
Danmarks Nationalbank's Projections for the Danish Economy 2008-12

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INTRODUCTION AND SUMMARY

Projections for the current state of and development in the Danish economy are an integral part of the economic-policy debate. The projections are produced not only by the government's economic ministries, but also by non-governmental organisations, private firms and independent institutions, including Danmarks Nationalbank.

Danmarks Nationalbank's core tasks include the planning of monetary policy in order to maintain a fixed exchange rate vis-à-vis the euro, thereby contributing as much as possible to price stability. Consequently, Danmarks Nationalbank must identify in due time whether the economic development and the planning of other economic policy entail risks in terms of price development, credit development and the stability of the financial system in order to counter such risks. Danmarks Nationalbank is dependent on always having a detailed understanding of the current state of the economy and its direction.

Hence, Danmarks Nationalbank has produced cyclical assessments and projections for the Danish economy for several decades. In 2007, Danmarks Nationalbank began to publish projections as part of its overall assessment of current economic trends published in the Monetary Review. This article reviews the experience with Danmarks Nationalbank's projections for the period covered by published forecasts, i.e. the period 2008-12.

It is important to bear in mind that the decisive success criterion for macroeconomic projections is not whether they hit the mark. They rarely do. Forecasts are more widely used by both firms and policy institutions to assess the direction and the major risks and imbalances in current economic trends. Forecasts form the basis for the strategic decisions and transactions of firms, while policy institutions use them to plan, assess and adjust economic policy on an ongoing basis. So their usefulness is ultimately determined by their positive contribution to the basis for those transactions and measures.

The period 2008-12 coincides almost exactly with the dramatic period when the global financial crisis caused a sudden recession in Denmark as well as internationally, and the following years of low growth during which the repercussions of the overheating in the mid-2000s in Denmark and economic problems in large parts of the euro area delayed a new upswing. The analysis shows that neither Danmarks Nationalbank nor other institutions which also forecast the economic development in Denmark predicted the magnitude of the crisis in 2008-09, and the subsequent stabilisation has also taken a somewhat different course than forecast.

Despite the sometimes substantial errors in growth forecasts, the cyclical assessments made it possible to identify and address a number of basic challenges and imbalances in the Danish economy during this period, including the inappropriate fiscal policy in the mid-2000s. This is apparent from a review of Danmarks Nationalbank's cyclical assessments and the resulting initiatives and recommendations. The review also stresses that it would be inexpedient to base cyclical assessments purely on the current growth in the gross domestic product, GDP, which is volatile and subject to great statistical uncertainty in the preliminary compilations. It is just as important to monitor developments in the labour market, prices and wages as well as other indicators contributing to providing an overall picture of economic trends and any imbalances. The considerable uncertainty about the assessment of the current state and direction of the economy emphasises that it is difficult to conduct active, discretionary fiscal policy and getting the timing right.

The next section provides a brief introduction to the model tool that provides the framework for Danmarks Nationalbank's forecasting activities and presents a number of more general principles concerning the use of projections in macroeconomic analysis. This is followed by a descriptive, statistical analysis of Danmarks Nationalbank's forecasts for GDP, unemployment and inflation compared with the forecasts of a number of other major institutions for 2008-12. The following section examines the primary causes of the substantial errors in the forecasts of economic developments in recent years, and, finally, Danmarks Nationalbank's cyclical assessments for the entire period are summarised, focusing on economic-policy conclusions and recommendations.

FORECASTS – BACKGROUND AND USE

Danmarks Nationalbank has published projections for the Danish economy in its Monetary Review since the 3rd quarter of 2007. At first, they were published every second time, i.e. semi-annually, but from the 3rd quarter of 2010 onwards they have been published on a quarterly basis.

However, Danmarks Nationalbank has been regularly analysing the current state of the Danish economy for much longer than that. In the 1970s, Danmarks Nationalbank already prepared quarterly national accounts, before Statistics Denmark began doing so. The purpose was two-fold: Firstly, by collecting all the available ratios, this provided an aggregate, consistent picture of the current position of the Danish economy; secondly, it provided the foundation for econometric analyses of central relations in the Danish economy in recent decades, cf. Christensen (1989).

The extensive data work thus formed the basis for Danmarks Nationalbank's macroeconomic model MONA, which was first constructed in the late 1980s and has been revised several times since then, cf. Danmarks Nationalbank (2003). As a model type, MONA corresponds to other well-known macroeconomic models in Denmark, including ADAM, which is developed and maintained by Statistics Denmark and forms the basis for the government's forecasts for the Danish economy, and SMEC, which is used in the same way by the chairmanship and the secretariat of the Economic Council (DØRS).¹

ADAM and SMEC are annual models, while MONA is a quarterly model that focuses on capturing key short-term economic relations. These relations are described by way of equations estimated on quarterly data going back to the early 1970s.² The economic relations in the model thus reflect the average evolution of business cycles over the latest decades.

About forecasts based on macroeconomic models

An economic model is a tool that can be used to project how the economy will develop in future. The model can provide a suggestion of the development, depending on the estimated relations in the preceding years as well as a number of assumptions. It should be borne in mind that the relations in the model will always be simplified relative to reality as it is impossible to create a formula for all relevant aspects of the economic reality.

It is consequently up to the forecaster to determine the final design of the projection. Such an assessment includes information that is not contained in the model, e.g. 'soft' indicators of business and consumer confidence. Ultimately, all projections are, to a considerable extent, based on sound judgement. In this connection, using a macroeconomic model ensures that the many pieces of information and statistics present a consistent picture.

¹ ADAM is described in Knudsen (2012) and SMEC is described in Grinderslev and Smidt (2007).

² While the first versions of MONA were based on the above-mentioned quarterly national accounts prepared by Danmarks Nationalbank, MONA has subsequently been based on the official quarterly national accounts for the periods and variables published by Statistics Denmark since then.

Basically, the economic variables included in MONA can be divided into two groups. One group consists of the exogenous variables determined outside the framework of the model. Based on the exogenous variables and the relations in the model, the model presents the other group of variables, i.e. the endogenous variables. When constructing the model, it should ultimately be decided how many relations the model should capture, how complex they should be, and how many conditions are included in the exogenous variables outside the model. In MONA, the majority of variables coming to us from abroad or decided politically are exogenous. They include fiscal policy, particularly public-sector demand, export market growth, interest and exchange rates and oil prices.

As mentioned above, the forecaster should determine the values of the exogenous variables in the projection period. It is often assumed that they develop more or less in line with their historical trend over a slightly longer period. Fiscal variables will typically be based on the Finance Act in force and the government's medium-term economic plans and, most recently, the related 4-year spending caps. Hence, fiscal policy reactions to movements in the economy will not be included in the projection.

At the same time, the model's equations entail a strong tendency for the economy to revert to a normal cyclical situation. Overall, this means that the projections tend to predict a calmer and more average development in the economy than what is normally the case in the real world. The uninterrupted series of events affecting the Danish economy – whether they come from abroad or occur in Denmark – is highly unpredictable and these events will, as a main rule, not be included in the projection. Accordingly, strong upswings and sharp declines in activity are both quite difficult to predict – especially if they are triggered by extraordinary factors such as the global financial crisis that began in 2007 and accelerated in 2008.

Uncertainty and risks

Danmarks Nationalbank's projection represents *the scenario that is estimated to be the most probable for the Danish economy* given the current economic policy. So while the purpose of the projection is to provide the most accurate overall picture of the current state of the economy and to identify the principal drivers of the near-term development, the specific forecast of the future development is subject to great uncertainty.

As already mentioned, there will often be substantial deviations between the projection assumptions concerning international and financial developments and actual developments, just as fiscal policy is changed in step with new economic challenges and political priorities.

More importantly, the economic and financial decisions of private agents will rarely match exactly what is implied by the model relations. This applies especially to the decisions of households to spend or save and their behaviour in the housing market; to the decisions of firms to invest, save or pay dividends to shareholders, and changes in their employment; and to wage formation trends in view of the current momentum in the labour market and labour-market reforms as well as economic policy in the broadest sense.

So according to experience, projections never hit the mark; however, that is not the decisive success criterion. An important and integral part of Danmarks Nationalbank's projection of developments in the Danish economy is to determine the major *risks* to the economic development – and thus the projection. Risks are those factors which, in the given situation, have considerable potential to decisively change the overall economic development relative to the projection assumptions. This often implies analysing general imbalances in the economy at risk of increasing further, or which may, conversely, be suddenly redressed. In other words, risks refer to factors and trends in the economy that are subject to considerable uncertainty and also have a marked impact on the current development, cf. also Box 1.

The macroeconomic model can be used to quantify the impact of major risks, whether in terms of growth patterns abroad, interest-rate trends in the financial markets, the design of next year's Finance Act or something entirely different. Danmarks Nationalbank often publishes alternative scenarios in connection with the projection in the Monetary Review, emphasising particularly uncertain conditions for the Danish economy and calculating their consequences for the projection.¹ Identification of major risks and their quantitative impact on the economic development is key to appropriate planning of economic policy.

PROJECTIONS FOR 2008-12 PRODUCED BY DANMARKS NATIONALBANK AND OTHERS

The following provides a comparison of Danmarks Nationalbank's forecasts of GDP, unemployment and inflation with those produced by other institutions (the government, DØRS, the OECD, the European Commission and the International Monetary Fund, IMF) for the period 2008-12.

¹ In recent years, the alternative scenarios have to a large extent affected the development in our export markets, which has been included in the risk scenarios in seven Monetary Reviews since 2008, most recently in the 2nd quarter of 2013. Economic policy is another factor considered, especially when new measures are being discussed; in the 2nd quarter of 2011 the effects of the retirement plan were calculated, and in the 1st quarter of 2013 the effects of the government's growth plan, Vækstplan DK, were assessed.

BASELINE SCENARIOS AND RISKS IN DANMARKS NATIONALBANK'S PROJECTIONS

Box 1

Danmarks Nationalbank's projection published in its Monetary Review is to be seen as *the scenario for the Danish economy that Danmarks Nationalbank considers the most probable*. This is often called the baseline scenario.

The probability of deviations from the forecast is often considered to be almost the same in either direction at the time of forecasting. In special situations, however, the major risks to the forecast may tend to have the same effect. This is called an *asymmetrical risk scenario* and may e.g. concern a situation in which the Danish economy is overheating while tensions are building up in the international economy. In that case, several important as well as fairly uncertain factors may impact the economy negatively relative to the baseline scenario that is considered the most probable. Large adverse deviations are then more probable than the opposite.

Another form of *asymmetrical risk scenario* results from non-linear relations in the economy. A case in point is the low levels of unemployment during the overheating in the years leading up to the financial crisis when the relation between wages and unemployment could be different than seen in the 1990s and before. Another example is the impact of interest rates on housing demand or the propensity to invest; a change of 1 percentage point may have a notably different effect if the level of interest rates is 2 per cent rather than 20 per cent. This, in turn, means that if interest rates decline to 4 per cent from a level of e.g. 5 per cent, it may have a greater impact on business investment than a similar increase to 6 per cent. Hence, a symmetrical risk scenario for interest rates will skew the risk scenario for investment in the sense that the probability of notably larger investment than forecast is greater than the probability of notably smaller investment.

The three measures summarise the projection for the Danish economy. GDP summarises the assessment of economic activity, while unemployment provides an indication of the labour market. At the same time, unemployment supplements the description of economic activity and indicates wage and price formation trends, which are reflected in the rate of inflation. It is important to ensure a broad view of the projections, as this may be skewed if only one measure is used. It should be endeavoured not to focus on GDP only, since the preliminary compilations of GDP development in particular are subject to considerable statistical uncertainty.

Evaluation of macroeconomic projections often focuses on systematic imbalances and other technical issues. However, this requires a data basis consisting of at least an entire business cycle and preferably more and extending far beyond the five years during which Danmarks Nationalbank has published projections. The Ministry of Finance (2008) conducted such an analysis, cf. Box 2, which also presents results from Danmarks Nationalbank's internal projections.

The analysis also shows that over a period of almost 30 years, different forecasters have all produced average errors in the forecast of GDP of around 1 percentage point. The accuracy has only been higher in periods characterised by economic stability, as was the case in the 1990s.

We evaluate the forecasting accuracy for the following year. This shows the ability of the institutions to predict the future development before the forecasters have statistical information from the year in question. Furthermore, we compare forecasts for the same year to illustrate whether the forecasts are able to capture the trends that are revealed during the course of the year.

EVALUATION OF FORECASTS FROM 1980 TO 2006

Box 2

The most recent systematic analysis of the government's forecasting accuracy conducted by Ministry of Finance (2008) concerned the period 1980-2006. The analysis also contains a comparison with the forecasts of other institutions for the same period. Danmarks Nationalbank also produced analyses during the period mentioned, but since they have not been published, they are not included in the comparison.

In the box, the comparison is supplemented by Danmarks Nationalbank's forecasts, with similar calculations being made on the same data basis. We rely as much as possible on the template in Ministry of Finance (2008), using Danmarks Nationalbank's projections from November/December for the following year. The comparison concerns GDP growth, consumer prices, CPI, and unemployment.

Table 1 compares the accuracy of various forecasts in terms of a number of statistical measures. The average error in forecasting (known as bias or skewing) is a measure of whether forecast errors are systematically made in either direction. The accuracy (dispersion) of the forecasts is measured by the average absolute deviation or alternatively by RMSE¹, which focuses on squared deviations. Finally, the forecasts are compared with two mechanical projections, using Theil indices. In the first projection, Theil-1, the variable is assumed to mechanically follow the historical average over the last 10 years, and in the second, Theil-2, it is assumed to be unchanged relative to the most recently published value. A Theil value of less than 1 means that the forecasts are more accurate than the mechanical forecast.

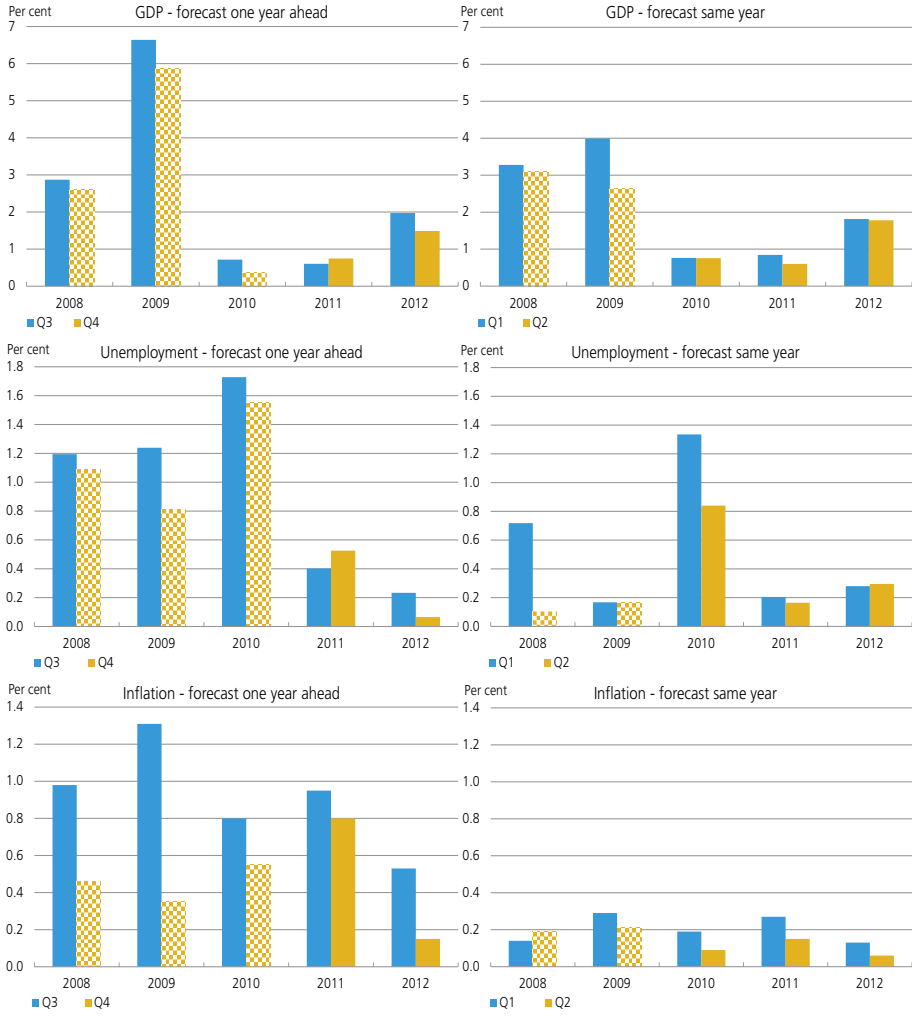
Viewed over the entire period, Danmarks Nationalbank's forecasts are generally not subject to substantial bias and they are more or less in line with the forecasts made by other forecasters. Likewise, they do not differ from the other projections as regards the dispersion measures – with the exception of the inflation forecast, which seems to be comparatively accurate. Overall, there are no systematic differences in the quality of the forecasts made by the individual institutions. It is true of all the projections that they turn out well in some respects and less well in others. Conversely, it is clear for all forecasters and all variables that the forecasts are more accurate in the 1990s than in the 1980s. No doubt, this has to do with the fact that the 1990s were characterised by greater economic stability. For example, the standard deviation for GDP growth fell by just over one third. Since the millennium rollover, the accuracy of the GDP forecast declined again, while the inflation accuracy increased further.

¹ RMSE stands for Root Mean Square Error, i.e. the square root of the mean of the squared forecast errors.

CONTINUED	Box 2							
Comparison of forecasts, 1980-2006								Table 1
	DN	ØO/ØR	DØRS	DI	Nordea	EU	OECD	
<i>GDP, per cent year-on-year</i>								
Avg. error (bias)	0.06	-0.05	0.24	0.27	0.20	-0.20	-0.01	
RMSE	1.08	1.08	0.97	1.06	1.02	1.15	1.24	
Avg. absolute deviation	0.86	0.85	0.76	0.86	0.75	0.90	0.97	
Theil/Alternative 1	0.68	0.57	0.52	0.56	0.54	0.61	0.66	
Theil/Alternative 2	0.44	0.43	0.39	0.42	0.40	0.46	0.49	
Avg. absolute deviation								
1980-1989	1.13	1.08	0.74	0.91	0.91	1.17	1.33	
1990-1999	0.61	0.63	0.67	0.76	0.47	0.62	0.70	
2000-2006	0.82	0.85	0.94	0.94	0.82	0.62	0.86	
<i>Inflation, per cent</i>								
Avg. error (bias)	0.07	0.10	0.23	0.33	-0.11	0.22	0.06	
RMSE	0.58	0.85	1.02	0.99	0.84	0.81	1.03	
Avg. absolute deviation	0.43	0.67	0.67	0.70	0.66	0.59	0.79	
Theil/Alternative 1	0.22	0.33	0.39	0.38	0.32	0.31	0.40	
Theil/Alternative 2	0.33	0.49	0.59	0.57	0.48	0.46	0.59	
Avg. absolute deviation								
1980-1989	0.72	1.09	1.22	1.19	1.00	0.96	1.12	
1990-1999	0.30	0.48	0.46	0.49	0.47	0.42	0.68	
2000-2006	0.19	0.33	0.20	0.29	0.35	0.29	0.43	
<i>Unemployment rate</i>								
Avg. error (bias)	0.03	-0.02	-0.46	0.02	-0.16	-0.10	-0.13	
RMSE	0.67	0.69	0.81	0.75	0.69	0.98	0.82	
Avg. absolute deviation	0.52	0.51	0.70	0.57	0.54	0.70	0.66	
Theil/Alternative 1	0.31	0.26	0.30	0.28	0.26	0.37	0.31	
Theil/Alternative 2	0.37	0.42	0.49	0.45	0.42	0.59	0.49	
Avg. absolute deviation								
1980-1989	0.52	0.71	0.92	0.45	0.66	1.01	0.86	
1990-1999	0.50	0.43	0.64	0.85	0.49	0.60	0.56	
2000-2006	0.33	0.33	0.47	0.34	0.43	0.41	0.52	
Source: Ministry of Finance (2008), <i>Economic Survey</i> , February 2008, and Danmarks Nationalbank.								

It should be borne in mind, however, that forecasters are, all else equal, getting more information and are thus able to make better and more accurate forecasts over time. Accordingly, an autumn forecast is likely to be closer to the actual value than a forecast in a spring projection six months earlier. This trend is clearly evident in Chart 1 where the forecast error for the following year is reduced from the 3rd to the 4th quarter. Similarly, it is seen how the accuracy for the current year improves from the 1st to the 2nd quarter.

ABSOLUTE FORECAST ERROR FOR GDP, UNEMPLOYMENT AND INFLATION Chart 1



Note: The unshaded columns are based on projections published in the Monetary Reviews, while the shaded columns are based on internal projections.

Source: Statistics Denmark and Danmarks Nationalbank.

As expected, the chart also shows a clear tendency for forecasts for the current year being better than forecasts for one year ahead.

The institutions' projections are produced at different times of the year. To ensure the best possible time consistency between the compared projections, forecasts one year ahead are taken from the last projection from each institution in the preceding year. Projections from the 2nd quarter are used for forecasts of the same year. It should be noted that although it has been attempted to compare forecasts that are published at around the same time, the IMF's projections tend to be pub-

lished first.¹ In view of the above discussion of the forecast errors being reduced the later our own projection is published, the IMF's projections tend to be less well-founded than those of the other institutions.

Forecasts of economic activity (GDP)

The first challenge when assessing GDP forecasts and comparing them with the actual development is to determine which actual GDP measure is to form the basis for comparison. The GDP measures are adjusted regularly in step with revisions of the quarterly national accounts and subsequently of the annual national accounts.

Interest in the accuracy relative to the preliminary forecasts reflects that the primary purpose of the forecasts is to qualify the debate on current challenges and economic policy. This is bound to be based on the first preliminary compilations rather than the final compilations that are issued with a lag of several years. The preliminary national accounts also better reflect the data basis available to Danmarks Nationalbank and other institutions when predicting the development, thus ensuring greater comparability.

On the other hand, economic forecasts are essentially about capturing important features of the actual economic development. This indicates that the forecasts should also be compared with the best and most accurate data, i.e. the currently available national accounts figures for 2008-12.

The following provides a comparison of forecasts for the coming year with the current compilation of the national accounts for 2008-12. It shows the accuracy of prediction of the actual development at the time of planning economic policy. Forecasts for the current year, on the other hand, are compared with the first compilation of the national accounts. This reveals the institutions' ability to incorporate available statistics to provide an up-to-date picture of the economic development over the year.

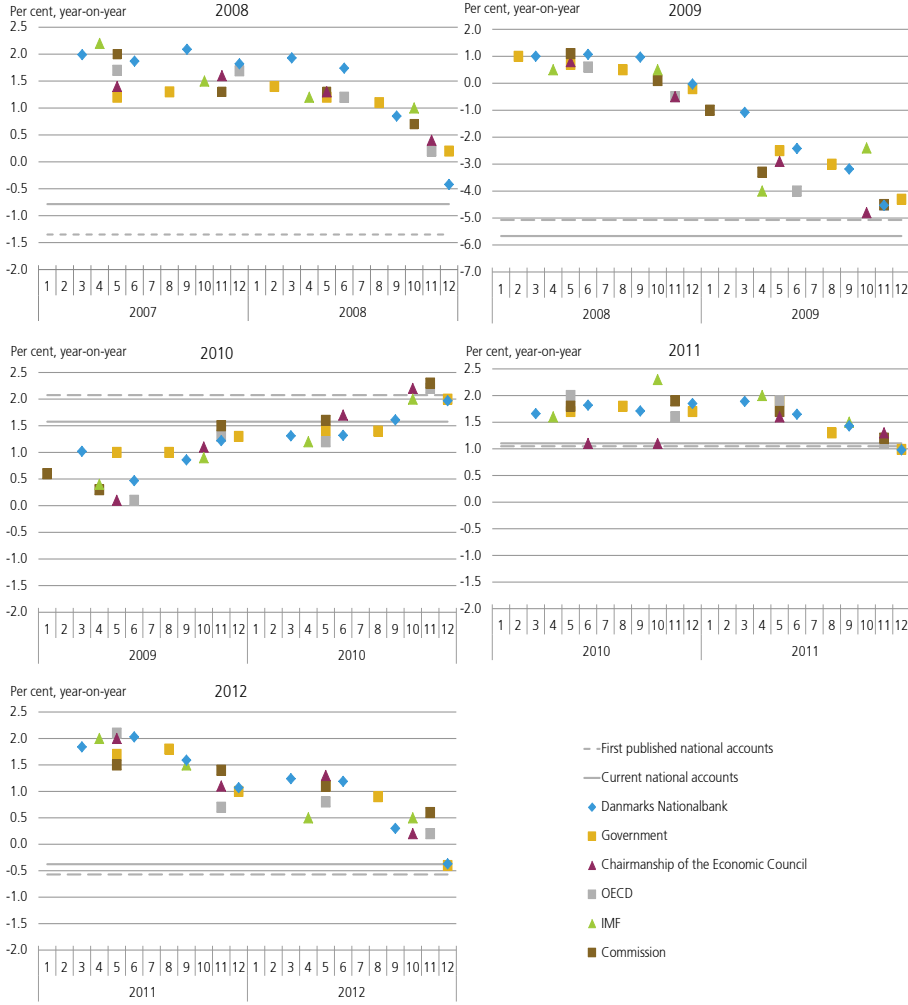
Chart 2 shows how selected institutions predicted GDP growth in a given year from the beginning of the previous year to the end of the year in question. Statistics Denmark's first (full line) and current (broken line) compilations are also indicated.

The chart clearly shows that the recession in both 2008 and 2009 came as a complete surprise to the institutions. They were also taken aback by the strength of the setback right up to the end of the year concerned.

¹ The IMF's spring projection is published in April while the other institutions issue their projections in May/June. In the autumn, the IMF's projection is issued in October; DØRS, the OECD and the Commission issue their projections in October/November, and the Danish government and Danmarks Nationalbank finally publish their projections in December.

PREDICTED AND REALISED GDP GROWTH IN THE PERIOD 2008-12

Chart 2



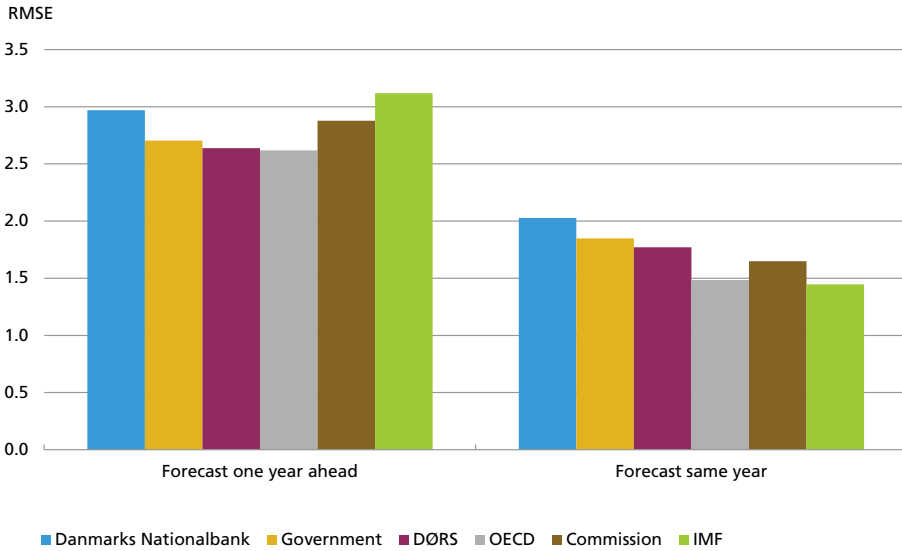
Source: Statistics Denmark, Danmarks Nationalbank, the Ministry of Finance's *Economic Survey* until May 2011 and subsequently the Ministry of Economic Affairs and the Interior's *Economic Survey* from December 2011, DØRS' semi-annual reports, the OECD's *Economic Outlook*, the European Commission's *Economic Forecasts* and the IMF's *World Economic Outlook*.

The growth forecasts in 2010 were considerably more pessimistic than the final compilation. This should be viewed in the light of the major recession in 2009, which affected the activity basis in 2010 and hence growth for 2009-10 (carry-over effects – or, in this case, carry-under effects).

In both 2011 and 2012, the institutions expected an upswing that failed to materialise to the predicted extent. This resulted in excessively high growth forecasts that were adjusted downwards over time, especially for 2012. In terms of Danmarks Nationalbank's forecast relative to

AVERAGE ERRORS IN THE FORECAST OF GDP

Chart 3



Note: The forecast for year t one year ahead is the institutions' forecast in the last projection in year $t-1$, while the forecast for year t in the same year is from the spring projections in year t .

The forecasts for Danmarks Nationalbank are from internal projections up to and including the 2nd quarter of 2010.

Source: Statistics Denmark, Danmarks Nationalbank, the Ministry of Finance's *Economic Survey* until May 2011 and subsequently the Ministry of Economic Affairs and the Interior's *Economic Survey* from December 2011, DØRS' semi-annual reports, the OECD's *Economic Outlook*, the European Commission's *Economic Forecasts* and the IMF's *World Economic Outlook*.

those of the other institutions, it is a characteristic feature that the first forecast for 2008-09 was relatively high, and that Danmarks Nationalbank did not subsequently adjust the forecast downwards to the same extent as the other institutions.

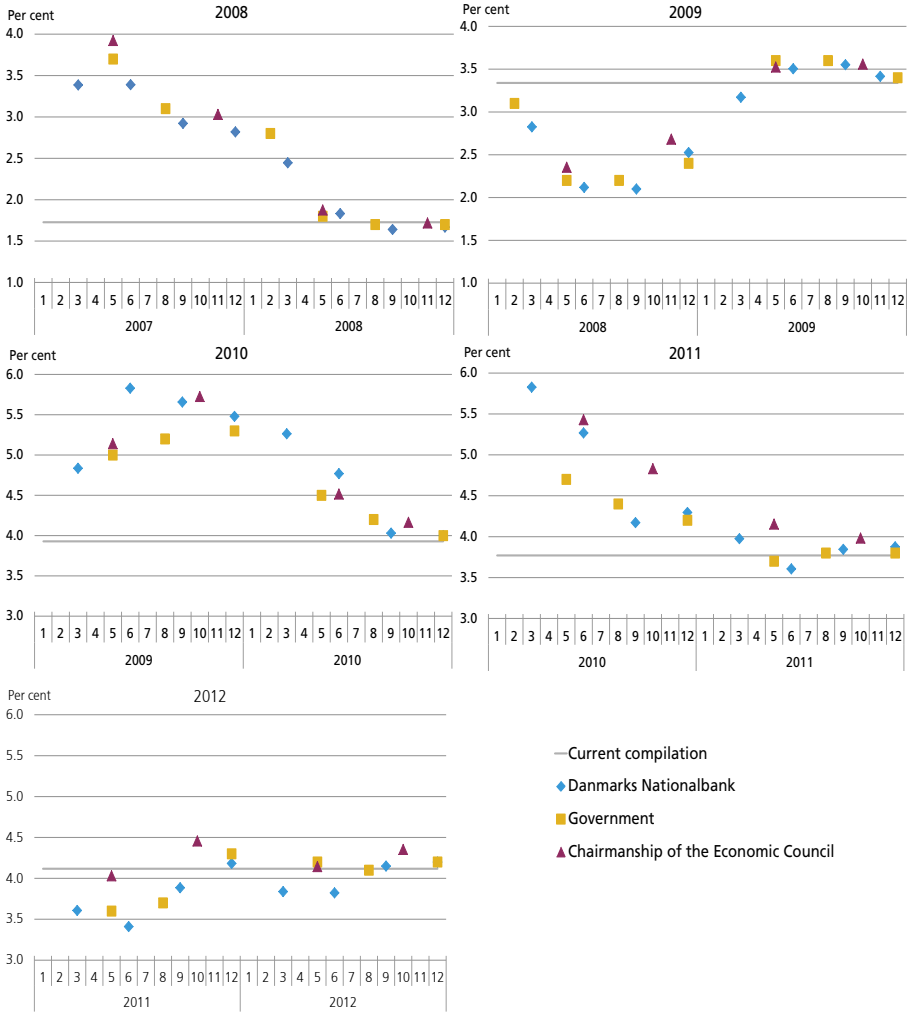
It has been attempted to summarise the overall picture for 2008-12 in Chart 3 using RMSE¹, which is an expression of the dispersion of the forecasts. Danmarks Nationalbank's forecasts of GDP growth one year ahead and in the same year are both among the comparatively inaccurate forecasts. The forecast errors can be explained mainly by the dramatic recession in 2008-09, cf. also the section below.

Unemployment forecasts

Different forecasters all use unemployment as a central forecast to describe the state of the Danish economy. The institutions do not use the

¹ RMSE stands for Root Mean Square Error, i.e. the square root of the mean of the squared forecast errors. The general reservation should be made that the RMSE calculation is based on only five observations, i.e. the years 2008-12.

PREDICTED AND REALISED NET UNEMPLOYMENT Chart 4



Source: Statistics Denmark, Danmarks Nationalbank, the Ministry of Finance's *Economic Survey* until May 2011 and subsequently the Ministry of Economic Affairs and the Interior's *Economic Survey* from December 2011, and DØRS' semi-annual reports.

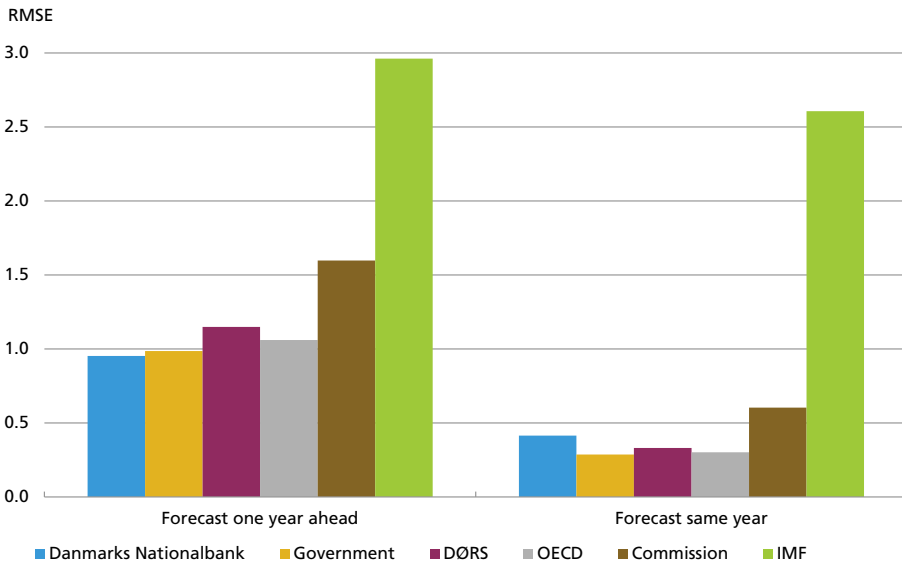
same measure of unemployment, however.¹ So the following provides only a comparison of the Danish institutions' forecasts of the level of unemployment, cf. Chart 4, while comparing the average forecast errors for the unemployment rate from all the institutions, cf. Chart 5.

In 2008, the three Danish institutions overpredicted unemployment, which was extraordinarily low as a result of the economic boom, cf. Chart 4. Although the recession accelerated already in 2008, this was not

¹ The Danish institutions all use forecasts of net unemployment, i.e. register-based unemployment, which does not include those in activation. The OECD, the Commission and the IMF instead use a measure of unemployment based on the labour-force survey, LFS.

AVERAGE FORECAST ERRORS, UNEMPLOYMENT

Chart 5



Note: The forecast for year t one year ahead is the institutions' forecast in the last projection in year $t-1$, while the forecast for year t in the same year is from the spring projections in year t .

Danmarks Nationalbank's forecast is from internal projections up to and including the 2nd quarter of 2010. For the Danish institutions, the forecast concerns net unemployment, while the forecasts made by the OECD, the European Commission and the IMF concern LFS unemployment.

Source: Statistics Denmark, Danmarks Nationalbank, the Ministry of Finance's *Economic Survey* until May 2011 and subsequently the Ministry of Economic Affairs and the Interior's *Economic Survey* from December 2011, DØRS' semi-annual reports, the OECD's *Economic Outlook*, the European Commission's *Economic Forecasts* and the IMF's *World Economic Outlook*.

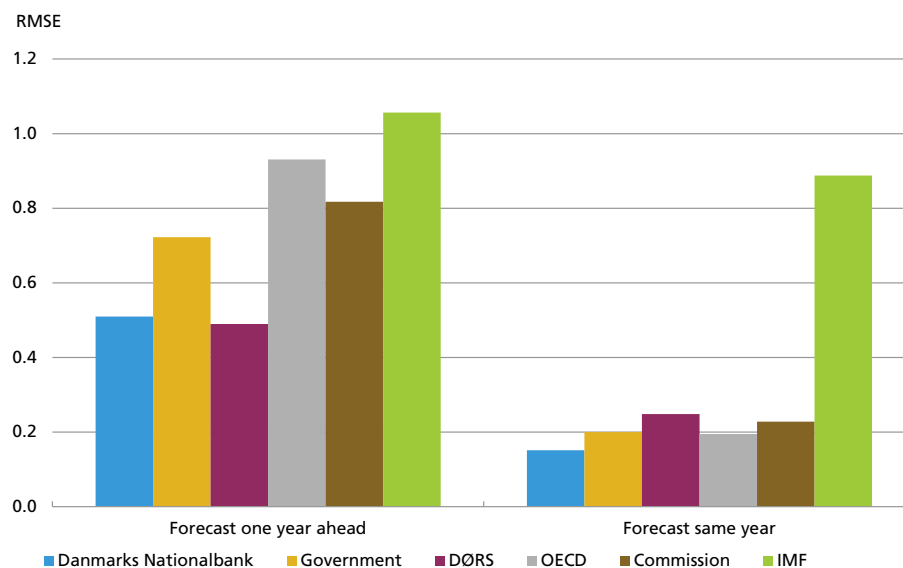
reflected in unemployment until 2009. It is normal for employment and unemployment to react to a decline in activity with a certain lag. The unemployment forecasts for 2009 reflected the underprediction of the scope of the setback. The forecasts should also be viewed in the light of the very low level of unemployment in 2008.

From 2010, unemployment stabilised at around 4 per cent. The rise in unemployment until that time was the result of more people becoming unemployed and more people experiencing longer spells of unemployment. Unemployment levels were overpredicted in the unemployment forecasts for 2010 and 2011, and the institutions were particularly slow to adjust the forecast downwards for 2010. In 2012, the forecasts were not far from the actual unemployment level.

Failing to foresee the reversal of the economy in time, the institutions made major forecast errors for 2009 and 2010, which is reflected in Chart 5. Danmarks Nationalbank's unemployment forecast for the next year is comparatively accurate. The chart also shows that the errors in the forecast of unemployment within the same year are relatively minor. Danmarks Nationalbank's forecast errors in the same year were particu-

AVERAGE FORECAST ERRORS, INFLATION RATE

Chart 6



Note: The forecast for year t one year ahead is the institutions' forecast in the last projection in year $t-1$, while the forecast for year t in the same year is from the spring projections in year t .

The forecasts made by Danmarks Nationalbank and the Commission concern HICP, the forecasts made by the Danish government, the OECD and the IMF concern CPI, while DØRS has made forecasts for the deflator for consumer prices.

Source: Statistics Denmark, Danmarks Nationalbank, the Ministry of Finance's *Economic Survey* until May 2011 and subsequently the Ministry of Economic Affairs and the Interior's *Economic Survey* from December 2011, DØRS' semi-annual reports, the OECD's *Economic Outlook*, the European Commission's *Economic Forecasts* and the IMF's *World Economic Outlook*.

larly affected by 2010, in which year forecasts tended to be relatively too high and not adjusted downwards in time.

Inflation forecasts

Inflation increased sharply at the end of 2007 and in early 2008, driven primarily by rising energy and food prices. But the strong wage development also contributed to the increase in consumer prices. This was followed by a sudden drop in inflation, as the recession began. The declining growth in consumer prices was mainly attributable to falling energy prices. In 2010, prices rose by just over 2 per cent annually, which continued in the last two years of the period. This should be viewed in the light of rising energy and food prices as well as higher indirect taxes affecting the rise in 2010 in particular.

The institutions do not use the same price measures.¹ But the measures are characterised by displaying more or less the same level and develop-

¹ Danmarks Nationalbank uses the Harmonised Consumer Price Index, HICP, which is also used by the Commission. The government, the OECD and the IMF use the consumer price index, CPI, while DØRS publishes figures for the consumption deflator.

ment. As a result, the forecast errors for the different measures are compared, although the different concepts should be borne in mind. Characteristically, the institutions' forecast errors for inflation forecasts show a significantly greater dispersion for forecasts one year ahead than for forecasts for the same year, cf. Chart 6. Danmarks Nationalbank's forecast is comparatively accurate.

FORECAST ERRORS BROKEN DOWN INTO PRIMARY FACTORS

As described above, the economic model can be used to explain which forecast assumptions and preconditions caused the forecast to miss the mark in terms of key factors. In Table 2, the estimation errors for GDP, unemployment and inflation in the period 2008-12 are thus broken down into four different factors:

1. *International economy*, including growth in the export markets of Danish firms and foreign wage developments.
2. *Financial conditions*, including interest and exchange rates and oil prices.

ERRORS IN THE FORECAST OF KEY VARIABLES BROKEN DOWN BY PRIMARY FACTORS						Table 2
Year	2008	2009	2010	2011	2012	
<i>GDP, per cent year-on-year</i>						
Forecast	2.1	1.0	0.9	1.7	1.6	
International economy	-0.8	-4.9	2.2	0.9	-0.5	
Financial conditions, etc.	-0.7	0.6	0.4	-0.8	0.4	
Fiscal policy	0.0	0.2	-0.4	-0.3	0.3	
Other factors	-1.4	-2.5	-1.5	-0.4	-2.2	
Actual	-0.8	-5.7	1.6	1.1	-0.4	
<i>Unemployment (net), 1,000 persons</i>						
Forecast	86	60	163	120	112	
International economy	9	56	-24	-21	1	
Financial conditions, etc.	9	-10	-3	8	-5	
Fiscal policy	-5	-2	1	12	8	
Other factors	-48	-6	-24	-12	3	
Actual	51	98	114	108	118	
<i>Inflation (HICP), per cent year-on-year</i>						
Forecast	2.4	2.6	1.4	1.7	1.9	
International economy	0.0	-0.1	0.1	0.1	0.0	
Financial conditions, etc.	0.3	-1.1	0.4	0.4	0.3	
Fiscal policy	0.0	0.0	0.0	0.0	0.0	
Other factors	0.9	-0.4	0.4	0.5	0.2	
Actual	3.6	1.1	2.2	2.7	2.4	

Note: The difference between the estimated and the actual scenario may not add up to the sum of the four sub-components due to rounding.

Source: Own calculations based on MONA.

3. *Fiscal policy*, including public investment and consumption.
4. *Other factors*, including, *inter alia*, other exogenous variables, data revisions and the financial transactions of the private sector in particular, i.e. Danish households and firms.

The calculation is based on the forecast for the individual years published by Danmarks Nationalbank in the preceding 3rd quarter. The selection reflects that this is the closest possible result to the statistical basis for the planning of the economic policy framework, including the Finance Act, for the year in question.

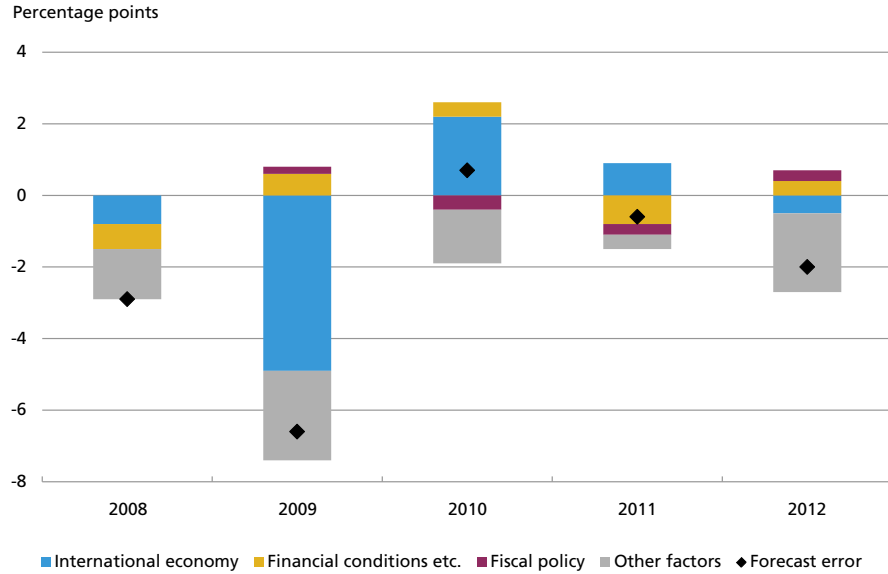
The period 2008-12 was severely affected by the global financial crisis. The development in the international economy differed considerably from the forecast development over the entire period, leading to substantial errors in the forecast of GDP growth and unemployment. The collapse in international trade at the end of 2008 and especially in the 1st quarter of 2009 led to substantial drops in activity by reducing demand for Danish exports, but also by households and firms showing greater restraint, which forms part of the negative contribution of other factors, cf. also Chart 7.¹ Thus, the large contributions to excessively high growth forecasts in 2009 can be attributed to the fact that the household consumption ratio and the corporate investment ratio for plant and equipment and buildings turned out to be lower than forecast, just as total demand led to increased inventory reduction rather than output relative to the forecast assumptions. This was contrasted by the unexpectedly sharp decline in interest rates which – viewed in isolation – contributed to higher-than-forecast activity and employment in 2009-10.

Nor was the rapid improvement in international trade in 2010-11 assumed in the forecasts for those years, which caused the positive contribution from the international factors to the errors in the forecast of GDP growth and the excessively high forecast of the scope of unemployment. In 2012, consumption showed a weaker-than-expected trend when compared with household disposable income, and demand was to some extent met via unexpected inventory reductions. These errors are included under Other factors.

¹ A similar calculation of the impact of selected factors on the large forecast error regarding GDP growth in 2009 was presented in Spange (2010). The results therein are somewhat different from the ones presented here, on account of several factors, including that Spange (2010) was based on the projection from the 1st quarter of 2008 rather than the 3rd quarter. Moreover, the calculation in 2010 reflects the version of MONA available at the time, whereas this analysis applies the current version of MONA for every year. As a result, certain relations in the model are different from what they were when the forecasts were produced. A main result in Spange (2010) was that 2/3 of the estimation error regarding GDP growth was attributable to the much poorer export market development in 2009, where the result is 3/4 according to the calculation in this article. But if we had used the model in the 2008 version, the result would have been 1/2.

ERRORS IN THE FORECAST OF ANNUAL GDP GROWTH BROKEN DOWN BY PRIMARY FACTORS

Chart 7



Note: The forecast error for each year is calculated as Danmarks Nationalbank's projection in the Monetary Review, 3rd quarter of the preceding year, compared with the current compilation of GDP.
 Source: Own calculations based on MONA.

Fluctuations in exchange rates and oil prices are directly passed through to inflation via the prices of imported goods and energy, and erroneous assumptions concerning those result in significantly skewed forecasts of price developments.

Deviations between estimated and actual fiscal policy also affected the errors in the estimation of growth and particularly unemployment, where deviations in public-sector employment are directly passed through.

As a result of excessively high forecasts of growth in public-sector demand, the estimated GDP growth was 0.3-0.4 percentage point too high in 2010-11. Public-sector consumption was subject to substantial uncertainty in those years in view of experience from the preceding years with major budget overruns and the escalating economic crisis. In the autumn of 2010, preliminary data for the first two quarters indicated major budget overruns, and in the 3rd quarter of 2010, Danmarks Nationalbank forecast substantially higher growth in both years, compared with the government. However, due to this particular uncertainty, Danmarks Nationalbank also compiled a risk scenario with lower public-sector consumption in 2011, which accompanied the projection in the Review. The scenario showed that GDP growth would be 0.2 percentage point lower

if public-sector consumption developed in accordance with the government's forecast. Ultimately, public-sector consumption turned out to be lower than forecast by the government.

THE OVERALL ECONOMIC SITUATION AND DANMARKS NATIONALBANK'S RECOMMENDATIONS IN 2008-12

As described above, the projections should more than anything be viewed as a tool to assess the current economic situation, and this assessment forms the basis for Danmarks Nationalbank's actions and recommendations. Hence, an overall evaluation of the projections should ultimately address how they affected Danmarks Nationalbank's assessment of developments in the economy and economic policy during the period since 2007.

A common feature of the Monetary Reviews for 2007 and into 2008 was that the Danish economy was assessed to be at the peak of a boom with strong capacity pressure and unsustainably low unemployment. On this basis, Danmarks Nationalbank repeated several times previous years' warning against continued expansionary fiscal policy that would result in further pressure on the labour market where wage inflation had increased and exceeded that of competitor countries.

During 2008 and into 2009, the conclusion was that the overheating had evolved into an economic slowdown, causing an unusually rapid rise in unemployment. At the same time, growing attention was paid to the development in banks and mortgage banks and their lending, including whether there were indications of a special credit crunch. In late 2008, Danmarks Nationalbank recommended temporary capital injections to well-managed banks to minimise the risk of a credit crunch that could exacerbate the deterioration of the economy. Such capital injections were implemented in Bank Rescue Package 2.

The government eased fiscal policy in a number of areas in 2009. Given the extraordinarily low level of interest rates, this meant that Danmarks Nationalbank was unable to recommend further easing. In this connection, Danmarks Nationalbank pointed out that the politicians had failed to tighten fiscal policy during the preceding boom. Furthermore, the recommendation was rooted in the fact that unemployment was rising from a very low initial level – far below its structural level – and that a period of low wage increases was necessary to restore Denmark's wage competitiveness. While Danmarks Nationalbank clearly underestimated the decline in activity in 2009, its labour-market expectations were more accurate – in fact, Danmarks Nationalbank overestimated unemployment in its forecasts for 2010-11.

In the 2nd half of 2009, Danmarks Nationalbank estimated that economic activity had bottomed out, but that unemployment would continue to rise. The sudden recession had put pressure on public finances, however, and there was increasing focus on government deficit and debt, including Denmark's obligations to the EU. The need for stronger mechanisms to manage public expenditure was stressed repeatedly. Danmarks Nationalbank also attached importance to the strongly increasing market focus on fiscal sustainability and credibility – the prospect of higher government debt being increasingly associated with the risk of substantial interest-rate hikes.

In the 3rd quarter of 2011, Danmarks Nationalbank presented a method to calculate cyclical gaps in the labour market and the overall economy, cf. Andersen and Rasmussen (2011), which was subsequently included in Danmarks Nationalbank's cyclical assessments. This supported the persistent focus on how to accommodate a renewed upswing by boosting the labour supply in a period when large generations will retire from the labour market.

The analyses for the period 2008-12 confirm previous experience to the effect that it is essential to maintain a broad perspective of the economy rather than focus purely on the most recent, uncertain compilations of GDP growth. This emphasises the extensive problems associated with conducting active, discretionary fiscal policy and getting the timing and dosage right. Furthermore, it can be politically difficult to implement sufficient tightening measures in good times.

The need for discretionary fiscal policy is generally lower in Denmark as the structure of the economy includes relatively large automatic stabilisers that set in fast. Danmarks Nationalbank stressed this several times in its cyclical assessments. In this connection, Danmarks Nationalbank has pointed out that it is inexpedient to deactivate automatic stabilisers, as was done in e.g. the housing market in the years leading up to the housing bubble.

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