |
| USA | 2.02 | 0.11 | 0.36 | 0.30 | 2.79 |
| Euro area | 1.27 | 0.02 | 0.47 | 0.29 | 2.06 |

Note: The figure for other public-sector expenditure for research in the USA does not include military research. The figures for the USA relate to 2008.
Source: Eurostat.

EDUCATIONAL COMPOSITION AMONG EMPLOYEES Chart 5




Source: Statistics Denmark.

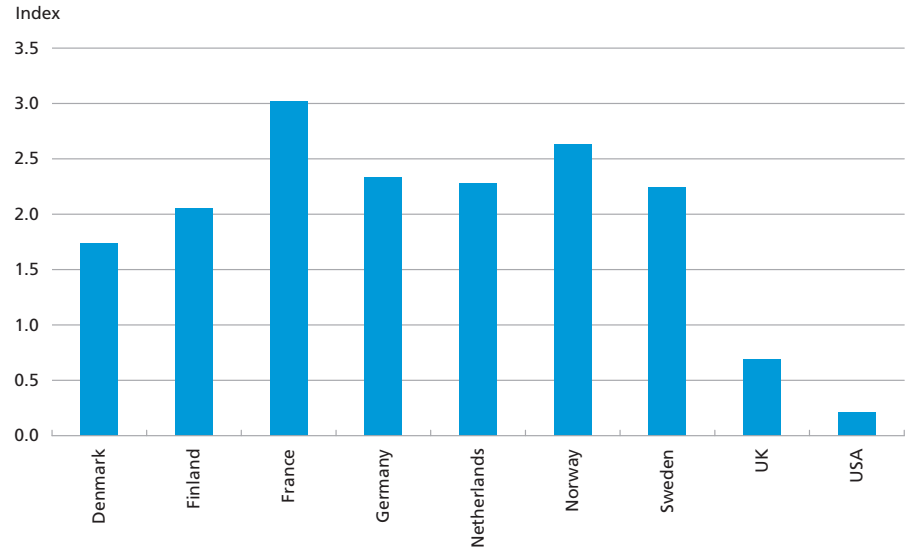
unemployment has thus helped groups of people with relatively little education to gain a stronger foothold in the labour market. This trend was clearly reinforced during the boom in the middle of the last decade. Due to the shortage of labour in those years, the proportion of employed persons with only basic general education began to flatten out after having been falling for many years. This may have contributed to lower productivity growth in those years.

It should be emphasised, however, that a decrease in productivity due to the inclusion of broader groups of employees in the labour market is not a problem in itself. On the contrary, the increase in employment will lead to considerable economic benefits. But it is important to focus on whether the qualifications of the less productive part of the labour force can be upgraded to become more in line with those of other employed persons.

A fourth factor which is often highlighted as important to productivity is the structure of the labour market. Based on a study of the labour markets of the OECD countries, Bassanini et al. (2008) find that rules protecting employees against dismissal have a negative impact on productivity growth. The reason may be that such rules impede the firms' adjustment of labour to the current need, whereby the labour force is retained in less productive activities.

The Danish labour market is characterised by a relatively low degree of protection against dismissal, cf. Chart 6. This is due to the flexicurity model, which combines flexible rules of hiring and firing with relatively

PROTECTION AGAINST DISMISSAL, AVERAGE 1990-2008 Chart 6




Note: The scale runs from 0 (lowest protection) to 6 (highest protection).
Source: OECD.

generous unemployment benefits and active labour-market policies. The flexibility element of the model makes it easier for labour to move towards the more productive firms and industries for the benefit of aggregate productivity. Conversely, flexibility can also lead to too frequent job changes, reducing the incentive to develop skills that are specific to the employee's current job. But the empirical results mentioned above indicate that the positive effects of the flexicurity model outweigh the negative ones, so there is no basis for concluding that the structure of the Danish labour market is behind the relatively weak productivity growth.

Finally, productivity growth in the economy as a whole may also be dependent on the corporate structure in terms of firm size. For example, large firms stand to gain more from research and development and thus to obtain higher productivity growth. There are no indications, however, that the corporate structure is a key explanatory factor behind Denmark's weak productivity growth. Overall, in terms of firm size, Denmark's corporate structure is comparable with that of the other European countries.

## HOW CAN PRODUCTIVITY GROWTH BE IMPROVED IN THE FUTURE?

On the basis of the factors often mentioned in connection with productivity, it follows that it is difficult to explain why the decline in

productivity growth since the mid-1990 has been stronger in Denmark than in its neighbouring countries. In the remainder of this article we will therefore focus on factors that can contribute to improving productivity growth in future – whether or not these factors have played a decisive role in the relatively weak Danish productivity growth in the last 15 years.

**Research, development and education**

As illustrated in the previous section, Denmark is in a good position in international comparisons of investment in education and research and development. The question is, however, whether the resources spent on these activities are appropriately prioritised. McMorrow (2011) argues that Denmark has had a low return on its investment in research and development compared with other countries. This implies that simply expanding the research effort is not necessarily the answer to the productivity challenge, and there may be reason to look into whether the resources dedicated to research are allocated optimally. There may also be reason to examine whether Danish firms benefit sufficiently from knowledge generated outside Denmark. New knowledge and technology can spread to other countries especially via international trade and direct investment. These topics are discussed in more detail in the following section.

A similar point can be made for education. Junge and Skaksen (2010) find that the productivity gain from increased education levels is much more pronounced for social and natural science education than for humanities education in the manufacturing and service sectors alike. Accordingly, giving higher priority to social and natural science programmes will potentially help to boost productivity.

**Taxation**

The structure of the tax system may also influence productivity. In Denmark, the corporate income tax rate has gradually been lowered from 50 per cent in 1989 to 25 per cent today and is currently in line with those of a number of European countries. On the other hand, Denmark's personal income tax rates are at the high end internationally. Furthermore, the top marginal tax rate is applies to incomes that are only slightly above the average. In countries such as Germany, the UK and the USA, on the other hand, the top marginal tax rate sets in at income levels four to nine times higher than the average income.

Based on data for 21 OECD countries in the period 1971-2004, Arnold et al. (2011) find that both personal and corporate income taxes have a dampening effect on productivity growth. One explanation may be that

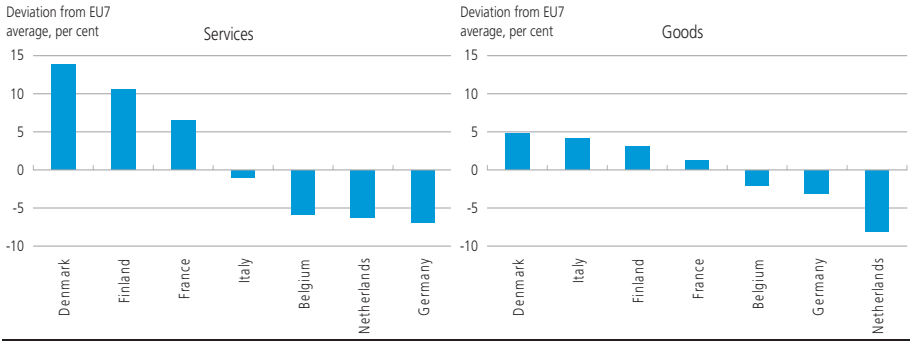
higher taxes reduce the return on productivity-enhancing investments. According to the authors, property taxation, on the other hand, has a much lower negative impact on productivity growth. Higher property taxation may lead to residential investment being channelled into more productivity-enhancing activities. The authors thus argue that a revenue-neutral tax reform that reduces income tax and raises property taxes will have a positive effect on productivity growth and economic growth in general.

**Competition and business structure**

As a result of both productivity improvements in individual firms and the fact that the most productive firms grow at the expense of the least productive firms, increased competition between firms may contribute to higher productivity. There are some indications of weak competition in parts of the Danish economy. This manifests itself in the price level, which is substantially higher than in other EU member states, especially for services, cf. Chart 7.

Denmark's relatively weak competition may be attributable, among other factors, to anti-competitive regulation in certain sectors. Cases in point are the construction and retail sectors, which are troubled by weak competition, cf. Gaard (2011) and McKinsey & Company (2010). Both sectors are characterised by weak productivity growth and considerable regulation, impeding competition from foreign firms. Deregulation may contribute to improved productivity growth. In terms of the Danish construction sector, its organisation with many small skilled-trade firms

PRICE DIFFERENTIALS IN EU7 MEMBER STATES, 2009 Chart 7




Note: The Chart shows Eurostat's Purchasing Power Parities less VAT and product-specific duties. Adjustment has also been made for differences in the countries' economic wealth. As far as goods are concerned, it cannot be ruled out that Eurostat's calculation of the price level in Denmark is slightly overestimated, the reason being that short-term sales are much more common in Denmark than in other countries. Without sufficient adjustment for such sales, the calculated price level will exceed the actual level. But the problem is probably less pronounced for services where short-term sales are less common.

Source: Danish Competition and Consumer Authority (2011)

may have a negative impact on productivity because of the inability to exploit economies of scale.

Weak competition can also be attributed to insufficient enforcement of competitive legislation. In recent years, the competition authorities in Denmark have been given better tools for efficient enforcement, but according to Gersing (2010) considerable enforcement challenges remain, especially as regards cartel cases. Measures to strengthen enforcement of existing legislation may potentially lead to improved competition and thus higher productivity growth.

A special aspect of competition and business structure concerns the conditions for establishing new firms. Ongoing work from the Danish Economic Councils suggests that new entrepreneurs had a negative impact on Danish productivity growth in the period 2002-07. This may be due to cyclical developments in those years. During an upswing, a number of relatively low-productivity firms may be established which are not viable in a cyclical downturn. This will have a negative impact on aggregate productivity.

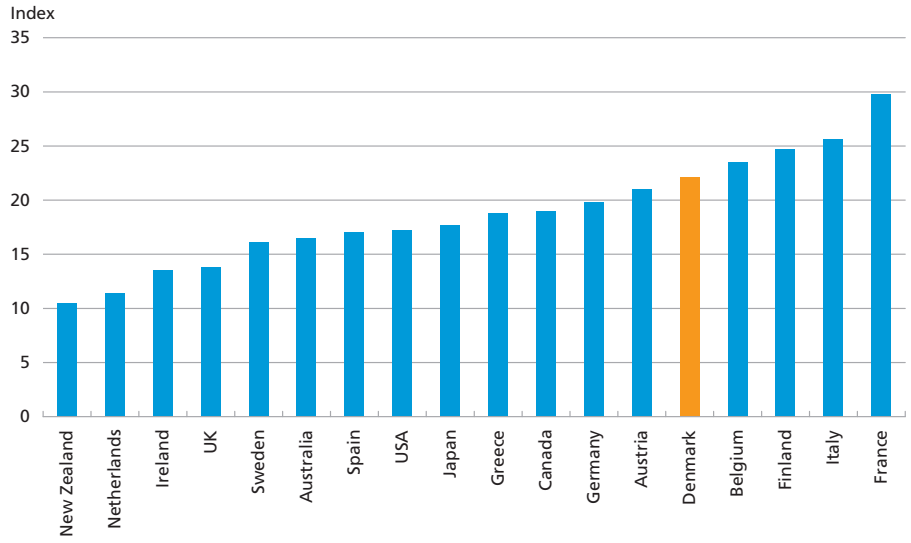
**International trade**

Another path to higher productivity may be increased openness to international trade. Import opportunities will expose Danish firms to more intensive competition from foreign firms, which may boost productivity in the industries involved. There is probably a particularly large potential for higher productivity growth through this channel in a large number of services, where the extent of international trade is lower than in other sectors. There may be several reasons for the relatively modest extent of international trade in the service sector, but in particular, for many types of services international trade requires one of the trade partners to cross the border.

However, legislative restrictions may also constitute a barrier to international trade in services, e.g. by way of a regulated number of providers in a particular sector, or requirements for national certification of providers. The extent of such restrictions is very difficult to quantify, but, according to international organisations such as the OECD and the World Bank, Denmark is at the more restrictive end of the group of advanced economies, cf. Chart 8 and Francois and Hoekman (2010). This gives reason to take a closer look at the possibilities of deregulating or liberalising the service sector in order to expand the scope for trade with foreign firms.

Increased international trade may also boost productivity in the service sector via the export side. Calculations based on Danish corporate data indicate that exporters of services are more productive than non-ex-

RESTRICTIONS ON INTERNATIONAL TRADE IN SERVICES, 2005 Chart 8




Note: The Chart shows the World Bank's index of political restrictions on international trade in services. A higher value of the index indicates a more restrictive policy. The index is based on publicly available data on policies and covers the financial sector, telecommunications, retail trade, shipping, aviation (passenger transport) and business service.
Source: Borchert et al. (2011).

porters, cf. Skaksen (2011). The probable reason is that the firms that already have the highest productivity become exporters, while the very act of exporting does not necessarily boost productivity. But the calculations also show that access to foreign markets causes productive exporters to grow faster than other – less productive – firms. This indicates that increased trade in services will be able to raise aggregate productivity in the service sector via reallocation of resources from the least productive to the most productive firms. Borchsenius et al. (2010) calculate the potential for international trade in a number of service sectors and assess that the greatest untapped potential is found in subsectors of e.g. transport, advisory services, IT services and research and development.

**Foreign direct investment**

Economic interaction with other countries may also take the form of inward and outward direct investment. Foreign direct investment leads to ownership and influence in foreign firms and is consequently a potential source of cross-border transfers of capital, knowledge and technology. Hence, the extent of inward and outward foreign direct investment may be essential to productivity growth.

Foreign-owned firms operating in Denmark are generally more productive than purely Danish-owned firms, cf. Table 2. Part of this differ-

CHARACTERISTICS OF FIRMS IN DENMARK, 2008 Table 2

| Average | Foreign-owned firms | Danish-owned firms |
|---|---|---|
| Number of employees (FTEs) | 86 | 11 |
| Value added (kr. million) | 58 | 6 |
| Labour productivity (kr. 1,000) | 683 | 540 |
| Share with higher education (per cent) | 27 | 15 |
| Share with long-cycle higher education (per cent) | 8 | 5 |
| Share with PhD degree (per cent) | 0.4 | 0.2 |
| Capital intensity (kr. 1,000) | 267 | 325 |

Note: The statistics include firms with minimum 0.5 full-time equivalents (FTEs), excluding firms in agriculture, fishing and raw materials extraction, energy and water supply, public and personal services, real estate letting and administration as well as unspecified sectors. Labour productivity and capital intensity are calculated as value added and capital stock per FTE, respectively.
Source: Ministry of Economic and Business Affairs (2011).

ence can be attributed to differences in e.g. size and the educational composition of the employees. But even when adjusted for such factors, the productivity of foreign-owned firms is 17-19 per cent higher than that of Danish-owned firms, cf. Pedersen (2011b) and Ministry of Economic and Business Affairs (2011).

There could be several explanations for the observed productivity differentials between Danish-owned and foreign-owned firms. For example, foreign ownership may have a direct beneficial effect on productivity, e.g. via international experience in management and organisation. But another explanation could be that foreign investors tend to acquire the most productive Danish firms rather than low-productivity firms, hence the higher productivity of foreign-owned firms. Finally, international studies point to a third channel that could contribute to explaining the higher productivity of foreign-owned firms. The most productive firms are the ones that establish subsidiaries abroad and become multinational, cf. Helpman, Melitz and Yeaple (2004). All things being equal, the presence of such high-productivity firms will raise the average productivity in society, and such foreign direct investment should therefore be expected to benefit Danish productivity growth.

In conclusion, it is important to bear in mind that the presence of foreign-owned firms in Denmark may also influence the productivity of Danish-owned firms via *spillover* effects. These may be positive (e.g. transfer of knowledge and technology) or negative (e.g. loss of market shares and hence loss of economies of scale). The existing empirical literature provides no firm conclusions on the importance of spillover effects, and there is a need for further studies of how foreign direct investment affects productivity of Danish firms – particularly in the longer term.

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