Chapter 2

Selected themes

2.1 Focus on unemployment

Unemployment is currently low. Disregarding 2007-2008, where the Danish economy and labour market was overheated, the number of unemployed has never been lower.

The low level of unemployment can be attributed, among other things, to labour market reforms. These include, for example, the reduction of the unemployment benefit period by half and lower tax on labour income, which has increased the incentive to work. In addition, the improvement in the Danish economy is reflected in a marked increase in employment since 2013. Typically, the majority of an increase in employment is matched by a decline in unemployment. This was the case, for example, in 2005-2009. However, during the current recovery, the development has been more unusual.

Employment has risen at a high pace, and by early 2018 the number of wage earners set a new record. Unemployment has also diminished, but not to the same extent. Compared with previous recoveries, a larger share of employment growth has originated from an increase in the workforce, including due to an inflow of foreign labour and as a result of reforms. Lower unemployment has contributed less. Last time employment was as high as now - in the second quarter of 2008 - only 68,000 persons were unemployed. In March 2018 there were 112,000 unemployed, *cf. figure 2.1*.

Figure 2.1

Gross unemployment

Note.: In July 2017, unemployment increased as a result of changes in the data. See box 3.10 in *Economic Survey*, August 2017 (Danish only).
Source: Statistics Denmark and own calculations.

From 2016 to 2017, unemployment has risen slightly due to a number of technical conditions, including the fact that integration benefit recipients today to a large extent are considered labour-market-ready and therefore are included in the gross unemployment. Disregarding this, unemployment has stagnated throughout 2017.

This analysis looks at the driving forces behind the unemployment development since 2013, including why unemployment has not diminished more in line with the cyclical upturn. The analysis looks, among other things, on unemployment across age groups and investigates whether there are signs of mismatch problems, i.e. that unemployed do not have the skills that companies are looking for.

The main results of the analysis are:

- The level of unemployment has decreased sharply and is currently at a low level.
- For individuals over the age of 60 and to some extent for young persons between the ages of 25 and 29 unemployment is stagnant.
- There is no indication that people over the age of 60 have had a weaker affiliation to the labour market – quite the contrary. The participation rate has increased significantly and the age group has a low level of unemployment compared with other age groups.
- The unchanged unemployment for 25-29 year-olds should be seen in conjunction with greater graduate unemployment. Conversely, unemployment among young persons with vocational training or no education has decreased.
- Labour market pressure has risen, but it is not clear that there are signs of mismatch problems. Some indicators could indicate that the Danish labour market is increasingly characterized by mismatch problems. Others indicate that there are available resources with the relevant skillset for the companies to hire from.
- Mismatch problems are not considered to be the main driver of the stagnating unemployment in the current recovery.

The analysis is based on register data and only considers the development in unemployment excluding recipients of integration benefits, *cf. box 2.1 (below)*.
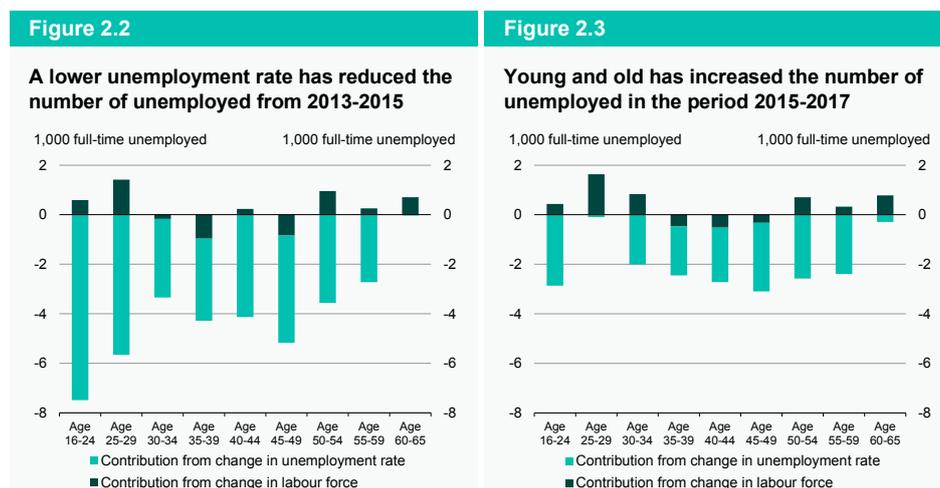
The population and cyclical position affect unemployment

The unemployment level peaked in 2012 and has generally been falling since. The drop in unemployment was largest between 2013 and 2015 (about 27.000 persons), while the pace has been lower during the following two years (about 13.000 persons from 2015 to 2017).

Many different conditions have affected unemployment in this period. Initially, two main effects are considered: the expansion of the *labour force* and the fall in *unemployment rates*.

The expansion of the labour force must be seen in the context of an increased population in Denmark. This means that the labour force has expanded, which in isolation increases the number of unemployed. At the same time, there has been a decline in the share of the labour force that is unemployed (a lower unemployment rate), which in isolation reduces the number of unemployed. This reflects, among other things, that the Danish economy currently is in an upturn where companies produce, invest and export more – and also employ more labour.

The drop in the number of unemployed in the period from 2013 to 2015 is mainly due to a lower unemployment rate, while a rise in the labour force for a number of age groups has had the opposite effect. This does not apply to persons aged 60 or over. The number of unemployed in this age group has increased in the period from 2013 to 2015. This is due to the fact that their unemployment rate, unlike the other age groups, has remained unchanged, while there are more elderly in the labour force, *cf. figure 2.2.*

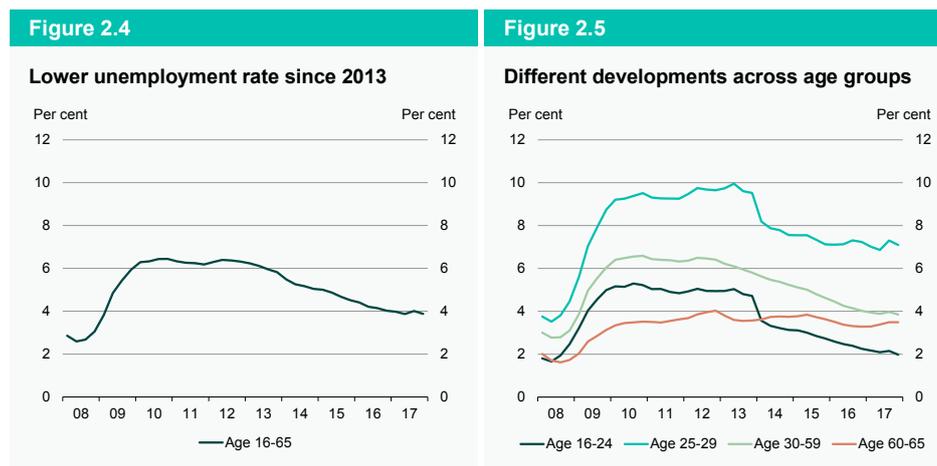| Figure 2.2	Figure 2.3
A lower unemployment rate has reduced the number of unemployed from 2013-2015	**Young and old has increased the number of unemployed in the period 2015-2017**

Note: Both figures show a decomposition of the change in the unemployment level on contributions from developments in the unemployment rate and the labour force. Changes are calculated from the fourth quarter in the respective years. The unemployment rate for 50-55 year olds may be underestimated as a result of the senior job scheme. The scheme means that persons who have exhausted the right to unemployment benefit less than five years before the retirement age are entitled to a senior job in the municipality of residence. Since 2013, there have been 3,000-4,000 persons in senior jobs on average. The drop in the unemployment rates for persons aged 16-24 years and 25-29 years in figure 2.2 should be seen in conjunction with the introduction of education assistance in the 2013 cash-benefit reform. Young cash-benefit recipients without a vocational education (or higher) was classified as available for education (as activity ready) rather than for employment (as labour market ready). This meant that a significant proportion of the young people were no longer included in the gross unemployment.

Source: Statistics Denmark and own calculations.

From 2015 to 2017, the fall in unemployment is driven by a continued, but more subdued decline in unemployment rates across age groups. However, young persons between 25 and 29 years and elderly (60-65 years) diverge. A larger labour force increases unemployment rates for both groups, while the unemployment rate of the age groups has only decreased slightly, *cf. figure 2.3.*

In the period 2013 to 2017, unemployment has decreased by approximately 40,000 persons. This corresponds to a fall in the unemployment rate - the number of full-time unemployed in per cent of the labour force - from approx. 6 per cent to 4 per cent, *cf. figure 2.4.*

Figure 2.4	Figure 2.5
Lower unemployment rate since 2013	**Different developments across age groups**

Note: The unemployment rate in both figures excludes recipients of integration benefits. See also the remark to figure 2.2. The workforce is calculated for 16-65 year olds and based on the employment statistics of employees and the registered gross unemployment, *cf. box 2.1*. The low unemployment rate for persons aged 16-24 year is partly due to the fact that students do not qualify for unemployment benefits, whereas they will count as part of the labour force if they have a job while studying.

Source: Statistics Denmark and own calculations.

Across age groups there are significant differences. For young persons between the ages of 16 and 24, as well as persons between the ages of 30 and 59, the unemployment rate has decreased since 2013. Conversely, the unemployment rate for the elderly and, to some extent, for young people between 25 and 29 years has been more or less unchanged, *cf. figure 2.5.*

It is especially surprising that the unemployment rate has not fallen more for 25-29-year-olds, as this age group has the highest unemployment rate (about 7 per cent in 2017). The unemployment rate for the elderly has been relatively unchanged, but the group has had a relatively low unemployment rate throughout the period (around 3.5 per cent in 2017).
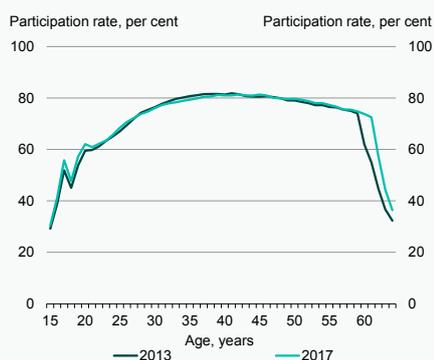
More elderly are part of the labour market
Since 2013, the participation of the elderly in the labour market has been significantly strengthened. Far more persons are in the labour market after the age of 60, partly because of retirement reforms.

As a result of the retirement agreement (2011), the early retirement age increased gradually from 2014, reaching 62 years in 2017. The higher early retirement age has increased the participation rate, i.e. the proportion of a given age group that are on the la-

bour market, either as employed or unemployed. In 2013, the participation rate fell sharply by the age of 60 – then, the early retirement age. In 2017, the participation rate first declined at the new early retirement age of 62 years, *cf. figure 2.6.*

Figure 2.6	Figure 2.7
Since 2013, more elderly have become part of the labour market	**The unemployment rate peaks the year prior to early retirement and retirement**
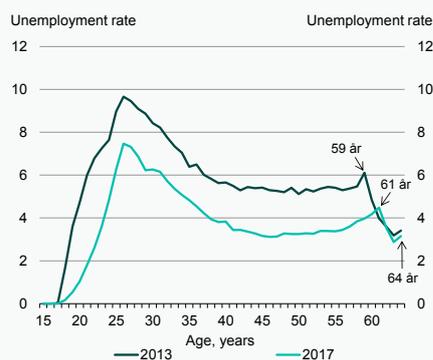
Note: The figures are based on fourth quarter of 2013 and 2017 respectively. The participation rage in figure 2.6 is excluding self-employed.
Source: Statistics Denmark and own calculations.

Later retirement from the labour force is estimated to have expanded the workforce by about 40,000 persons in the period 2013-2017, *cf. section 1.4 of the Economic Survey, December 2017.* This implies that this age group now has a much stronger labour market participation. By far the majority of persons in their early 60's are in employment, but there has also been a slight increase in the number of unemployed among the over 60 year-olds. Previously, many would probably have left the labour market permanently if they lost their jobs.

Unemployment still peaks just prior to the early retirement age. It may reflect that the incentive to apply for jobs is weaker just prior to retirement age or that it is harder to find employment when the remaining time-span on the labour market may be shorter. Similarly, a small peak in unemployment rates is also seen before the regular retirement age, *cf. figure 2.7.*

Higher unemployment rate for young people with higher education

There have also been changes in young people's participation in the labour market. In the wake of the financial crisis, many young people started an education. In recent years, these young people have begun to graduate and are now entering the labour market.

Across education level, there have generally been slight changes in the unemployment rates since 2015, when looking at all age groups as a whole. The unemployment rate has fallen the most (by about 1½ percentage point) for people with primary education as the

highest level of education, while it has increased slightly for people with higher educa-
tion, *cf. figure 2.8.*

Figure 2.8	Figure 2.9
Unemployment rate by level of education for all age groups as a whole	**Unemployment rate by level of education for 25-29 year-olds**
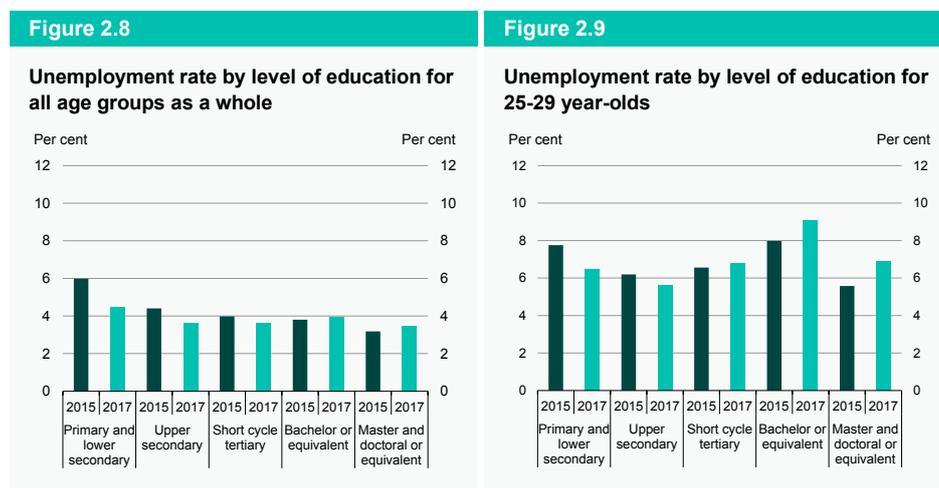
Note: People with unknown level of education are included in *primary and lower secondary*. The figure is based on
         the fourth quarter in 2015 and 2017, respectively.
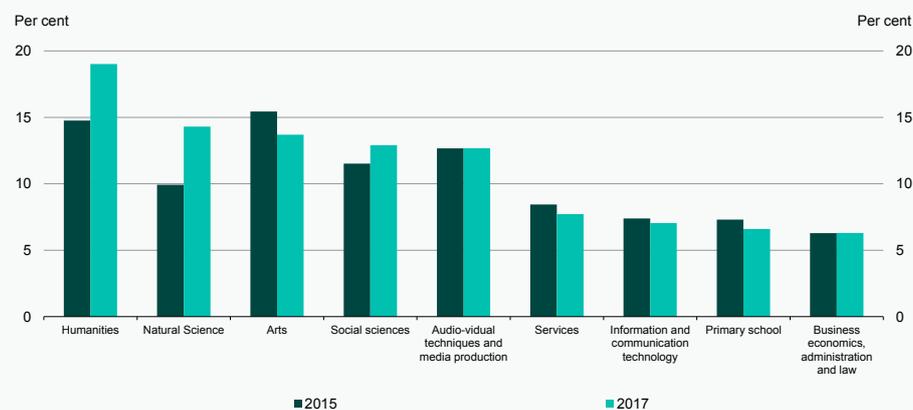Source: Statistics Denmark and own calculations.

However, for young people between 25 and 29 years, changes in unemployment rates
are more pronounced. There is still a decline in the unemployment rates for young peo-
ple, with, for example, primary school as the highest level of education. Since 2015 how-
ever, unemployment has increased especially for those with higher education. The in-
crease since 2015 was 1.1 percentage points for *bachelors or equivalent,* and 1.3 percent-
age points *masters etc.*, *cf. figure 2.9.*

It is especially young persons with education in *humanities, natural sciences* and *social
sciences* that have seen an increase in the unemployment rate. These subjects are usually
university educations. Conversely, the unemployment rate has, for example, fallen for
individuals with an artistic education, although they still have one of the highest unem-
ployment rates, *cf. figure 2.10.*

Humanities, natural sciences and *social sciences* cover a wide range of educations. In
the humanities, it is especially candidates from history and English that have seen an in-
crease in unemployment, while in natural science it is candidates from biology and bio-
chemistry that to a higher degree are unemployed. For social sciences, it is mainly can-
didates from psychology and sociology who have been affected by unemployment.

Figure 2.10

Unemployed 25-29 year-olds by educations with the highest unemployment rate in 2017
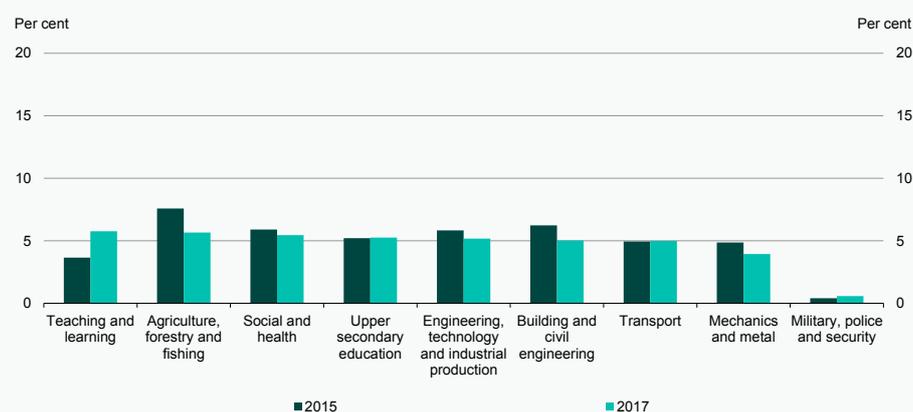

Note: The figure is based on the fourth quarter in 2015 and 2017. Persons with unknown level of education are in-
          cluded in *primary school*.
Source: Statistics Denmark and own calculations*.*

There are also a number of educations where unemployment among young people has
been low and decreasing. This is mainly vocational training in, for example, *building
and civil engineering, agriculture, forestry and fishing,* as well as *mechanics and met-
al, cf. figure 2.11*.

Figure 2.11

Unemployed 25-29 year-olds by educations with the lowest unemployment rate in 2017

Note: The figure is based on the fourth quarter in 2015 and 2017.
Source: Statistics Denmark and own calculations.

This indicates that an increase in unemployment among young unemployed with higher education in part explains why unemployment has not fallen more in recent years; *cf. also Dagpenge til nyuddannede, Økonomisk Analyse nr. 33*. In contrast, unemployment has decreased for individuals with shorter educations.

Skill level of the unemployed and demand from firms

The structures in the Danish labour market are sound. Structural unemployment, which expresses underlying unemployment in a neutral business cycle stance, has been declining since 2013 and is today at a very low level (around 4 per cent). The actual level of unemployment corresponds approximately to the structural level. This generally points to a labour market in balance.

One possible explanation for the slow decline in unemployment, may be that the skill-set of the unemployed does not match the demand from firms - a mismatch problem. Mismatch can keep unemployment high despite economic progress and may also reflect underlying structural trends.

Many factors determine the match between the individual applicant and the company. This counts, for example, professional skills, experience, education or residence, but also factors such as personality, which are more difficult to measure. It is very difficult to assess whether there are indications of mismatch or not, but a number of different indicators may give a clue.

One indicator is the so-called Beveridge curve. The curve shows the correlation between the number of job vacancies and the number of unemployed. Typically, there is a negative relationship, as the number of job listings often is high during a boom, while the number of unemployed is low and vice versa.

Currently, the number of vacancies increases - also across industries - without a corresponding decrease in unemployment, *cf. figure 2.12 (blue dots)*. It may be an indication of mismatch problems, but may also reflect other factors, such as a change in the efficiency of job search or in the structure of the labour market in general.

At the same time, companies are increasingly reporting a shortage of labour as a limiting factor for production. In all three main industries - industry, construction and private service - the level is currently high and in the absence of new reforms that expand the labour supply, there is a risk that bottlenecks will surge in the coming years.

Figure 2.12

The number of vacancies increase while unemployment is unchanged (Beveridge-curve)
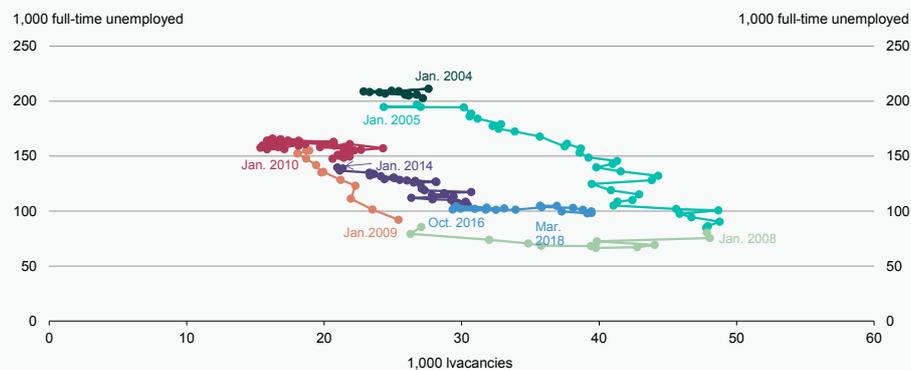
Note: The level of unemployment excludes integrations benefit recipients.
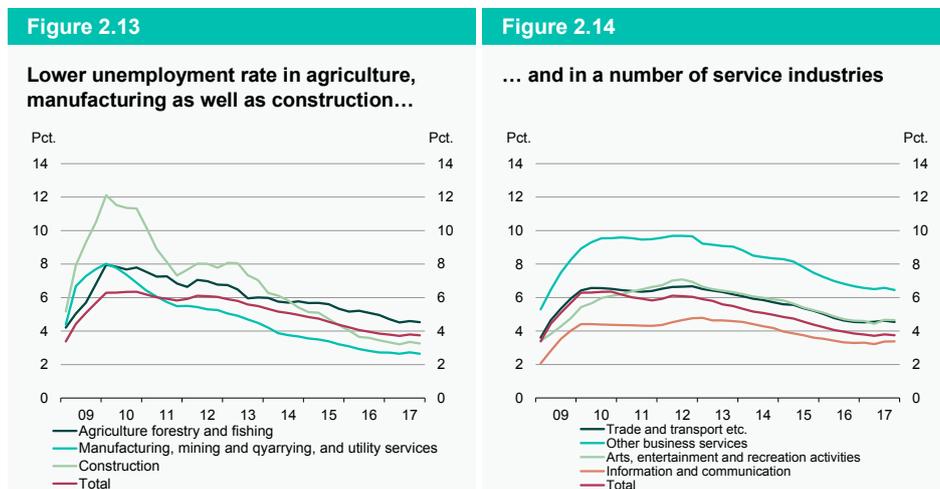Source: Statistics Denmark, Jobindsats and own calculations.

Educational level among the unemployed in the private sector

One mismatch indicator may be a consistently high unemployment level in certain industries or among persons with specific educations. This indicates that the unemployed do not have the skills or professional experience required.

Skills are not necessarily industry-specific, and one individual's qualifications can often be used in different industries. However, with certain reservations, it is possible to calculate the unemployment in a given industry (based on the most recent employment) and formal qualifications of the unemployed in the form of educational attainment, *cf. box 2.1.*

Since 2013, the decline in unemployment has been greatest among persons with previous employment in *construction* and *manufacturing, mining and quarrying, and utility services*. With an unemployment rate of 3.3 per cent and 2.6 per cent respectively, unemployment is low in historical terms, *cf. figure 2.13.*

The unemployment rate among persons who have been employed in the service industries has also declined since 2013, but the decline has been less steep than in the other industries. The highest unemployment rate (approximately 6.5 per cent in 2017) is found in *other business services*, which includes a wide variety of services, from temporary employment agency and cleaning services to engineers, lawyers and architects, *cf. figure 2.14.*

Figure 2.13

Lower unemployment rate in agriculture, manufacturing as well as construction…

Figure 2.14

… and in a number of service industries

Note: Industry based on most recent employment and for individuals age 30 or older. See also box 2.1.
Source: Statistics Denmark and own calculations.

If the unemployed do not have the skillset or experience that the firms require, it may explain why they have trouble finding employment despite generally good job opportunities. It is often a hypothesis that unskilled workers find it hard to find a new job if they become unemployed as they lack documentation for their skills. Comparing the level of education among employed and unemployed in the industries generally shows small differences, *cf. figure 2.15*.

Figure 2.15

The educational composition of employed and unemployed is more or less the same in each industry
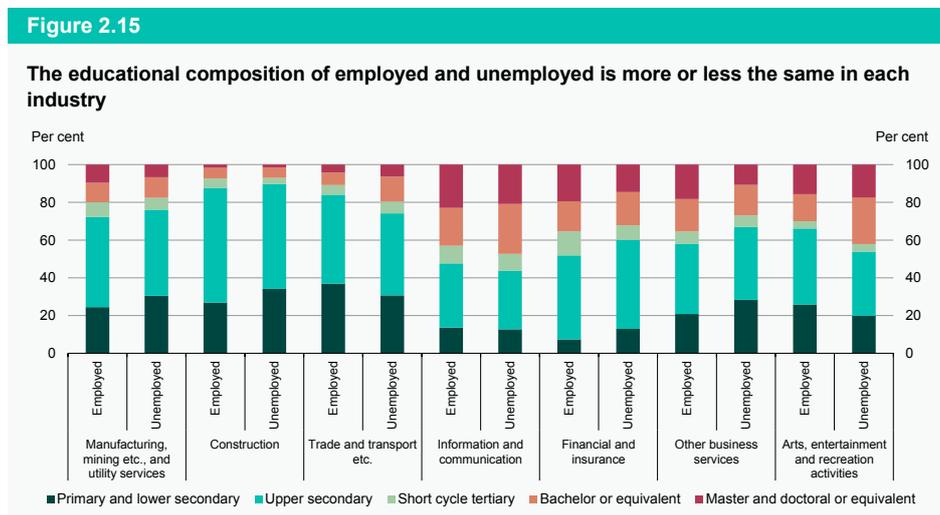
Note: The figure is for fourth quarter 2017. Individuals with unknown education are included in primary schooling.
Source: Statistics Denmark and own calculations.

Within services, the differences in some sub-industries are more pronounced than in *manufacturing, mining etc., and utility services* and *construction.* In *other business services* there is a larger share of unemployed persons with *primary and lower secondary education* than among the employed. Conversely, unemployed with higher education are underrepresented compared to those employed in the industry. This may indicate that low-skilled unemployed, who have previously worked in this industry, find it more difficult to find employment than low-skilled in other industries.

Overall, it indicates that the qualifications of the unemployed (based on the level of education) in general match corporate demand (based on the employees' level of education). However, this is based on relatively aggregated education groups, and the differences may be more pronounced if you make a finer definition of the education groups.

In addition, foreign labour has contributed significantly to employment growth in Denmark in recent years. Thus, the composition of education among unemployed in Denmark does not give the full picture of the recruitment base available for the firms.
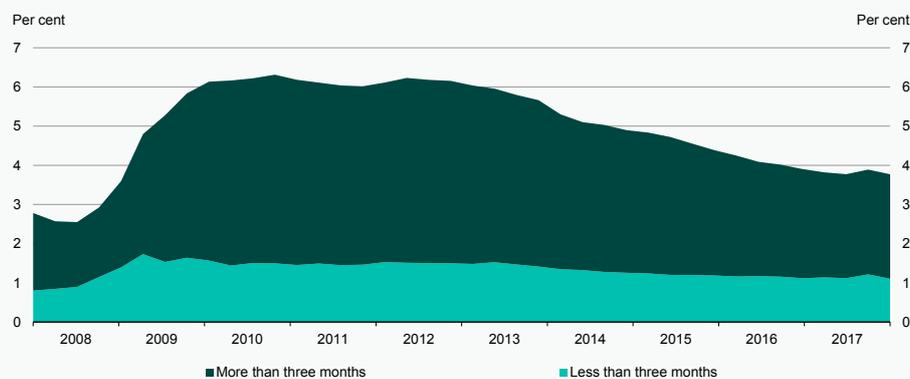
Duration of unemployment

Another indication of mismatch problems is a tendency towards long-term unemployment in specific industries compared to other.

In general, the decline in unemployment since 2013 is mostly due a decline in the number of long-term unemployed (more than three months), c*f. figure 2.16*.

Figure 2.16

The short term unemployment rate has been relatively constant

Note: The duration of the unemployment spells is calculated as the total length of a given unemployment period. For shorter breaks in the unemployment period of less than four weeks, the duration is calculated as one continuous unemployment spell.
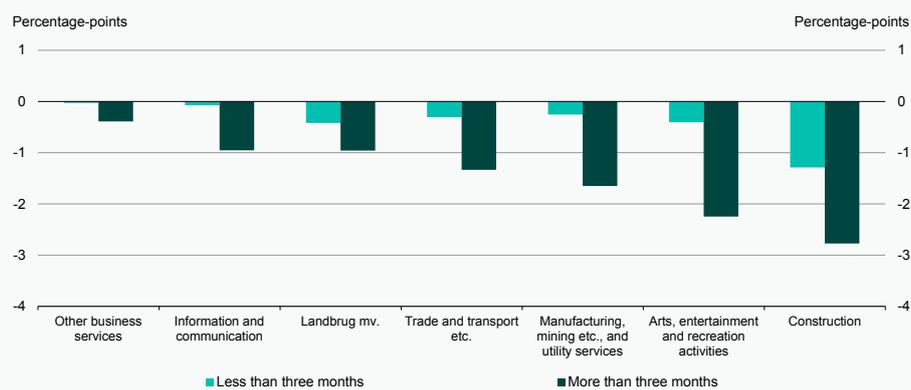Source: Statistics Denmark and own calculations.

In contrast, short term unemployment, for example related to seasonal work and job changes, has remained roughly unchanged. A certain level of short term unemployment

is expected in an adaptable economy with a dynamic labour market. The same trend is seen across industries, c*f. figure 2.17*.

Figure 2.17

Small declines in the short term unemployment rate except for construction since 2013

Note: The figure shows changes in the unemployment rate for short term and long term unemployment from the fourth quarter of 2013 to the fourth quarter of 2017. See also note to figure 2.16.
Source: Statistics Denmark and own calculations.

Only *construction* stands out with a marked decline in the short term unemployment rate of 1.3 percentage points since 2013. This is a significantly larger decline than for the other industries. Construction is highly cyclical, and the short term unemployment rate was therefore significantly higher here after the crisis than in other industries. With the large drop since 2013, the short term unemployment rate in construction is now on the same level as in other industries.

Across industries there is no clear indication of mismatch. There is in general a pool of unemployed to recruit from and there are indications that the unemployed have the relevant skillset that make them potential employees. However, this does not rule out the possibility of recruitment problems for some companies and within certain job functions and industries.

### Geographical mobility in the labour market

Discrepancy between supply and demand can also occur if the unemployed persons live and search for jobs other than where the job vacancies are. An indicator of the number of vacancies is the number of job postings (though not all vacancies are advertised). The larger the fraction of job postings to the number of unemployed, the sharper is the competition for the available labour.

There is considerable variation across municipalities and employment regions in how many unemployed persons there are for each job vacancy. In Central Jutland, the competition for the unemployed was sharpest in 2017 with about 350 available job vacancies

per 1,000 full-time unemployed. In North Jutland there were almost 200 vacancies per 1,000 full-time unemployed, c*f. figure 2.18*.

Figure 2.18

Job vacancies per unemployed varies between employment regions

Job vacancies per 1,000 full-time unemployed .... Job vacancies per 1,000 full-time unemployed
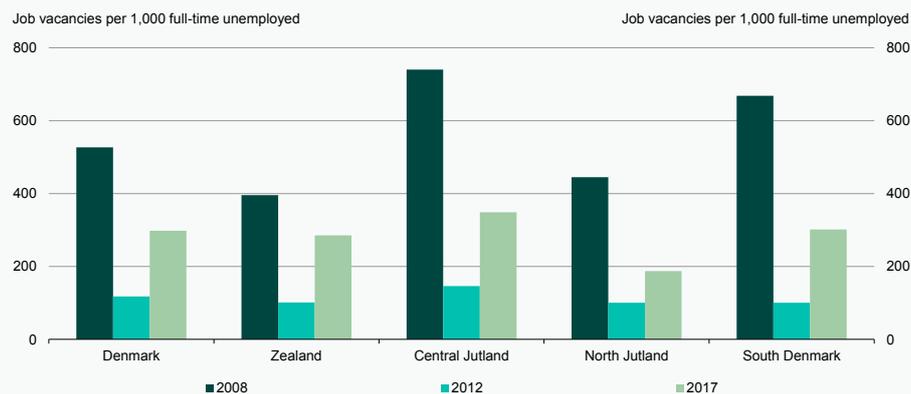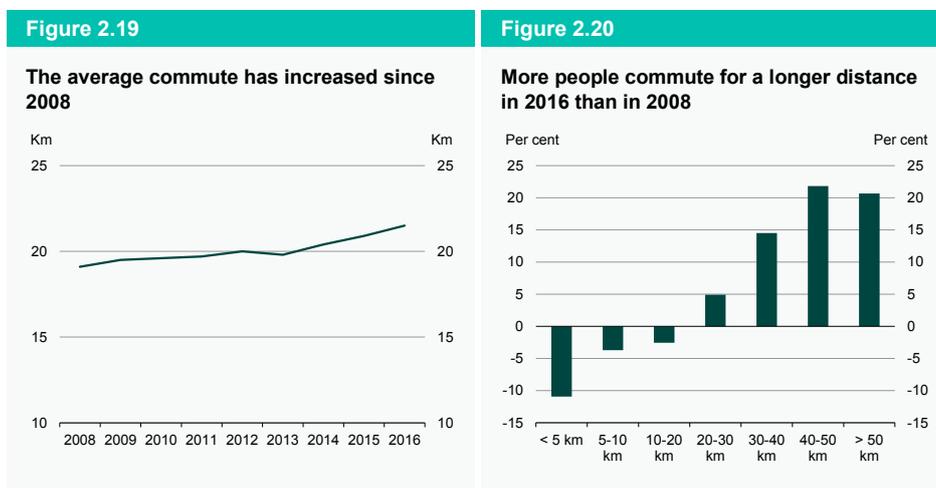

Source: Statistics Denmark, Jobindsats and own calculations.

In 2008, where the labour market was overheated, the level of job vacancies was higher than now. For the country in general there were approximately 500 vacancies per 1,000 full-time unemployed, which is almost twice as many as in 2017. Conversely, there were only about 100 vacancies per 1,000 full-time unemployed, when the labour market was at the lowest in 2012.

Unemployed persons can of course live in one municipality and search for work in another. Therefore the number of job vacancies per unemployed person within the employment region does not necessarily give the full picture of labour market tightness across employment regions.

This is seen, among other things, by the fact that geographical mobility has increased since 2008. The average commute has increased by 2.4 km from 2008 to 2016, where it amounted to 21.5 km, c*f. figure 2.19*.

Figure 2.19	Figure 2.20
The average commute has increased since 2008	**More people commute for a longer distance in 2016 than in 2008**

Note: The commuting distance is calculated for employed persons in November each year and measures the distance from residence to workplace.

Source: Statistics Denmark and own calculations.

In particular, the number of persons with long commutes has increase since 2008. In 2016 there were 20 per cent more persons, who commuted over 50 km to get to work than in 2008, c*f. figure 2.20*.

Across the country it is particularly people in West and South Zealand that have the longest commutes. On average, people from this part of the country commute about 30 km to get to work. Conversely, commuters living in the metropolitan area have the shortest distance to work.

When persons are willing to commute a longer distance, it helps to attenuate the tightness of the local labour market.

When the labour market was overheated in 2008, there was significantly greater difference in the tightness of the labour market across municipalities (measured as the fraction of job vacancies to unemployed persons). However, the gap has narrowed in the wake of the financial crisis and has remained roughly unchanged since 2010, c*f. figure 2.21*.

This indicates that the current upturn in the labour market is geographically broad based.

Figure 2.21

Differences in job vacancies per unemployed across municipalities have narrowed since 2008
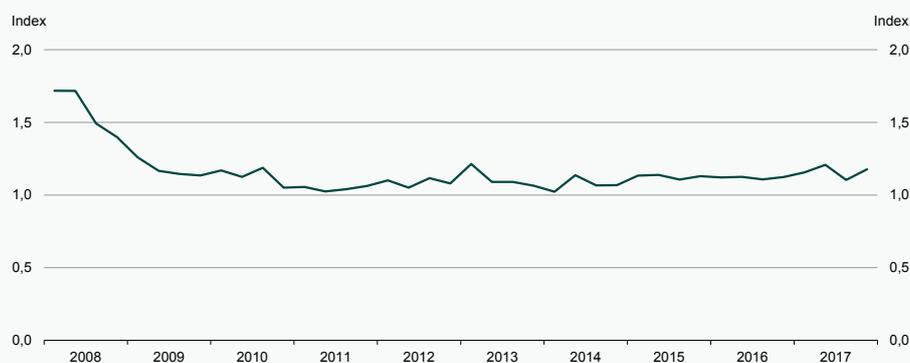
Note: The figure shows the relative deviation between municipalities and the national average. The deviations are
         squared and weighted with the municipality's share of the total labour force. Index 1 corresponds to the
         same number of vacancies per unemployed across municipalities. The figure is excluding Fanø and Læsø.
Source: Statistics Denmark, Jobindsats and own calculations.

Boks 2.1

Calculation of unemployment in the analysis

In the analysis, unemployment is calculated on the basis of register data (the register for persons receiving public transfers). Unemployment is calculated as full-time unemployed persons. Recipients of integration benefits are not included (calculated on the basis of the database DREAM).

The labour force, which is used to calculate the unemployment rate, is based on the employment statistics of employees and the registered gross unemployment. The registered employment for employees includes wage earners where the employers report the income to SKAT's e-income register. Self-employed persons, for example paid through the company's profits, are not included in the statistics and therefore not in the labour force measure used in the analysis. All employees are included regardless of whether they work full-time or part-time. This corresponds approximately to the measure in the national accounts. The labour force is corrected for unemployed persons in subsidized employment, as they are included both in the unemployment statistics and the register of employees.

The analysis covers people aged 16-65, as the register for recipients of public benefits covers this age group.

Unemployment across industries

In the analysis unemployed across industries is calculated for individuals over the age of 30 and based on most recent employment. The calculation is based on the register of employees, which do not start until 2008. In the first years there is a relatively brief period to form the measurement upon. Therefore, the first years should be interpreted with caution.

Job requirements are not necessarily industry-specific, and unemployed can seek employment in other industries than their latest employment. The majority of persons in the statistics have been employed in more than one industry in the period 2008-2017. Unemployment by industry must be seen in this light.

2.2 Evaluation of forecast accuracy

The accuracy of the forecast in Economic Survey is subject to regular evaluations. The evaluations are designed to investigate the performance of the forecasts in Economic Survey compared with forecasts from other institutions and whether these forecasts are subject to systematic errors. The latest evaluation was completed in 2014.[1]

Since then, Statistics Denmark has made two major revisions of the national accounts. The revisions have caused significant increases in annual GDP growth, especially in the years following 2010, and a changed view of the strength of the post-crisis recovery, *cf. figure 2.22*. The also has implications for the interpretation of the forecast deviations in recent years.

Figure 2.22

Significant revisions to annual GDP growth from first to last estimate
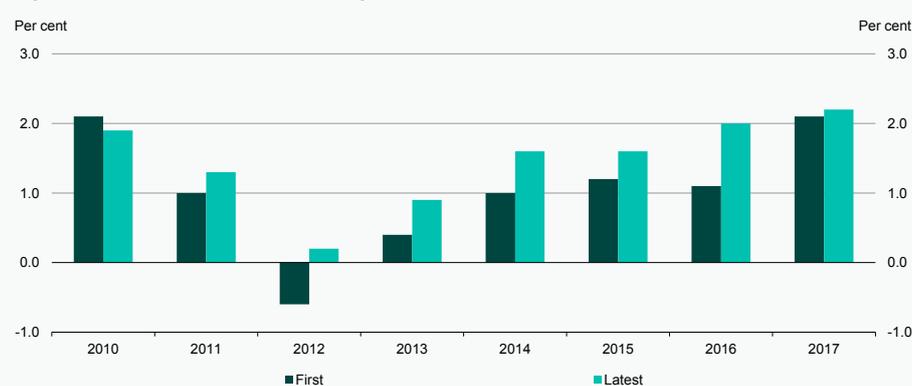
Note: *First* shows the annual GDP growth, which is published at the time of the first estimate of the national ac-
        counts for the fourth quarter of the year. *Latest* is the annual growth by the latest version of the national ac-
        counts (April 5, 2018).
Source: Statistics Denmark.

This section examines the accuracy of the GDP estimate in the forecasts in Economic Survey and compares them with GDP estimates from other institutions. In this context, it is important to remember the fact that various other elements of the forecast are equally as important as the GDP estimate when planning of economic policy. Among these are estimates of the public balance, unemployment and employment or the assessment of whether imbalances are building up, for example on the housing market.

A summary of methodology, the basis for comparison, and the main results are given in box 2.2.

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[1] Ministry of Economics and the Interior (2014), *Hvor godt rammer prognosen i Økonomisk Redegørelse?*, Economic Analysis no. 20.

Box 2.2

Methodology and main results

The forecast in Economic Survey (Economic Overview before 2000) is compared with forecasts from the Danish Economic Council (DØR), the Confederation of Danish Industry (DI), Nordea (formerly Unibank and Privatbanken, NDA), Danmarks Nationalbank (NB), the European Commission (EU), and the OECD. This is a non-exhaustive list of institutions that make forecasts for the Danish economy but the institutions are selected based on significant history. They have also been the basis for comparison in previous forecast evaluations.

The analysis is focused solely on the estimates of GDP growth, which is the most widely used and comprehensive measure of economic development. According to Statistics Denmark, the estimates of quarterly GDP growth are subject to uncertainty in the range of ± 0.5 percentage points. Estimates of other key figures may, however, be of equal relevance and importance to the planning of economic policy and assessment of the current economic situation, notably labour market developments.

Forecasts are prepared and published regularly throughout the year. The later a forecast is prepared, the more information is available. Thus, in order to best compare the accuracy of the forecasts, the last published forecast that year is used. This ensures, as far as possible, that GDP estimates are comparable. As the December Economic Survey is prepared later than the forecasts of most other institutions and as such has an information advantage, the comparison also includes the forecast from the August Economic Survey.

As a basis for comparison of the accuracy of the forecasts, the first preliminary publication of the national account for the year is used. This approach has also been used in previous forecast evaluations and additionally allows for the inclusion of 2017-forecasts in the comparison. The evaluation, however, also includes a comparison between the forecasts and the revised national account figures in order to assess the importance of subsequent revisions of the national account figures.

As baseline (or where nothing else is stated), the comparison uses GDP estimates for the following year (t+1), however, some of the comparisons are made with current year forecasts (t) or with forecasts regarding two years later (t+2).

In summary, the analysis gives rise to the following statements:

- Generally, there is no big difference in accuracy between institutions.
- The accuracy of the estimates in Economic Survey is among the better.
- Generally, there are no signs of systematic forecast errors in the Economic Survey.
- All forecasters have to some degree overestimated GDP growth since the beginning of the 2000's. That is to be interpreted in the context of the fact that the setback during the financial crisis was significantly greater than anticipated.
- The two revisions of the national accounts in 2014 and 2016, significantly increased GDP growth for the years 2010 to 2015. Compared to the revised national accounts, the forecast deviations are smaller, especially for the years 2012 and 2013, but not insignificant.

## Tendency to uniform forecasts among institutions

An accurate forecast in this context is a forecast that, with some certainty, predicts GDP growth in the following year. For 2017, the growth rate was 2.1 per cent according to the first publication of the national accounts for that year (February 28, 2018). In *Economic Survey*, December 2016, the growth forecast for 2017 was 1.5 per cent. Thus, growth was underestimated by 0.6 percentage points.

The Economic Survey cannot forecast the actual growth rate accurately. For some years growth was higher than estimated, in other years growth was lower.

In particular, there seems to be a tendency towards underestimating growth in periods of strong economic expansion, as for example in 2005-2006, and overestimating growth in periods of relatively slow pace, as in 2011-2016, or even negative GDP growth. This was the case in 2009, where the magnitude of the setback was significantly underestimated, *cf. figure 2.23.* Nevertheless, there are no signs of systematic forecast errors in the sense that estimates are systematically too high or too low, *cf. below.*

Figure 2.23

**Estimates are mostly prone to skewness when growth is very high or very low**
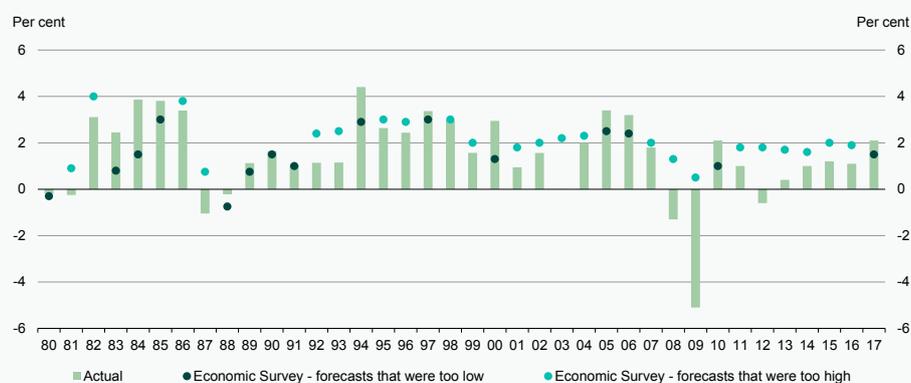
Source: Statistics Denmark and various editions of Economic Survey/Economic Overview.

This tendency is also seen among other forecasters. This should be seen in conjunction with the fact that different institutions' forecasts for the Danish economy are largely based on the same basic economic understanding and typically the same information and indicators for the condition of the Danish economy, which in themselves may be associated with considerable uncertainty. This also applies to the assumptions underlying the economic models, which are used in the preparations of the forecasts.

Thus, there is a relatively strong consensus on various institutions' GDP estimates. Consensus has been particularly pronounced in recent years*, cf. figure 2.24.*

Figure 2.24

Small spread in growth estimates by various forecasters

Per cent   Per cent
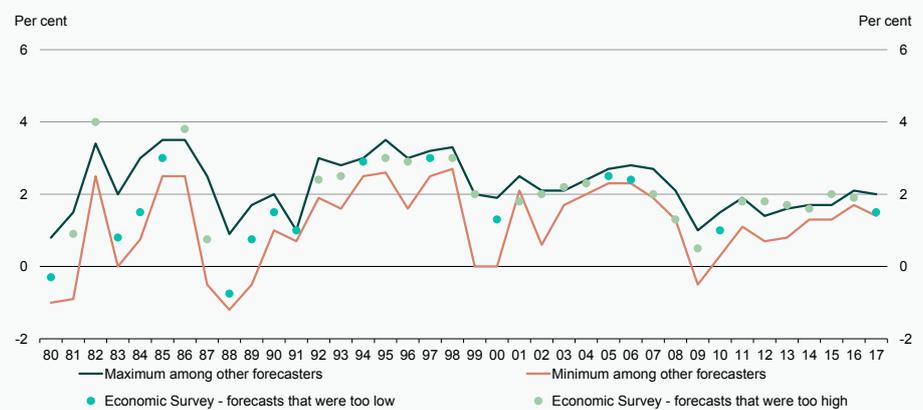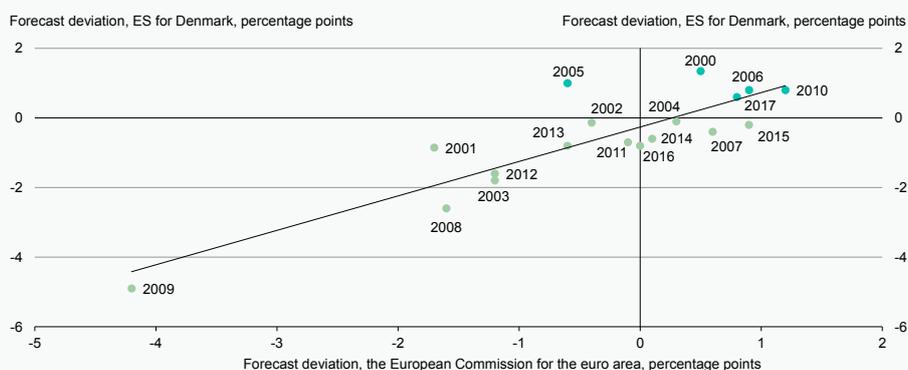
Source: The Danish Economic Council, the Confederation of Danish Industry, Danmarks Nationalbank, Nordea, the
           European Commission, and the OECD and various editions of Economic Survey/Economic Overview.

In addition, the tendency towards uniform estimates should also be seen in conjunction with the fact that the various institutions largely base their forecasts on the same assumptions about developments in the international economy, which for a small, open economy such as the Danish is often a decisive factor with regard to economic development.

International organizations' estimates of growth in the global economy form the basis of many forecasts, including the Economic Survey, and as such naturally affect the accuracy of the forecasts. Thus, a significant source of discrepancy in the estimate for the Danish economy is assumptions about the economic development among Danish trading partners, which turn out wrong.

This is shown, among other things, by the fact that the deviation of the forecast in the Economic Survey is closely correlated with the deviation of the forecast for growth in the euro area by the European Commission, *cf. figure 2.25*. A similar result is found for other institutions.

Figure 2.25

Developments in the international economy is important for accuracy

Forecast deviation, ES for Denmark, percentage points   Forecast deviation, ES for Denmark, percentage points

Note: Each point in the figure shows the deviation for one year. The green observations are years where the fore-
cast for Danish growth was too high, while the light blue observations are years where the forecast was too
low. Forecast deviations for the euro area are calculated similarly to forecast deviations for the Danish
economy in Economic Survey but are based on the European Commission's estimates for the growth of the
euro area in the autumn forecasts.

Source: The European Commission, Statistics Denmark, various editions of Economic Survey (ES)/Economic Over
view and own calculations.

Comparison of forecasts from different institutions

There are several approaches to assessing the accuracy of economic forecasts. This anal-
ysis focuses on three approaches: the average numerical deviation, the root-mean-
square error, and a comparison with a mechanical estimate.

The *average numerical forecast deviation* is the most common approach. The numeri-
cal average is used instead of the average in order to avoid negative deviations in some
years offsetting positive deviations in other years. A smaller numerical mean deviation
thus reflects better accuracy.

At first glance, there are no major differences between the institutions when measured
on the basis of the mean numerical deviation. The forecasts from the Economic Survey
are generally in the better half, but common for all institutions is that on average the de-
viations are not insignificant.

The forecasts for the following year in the Economic Survey have since 1980 had an av-
erage numerical deviation of 0.95 percentage points against, for example, 1.08 and 1.06
percentage points for the Confederation of Danish Industry and Danmarks National-
bank respectively, *cf. figure 2.26.*

Figure 2.26

Forecasts from the Economic Survey perform reasonably well when measured by the average numerical forecast deviation
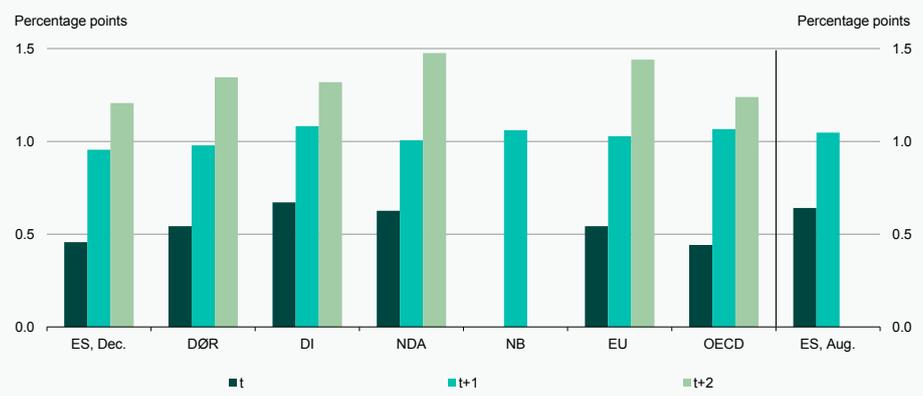
Note: Forecasts from Danmarks Nationalbank for periods t and t+2 are not available until 2007 and 2009 respectively and thus are not included. The figure covers the period 1980-2017, however only 1993-2013 for period t+2 as 1993 was the first year to feature forecasts two years ahead in the Economic Survey.

Source: Statistics Denmark, the Danish Economic Council, the Confederation of Danish Industry, Danmarks Nationalbank, Nordea, the European Commission, and the OECD and various editions of Economic Suvey /Economic Overview and own calculations.

Economic Survey, December is being prepared a little later in the year than the estimates from other institutions and thus has slight information advantage.

The forecasts in the Economic Survey typically become slightly more accurate as the year progresses and new information can be incorporated. The improvement, however, is relatively modest. The average numerical forecast error for the period 2000-2017 is thus 0.1-0.2 percentage points lower for the December forecast compared to the August and May forecasts, *cf. Appendix 2.1.*

Using instead the August forecast as a basis for comparison, the Economic Survey remains on par with the other institutions.

The average numerical deviation assigns equal weight to all forecast deviations. It may, however, be relevant in the comparison to weigh large deviations higher than small deviations. For example, a forecast deviation of several percentage points will be more important in terms of economic policy and public finances, while a minor deviation may be less relevant.

A method commonly used in this context is the *root-mean-square error* (RMSE). As the forecast deviations are squared, major deviations will more heavily impact the average error.

Nothing implies that the forecast in the Economic Survey should be more prone to large forecast deviations than other institutions. The forecast deviations in the Economic Survey are among the lower by this measure. Forecasts for the following year in the Eco-

nomic Survey have had an RMSE of 1.32 percentage points compared to for example 1.31 and 1.52 percentage points for the Danish Economic Council and Danmarks Nationalbank respectively, *cf. figure 2.27*.

Figure 2.27

The Economic Survey performs relatively well measured by the RMSE
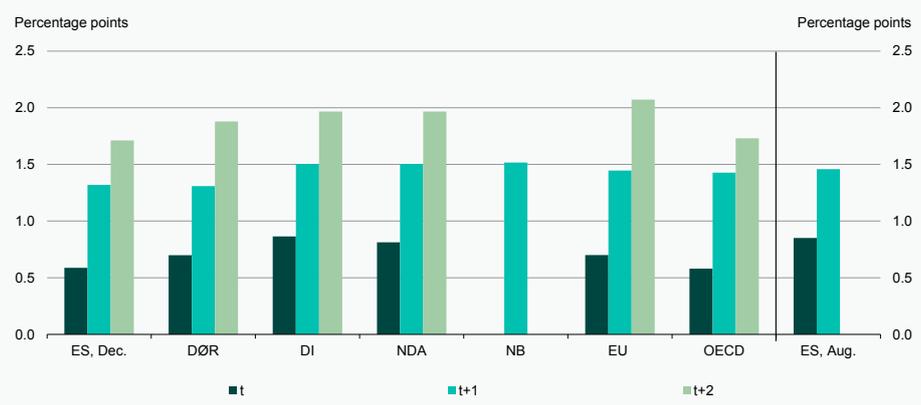
Note: See also note to Figure 2.26.
Source: Statistics Denmark, the Danish Economic Council, the Confederation of Danish Industry, Danmarks Nationalbank, Nordea, the European Commission, and the OECD and various editions of Economic Survey /Economic Overview and own calculations.

One can also evaluate the quality of information in the forecast. This is typically done by comparing with a *mechanical estimate*. A mechanical estimate may for example be an assumption that growth the following year will be the same as a historical average.

If a forecast does not perform better than a mechanical estimate, it is a sign that the information from the forecast is limited. In such comparisons, it is useful to look at the so-called Theil coefficient, which compares the spread in deviations from the forecast with the spread in deviations from the mechanical alternatives. A Theil coefficient of less than one indicates that the information content in the forecast is better than the mechanical alternative.

The various forecasts are all better than the mechanical alternative. For example, in the December Economic Survey, the Theil coefficient is 0.66 when the mechanical alternative is the average rate of growth for the previous 10 years. The Economic Survey estimate for growth in the following year also performs well compared to other institutions, although the difference across forecasters is fairly limited, *cf. table 2.1*.

The forecasts in the Economic Survey are also among the better ones, both when examining the entire period since 1980 and for different periods of time, *cf. Appendix 2.1*. This finding is consistent across all three mechanical alternatives.

Table 2.1

Comparison with mechanical alternatives

	ES (Dec.)	ES (Aug.)	DØR	DI	NDA	NB	EU	OECD
Theil coefficient − comparison with growth estimates based on average growth rate for:								
- Last 10 years	0.66	0.72	0.67	0.77	0.77	0.76	0.70	0.72
- Last 5 years	0.63	0.69	0.63	0.73	0.73	0.73	0.67	0.68
- Last year	0.50	0.55	0.51	0.59	0.59	0.58	0.54	0.55

Source: Statistics Denmark, the Danish Economic Council, the Confederation of Danish Industry, Danmarks Na-
tionalbank, Nordea, the European Commission, and the OECD as well as various editions of Economic Sur-
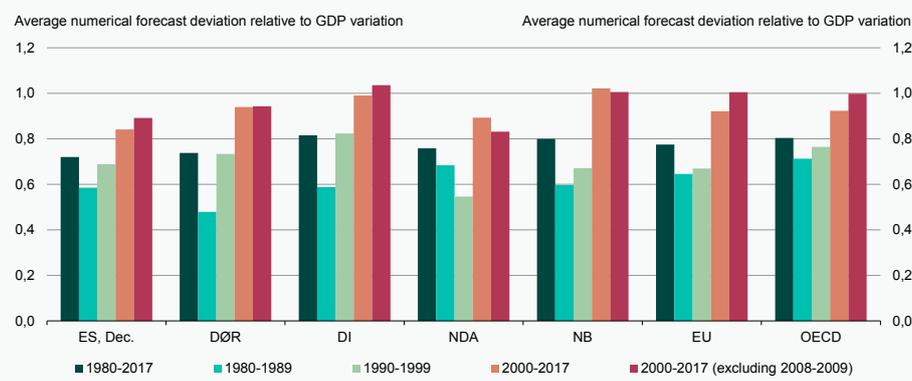vey/Economic Overview and own calculations.

Forecast accuracy over time

The forecasts in the Economic Survey thus perform relatively well in comparison with
forecasts from other institutions. There are, however, no signs that the Economic Survey
or other institutions have become more accurate since the 1980s – quite the contrary in
fact. There is no clear explanation of why this is the case. This might be due, for exam-
ple, to the fact that economies have become more complex and that the increased inter-
nationalization results in economic downturns quickly spreading from one country to
another.

Forecast accuracy over time can be illustrated by dividing the average numerical forecast
deviation over time with the variation in GDP growth (measured by the standard devia-
tion). The smaller the ratio, the greater the information content in the forecasts. A ratio
greater than one indicates that the average forecast deviation exceeds the usual variation
in GDP growth and thus that the forecasts are not particularly informative.

Measured this way, the forecasts in the Economic Survey have not improved since the
1980s. Accuracy was highest in the 1980s and 1990s, but has decreased somewhat in the
new millennium. This also applies to the other institutions, *cf. figure 2.28*.

Figure 2.28

Economic forecasts have not become more accurate over time

Source: Statistics Denmark, the Danish Economic Council, the Confederation of Danish Industry, Danmarks Nationalbank, Nordea, the European Commission, and the OECD as well as various editions of Economic Survey/Economic Overview and own calculations.

Disregarding the years of crisis, 2008 and 2009, does not matter much, as the reduced variance in GDP is equivalent to the reduction in forecast deviations. Compared with the other institutions, the forecasts in the Economic Survey perform reasonably well for the entire period and for most sub-periods. However, in the 1980s the forecast deviations from the Danish Economic Council were smaller than the forecast deviations in the Economic Survey, while in the 1990s the forecasts from, for example, the European Commission and Danmarks Nationalbank performed better.

Are there systematic errors in Economic Survey?

International studies have shown that forecasters make systematic forecast errors over the business cycle. This is partly due to a tendency for more gradual revisions of forecasts during reversal of the business cycle, which forecasters may be slow to perceive.[2]

Thus, it is relevant to investigate whether the forecasts in the Economic Survey are subject to systematic errors. If the GDP forecasts are systematically too high or too low it may lead to errors in economic policy. A similar effect could arise if the fluctuations in GDP growth are generally over- or underestimated.

Systematic forecast errors can be detected using a linear regression to determine the correlation between actual growth and forecast in the Economic Survey. A constant different from zero may be a sign of systematic over- or underestimation of growth.

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[2] See e.g. Dovern, Jonas og Nils Jannsen, Systematic errors in growth expectations over the business cycle, International Journal of Forecasting, 33, 2017, pp 760-769 and Carnot, N. et al., *Economic Forecasting, Palgrave Macmillan UK, 2005,* pp 235-250.

At a first glance, the regression shows signs of growth overestimation (a negative constant), *cf. figure 2.29*. The coefficient, however, is not statistically significant and is also heavily influenced by the development in 2008-2009, where GDP declined considerably more than predicted by all forecasters. Disregarding 2008 and 2009, the result is a clearly insignificant constant, *cf. figure 2.30*. In other words, there is no indication that the forecasts in the Economic Survey systematically over- or underestimate GDP growth.

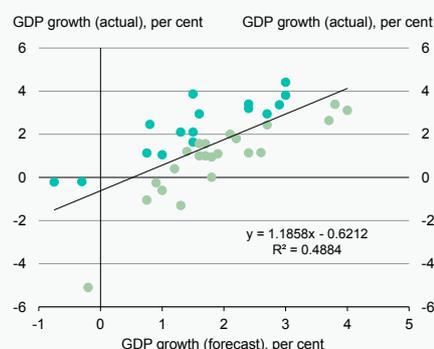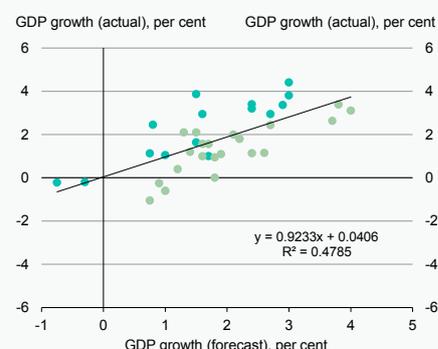| Figure 2.29	Figure 2.30
Systematic errors in the Economic Survey? – not statistically significant	**Same regression excl. 2008-2009 – no signs of systematic errors**

Note: The regression in Figure 2.29 is for forecasts from the Economic Survey for 1980-2017. Figure 2.30 shows the same regression and time period, but excl. observations for 2008 and 2009. The green observations are years where the forecast for Danish growth was too high, while the light blue observations are years where the forecast was too low

Source: Statistics Denmark and own calculations.

A regression coefficient different from 1 may indicate a tendency for systematic errors in the assessment of fluctuations in GDP growth. For the entire period 1980-2017, the regression coefficient is almost 1.2 (although not statistically significantly different from 1), which may indicate that forecasts slightly overestimate fluctuations in GDP growth. Disregarding again 2008 and 2009, the opposite is found as the regression coefficient is smaller than 1, but still not significantly different from 1.

Thus, there are no signs that the estimates in Economic Survey systematically over- or underestimate GDP growth or its fluctuations. Corresponding tests show the same finding for other institutions.

Another approach to investigating systematics in the deviations is to measure the proportion of forecasts that overestimate growth. For example, if the forecasts as a general rule estimate too high growth rates, that might be a signs of over-optimism.

The forecasts in the Economic Survey have overestimated GDP growth the following year in 58 per cent of all forecasts since 1980. That is on par with Danmarks National-

bank and the OECD. Nordea and the European Commission have slightly larger shares
of overestimation, while the Danish Economic Council and the Confederation of Danish
Industry have overestimated a slightly smaller share of their forecasts, *cf. figure 2.31.*

Figure 2.31

Measure by the proportion of forecasts that overestimate GDP growth, the Economic Survey is in the middle of the field
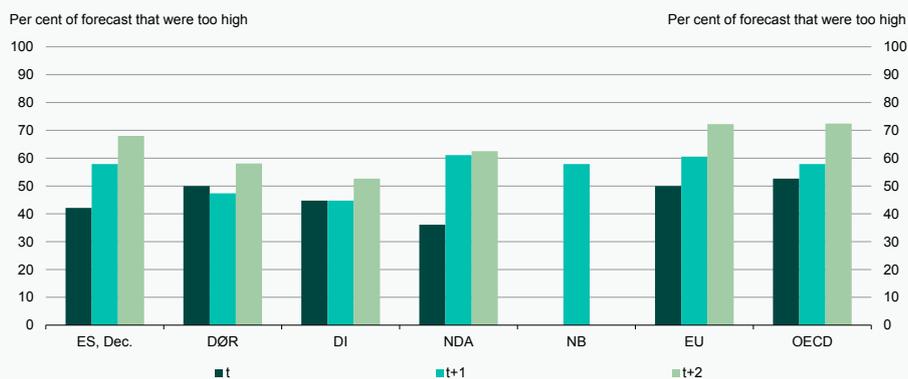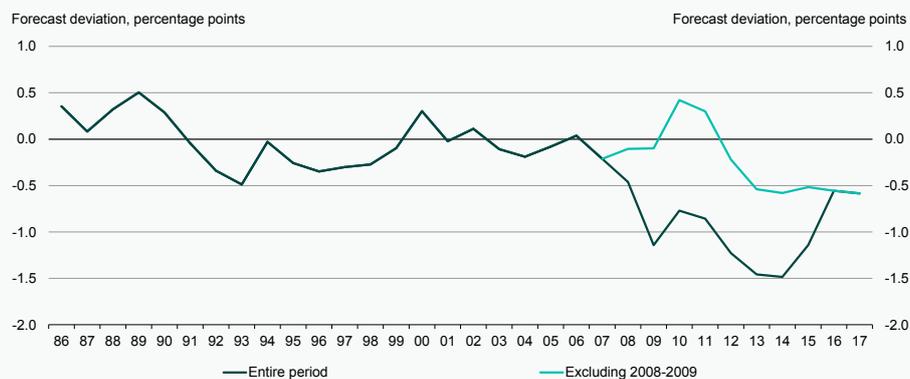

Note: See note to figure 2.26.
Source: Statistics Denmark, the Danish Economic Council, the Confederation of Danish Industry, Danmarks Na-
         tionalbank, Nordea, the European Commission, and the OECD as well as various editions of Economic Sur-
         vey/Economic Overview and own calculations.

Particularly the recent years have been characterized by a tendency to overestimate GDP
growth. That is to a large extent due the large difference between expected and actual
growth during the financial crisis. The significant overestimation of growth thus results
in a significant forecast deviation, which carry over if the deviation is measured as a
moving average. Disregarding 2008 and 2009, there are no clear signs of systematic
tendencies to overoptimism in the various forecasts, *cf. figure 2.32.*

It should also be noted that Statistics Denmark's revisions of the national accounts in
2014 and 2016 generally have raised GDP growth since 2010. In comparison with the
revised national accounts, there is even less evidence of overoptimism, *cf. below.*

Figure 2.32

No sign of systematic tendency to overoptimism when 2008 and 2009 are disregarded

Forecast deviation, percentage points   Forecast deviation, percentage points

86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17

—— Entire period   —— Excluding 2008-2009

Note: Seven-year moving average.
Source: Statistics Denmark and own calculations.

One can also examine systematic forecast deviations by analysing autocorrelation in the forecast deviations. If the deviation one year reliably can explain the deviation the following year, there is sign of systematic errors in the forecasts. Although there is weak positive correlation between two subsequent forecast deviations, it is not statistically significant, *cf. figure 2.33 and 2.34.*
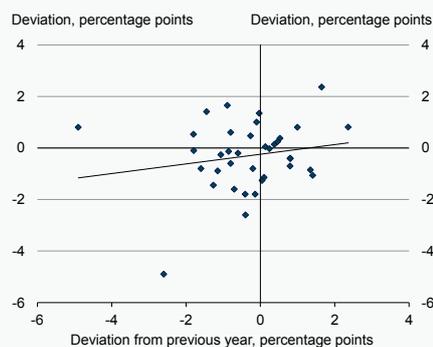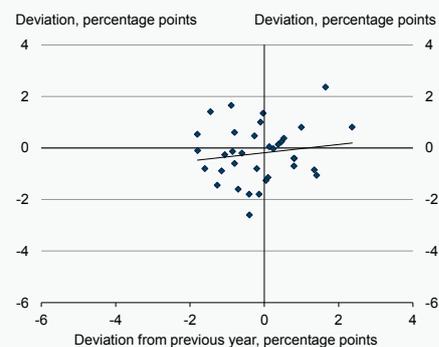
Figure 2.33

Regression of forecast deviation with last year's forecast deviation – not significant

Deviation, percentage points   Deviation, percentage points

Deviation from previous year, percentage points

Figure 2.34

Same regression excl. 2008-2009 – no evidence of positive autocorrelation

Deviation, percentage points   Deviation, percentage points

Deviation from previous year, percentage points

Note: The hypothesis of autocorrelation in the forecast deviation is also tested using the Durbin-Watson statistic.
             In both cases, autocorrelation is rejected.
Source: Statistics Denmark and own calculations.

For use in terms of planning economic policy, it is often relevant to focus on whether the forecasts correctly estimate the direction of the change in the GDP growth rate. For example, if the economy is already close to the capacity limit, and growth is expected to in-

crease further, it might all other things being equal imply a need for tighter economic
policy.

The forecasts in the Economic Survey are correct just below 80 per cent of the time with
regard to the change in growth. That is better than forecasts from both the Danish Eco-
nomic Council and Nordea, *cf. figure 2.35*.

Conversely, there is a clear tendency for the forecast deviations, and their variability, to
increase when growth is either unusually low or high, *cf. figure 2.36*. Thus, there is evi-
dence of systematic error in the assessment of growth when the economy is either grow-
ing rapidly or slowly/declining.

This is especially true in periods of cyclical setbacks, but also at the beginning of recov-
ery periods, where the so-called ketchup effect can result in sudden and sharp increases
in demand.

Figure 2.35	Figure 2.36
The Economic Survey generally forecast the change in growth correctly	**Larger deviations in periods of non-normal growth (1½-2 per cent)**
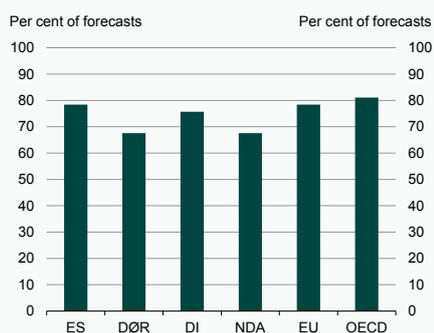
$$y = 0.3152x^2 - 1.0694x + 1.3053$$
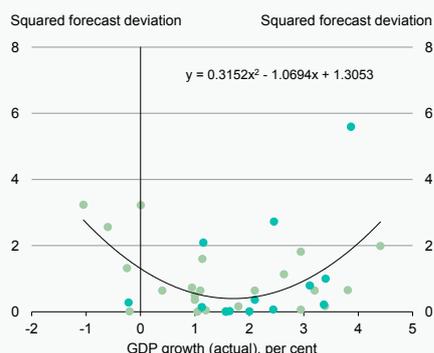
Note: The trend is a second-degree polynomial. The squared forecast deviation is minimized at a growth rate
          about 1.82 per cent. 2008 and 2009 are disregarded.
Source: Statistics Denmark and own calculations.

The revisions of the national accounts have reduced the forecast deviations in recent years

In the section above, the accuracy of the GDP forecasts is examined in relation to the
first preliminary estimate in the national accounts. However, it may also be relevant to
compare the forecast to later estimates.

National accounts figures are revised on a regular basis and are first classified as so-called final estimates more than three years after the end of the year. This is due to the fact that Statistics Denmark continuously incorporates new information as it becomes available, as well as checking already available information. National accounts figures, however, are never completely final, as there are main revisions of the national accounts as well, where new methods and international standards are incorporated, including in the final years.

In recent years, extensive revisions of the national accounts have been carried out in 2014 and 2016 respectively. This is due to the incorporation of a new international national accounting standard, including new methods for calculation, among other things, exports and public sector production, *cf. Economic Survey, December 2014 and December 2016.*

One would think that it might be harder to forecast the final GDP figures than the preliminary figures. Thus, the examination of forecast accuracy in *Economic Survey*, February 2008, showed that the average forecast deviations were slightly lower when comparing to preliminary GDP figures rather than final figures.

This is also the case when you look at the entire period 1980-2017. The average numerical forecast deviation is 1 percentage point relative to the final GDP figures, but slightly below 0.95 percentage points compared to the first preliminary estimate of annual GDP growth.

In recent years, however, the trend has been reversed. The forecasts for recent years have generally proved to be more accurate compared to the revised estimates of the national accounts than in relation to the first estimates.

Compared to the first estimates, the forecasts in the Economic Survey seem overoptimistic. Compared to the revised estimates, the forecast deviations are significantly smaller, and in 2015 the sign of the forecast error has changed, *cf. figure 2.37.*

Figure 2.37

Recent revisions of the national accounts result in smaller forecast deviations
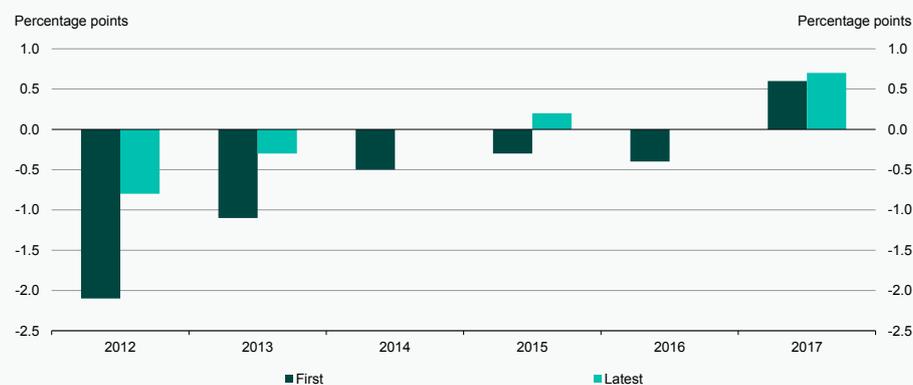

Note: The forecast deviation is measured on the basis of the estimate for the next year in the December issue of
        the Economic Survey. *First* is the forecast deviation measured in relation to the first estimates of the nation-
        al account for the fourth quarter of the year concerned. *Latest* indicates the forecast deviation compared to
        the annual GDP growth based on the latest national accounts (April 2018).
Source: Statistics Denmark, various editions of Economic Survey and own calculations.

However, the revisions of the national accounts do not change the fact that there were
significant forecast deviations for 2012 and 2013 and that the recovery was not as strong
as forecasted.

The new national accounting standards included, among other things, a significantly
higher level of exports, not least because Danish companies' trade outside the Danish
borders is included in exports as well following the new national accounts standards.
Overall, the growth contribution from exports has been higher than forecasted, while the
growth contribution from domestic demand for most years has been weaker than origi-
nally expected, *cf. figure 2.38*.

Figure 2.38

Exports have contributed more than predicted, while the opposite is true for domestic demand
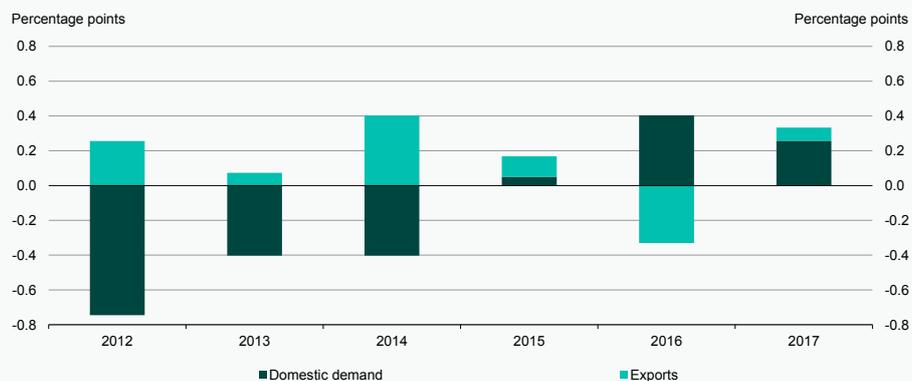
Note: The growth contributions are adjusted for the import content of the individual demand components using the so-called input-output-based method. The figure shows the difference between the estimated growth contributions for the following year in the December issue of Economic Survey and the growth contribution based on the latest figures.

Source: Statistics Denmark, various editions of Economic Survey and own calculations.

The national accounts revisions have had similar effect on the accuracy of other forecasters. The average numerical forecast deviation is reduced by approximately the same amount across institutions.