DANISH PRODUCTIVITY DURING THE UPSWING

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INTRODUCTION AND SUMMARY

Productivity is a key driver of economic growth. However, productivity growth in the Danish economy, measured by gross value added, GVA, per hour has been weak since the financial crisis. This is especially the case from the 2nd half of 2015 and onwards when the decoupling of output and the labour market situation calls into question future productivity growth and the actual sustainability of the growth in employment seen during the last year or so. Nevertheless, the wage share of the employment-intensive private non-primary sector excluding transport does not indicate a general imbalance between productivity and wages. The adjustment for fluctuations related to the transport industry reflects that this industry is currently characterised by declining earnings in shipping, which has a limited content of domestic employment. Consequently, the increase in employment is currently assessed to be sustainable, albeit with potential regional and industry-specific differences.

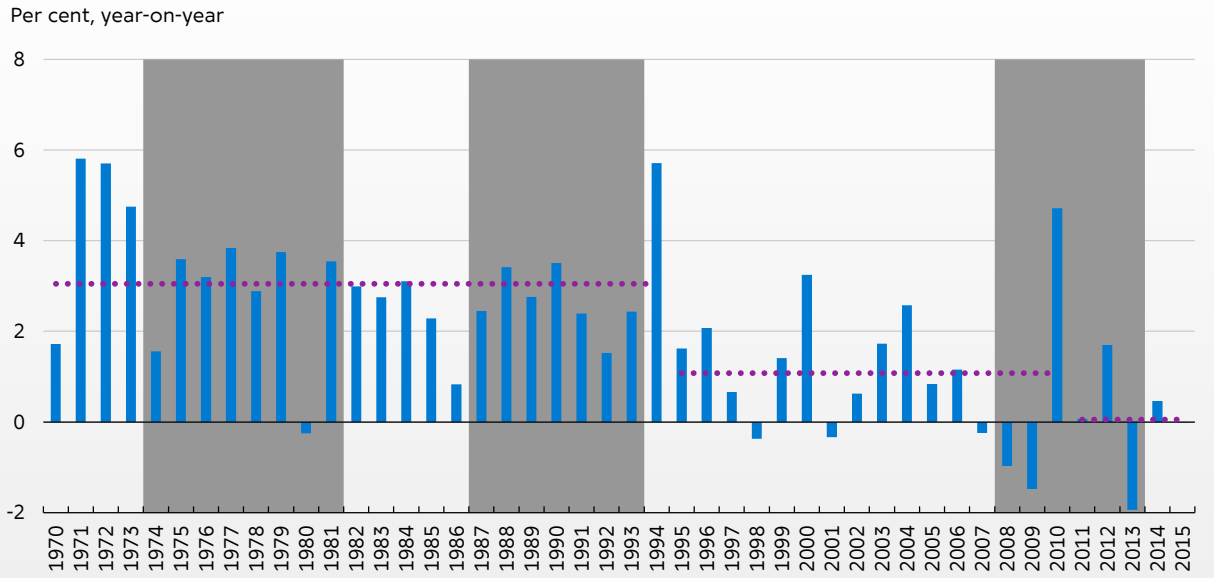
The low productivity growth of the Danish economy as a whole is attributable to a series of factors. Since the mid-2000s, declining North Sea activity has been reducing productivity growth for the overall economy by around 0.3 percentage point per year. In addition, during the upswing employment growth has been higher in industries with below-average productivity. This, in itself, contributes to weaker aggregate productivity growth. The analysis finds that between-sector shifts reduced productivity growth in the private non-primary sector by 0.3 percentage point per year from 2011 to 2015. On the other hand, within-sector shifts boosted productivity growth by 0.7 percentage point.

A comparison of the survival rate of firms during various recessions also indicates that the low level of interest rates may have prevented productivity-enhancing reallocation of production resources and dampened productivity growth during the upswing. Moreover, productivity growth is also curbed by lower capital intensity, both as a result of the structural shift from manufacturing to services and due to the limited level of investment in recent years.

Productivity growth is not the only source of enhanced prosperity. For a prolonged period of time, Denmark's terms of trade have been improving substantially and the return on foreign assets has been increasing. This has expanded consumption opportunities and brought greater prosperity, even if productivity growth has been weak. In practice, distinguishing between quality improvements and price developments can be difficult. The analysis finds that nominal value added per hour in the non-primary sector has increased more than real productivity compared with previous upswings.

In principle, the slowdown in productivity growth may reflect temporary fluctuations as well as factors of a more structural nature. Danmarks Nationalbank's projection is based on an assumption of gradual restoration of productivity growth over the next couple of years to a level more or less matching the long-term level since the mid-1990s. In the coming years, sector shifts and lower capital intensity may put more downward pressure on productivity growth than assumed in the projection. This would entail a long period of low growth.

Productivity growth in the Danish economy 1970-2015 Chart 1



Note: The chart shows real GVA per hour. Shaded areas indicate periods of economic downturn, cf. Pedersen et al. (2015).
Source: Statistics Denmark.

WEAK DANISH PRODUCTIVITY GROWTH DURING THE UPSWING

A prolonged trend of low productivity growth in Denmark seems to have been reinforced in the wake of the financial crisis. Real productivity in terms of GVA per hour for the entire economy has not grown for the last five years, cf. Chart 1.[1] Productivity growth was particularly weak in the 2nd half of 2015 when the gross domestic product, GDP, stagnated following eight quarters of steady growth. The slowdown would seem to be in contrast to a strong labour market with rising employment and falling unemployment, which has continued into 2016, cf. Chart 2. Weak productivity growth is not an isolated Danish phenomenon, but very much part of an international trend. Thus, most of our usual European benchmark countries have experienced lower productivity growth since the crisis, cf. Box 1.

DECLINING NORTH SEA PRODUCTION CONTRIBUTES TO WEAK PRODUCTIVITY GROWTH

The modest productivity growth of the Danish economy as a whole is, to some extent, attributable to declining North Sea activity since the mid-2000s. The fall means that the high level of GVA per hour that characterises oil and gas extraction has less and less weight in the total productivity of the economy. Viewed in isolation, this has weakened productivity growth by approximately 0.3 percentage point in recent years, cf. Chart 3. Although declining North Sea production contributes to the moderate productivity growth, it constitutes a longer-term trend, which does not imply a structural productivity challenge for the economy in general. Thus, in the remaining part of the analysis, the focus will be primarily on the private non-primary sector, i.e. the market-related part of the economy less raw material extraction, housing and agriculture.[2]

1 There are several relevant productivity measures. This analysis generally focuses on hourly productivity, i.e. output measured by GVA in volumes divided by the number of hours worked.

2 This delineation is assessed to give the truest and fairest view of underlying productivity growth. Mining and quarrying, agriculture and housing tend to experience wide fluctuations in productivity and have a relatively limited employment content. Public sector productivity measurement is subject to uncertainty, given that the output is not sold in a market and thus does not necessarily reflect the consumers' assessment of the quality. Consequently, the focus is on the market-related part of the economy.

Weak productivity growth in the post-crisis period is an international phenomenon

Box 1

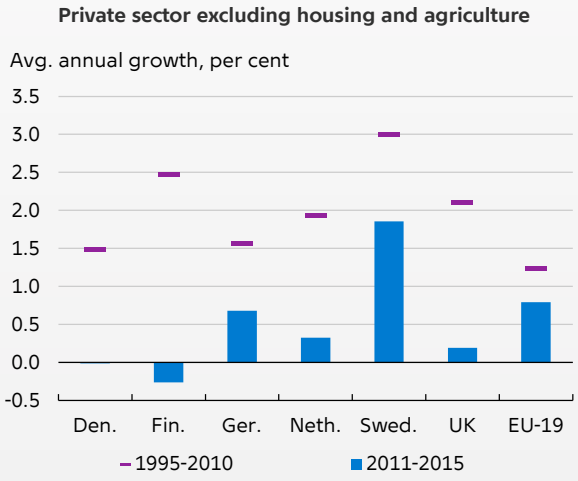
Subdued productivity growth is not an isolated Danish phenomenon. Thus, productivity growth has also slowed in our European benchmark countries in the wake of the financial crisis, although the trend is particularly pronounced in Denmark, cf. the chart.

Several possible explanations have been offered for the declining productivity growth in the advanced economies. For instance, private investment dropped to low levels due to the need for consolidation among firms, a decline in demand and increased uncertainty in the aftermath of the financial crisis, cf. Kramp and Pedersen (2015). This may have contributed to dampening productivity growth. Moreover, several advanced economies are gradually undergoing a transition in which less capital-intensive services sectors account for a growing share of employment.

Productivity growth may be further hampered by less dynamic resource reallocation, for example due to fewer business openings and closures, as is the case in the USA, and less knowledge dissemination. An OECD study (2015) finds that innovative technology firms continue to experience strong productivity growth. It is the pace of knowledge dissemination from high-productivity firms to less productive firms which has slowed down.

Another explanation is linked to measurement errors, for instance due to technological advances where online shopping, free web applications and quality improvements of e.g. smartphones may be difficult to measure.

International productivity growth

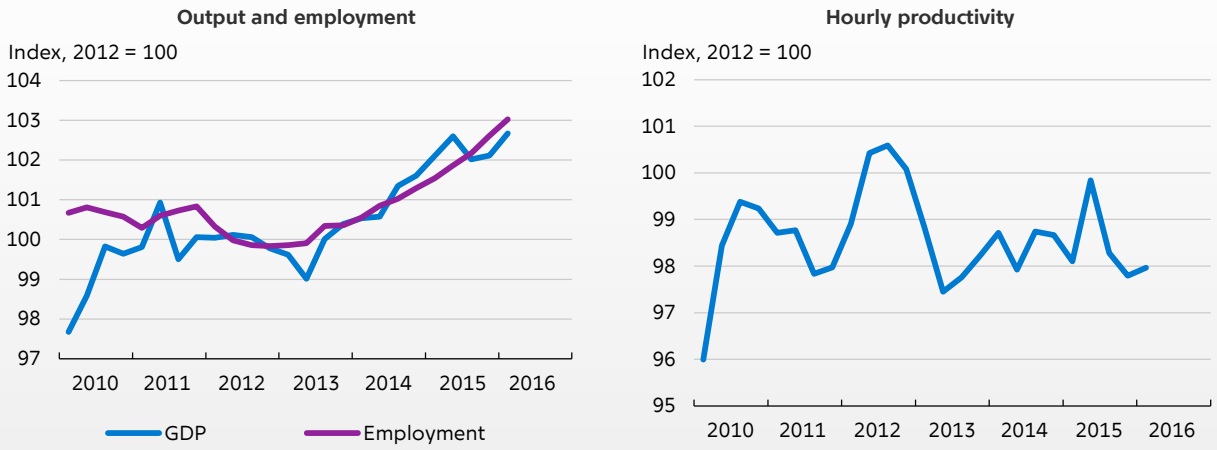


Note: EU-19 covers euro area member states.
Source: OECD.

Weak productivity growth since the crisis has amplified the debate about whether future technological advances will make substantial contributions to productivity growth. Gordon (2012), among others, argues that the productivity gain from technological advances has diminished and will not necessarily increase in the future. According to Gordon, the technological breakthroughs of the 19th and early 20th centuries, for instance electricity and the internal combustion engine, boosted productivity more than the breakthroughs of recent decades, including flat screen televisions, smartphones, etc.

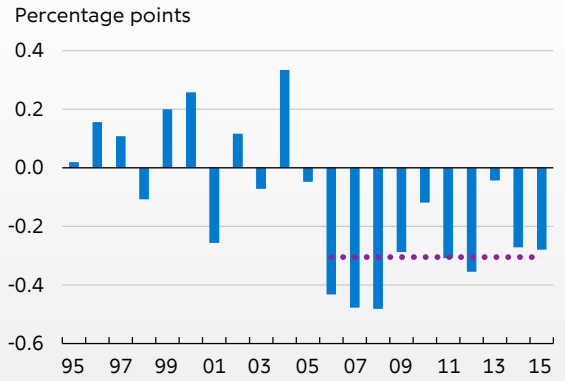
Others take a more optimistic view of the future, including Brynjolfsson and McAfee (2011), Byrne et al. (2013) and Miller and Atkinson (2014). They argue, inter alia, that we are still in the early stages of a process in which digitisation will continue to produce efficiency gains in individual sectors of the economy, while interconnected innovations and spin-offs will be the source of increased productivity growth in the future. However, history shows that technological breakthroughs and their impacts on productivity growth are subject to considerable uncertainty.

Output and employment in the Danish economy Chart 2



Note: Right-hand chart: Productivity is measured as GVA per hour for the whole economy.
Source: Statistics Denmark.

Contribution to overall productivity growth from mining and quarrying Chart 3



Note: The broken line indicates a simple average since 2006 when North Sea production began to decrease.
Source: Statistics Denmark.

SUBDUED PRODUCTIVITY GROWTH IS BROADLY BASED ACROSS INDUSTRIES

Sluggish productivity growth during the upswing is broadly based across the non-primary sector, but seems to be particularly pronounced in construction, finance and insurance and trade and transport, etc., cf. Chart 4.[3] Part of the decline in trade and transport, etc., probably reflects a reduction in sea transport during 2015. In manufacturing , productivity has generally been increasing in recent years, albeit with some volatility. Productivity in information and communication has been rising steadily for a long period of time.

PRODUCTIVITY GROWTH HAS BEEN PARTICULARLY SLUGGISH DURING THE CURRENT UPSWING

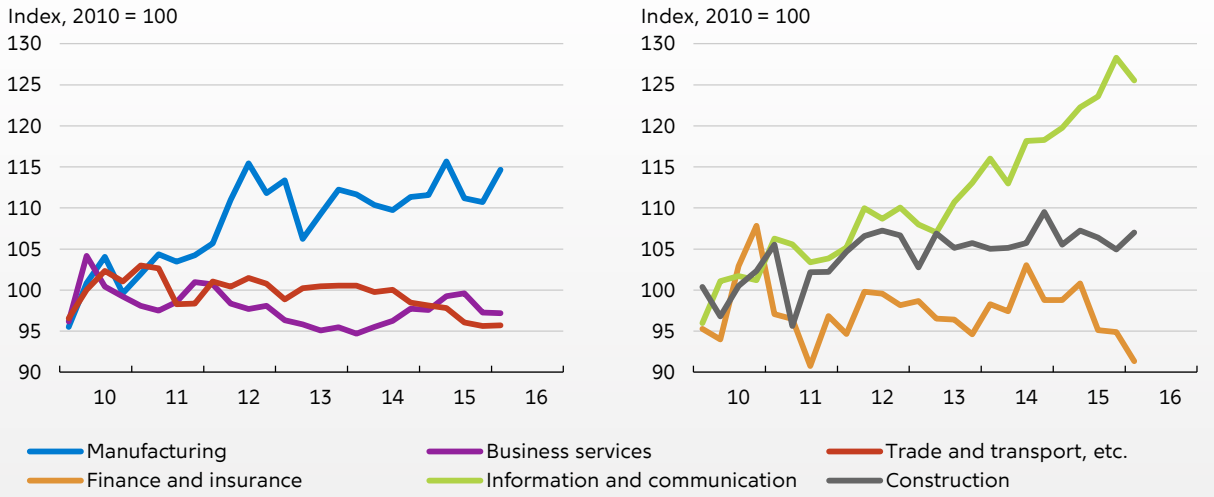
Sluggishness in the adjustment of labour often entails more intensive resource utilisation among firms as demand picks up. Thus, productivity will tend to increase the most in the early stages of a cyclical recovery. However, this does not seem to be the case during the current upswing in which productivity in the non-primary sector has been very modest, cf. Chart 5 (left). As capacity pressures build during the upswing, persons with a weaker attachment to the labour market will typically account for a larger share of the growth in employment, which normally dampens productivity growth.

In practice, distinguishing between quality improvements and price developments can be difficult, especially at industry level, cf. Danish Productivity Commission (2013). Nominal value added per hour in the private non-primary sector has risen more than real productivity compared with previous upswings, cf. Chart 5 (right). Especially manufacturing and finance and insurance have benefited from relatively favourable price developments.

3 Productivity developments at industry level, especially in construction, may be subject to statistical uncertainty, cf. Danish Productivity Commission (2013).

Productivity development in the private non-primary sector, broken down by industry

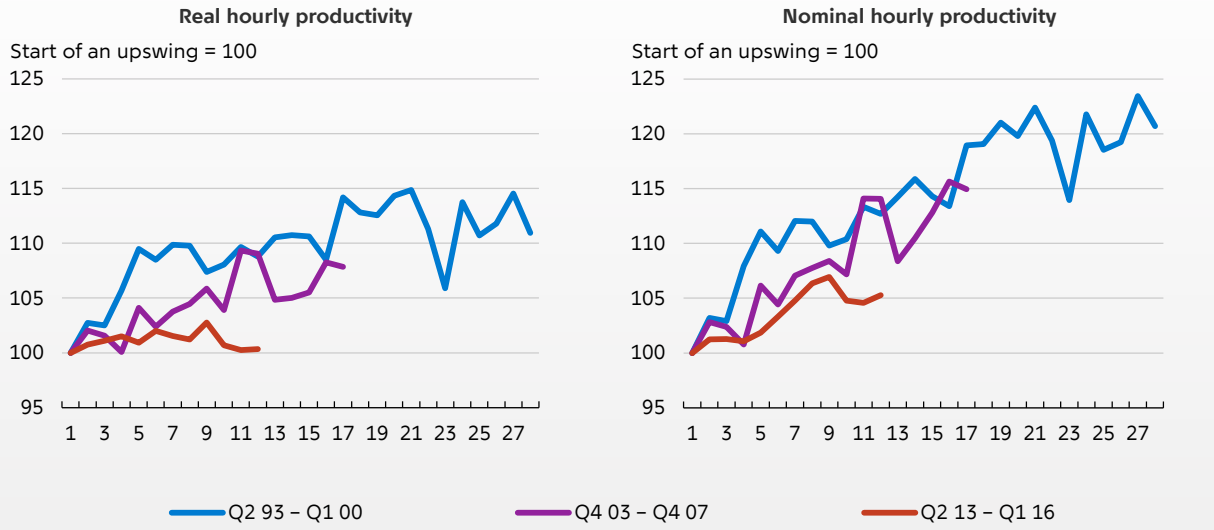
Chart 4



Note: The chart is based on GVA per hour for industries in the private non-primary sector, excluding some small industries. In the non-primary sector, the industries' share of GVA is: manufacturing 22 per cent; trade and transport, etc. 28 per cent; business service 13 per cent; finance and insurance 10 per cent; information and communication 7 per cent; and construction 7 per cent.
Source: Statistics Denmark and own calculations.

Real and nominal hourly productivity in the private non-primary sector during economic upswings

Chart 5



Note: Productivity is defined as real and nominal GVA per hours worked, respectively, in the private non-primary sector. The definition of upswing periods follows Pedersen et al. (2015).
Source: Statistics Denmark.

SECTOR SHIFTS CONTRIBUTE TO WEAK PRODUCTIVITY GROWTH

Productivity growth in individual industries naturally has an impact on aggregate productivity developments in the economy. However, the relationship is not necessarily one-to-one, given that aggregate productivity growth also depends on the relative sizes of the industries and their levels of productivity. Even if no individual industry experiences productivity growth, productivity growth could still be achieved for the economy as a whole by shifting resources to more productive industries and vice versa.

THE GROWTH IN EMPLOYMENT IS MAINLY IN SERVICES

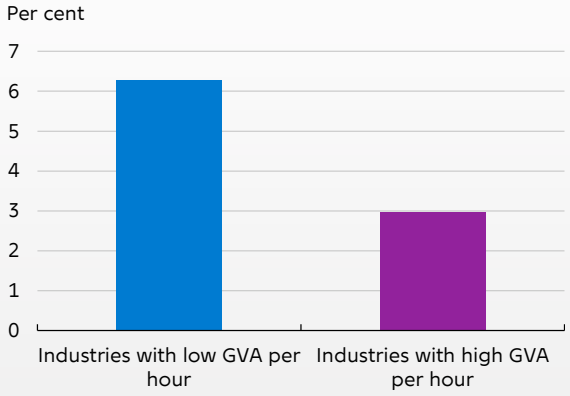
Throughout the upswing, the increase in employment has occurred primarily in the private sector where the number of hours worked has increased by around 5 per cent since 2012. This means that just under half of the decline in hours worked from 2008 to 2012 in the private sector has been reversed over the past three years. The rise is broad-based, but seems to be particularly pronounced among industries with low GVA per hour, cf. Chart 6. A few industries have experienced an actual contraction in employment. These include industries with high GVA per hour, such as finance and insurance where the number of hours worked has decreased in recent years.

Some industries, especially in the services sector, have contributed more to a higher number of hours worked, cf. Table 1. These include employment and temp agencies, cleaning and other operational services, hotels and restaurants, postal and courier services, wholesale trade and education-intensive sectors such as lawyers, accountants, architects and engineers. In construction and the pharmaceutical industry, the number of hours worked has also increased substantially.

In some sectors, developments in employment may be affected especially by political measures

Increase in the number of hours worked in the private non-primary sector 2012-15

Chart 6



Note: An industry is assessed to have high GVA per hour if it exceeds the average of the private non-primary sector.
Source: Statistics Denmark and own calculations.

or changes in underlying trends. As a case in point, tax deductibility of home repairs and improvements has presumably contributed to shifting demand to construction and cleaning, both of which have relatively low GVA per hour. Growing online trade may also have helped to increase employment in postal and courier services.

SECTOR SHIFTS HAVE DAMPENED PRODUCTIVITY GROWTH DURING THE UPSWING

When an industry such as business services, with relatively low GVA per hour as a whole, accounts for an increasing share of employment, this *per se* contributes to weaker aggregate productivity growth, cf. Chart 7.[4] Similarly, viewed in isolation, the decrease in employment in, for instance, finance and insurance has contributed to lower aggregate productivity growth, since GVA per hour is generally relatively high[5].

A decomposition indicates that between-sector shifts alone detracted 0.3 percentage point from productivity growth in the non-primary

4 Business services comprise the industries travel agents, cleaning and other operational services as well as knowledge-based services.

5 A sector shift may occur both as a result of a change in the allocation of industries' share of hours worked and as a result of new relative prices. If a high-productivity industry experiences a relatively deterioration in prices, this may lead to lower aggregate productivity growth, given that it subsequently has less weight in the total output of the economy.

Increase in hours worked, broken down by industry 2012-2015

Table 1

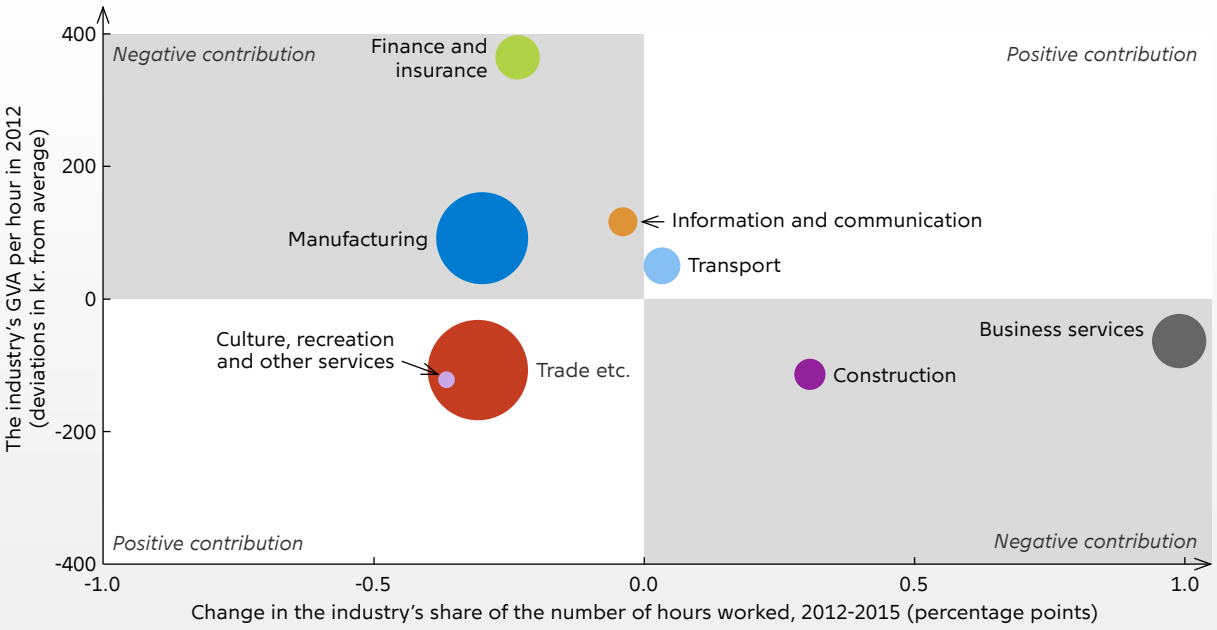
Per cent	Increase in hours worked	Share of total increase in hours worked
Travel agents, cleaning and other operational services	16	19
Knowledge-based services	10	18
Construction	8	16
Hotels and restaurants	15	12
Manufacturing	3	11
Transport	5	9
Trade	2	9
Other industries	0	6

Note: The table is based on figures for the whole economy. The industry travel agents, cleaning and other operational services includes, inter alia, temp agencies, while knowledge services include lawyers, accountants, architects, engineers, etc. Collectively, travel agencies, cleaning and other operational services and knowledge services are referred to as business services. In addition to postal and courier services, transport also includes shipping and air transport as well as land transport, while trade includes car sales, wholesale and retail trade. Collectively, hotels and restaurants and trade are often referred to as trade, etc.

Source: Statistics Denmark.

Sector shifts in the private non-primary sector during the upswing

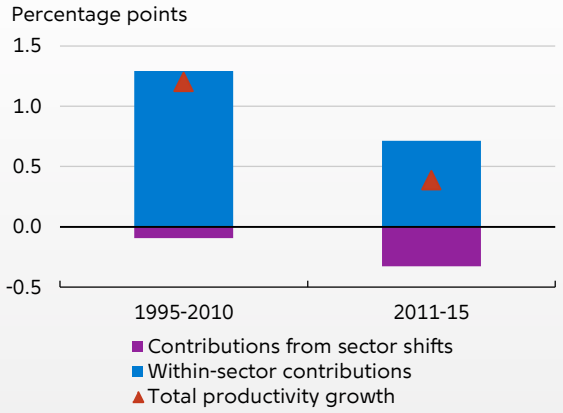
Chart 7



Note: The chart focuses on industries in the private non-primary sector, excluding some small industries. The shaded area indicates that sector shifts have contributed negatively to aggregate productivity growth. The sizes of the bubbles are proportional to the industries' share of nominal GVA in the private non-primary sector. Trade, etc. includes trade, hotels and restaurants.

Source: Statistics Denmark and own calculations.

Decomposition of productivity growth in the private non-primary sector Chart 8



Note: The decomposition used is based on the approach in Tang and Wang (2004). A simple average of annual growth contributions is used.
Source: Statistics Denmark and own calculations.

sector each year from 2011 to 2015, cf. Chart 8. This indicates that between-sector shifts have, to some extent and to a greater extent than previously, contributed to weak productivity growth during the upswing. Sector shifts may reflect efficient adjustments to changes in demand patterns that are appropriate from an overall perspective, although they may, in the first instance, have a negative impact on productivity growth at the macro level.

Viewed in isolation, within-sector productivity growth boosted productivity growth by 0.7 percentage points from 2011 to 2015. However, this is less than previously, which also contributed to weaker productivity growth in the private non-primary sector[6].

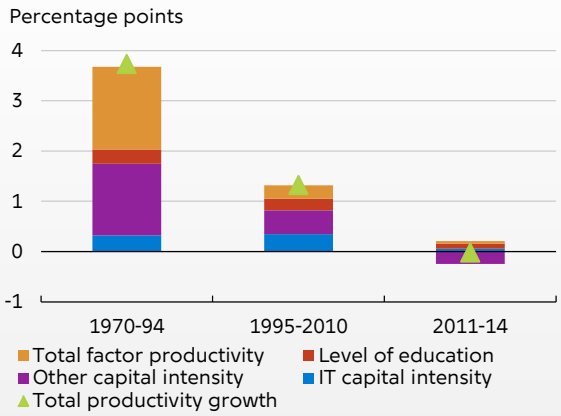
LOWER CAPITAL INTENSITY DAMPENS PRODUCTIVITY GROWTH

Labour productivity refers to the amount of output produced per hour, without taking the use of any other production factors into account. However, efficiency in the production of goods and services also depends on firms' capital stock such as machinery and buildings and on other resources in the economy such as the quality and educational level of the labour force. To take these factors into account, productivity can be decomposed into contributions from observable input factors and total factor productivity, i.e. the portion of productivity growth that cannot be immediately explained by input factors. Total factor productivity includes technical advances in the broad sense of the word, but also between-sector shifts.

Results indicate that reduced capital intensity has contributed to declining productivity growth in the Danish economy since the mid-1990s, cf. Chart 9, partly reflecting a structural shift from manufacturing to services. There are indications that the trend towards lower capital intensity has accelerated during the upswing, for instance as a result of subdued investment activity after the crisis. The decline in productivity growth should also, to a great extent, be attributed to the cessation of strong growth in total factor productivity, the reason for which is not clear.

Part of the explanation could be that the survival rate of firms has been relatively high after the financial crisis compared with earlier recessions. This is likely to have weakened productivity-enhancing reallocation of economic resources, cf. Box 2.

Contributions to hourly productivity growth Chart 9



Note: The chart shows a simple average of annual growth contributions to productivity in the market economy measured by gross domestic product at factor cost, GDPFC, per hour.
Source: Statistics Denmark.

6 The decomposition of productivity growth into contributions from sector shifts and within-sector productivity developments is based on 16 individual industries in the private non-primary sector, for which data is available until and including 2015. The calculation does not take possible within-sector shifts into account.

Is the low level of interest rates buoying up low-productivity firms?

Box 2

The establishment of new firms and closure of old ones are important aspects of the dynamic resource allocation process to ensure that production is optimised. Economic growth is not just about the creation of new jobs and firms – it also entails that a number of existing firms and jobs become superfluous and disappear. Lower demand in an economic downturn tends to stimulate this adjustment process. The reason is that corporate earnings are reduced, which may lead to employment reductions or defaults, especially among low-productivity firms. This will have a negative short-term economic impact on the economy, but in the process resources and labour will be released, which can be used by more productive firms during a subsequent economic upswing.

Six years after the financial crisis, the survival rate of firms in the private non-primary sector has been higher than during the downturn in the early 2000s, cf. the chart. This is despite the fact that the negative shock to the economy in 2008 and the subsequent recession were considerably stronger. A key difference between the two periods is that the current level of interest rates is lower, which may have helped to buoy up highly leveraged, low-productivity firms and prevent productivity-enhancing allocation of economic resources.

Share of surviving firms in the private non-primary sector and GDP during various economic downturns

Note: On the x-axis, t denotes the first year of the downturn. Only firms with at least 10 employees are included. A detailed description of the sample is provided in Kuchler (2015).
Source: Own calculations based on firm data for the private non-primary sector from Statistics Denmark.

SUSTAINABLE EMPLOYMENT GROWTH

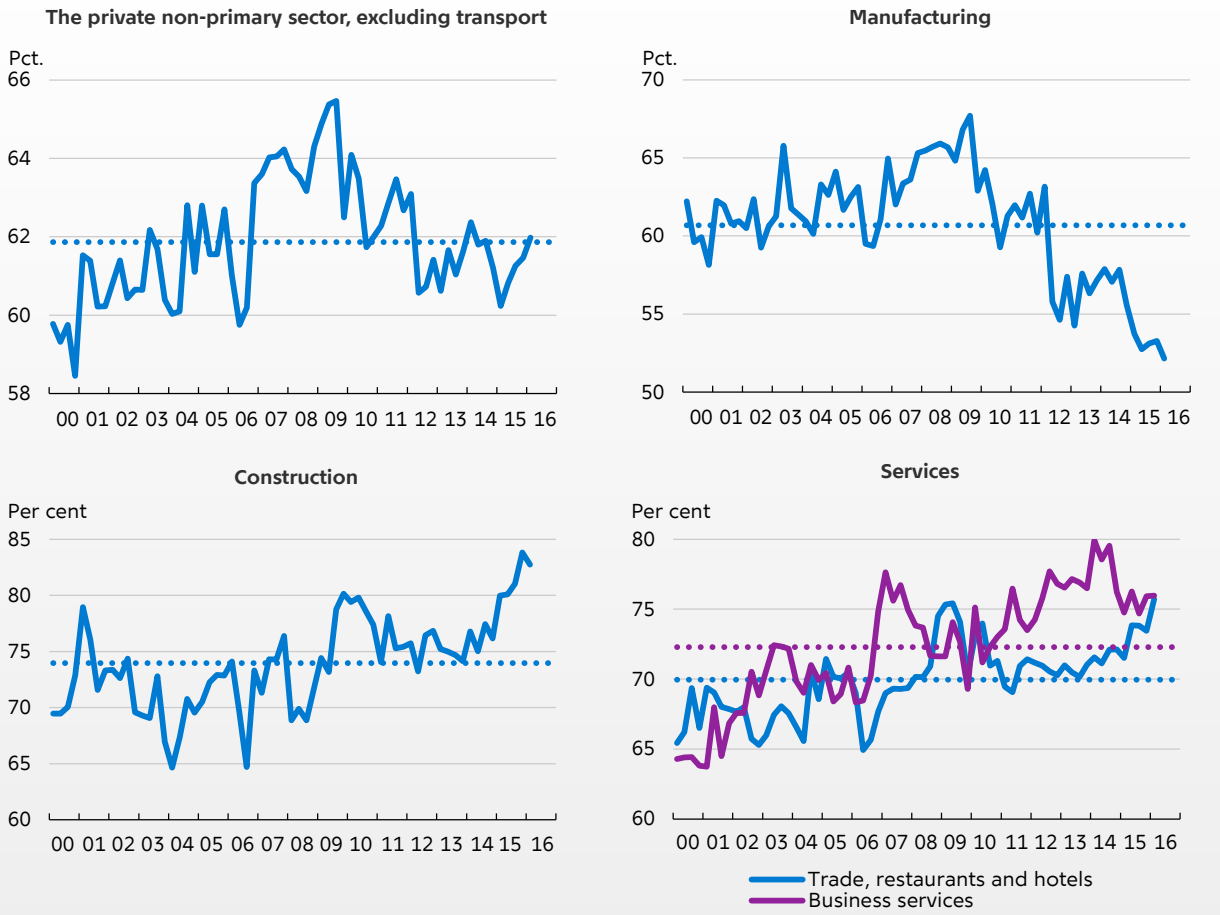
NO INDICATIONS OF IMBALANCE BETWEEN DEVELOPMENTS IN PRODUCTIVITY AND WAGES

The decoupling of output and the labour market situation calls into question future productivity growth and the actual sustainability of the growth in employment seen during the last year or so. The wage share, reflecting the relationship between product real wages and productivity, can be used to assess whether the growth in employment is sustainable or not[7]. If productivity is out of sync with firms' prices relative to hourly wages, the wage share will be increasing. Thus, in principle, wage increases are compatible with unchanged productivity and will not, per se, result in adjustment of employment, provided prices rise similarly.

Wage share developments do not indicate a general imbalance in the employment-intensive private non-primary sector excluding transport. The adjustment for fluctuations related to the transport industry reflects that this industry is currently characterised by declining earnings

7 Product real wages measure firms' hourly payroll costs relative to the price of their products measured by the GVA deflator.

Wage share in the private non-primary sector, excluding transport and selected industries Chart 10



Note: The broken line shows the historical average since 2000.
Source: Statistics Denmark and Danmarks Nationalbank.

from shipping, which has a limited content of domestic employment. Although the wage share in the private non-primary sector excluding transport has risen in recent quarters, there was a similar fall towards the end of 2014, and, viewed over a longer period, the wage share is in line with its average since 2000, cf. Chart 10. This indicates low risk of labour market moderation, and the growth in employment is currently assessed to be sustainable, albeit with potential regional and industry-specific differences.

The wage share in the manufacturing industry has been declining in recent years. This is partly attributable to a sector shift of activities towards sectors with relatively low wage shares. This is particularly true of the pharmaceutical industry, whose progress alone accounted for almost half of the decrease in the manufacturing industry's total wage share from 2008 to 2014.[8] However, the wage restraint of recent years is also contributing to a falling wage share in the manufacturing industry.

Construction is one of the industries experiencing the greatest increase in the wage share during the upswing. This indicates that capacity pressures are building, which is also underpinned by labour shortage indicators. In the services sectors, wage shares are high, seemingly trending upwards.

8 Data at detailed industry level is available only until 2014.

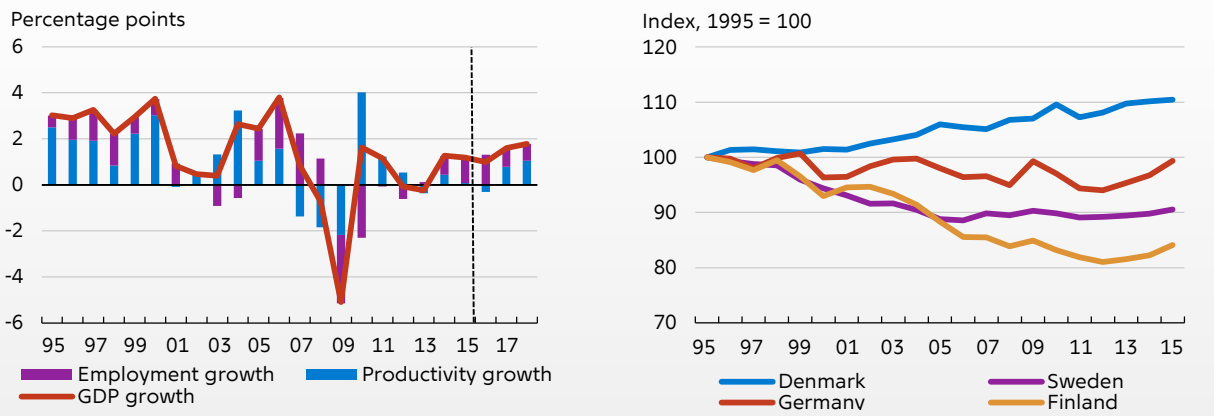
WEAK PRODUCTIVITY DEVELOPMENT COULD LEAD TO A PROLONGED PERIOD OF LOW GROWTH

In principle, recent productivity developments may reflect temporary fluctuations as well as factors of a more structural nature. GDP growth in Danmarks Nationalbank's projection is based on an assumption of restoration of productivity growth to a level roughly matching the average level since 1995, cf. Chart 11 (left). In the coming years, sector shifts and lower capital intensity may put more downward pressure on productivity growth than assumed in the projection. If so, this will entail a prolonged period of low output growth. If weak productivity growth persists over the projection period, the expected increase in demand will cause capacity pressures to tighten faster than assumed. This may result in upward pressure on wages – and there is some scope for this without the emergence of imbalances. The possibilities of higher wage increases should be seen in light of persistently large current account surpluses.

PRODUCTIVITY IS NOT THE ONLY SOURCE OF INCREASED PROSPERITY

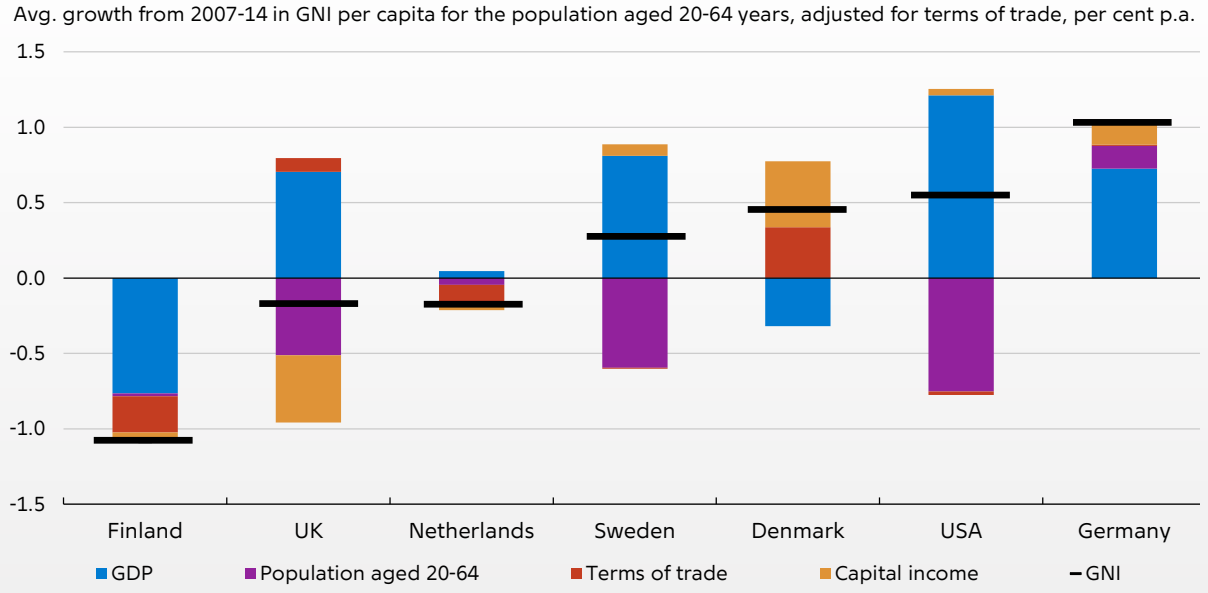
Productivity is a key driver of economic growth, but it is not the only source of increased prosperity. For a prolonged period of time, Denmark has benefited from substantially improved terms of trade, i.e. the prices at which Danish exporters are selling goods and services in the world market have increased more than the import prices at which Danish households and firms are buying. This, in combination with a high return on foreign assets, has expanded consumption opportunities and brought greater prosperity, even if productivity growth has been weak. This is in contrast to the situation in several of our neighbouring countries, where the terms of trade have been either constant or deteriorating, cf. Chart 11 (right). Productivity gains are often passed on to consumers in the form of lower prices. When countries have specialised in industries with high productivity growth such as IT and electronics products, this is typically accompanied by downward pressure on prices. This way, Denmark has also benefited from productivity gains generated abroad. This has helped to ensure that the Danish economy has performed in line with comparable countries since 2007 when the focus is on prosperity developments in the broader sense of the word, cf. Chart 12.

Danmarks Nationalbank's projection and development in terms of trade Chart 11



Note: Left-hand chart: productivity is measured as GDP per employee.
Source: Danmarks Nationalbank and Eurostat.

Development in per capita prosperity in various countries in the period 2007-14 Chart 12



Note: "GNI" is average annual growth in the period 2007-14 in the real gross national income per capita for the population aged 20-64 years, adjusted for terms of trade. "Capital income" is the net return on foreign assets deflated by the index of import prices.
Source: Statistics Denmark, Eurostat, U.S. Census Bureau, Bureau of Economic Analysis, U.S. Department of Commerce.

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