FALLING OIL AND CONSUMER PRICES

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INTRODUCTION AND SUMMARY

Consumer prices have fallen over the last year, not least because the price of crude oil halved in the period from June 2014 to January 2015. Consumer prices were already rising very slowly, and the oil price fall reduced the price of e.g. petrol and fuel oil to the effect that the aggregate consumer price index in January was lower than one year earlier.

A negative annual rate of increase in the consumer price index is not the same as deflation, however. Instead, the term deflation can reasonably be used about a period of general and sustained price falls. In the current situation, there is no prospect of consumer prices continuing to fall. The decline in the effective krone rate seen in recent months is expected to raise the prices of imported goods, and this will, in combination with rising wage increases, contribute to pushing up prices.

The direct effect of the oil price fall on the rate of increase in consumer prices is temporary, unless oil prices decline further. Hence, the actual risk of undesirable price developments is that the substantial price fall will spread to other goods and services via the wage formation. This could exacerbate the immediate price fall and ultimately trigger a negative self-reinforcing wage-price spiral. The risk of that happening remains limited.

There are several reasons why the risk has increased over the last year, however. Firstly, the oil price fall is substantial. With the current oil prices, energy prices will considerably reduce the annual rate of increase in consumer prices in the coming months. Secondly, inflation was low from the outset, and monetary policy interest rates were very low. And finally, inflation expectations have decreased after the dive in oil prices – both in Denmark and in the euro area.

One of Danmarks Nationalbank's main objectives is to maintain stable prices. This means that prices neither rise nor fall too quickly. Since the early 1980s, monetary policy has been aimed at keeping the krone rate stable, initially against the German D-mark and then against the euro. As the monetary policy target of the euro area is to keep inflation below, but close to 2 per cent, the fixed exchange rate policy provides a framework for a stable price development in Denmark.

Because of the fixed exchange rate policy, Denmark mirrors the monetary policy stance of the euro area. Here, the European Central Bank, ECB, has expanded its asset purchase programmes to include government bonds. The aim is to further ease monetary policy and to support lending to the private sector. This creates a basis for higher economic activity and a gradual reduction of spare capacity that has helped to relieve the pressure on production factors. Ultimately, this will lead to higher wages and prices.

In view of the fixed exchange rate policy, Danish policy-makers must primarily keep an eye out for signs that domestic price and wage developments are becoming unstable. Consequently, to examine the domestic price pressure, Danmarks Nationalbank has been calculating a price index for domestic market-determined inflation, IMI, since 1984. It has been low since 2010, but with an upward tendency. In combination with slightly

higher wage increases and a lower effective krone rate, this indicates that the rate of increase in consumer prices will become higher in the medium term.

OIL AND CONSUMER PRICES HAVE FALLEN

Consumer prices have developed more weakly than usual for a prolonged period. Since the beginning of 2013, the annual rate of increase in the EU Harmonised Index of Consumer Prices, HICP, has not exceeded 1 per cent. This reflects both falling global commodity prices and spare capacity in Denmark and among Denmark's trading partners abroad.

Oil price developments have a strong impact on consumer prices, cf. Chart 1. From the summer of 2014 until January 2015, the price of a barrel of Brent oil fell by 50 per cent. So far, this has reduced consumer prices by just under 1 per cent, and the overall effect may grow to more than 3 per cent in the longer term.

In January 2015, the annual rate of increase in consumer prices was -0.3 per cent, while it rose to 0.0 per cent in February. In the slightly longer term, the rate of increase is expected to increase again, however, so this does *not* constitute deflation, i.e. general and sustained price falls. The overall rate of increase in consumer prices has, to a large extent, been pushed to such low levels by lower energy prices. But low energy prices are not likely to induce Danish consumers to postpone decisions to buy petrol because they think it will become cheaper later. In fact, consumers are more likely to buy more petrol because driving a car has become relatively cheaper, or to take advantage of the savings by purchasing other consumer goods.[1]

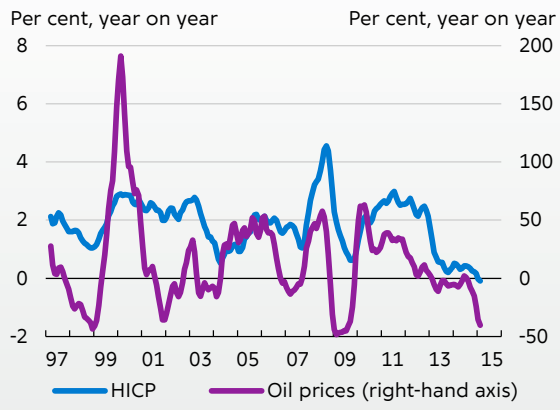
It is more likely that consumers will take the expected price development into account when purchasing large consumer goods such as washing machines, computers or cars. But this product category comprises several examples of prices falling systematically in step with technological advances. Sustained price falls have not prevented consumers from purchasing e.g. computers and smartphones.

In any event, there probably has to be signs of considerable price falls in order to trigger a self-reinforcing negative price-wage spiral. The postponement of consumption will be limited in the case of mild deflation in the form of minor, but sustained price falls. If the economy is seriously hit by a prolonged period of deflation, it will entail a number of social costs compared with a more stable price development, cf. Box 1.

The main explanation of the lower oil prices seems to be rising production, while declining demand has been less important, cf. ECB (2015). Hence, this is first and foremost a positive supply shock that will stimulate e.g. economic growth in Denmark and the euro area.

Global oil production has risen as a result of increased production in North America where technological advances in recent years have made it possible to increase shale oil production and extraction of oil from tar sands. Furthermore, the increase in production is a natural economic consequence of a number of years with high oil prices. At the same time, the members of the Organization of the Petroleum Exporting Countries, OPEC, kept their oil production unchanged. OPEC accounts for around 40 per cent of global oil pro-

Development in oil and consumer prices Chart 1



Note: Annual rate of increase in the EU Harmonised Index of Consumer Prices, HICP. The most recent observation is from February 2015. Oil prices are stated in kroner, and the most recent observation is from February 2015. The series are shown as 3-months moving averages.
Source: Statistics Denmark, Danmarks Nationalbank and EcoWin.

1 Bordo et al. (2005) distinguish between good, bad and ugly deflation. Deflation based on positive supply shocks is generally considered good. See also Borio et al. (2015).

Damaging effects of deflation

Box 1

The real problem of deflation is related to the real interest rate and central banks' scope for easing monetary policy, cf. Danmarks Nationalbank (2009). The real interest rate is the nominal interest rate less expected inflation. If the nominal interest rate cannot be reduced any further, declining inflation expectations will cause the real interest rate to rise. This reduces firms' incentive to invest and increases consumers' incentive to save, i.e. postpone consumption. To counter this trend, central banks can ease monetary policy through unconventional measures. However, such measures may involve greater uncertainty than normal adjustments of monetary policy interest rates.

If the real interest rate goes up, the real debt burden will increase. While a positive rate of inflation will slowly erode the value of nominal debt, households with high debt, for instance, will not be helped by falling prices. After the financial crisis, the focus of many households and firms has been on reducing debt, and such adjustment takes longer if prices are falling.

Household purchasing power is determined by the development in real wages. Nevertheless, many employees have an aversion to nominal pay cuts, cf. Messina et al. (2010). This causes some downward wage rigidity, which is a problem if the economic situation otherwise requires an adaptation of real wages between firms, sectors or in the whole economy. The result is an unnecessary period of lower economic activity and employment. At a positive, but low rate of inflation, adjustments can often be implemented more flexibly – without the need to cut nominal wages.

Deflation is sometimes also described as a self-reinforcing negative spiral. Consumers buy fewer products "today" if they can buy them more cheaply by waiting. This reduces demand so firms have to produce fewer products. If the reaction is strong enough, firms may be forced to reduce wages. This reduces production costs and increases the downward pressure on consumer prices, thereby triggering a negative wage-price spiral. The self-reinforcing effect does not differ significantly from a normal situation with inflation. In such a situation, households move consumption forward in expectation of rising prices, thereby increasing activity, wages and prices. Again, the result is a self-reinforcing process, but this time with an upward pressure on prices and wages. Before it comes to that, however, central banks will attempt to halt price developments by raising or reducing interest rates.

Overall, deflation, i.e. general and sustained price falls, involves a number of costs. This also applies to high inflation, partly because it usually also leads to greater fluctuations. Denmark's fixed exchange rate policy means that it is closely linked to monetary policy in the euro area. Here, the ECB's monetary policy target is symmetrical in the sense that significantly higher or lower price increases both are undesirable, cf. ECB (2011). Furthermore, the inflation target has been set slightly higher than 0 per cent in order to reduce the risk of the central bank being unable to ease monetary policy sufficiently.

duction and is consequently able to impact global supply to some extent – e.g. to stabilise oil prices.

PREVIOUS EPISODES OF OIL PRICE DIVES

Oil supply and demand are both characterised by being inelastic in the short term.[2] Firms are unable to adapt production in the short term to make it more or less energy intensive, and it takes time to implement substantial oil production changes. This means that prices may change quickly – even if the shifts in the balance of supply and demand are small. The most recent adjustment of the price of oil was fairly substantial, but similar price falls have been seen on several previous occasions, cf. Chart 2.

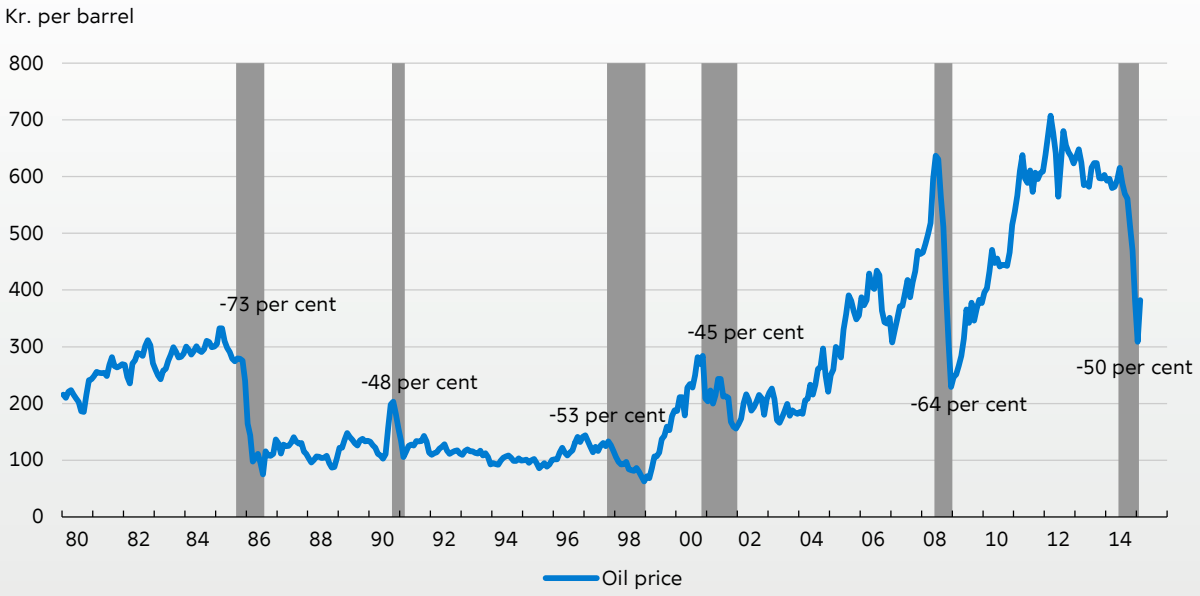
In the longer term, major oil price changes result in dynamic adjustment of both supply and demand so as to establish a new equilibrium price. It is notoriously difficult to predict the future price of oil, but the price of purchasing oil for delivery in the coming years – so-called oil futures – indicate that the price will rise moderately to around kr. 475 per barrel in 2017. Thus, an imminent return to recent years' prices of more than kr. 600 per barrel is not on the cards.

In earlier periods with sharp declines in oil prices over a short period, the annual rate of increase in consumer prices declined by 0.7 percentage point on average. Not surprisingly, this masks considerable variations between different episodes. When oil prices fell in 2008 after the outbreak of the financial crisis, the increase in consumer prices declined by as much as 1.8 percentage points, partly because the oil price fall coincided with a severe global economic downturn. In 1985-86, on the other hand, the increase in consumer prices declined by only 0.3 percentage point, because the oil price fall to a large extent was counteracted by rising energy taxes. The subsequent prolonged period of relatively

2 See e.g. Hamilton (2009).

Periods of marked oil price falls

Chart 2



Note: Monthly price of a barrel of Brent oil stated in kroner. The most recent observation is from February 2015. The shading indicates periods of plummeting prices.
Source: Danmarks Nationalbank and EcoWin.

low oil prices should also be viewed in light of a global increase in energy taxes. This contributed to dampening the normal dynamic adjustment where a pronounced fall in oil prices leads to increased demand in the longer term.

Although the rate of inflation normally is reduced when oil prices dive, the variation between previous periods emphasises the need to understand *how* the price of oil affects consumer prices through various channels. The impact depends e.g. on the underlying causes of the oil price fall, the duration of the price fall, the cyclical position and the economy's dependence on energy.

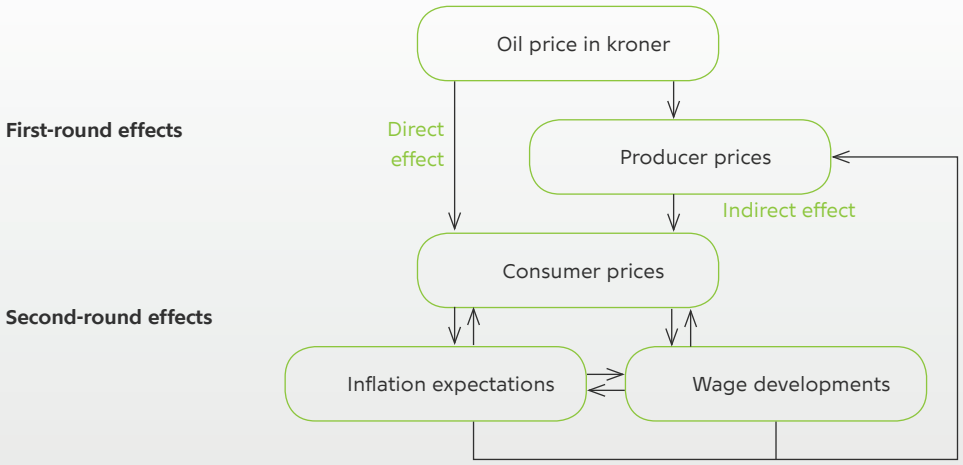
CONSUMER PRICES ARE AFFECTED THROUGH VARIOUS CHANNELS

The implications of oil prices for consumer prices can be divided into direct and indirect first-round and second-round effects, cf. Chart 3. The strongest immediate impact is from the direct effect on the price paid by consumers, e.g. for petrol and fuel oil. Oil prices also affect corporate production costs, and this has an indirect effect when the change in costs is passed on to consumers.

In principle, first-round effects of the oil price fall will only result in a one-off decrease in prices – with no sustained impact on the inflation rate. Second-round effects may have such an impact, however. They comprise changes in price and wage formation as a result of changed inflation expectations. If the oil price shock works through this channel, there is a risk that even temporary shocks may have a prolonged effect on consumer prices.

In addition to the outlined channels, consumer prices are also affected more generally by the impact of oil prices on developments in the financial markets – including the impact on the prices of other commodities – and economic activity in both Denmark and abroad.

Oil prices affect consumer prices through various channels Chart 3



Note: The chart outlines the relationship between oil prices and consumer prices.

DIRECT EFFECT ON ENERGY PRICES

Oil prices affect the price of household energy consumption. The HICP measures developments in the price of a basket of goods and services reflecting the average consumption of a Danish household. Energy products, including taxes, are included at a weight of 11.3 per cent, with liquid energy products in the form of fuel and fuel oil making up just over one third of this. The remaining share is made up of electricity, district heating, natural gas and firewood.

Energy prices fluctuate more than the prices of other goods and services.[3] Therefore, the direct effect on HICP inflation may be substantial. For example, during 2011 energy prices increased HICP inflation by approximately 1 percentage point, while reducing it by 0.9 percentage point in January 2015.

PRICES REFLECT PRODUCTION COSTS AND ENERGY TAXES, AMONG OTHER FACTORS

Energy product prices reflect the underlying production process, among other factors. Crude oil lifted from the North Sea cannot be used directly by consumers e.g. First, the oil is transported to a refinery where it is converted into finished products such as petrol, diesel and fuel oil. Then the finished products are distributed to the points of sale. The final consumer price also reflects corporate gross profits as well as energy taxes and indirect taxes.

For petrol and fuel oil, energy taxes and indirect taxes make up around half of the price paid by consumers, cf. Table 1. And for electricity and natural gas, taxes and distribution costs make up an even larger share. For these products, the commodity price therefore constitutes only around 10-20 per cent. Since a considerable part of the indirect taxes are fixed, they contribute substantially to dampening the pass-through from oil price fluctuations to consumer prices.

PRICES OF FUEL AND FUEL OIL

The extent and speed of energy price adjustments vary substantially, cf. Chart 4.[4] For oil-based energy products such as petrol, diesel and fuel oil, oil price changes are usually passed on quickly to consumers. For example, list prices of petrol are changed daily based on the world market price. Petrol prices at the pump often deviate from list prices, because petrol companies compete locally

3 Energy price fluctuations are more than five times those in the aggregate consumer price index measured in terms of the standard deviation of the monthly price changes since 1997.

4 See also Hansen and Hansen (2007) for an analysis of the underlying microdata.

The price of oil halved in the period from June 2014 to January 2015 – what happened to energy prices?

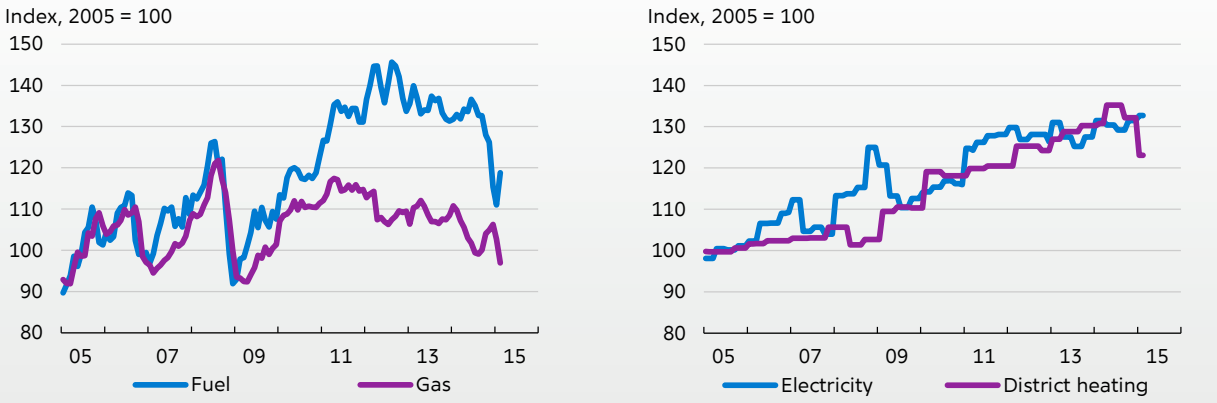
Table 1

Per cent	Electricity (3.3)[1]	Natural gas (1.0)[1]	Fuel oil (0.7)[1]	Firewood (0.4)[1]	District heating (2.8)[1]	Fuel (3.3)[1]
Composition of consumer prices, June 2014						
Commodity prices	11	17	52	43	53	43
Distribution, gross profits, indirect taxes and VAT	89	83	48	57	47	57
Price changes from June 2014 to January 2015	1.8	0.9	-22.5	-1.0	-8.9	-18.7

Note: The composition of consumer prices of the individual products varies e.g. geographically and as a result of different subscriptions etc.
Source: Danish Energy Agency, DONG Energy, Nord Pool, Danish Energy Regulatory Authority, the European Commission's *Weekly Oil Bulletin*, Danish Oil Industry Association (EOF), Hofor and own calculations.
1. Weight in HICP, January 2015.

Considerable variation in energy price fluctuations

Chart 4



Note: Energy prices in the EU Harmonised Index of Consumer Prices, HICP. The most recent observation is from February 2015.
Source: Statistics Denmark.

on price. However, this does not change the fact that, typically, fluctuations in oil prices are fully reflected in petrol prices in the same month.

In January 2015, petrol prices had fallen by 19 per cent since June 2014. This is slightly less than the calculated pass-through, possibly due to an increase in gross profits.

GAS PRICES

Gas prices normally fluctuate with oil prices – albeit with a certain lag. From June 2014 until January 2015, there was, however, a slight *rise* in European gas prices, cf. Chart 4 (left). This is probably attributable to the unrest in Ukraine, which is a transit country for a large share of Europe's import of gas from Russia. Furthermore, prices had also fallen during the first half of 2014, because the weather had been mild and substantial European stocks had been accumulated. This illustrates how local market conditions may blur the relationship with the price of oil.

In the slightly longer term, there has been a clearer relationship between the prices of gas and oil. One reason is that some long-term gas contracts are index-linked directly to the price of oil. Furthermore, oil and gas act as substitutes in

some cases – e.g. in electricity production. This naturally curbs price variance. The price of natural gas in the Danish consumer price index typically reacts with a 1-3 month lag relative to oil price changes.

PRICES OF ELECTRICITY, FIREWOOD AND DISTRICT HEATING

For electricity, firewood and district heating, the relationship with the price of oil is weaker, reflecting that the commodity price constitutes such a small share of the consumer price – particularly for electricity. Price fluctuations are also less frequent, cf. Chart 4 (right). In addition, local conditions of supply and demand may also play an important role. From June 2014 until January 2015 e.g., the market price of electricity fell by approximately 20 per cent in Western Denmark, while the decline in Eastern Denmark was only 10 per cent.[5] The price of electricity in the consumer price index increased by 1.8 per cent.

The price of district heating is also characterised by considerable local variation, partly because the profitability of Denmark's many district heating plants varies substantially. Moreover, the price is regulated according to the self-sustained principle, covering only the actual costs. The price of district heating fell by 9 per cent from June 2014 until January 2015, but the reason is the abolishment of the security of supply tax and not an actual adjustment of the energy price.[6]

INDIRECT EFFECTS VIA CORPORATE PRODUCTION COSTS

Oil prices also have an indirect impact on consumer prices, because oil prices affect corporate energy costs. If oil prices fall, it becomes cheaper to produce the goods and services that are bought by consumers. To some extent, this will be passed on to consumer prices.

The indirect effects of oil prices are associated with far greater uncertainty, however. Energy costs are just one of many factors influencing how firms set their prices. Other factors include strategic deliberations on competitor behaviour and the current cyclical position of the economy.

INPUT-OUTPUT ANALYSIS

A calculation of the indirect effect may be based on an input-output table, cf. Statistics Denmark (2011).[7] It describes the production structure of the economy and the use of goods and services. Assuming that the production technology is unchanged, the table can be used to analyse the amount of energy input used to produce a particular consumer good such as bread. Bread is produced by bakeries and bread factories that use a certain amount of energy in production. They also use input from the agricultural sector, which in itself uses energy to produce cereals. This is also included. The input-output calculations thus provide a measure of total energy consumption in the production of bread.

This exercise is repeated for all consumer goods in the HICP basket of goods, except energy products for which the price effect has already been included in the direct effect. The indirect effect is greatest when production is highly energy intensive. It is obvious that the price of transport services is affected by oil price changes as fuel constitutes a substantial cost. But most processed food and beverages and e.g. visits to restaurants and hotels indirectly comprise a certain amount of energy in production too.

An alternative approach to examining indirect effects is to identify the most oil price sensitive prices in core inflation, cf. Box 2. Core inflation is measured as the development in HICP excluding energy and unprocessed food. This means that oil prices have no direct effect on core inflation via energy prices. If core inflation nevertheless is affected by short-term fluctuations in oil prices, this is attributable to indirect effects. In February 2015, core inflation was 0.8 per cent, and it has not fallen in step with oil prices over the last six months. Based on the historical relationship, this indicates the need for some adjustment via

5 The market price is calculated as the average hourly rate on the Nord Pool electricity exchange.

6 District heating is supplied as either steam or water. A wide variety of energy sources is used to heat water and generate steam. In 2012, 73 per cent of the district heating was produced at combined heat and power (CHP) stations that also produce electricity, cf. Danish Energy Agency (2014). The primary fuel types are coal, natural gas, waste and biomass.

7 The calculations use the latest input-output tables from 2011 and the weights in the consumer price index and the index of net retail prices from January 2015.

How is core inflation affected by the oil price fall?

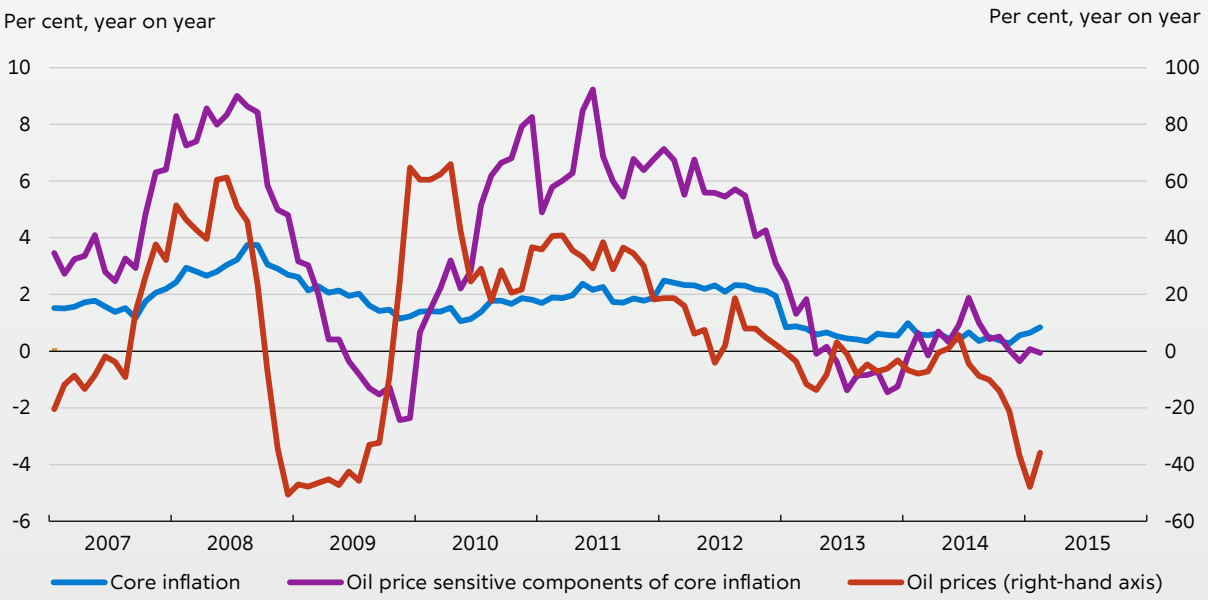
Box 2

Core inflation is measured as the development in HICP excluding energy and unprocessed food. This means that oil price changes have no direct effect on core inflation via energy prices. If it nevertheless is affected by oil prices, this is attributable to either indirect effects via corporate production costs or second-round effects via wage formation. In the short term, it is probably mainly attributable to indirect effects, because prices are typically adjusted more quickly than wages. The indirect effect may also reflect that prices of other commodities develop in step with the price of oil.

In order to assess the impact of oil prices on core inflation, a price index is calculated for the goods and services in core inflation that are most sensitive to oil prices. The oil price sensitive components are selected on the basis of a simple autoregressive model for each of the 82 sub-indices that jointly make up core inflation. There is a marked tendency for the prices of the selected goods and services to react to oil prices, cf. the chart. The reaction often takes place with a lag of around six months, so the oil price falls in recent months have not had a full impact yet. In February, core inflation was 0.8 per cent, which is around the same level as in all of 2013 and 2014. The correlation therefore indicates that some adjustment via the oil price sensitive part of core inflation has not taken place yet. If that is the case, this will curb core inflation in the coming months.

Although the oil price sensitive products make up only around 10 per cent of core inflation, the price fluctuations are considerably more pronounced than for other goods. The products thus account for one fourth of the decrease in core inflation since December 2012, when it was 2 per cent.

Oil price sensitive elements of core inflation



Note: Core inflation is measured as HICP excluding energy and unprocessed food. The oil price sensitive components are selected on the basis of a simple autoregressive model for each of the 82 sub-indices that jointly make up core inflation. These include (with the COICOP codes in brackets): milk, cheese and eggs (011400), oils and fats (011500), coffee, tea and cocoa (012100), mineral waters, soft drinks, fruit and vegetable juices (012200), beer (021300), tobacco (02200), passenger transport by air (073300), passenger transport by sea and inland waterway (073400), gardens, plants and flowers (093300). Oil prices are stated in kroner. The most recent observation is from February 2015.

Source: Statistics Denmark, Thomson Reuters Datastream and own calculations.

oil price sensitive goods and services. If that is the case, it will curb core inflation in the coming months.

OVERALL PRICE EFFECT OF THE OIL PRICE FALL

The price of oil halved in the period from June 2014 to January 2015. The short-term direct effect of the price fall on HICP is estimated at -1.2 per cent, cf. Table 2. Until January 2015, energy prices contributed to the HICP falling by 0.9 per cent. Of this, approximately 0.2 per cent can be attributed to lower energy taxes. Hence, the short-term effect via the prices of petrol, fuel oil and natural gas has not yet been fully reflected in consumer prices.

In the longer term, prices of electricity, district heating and solid fuel are also assumed to adjust. Combined with the indirect effects of falling corporate energy costs, this will result in a total fall

Isolated impact of energy price changes on HICP

Table 2

Per cent	Based on an oil price of 50 dollars per barrel[1]	Based on an oil price of 100 dollars per barrel[1]
Impact of a 10 per cent oil price fall on HICP		
Direct short-term effect (natural gas, fuel oil and fuel)	-0.2	-0.2
Direct medium-term effect (electricity, firewood and district heating)	-0.2	-0.3
Indirect medium-term effect	-0.3	-0.2
Overall effect	-0.6	-0.7
Impact of a 50 per cent oil price fall on HICP		
Direct short-term effect (natural gas, fuel oil and fuel)	-0.8	-1.2
Direct medium-term effect (electricity, firewood and district heating)	-0.9	-1.2
Indirect medium-term effect	-1.4	-1.2
Overall effect	-3.1	-3.6

Note: The calculations are based on distribution costs, profits and indirect taxes as at June 2014. The direct short-term effect is the contribution from natural gas, fuel oil and fuel. In the medium term, the calculation includes the direct effect on electricity, firewood and district heating as well as indirect effects. Only direct and indirect price effects are calculated. Hence, any second-round effects or general effects via the impact of oil prices on real-economic activity etc. are not taken into account.

Source: Danish Energy Agency, DONG Energy, Nord Pool, Danish Energy Regulatory Authority, the European Commission's *Weekly Oil Bulletin*, Danish Oil Industry Association (EOF), Hofor, Statistics Denmark and own calculations.

1. The elasticity is a function of the oil price due to a number of energy taxes in constant prices.

in HICP of 3.6 per cent. The effect will be smaller if the oil price fall is not reflected in all energy products.[8]

In practice, such a large supply-related oil price fall will also act as a catalyst for the level of real economic activity – in Denmark as well as abroad – thereby contributing to an upward pressure on the general price development. By simulating the overall effect in Danmarks Nationalbank's macroeconomic model MONA, HICP inflation in 2015 and 2016 is forecast at -1.0 and -0.1 per cent lower, respectively, than if the oil price fall had not occurred. Consequently, the overall effect of the oil price fall is deemed to be considerably smaller than the isolated price effect calculated in Table 2. One reason is that the simulation does not apply a permanent halving of the price of oil. It increased strongly in February and is expected to increase moderately in the coming years.

SECOND-ROUND EFFECTS

Easing of monetary policy affects the real economy with a certain lag. This makes it difficult for central banks to influence price developments in the short term. Instead, focus is on inflation in the medium term. Consequently, central banks will normally to some extent disregard the temporary direct and indirect first-round effects of an oil price fall. Only if they spread to the prices of other goods and services via wage formation, may the falling energy prices have a sustained effect. This is also known as second-round effects.[9] The risk of such effects arising depends on inflation expectations and wage formation, among other factors.

INFLATION EXPECTATIONS HAVE DECREASED

Inflation expectations determine the risk of second-round effects. Inflation expectations are anchored if there is confidence in the central bank's ability to ensure price stability through its

8 The effects are of the same size as in the euro area, cf. ECB (2014). At an oil price of 60-80 dollars, an oil price change of 10 per cent results in a change in HICP inflation of 0.6 percentage point. Two thirds of the effect is observed fairly quickly via the direct effects, while the rest comes from indirect effects over a period of up to three years.

9 The effect of commodity prices was previously analysed in Spange (2011).

monetary policy. This has an impact on e.g. wage formation, since the expected price development constitutes an important starting point for wage negotiations. A more stable wage development contributes to stabilising corporate costs and hence prices. Therefore, inflation expectations are to a large extent self-fulfilling.

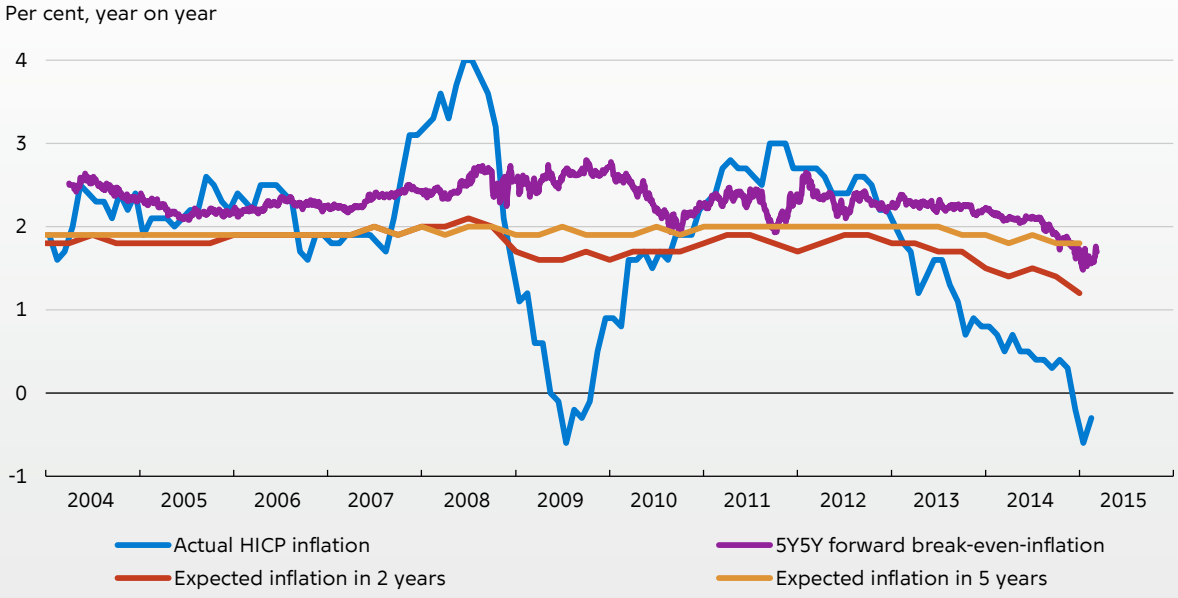
Inflation expectations are compiled in various ways. An obvious method is to ask households how they expect prices to develop in the future. The monthly survey of consumer expectations from Statistics Denmark shows that Danish residents do not expect continued price falls in the coming year.[10]

As a natural consequence of the fixed exchange rate policy, price developments in Denmark have correlated closely with those in the euro area for many years. For this reason it is also relevant to consider inflation expectations for the euro area. On a quarterly basis, the ECB asks professional investors and analysts about expected inflation rates in both the short and the long term. The results of the survey show that the respondents have been confident for a long time that, over a 5-year horizon, inflation will be in accordance with the ECB's target of an annual rate of inflation close to, but just under, 2 per cent, cf. Chart 5.

Expectations 2 years ahead have shown slightly greater fluctuations. They fell to 1.2 per cent in the 1st quarter of 2015, the lowest level since the survey was launched in 1999. Longer-term expectations of inflation 5 years ahead also decreased, but only to 1.77 per cent.

A number of financial products directly index-linked to inflation are traded in the financial markets. The most frequently used products

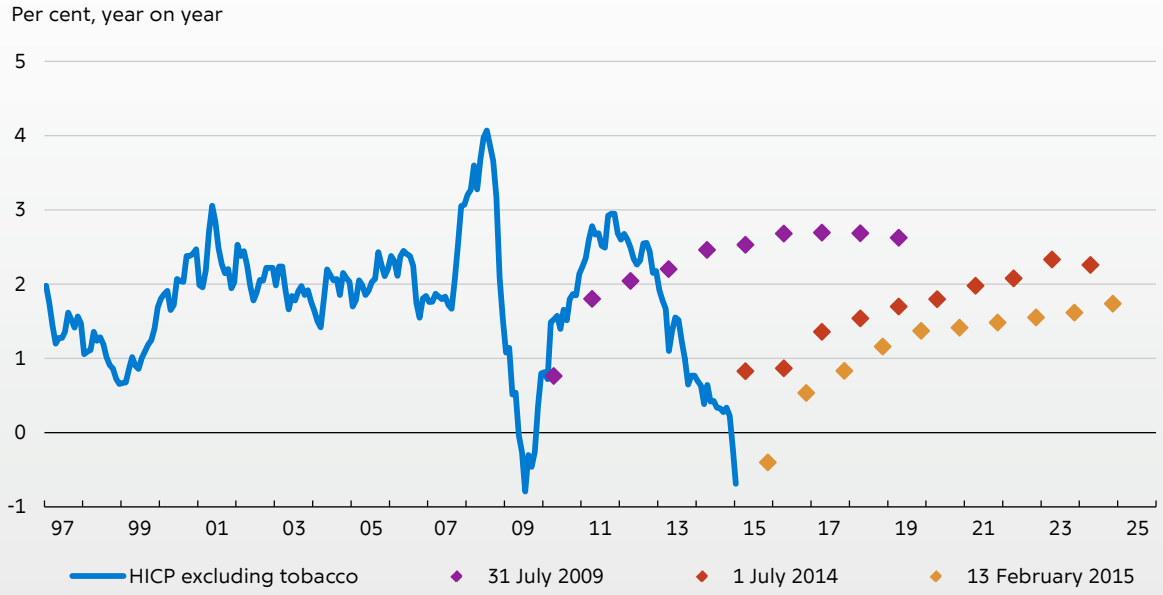
Inflation expectations for the euro area have declined Chart 5



Note: HICP inflation for the euro area. The most recent observation is from February 2015. Expected inflation in two and five years according to the ECB's *Survey of Professional Forecasters*. The most recent observation is from the 1st quarter of 2015. 5Y5Y forward break-even inflation is calculated based on inflation-linked swaps with a maturity of 5 and 10 years. The most recent observation is from 9 March 2015.
Source: Eurostat, ECB and Thomson Reuters Datastream.

10 According to the survey, consumers often expect the rate of increase to remain unchanged when asked to assess price developments one year ahead. Furthermore, they are not asked directly what they expect the inflation rate to be, and the survey contains no information on expectations in the slightly longer term. This reduces the scope for using it to assess the risk of second-round effects.

Break-even inflation indicates sustained adjustment to target for the euro area Chart 6



Note: Break-even inflation is calculated on the basis of swaps index-linked to euro area HICP excluding tobacco. The most recent observation for HICP excluding tobacco is from January 2015. Adjustments for inflation risk and liquidity premiums have not been made, so the curves can only be used as an indicator of expected inflation developments.
Source: Thomson Reuters Datastream and own calculations.

in that context are inflation-linked bonds and swaps.[11] When the prices of such products change, it reflects changed expectations of future inflation, among other factors. This can be used to calculate a measure of inflation expectations.

Other elements may also affect prices, including e.g. changes in risk and liquidity premiums, but the derived inflation expectations act as a key indicator of expectations.[12] The derived break-even inflation over a 5-year period beginning five years into the future was 1.6 per cent in February 2015, cf. Chart 5. This is 0.6 percentage point lower than in June 2014. Long-term inflation expectations have not previously been this sensitive to current price developments.

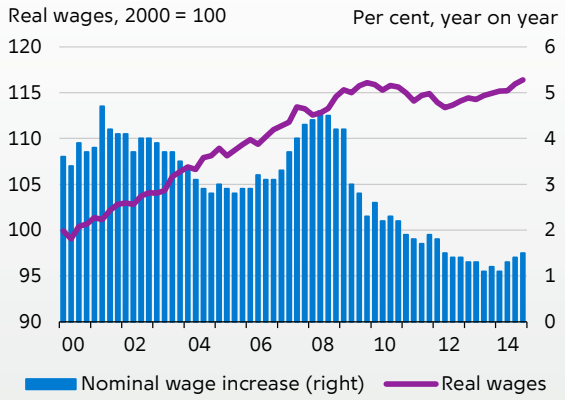
Based on inflation-linked swaps, it is also possible to derive break-even inflation year by year over a 10-year period. When oil and consumer prices fell heavily in 2009, it was widely expected to be a temporary development, cf. Chart 6. According to the break-even inflation curve, the annual rate of increase in consumer prices would rapidly return to the ECB target.

The most recent oil price fall took place against a completely different backdrop. Even before oil prices began to fall, the market expectation was that price increases would only slowly revert to target. After the oil price fall, the curve shifted further downward, and according to break-even inflation, an inflation target of close to 2 per cent can only be expected in the long term. The ECB's most recent easing of monetary policy with the announcement of further bond purchases from March 2015 should be viewed in light of that development.

11 In an inflation-indexed bond, the return is determined by the development in inflation. Similarly, an inflation-indexed swap is a financial contract where one party pays a fixed rate of interest and receives an interest rate that is index-linked to the actual inflation. The products can be used to transfer inflation risk. For example, property companies can reduce their natural exposure to inflation, while pension companies can hedge the inflation risk associated with their obligations – in the form of future payments to customers – by assuming an equivalent investment risk on the asset side. The Danish market for this type of products is less liquid than in the euro area, but prices are typically in accordance with each other.

12 ECB (2015) points out that the inflation risk premium may currently be negative, which would reduce the calculated break-even inflation. The sign depends on market expectations of the correlation between inflation and the business cycle, cf. Danmarks Nationalbank (2012), pp. 100-101.

Private sector wage developments Chart 7



Note: The wage index for the private sector has been seasonally adjusted, and the most recent observation is from the 4th quarter of 2014. Real wages are calculated by deflating by the development in the EU Harmonised Index of Consumer Prices, HICP.
Source: Statistics Denmark.

WAGE DEVELOPMENTS DO NOT SUGGEST A PROLONGED PERIOD OF FALLING PRICES

While inflation expectations have decreased in both Denmark and the euro area, nominal wage increases in Denmark are slowly rising, cf. Chart 7. This development is expected to continue as the output gap gradually narrows and pressures in the labour market increase. Hence, there are no immediate signs of substantial second-round effects via wage formation. Combined with the low increase in prices, it will in fact improve real wages, which may in itself contribute to expanding private consumption and thus economic activity.

In recent years, wage increases have been low in a historical context, however. The weak price development may have had a certain spillover effect on wage formation in that period. But this mild version of a negative price-wage spiral has not gained real momentum, and wage increases are slowly beginning to grow. Against this background, the most recent price development cannot be regarded as a sustained deflationary trend with general price falls.

DOMESTIC PRICE FORMATION

Consumer price inflation in Denmark is determined by domestic market conditions as well as a number of external factors. In addition to oil prices, the effective krone rate and import prices, among other factors, have a significant impact on prices in Denmark. To examine domestic price pressures, Danmarks Nationalbank has been calculating a price index for domestic market-determined inflation, IMI, since 1984. Based on the overall consumer price index, HICP, the price effect of exogenous factors is gradually removed, cf. Hansen and Knudsen (2005).

First, the prices of energy and unprocessed food are excluded. Energy prices are characterised by being determined mainly in global markets and by politically determined energy taxes. Food prices are also to some extent determined in global markets and are, moreover, influenced by supply-related changes, e.g. due to weather conditions. These factors do not reflect domestic price pressures.

Then the impact from products with administered prices, e.g. rent, day care centres and public transport, is excluded, since these prices are partially politically determined and thus not market-determined. For the same reason, the effects of indirect taxes are also excluded, using the index

How is the price effect of imported goods excluded? Box 3

Continues next page

Many consumer goods are produced abroad, e.g. most electronic products such as flat screen TVs, computers and household appliances. Other goods and services are produced in Denmark, but using imported raw materials and intermediate goods. Therefore, import prices have a strong impact on consumer prices.

Although many goods are produced abroad, the final consumer price is still to a considerable degree affected by domestic factors. Consequently, the costs of distribution, sales, marketing, indirect taxes and VAT account for most of the price paid by consumers – including for these goods. Approximately one-fourth of overall private consumption is attributable to imports.

In the calculation of domestic market-determined inflation, IMI, the impact of a number of prices has already been eliminated in previous steps. The import content is therefore calculated for the remaining consumption components (IMI components) using an input-output analysis. The products account for 58 per cent of the components in the index of net retail prices.

Continued

The calculations show that the direct import content constitutes 18 per cent of the IMI components, while 14 per cent can be attributed to indirect imports. The impact of import prices is then excluded by multiplying the weights by two customised import price indices. They are constructed on the basis of Statistics Denmark's import price index for goods, in which import prices are broken down by industry. The prices are weighted by imports broken down by industry from the input-output calculations.[1] This is done separately for direct and indirect import content in order to allow the pass-through to consumer prices to take place at different speeds.

Price developments in the direct and indirect import content vary considerably, cf. the chart (left). Direct imports reflect e.g. the prices of food, clothing, electronic products, cars, furniture and medicine, which have risen by an average of 0.6 per cent p.a. since 1997. This is considerably less than the average increase in the HICP of 1.9 per cent. Increased international competition and the possibility of importing goods from countries with a lower level of costs have thus, via import prices, helped to dampen price increases in Denmark.

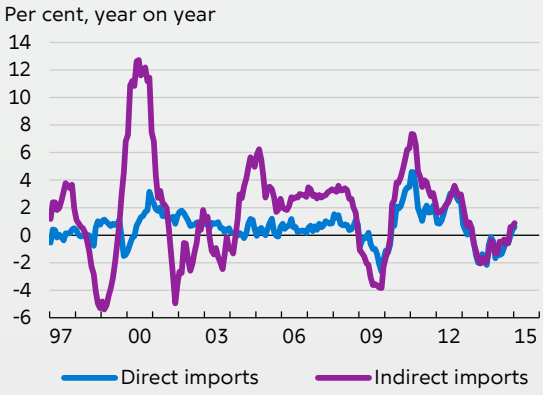
Indirect imports to the IMI components are to a higher extent composed of commodities. This includes food, rubber and plastics, machinery and chemical products. The prices of these products have risen by an average of 1.7 percent p.a. since 1997. Fluctuations are considerably stronger than for direct imports and are also correlated with oil price changes. If the correlation reflects a causal effect from oil prices to the prices of other commodities, oil prices thus also have an indirect effect through import prices. Alternatively, the correlation may be attributable to the fact that the oil and commodity markets extensively are hit by the same demand shocks. If this is the case, the effect is not triggered by oil prices.

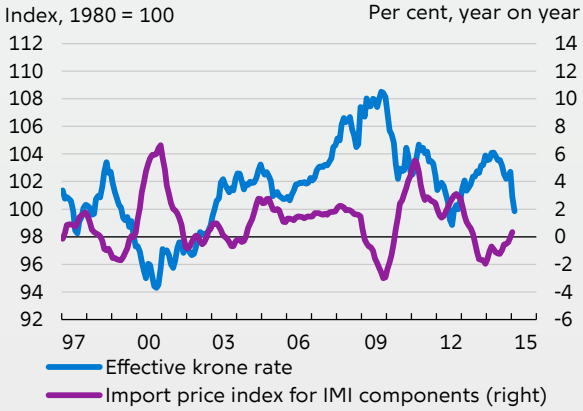
In the IMI calculations, developments in direct import prices immediately impact consumer prices. Therefore, they are excluded using the average price development of the last two months. The price of indirect imports is included as a 3-month average and with a lag of one month. Both direct and indirect import prices are assumed to be fully passed through to consumer prices. If this does not happen, profits have been adjusted, and they are included in the IMI.

When Danish firms purchase goods abroad, prices are dependent on the effective krone rate. Consequently, a negative relationship exists between the krone rate and import prices, cf. the chart (right). When the krone rate rises, importing goods becomes cheaper – and vice versa. In the first 10 years after the turn of the millennium, the rising krone rate generally contributed to import prices rising at a slow pace, thereby helping to keep overall inflation at bay.

Subsequently, the effective krone rate has generally fallen again. The most recent decline since April 2014 has contributed to pushing up import prices, so that they in January 2015 no longer had a negative impact on consumer prices in Denmark. To the extent that the effective krone rate will decline further in view of the diverging monetary policies in the euro area and the US, imports will contribute to pushing up prices.

Developments in import prices and the effective krone rate





Note: Left-hand chart: Import prices are weighted using the industry classification of imports directly or indirectly included in the IMI components. Right-hand chart: Direct imports are included as an average of the last two months, while indirect imports are included as a 3-month average with a lag of one month. Before 2005, import prices are based on the price index for the domestic supply of goods. The most recent observations are from January 2015 for import prices and from February 2015 for the effective krone rate.

Source: Statistics Denmark and own calculations.

1. Part of the import content is made up of services that are not covered by the import price indices for goods. For direct imports, this figure is 2 per cent out of the share of direct imports of 18 per cent, while for indirect imports services make up 6 per cent of the share of indirect imports of 14 per cent. The lack of cover applies e.g. to the air transport, haulage contractor, IT consultancy, advertising and analysis, banking and telecommunications industries. Thus, the calculated price indices reflect price developments for imported goods only. It should also be noted that, in practice, the industry classification of import price indices for goods can also be interpreted as a classification by goods. In accordance with international standards, the industry category is determined by the properties of the imported product. For example, the industry classification of furniture manufacturing covers only imported furniture and not actual imports for the production of furniture, which might include wood, textiles and energy.

of net retail prices where the effects of taxes, subsidies and indirect taxes have been deducted. The remaining goods and services account for 58 per cent of the overall basket of goods.

As the last step in the calculation, the price effect from import prices is excluded. There is no subdivision of the HICP for imported goods and services, however. Instead, the exclusion is based on input-output calculations of the import content of the relevant consumer goods. Since January 2014 Statistics Denmark has calculated a new import price index for goods. The index makes it possible to exclude the relevant import prices more accurately than previously. Hence, the method has been adjusted, cf. Box 3.

INTERPRETATION OF THE INDEX FOR DOMESTIC MARKET-DETERMINED INFLATION

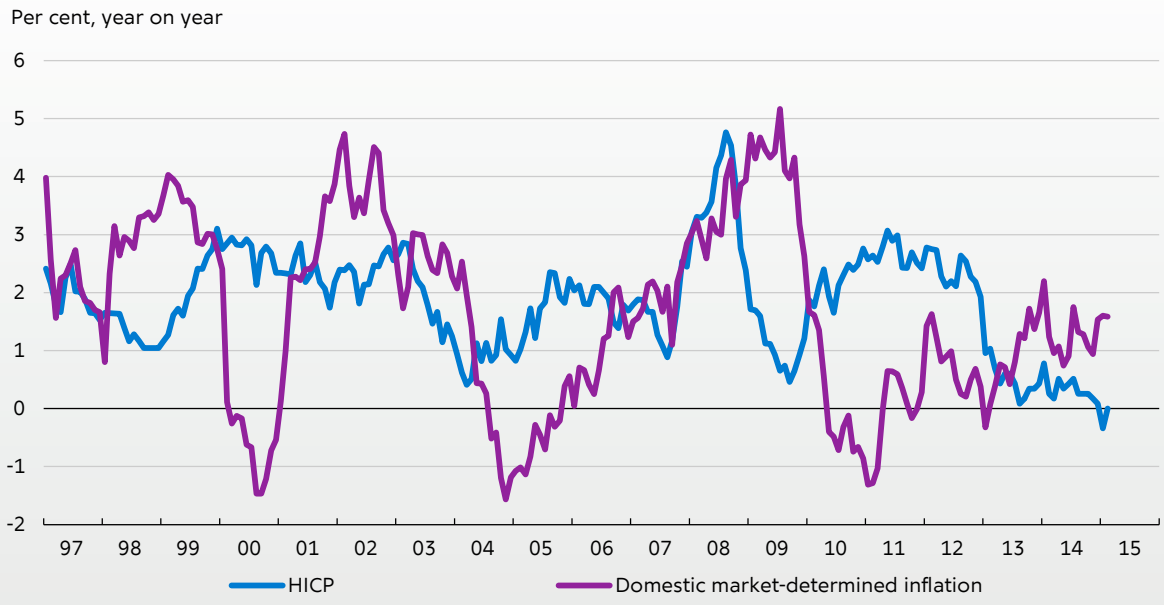
Once external factors have been excluded, domestic market-determined inflation remains. Here, input to production in the form of imported commodities and energy has been deducted. The IMI index therefore describes value added, indicating what is available for remuneration of production factors, i.e. labour and capital. Hence, the IMI corresponds to developments in wages and gross profits. Since both wages and profits are related to capacity utilisation in the economy, the IMI index is an indicator of current domestic price pressures.

Short-term changes in the IMI index are typically attributable to changes in profits. Temporary fluctuations in energy and import prices are often smoothed out by adjusting profits in the domestic distribution and sales links. If price changes are persistent, firms will pass on the changed costs to consumers when the cyclical position of the economy and competition allow it.

The development in the IMI index shows how domestic price pressures contributed to rapid price increases during the overheating leading up to 2008, cf. Chart 8. During that period, wage increases in the private sector peaked at almost 5 per cent annually. This changed after the outbreak of the financial crisis, but at the same time oil prices dived. Firms did not reduce consumer prices in step with the fall in oil prices. Profits therefore increased, and the IMI index continued to rise substantially until the end of 2009.

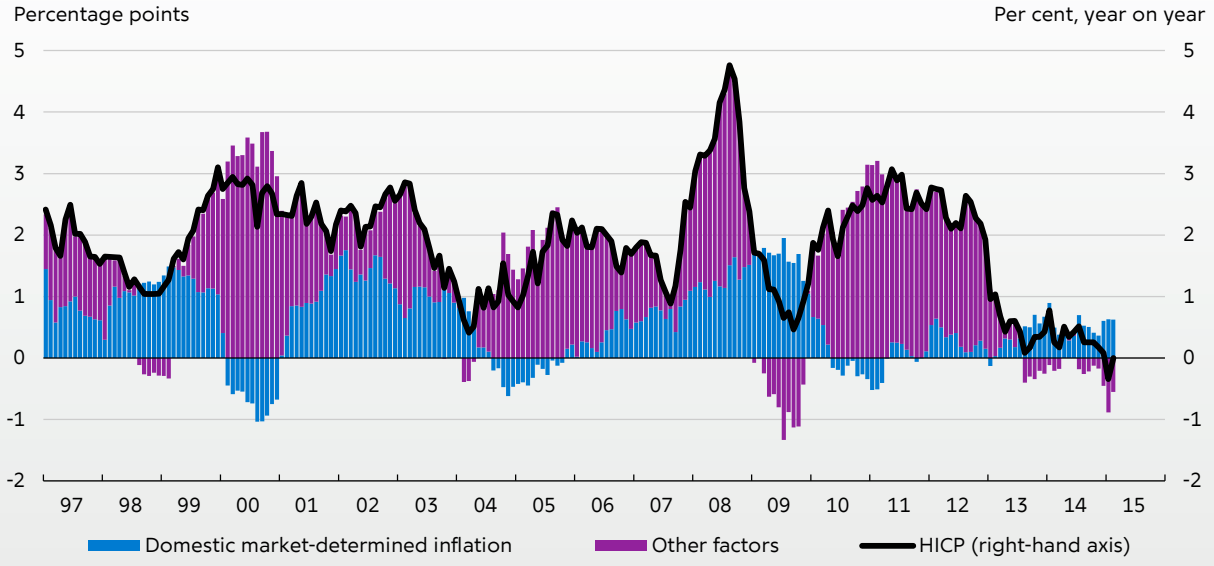
This was followed by a period where a negative rate of increase in the IMI index indicated very weak domestic price pressures. In the period, the focus of many firms was to trim costs rather than to expand into new markets. From this low

HICP and domestic market-determined inflation Chart 8



Note: The most recent observation is from February 2015.
Source: Statistics Denmark and own calculations.

Domestic market-determined inflation and other factors Chart 9



Note: Contribution to the annual rate of increase in HICP. Other factors comprise the price of energy, unprocessed food, rent, indirect taxes and administered prices. The most recent observation is from February 2015.
Source: Statistics Denmark and own calculations.

starting point, there has since been an upward tendency in domestic price pressures.

In February 2015, at an annual rate of increase of 1.6 per cent, the IMI index was close to the average rate of increase of 1.7 per cent since 1997. With the sharp drop in oil prices, a more rapid increase in the IMI index due to rising profits might have been expected, however. Consequently, domestic price pressures are still assessed to be rather limited.

DEVELOPMENTS IN CONSUMER PRICES ARE TO A HIGH DEGREE DETERMINED BY EXTERNAL FACTORS

The IMI index represents less than half of private consumption, implying that a considerable share of consumer prices is determined by factors other than domestic market prices. The overall rate of increase in the HICP is to a large extent determined by energy prices, import prices and politically determined indirect taxes, cf. Chart 9.

Especially in 2010-12, the overall increase in consumer prices was significantly higher than domestic price pressures. During the period 2013-14, on the other hand, domestic market-determined inflation has kept consumer price inflation in positive territory.

LITERATURE

Bordo, Michael, Andrew Filardo, Andrés Velasco and Carlo Favero (2005), Deflation and monetary policy in a historical perspective: Remembering the past or being condemned to repeat it?, *Economic Policy*, No. 44.

Borio, Claudio, Magdalena Erdem, Andrew Filardo and Boris Hofmann (2015), The costs of deflations: a historical perspective, *BIS Quarterly Review*, March.

Danmarks Nationalbank (2009), *Monetary Policy in Denmark*, 3rd edition.

Danmarks Nationalbank (2013), *Danish Government Borrowing and Debt – 2012*.

Statistics Denmark (2011), *Danish Input-Output Tables and Analyses 2009*.

ECB (2010), Oil prices – their demand and impacts on euro area inflation and the macroeconomy, *Monthly Bulletin*, August.

ECB (2011), *The Monetary Policy of the ECB*, 3rd edition.

ECB (2013), Commodity prices and their role in assessing euro area growth and inflation, *Monthly Bulletin*, October.

ECB (2014), December 2014 Eurosystem staff macroeconomic projections for the euro area, *Monthly Bulletin*, December.

ECB (2015), *Economic Bulletin*, No. 1.

Danish Energy Agency (2014), *Energy Statistics 2012*, 2nd edition.

Hansen, Bo William and Niels Lynggård Hansen (2007), Price setting behaviour in Denmark – A study of CPI micro data 1997-2005, *Danmarks Nationalbank Working Paper*, No. 39.

Hamilton, James D. (2009), Causes and consequences of the oil shock of 2007-08, *Brookings Papers on Economic Activity*, spring.

Hansen, Ester, Morten Hedegaard Rasmussen and Jonas Staghøj (2013), Price formation in Denmark, Danmarks Nationalbank, *Monetary Review*, 3rd Quarter, Part 2.

Hansen, Bo William and Dan Knudsen (2005), Domestic market-determined inflation, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Messina, J., C. F. Duarte, M. Izquierdo, P. Du Caju and N. L. Hansen (2010), The incidence of nominal and real wage rigidity: An individual-based sectoral approach, *Journal of the European Economic Association*, No. 8.

Spange, Morten (2009), Price stability and employment, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Spange, Morten (2011), Commodity prices and inflation in Denmark, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter, Part 1.