

DANMARKS
NATIONALBANK

MONETARY REVIEW
4TH QUARTER

2016



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CONTENTS

7 CURRENT ECONOMIC AND MONETARY TRENDS

ARTICLES

47 REGIONAL ASPECTS OF THE HOUSING MARKET

Simon Juul Hviid, Tina Saaby Hvolbøl and Erik Haller Pedersen,
Economics and Monetary Policy

The housing market has been picking up over the last three to four years. This development has been particularly pronounced in the Copenhagen housing market, which tends to set the course for the rest of Denmark. In this article, a demand relation is estimated for the Copenhagen market for owner-occupied flats, and the conclusion is that the price level in Copenhagen is high relative to incomes and interest rates. Hence, there is a considerable risk that continuation of the price increases of recent years may be followed by corresponding falls. The Copenhagen housing market is more vulnerable to sudden interest rate hikes than the rest of the country. The combination of high interest rate sensitivity and high house prices increases the risk that even a small rise in interest rates could trigger price falls.

61 EFFECTS OF DANMARKS NATIONALBANK'S INTERVENTIONS IN THE FOREIGN EXCHANGE MARKET

Morten Spange and Jonas Sørensen, Economics and Monetary Policy

The article shows that Danmarks Nationalbank's interventions constitute an effective instrument to stabilise the exchange rate. This applies both in periods of calm in the foreign exchange market for Danish kroner and in periods of considerable pressure on the krone to either appreciate or depreciate against the euro. There are indications of a slightly greater impact on the exchange rate when Danmarks Nationalbank intervenes compared to when private agents trade kroner against foreign exchange. This may reflect that market participants see interventions as a sign of potential, imminent interest rate change.

Martin Dencker Raffnsøe, Financial Statistics, and Jakob Roager Jensen and Anders Larsen, Economics and Monetary Policy

Danish pension wealth has grown substantially in recent years, totalling approximately 175 per cent of GDP. Consequently, the companies' investment and risk hedging decisions have a considerable impact on the foreign exchange market. As a result of the regulation of pension companies and the credibility of Denmark's fixed exchange rate policy, pension companies' level of hedging of foreign exchange risks tends to be considerably smaller in euro than in other currencies such as dollars. Moreover, the hedging ratio in euro varies greatly across the companies. The article analyses the potential impact of the transition to market rate products on the pension companies' hedging of exchange rate risks. Companies with large shares of market rate products tend to rely less on hedging of exchange rate risk. This means that the total hedging ratio is expected to fall in step with the continued gradual transition to market rate products.

CURRENT ECONOMIC AND MONETARY TRENDS

SUMMARY

The upswing continues in the USA and the euro area. In the USA, unemployment is now more or less at its structural level and the economy is close to full capacity utilisation. The President-elect has presented economic plans that entail considerable fiscal easing, which has caused inflation expectations and yields on US Treasury bonds to rise since the presidential election. If these plans are realised, this will also lead to a further increase in US federal debt, which is already at its highest level since the period just after World War II. A subsequent downturn in the US economy could trigger a global economic slowdown.

Another risk factor in relation to the global economy is the increased tendency towards protectionism and anti-globalisation witnessed in e.g. the debates in connection with the Brexit referendum and the US presidential election campaign. Recent years' weak growth in world trade is attributable to other factors, but a more protectionist stance, including termination of existing trade agreements, would lead to loss of welfare and reduce growth in the global economy.

The Danish economy is in a solid upswing. This was further emphasised by Statistics Denmark's most recent revision of the national accounts. Growth in the real gross domestic product, GDP, is now far more in line with the strong rise in employment seen since the beginning of 2013.

The upswing is expected to continue. There are still strong underlying forces that support demand, although they have abated a little recently. The outlook for Denmark's export markets has

weakened. Yields on 10-year government bonds have risen slightly, especially after the US presidential election. The effective exchange rate of the krone has strengthened. Viewed in isolation, that weakens Denmark's competitiveness. In the current cyclical situation, lower growth in demand would be expedient.

All in all, this means that growth is now expected to be a little more subdued in Denmark over the next couple of years than assumed in the previous projection. Growth in GDP is estimated at 1.0 per cent this year, rising to 1.4 per cent in 2017 and 1.5 per cent in 2018. Employment is expected to grow by 50,000 persons until the end of 2018.

The economy is in a broadly neutral cyclical position and heading towards a boom. The signs of labour shortage are becoming still clearer. The aim should be to achieve equilibrium on the structural balance within the next couple of years so that fiscal policy contributes to stabilising the economy. At the same time, this will provide scope for fiscal easing if the economy enters a new recession.

The annual rate of increase in house prices has fallen slightly, but remains high. The price level for owner-occupied flats in Copenhagen is high relative to incomes and interest rates. Add to this a risk that prices are being pushed up by self-fulfilling expectations. At the same time, interest rate sensitivity is higher in Copenhagen than the average for Denmark overall. This makes the Copenhagen housing market vulnerable to interest

rate hikes. Hence, there is a considerable risk that if the real price rises seen in recent years continue, they will be followed by corresponding falls.

THE INTERNATIONAL ECONOMY AND THE FINANCIAL MARKETS

THE ECONOMIC UPSWING CONTINUES, BUT UNCERTAINTY HAS INCREASED

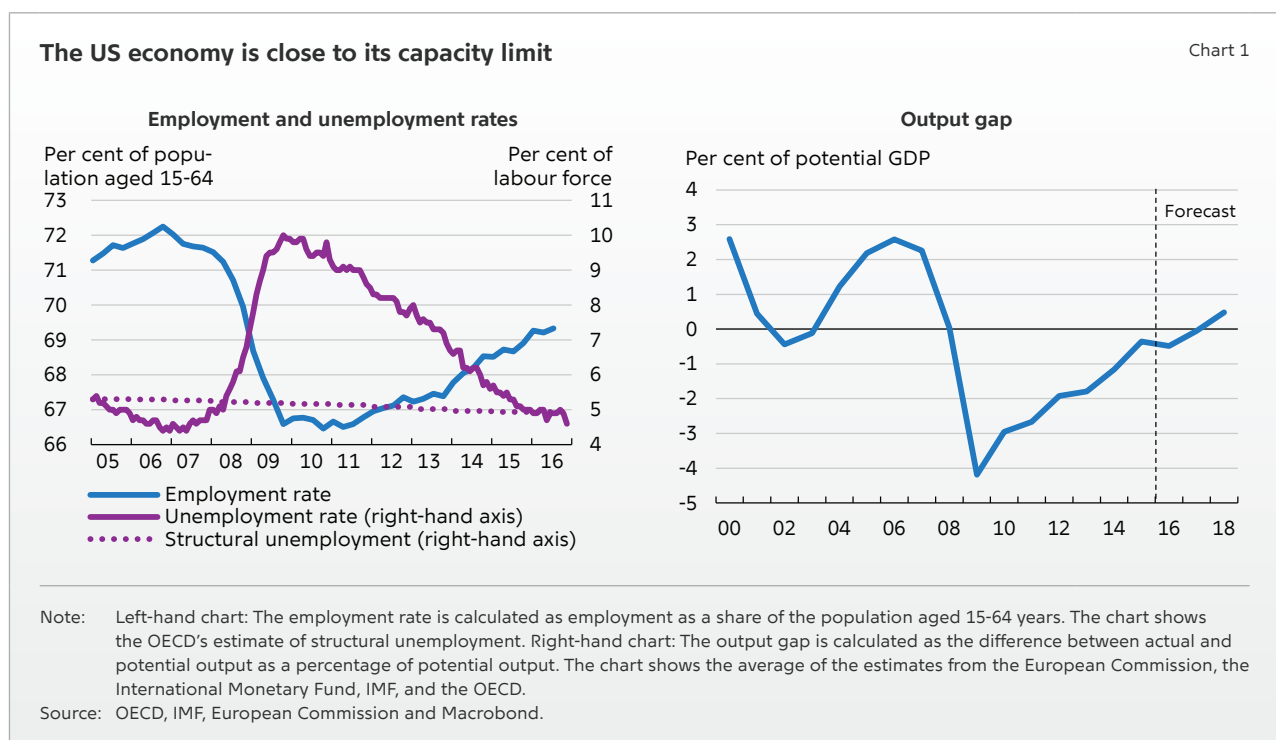
The economic upswing in the euro area and the USA continued into the 3rd quarter. In the USA, employment outside the agricultural sector has increased every month since October 2010. This is the longest continuous period of employment growth since the statistics were introduced in 1939. The rise in employment has by far exceeded the rise in the number of people of working age so that spare resources in the labour market have decreased. Since 2010, the employment rate – employment as a share of the population aged 15-64 years – has increased by more than 2.5 percentage points, and unemployment has declined by approximately 5 percentage points, cf. Chart 1 (left).

US unemployment has been around 5 per cent over the last year, which is equivalent to the OECD's estimate of the structural unemployment

rate. In future, additional labour resources must be found among those currently outside the labour market. The US economy is expected to reach full capacity utilisation next year, cf. Chart 1 (right).

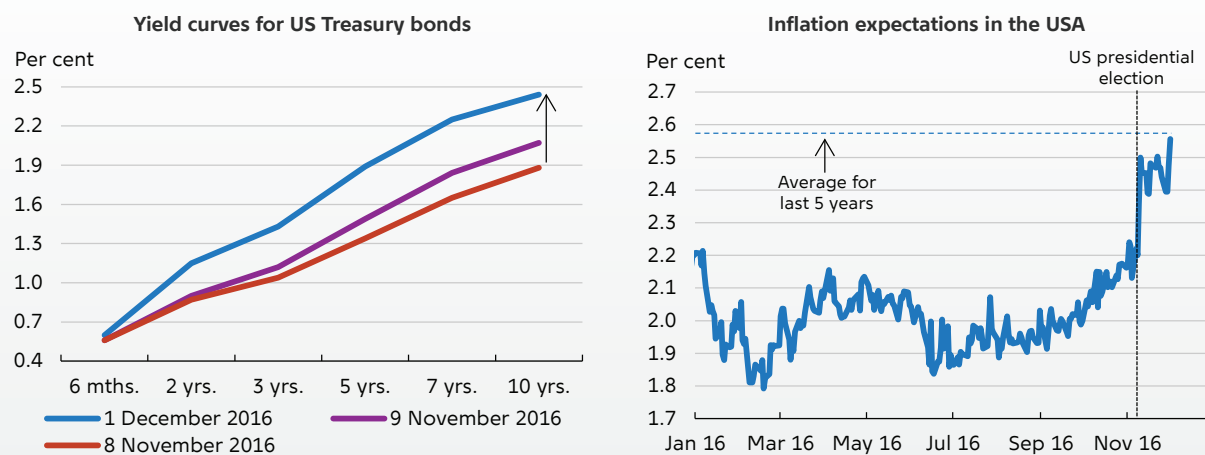
Due to the capacity situation, market participants expect the Federal Reserve to raise the interest rate at the monetary policy meeting in December. In his election campaign, President-elect Donald Trump indicated that he would introduce expansionary fiscal policy measures, including sizeable tax cuts. This could lead to substantially increased pressure on the US economy, which is already close to its capacity limit. Hence, there is a risk of bottlenecks in the labour market, which will intensify wage and price increases, especially if the labour supply is not expanded. As a result, yields on US Treasury bonds and inflation expectations have risen since the US presidential election on 8 November, cf. Chart 2.

Historically, there has been a tendency for US fiscal policy to be eased in order to boost demand when spare capacity in the economy has risen strongly, cf. Chart 3 (left). Conversely, fiscal policy has typically been tightened in order to counter overheating of the economy in periods when spare capacity has shrunk. So if fiscal policy is eased substantially at the current juncture, this would be a deviation from the usual pattern.



Rising yields and inflation expectations in the USA

Chart 2



Note: Left-hand chart: Yields on US Treasury bonds with maturities of 6 months to 10 years. The US presidential election took place on 8 November. Right-hand chart: Inflation expectations have been derived via the inflation swap rate and can be interpreted as the expected average rate of consumer price inflation 5-10 years into the future.

Source: Macrobond and Bloomberg.

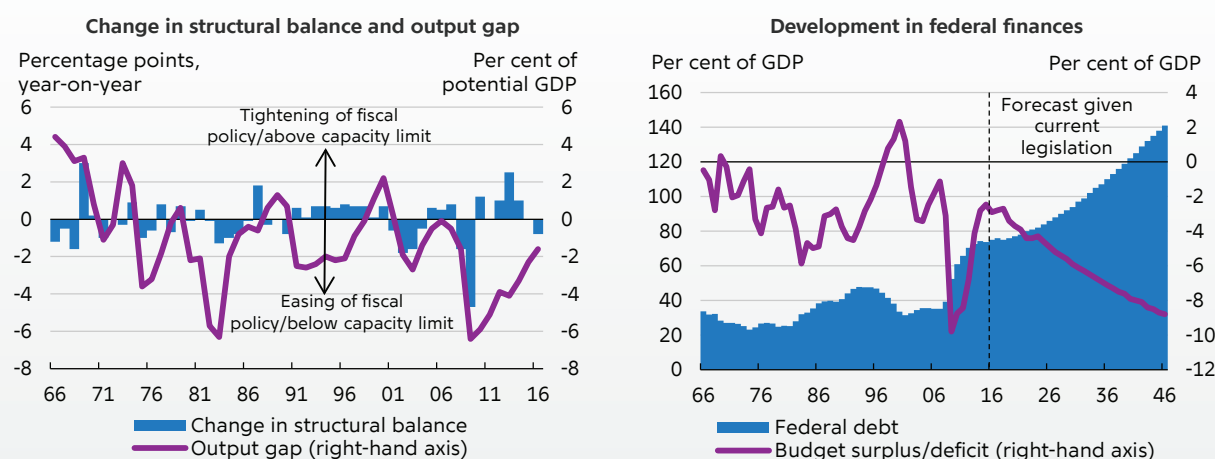
Besides the risk that the economy could overheat, it would lead to a further increase in the federal debt, which is already historically high and is expected to rise in the coming years in the absence of fiscal tightening relative to current regulation, cf. Chart 3 (right).

The US presidential election campaign was characterized by growing opposition to free trade

agreements and globalization. Similar tendencies were seen in the debate up to the UK referendum on continued EU membership in June. It is assessed that so far protectionism has not been a major factor behind the slowdown in world trade. However, rolling back international trade agreements would have a negative impact on international trade and dampen growth in the global economy.

Mounting US federal debt

Chart 3



Note: Left-hand chart: The structural balance shows the underlying position of federal finances, adjusted for the cyclical position and other temporary factors. The output gap is calculated as the difference between actual and potential output as a percentage of potential output. Right-hand chart: The forecast is based on an assumption that no amendments are made to current legislation.

Source: Congressional Budget Office (CBO).

Monetary policy remains very accommodative in most advanced economies, thereby supporting growth. Many countries conducted expansionary fiscal policies during the crisis years, which has led to increased government debt. In a scenario with increasing interest rates without a simultaneous improvement in the economy, many countries' monetary policy options and fiscal scope would be limited. This scenario could potentially materialise if the USA in the near future introduces significant trade barriers combined with expansionary fiscal policy that contributes to higher global interest rates.

In the euro area, the employment rate has risen by approximately 2 percentage points since 2013, when the upswing began, cf. Chart 4 (left). Unemployment has fallen in recent years, to 9.8 per cent at present. This is slightly higher than the OECD's estimate of the structural unemployment rate, which is 8.9 per cent. There are still spare resources in the euro area, and the European Commission has recommended that member states which have room to ease fiscal policy do this, so that aggregate euro area easing amounts to 0.5 per cent of GDP in 2017. The economy is expected to approach full capacity utilisation in 2018, cf. Chart 4 (right).

GLOBAL GROWTH SLIGHTLY BELOW THE HISTORICAL AVERAGE

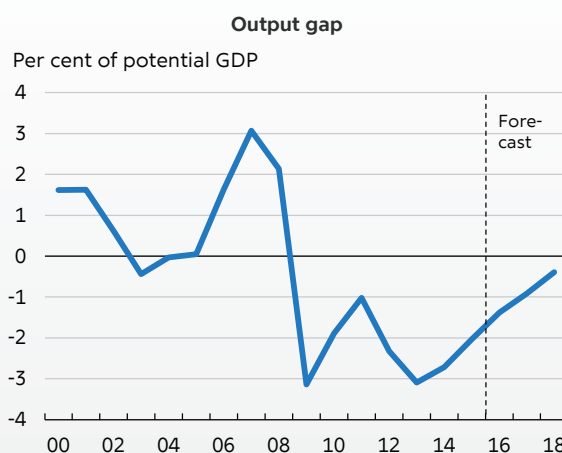
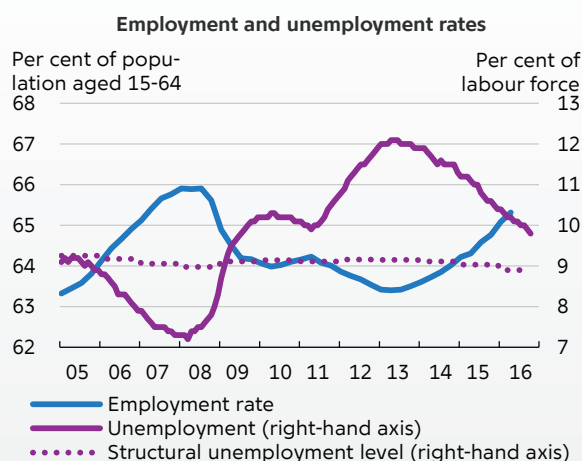
In the euro area, GDP grew by 0.3 per cent in the 3rd quarter, which meant that the moderate increase in economic activity continued, cf. Chart 5 (left). Among the large euro area member states, Spain saw the strongest growth, at 0.7 per cent. Growth was 0.3 per cent in Italy, while economic activity grew by 0.2 per cent in both Germany and France.

In the USA, GDP growth rose to 0.8 per cent in the 3rd quarter, cf. Chart 5 (right), and hence growth in economic activity has increased after a couple of weak quarters in late 2015 and early 2016. Growth was driven mainly by private consumption and exports, while residential investment and imports contributed negatively.

GDP growth in the UK was 0.5 per cent in the 3rd quarter, so the short-term real economic effect of the Brexit referendum seems to be limited, cf. Chart 6 (left). Nor has the referendum had any significant impact on the UK housing market until now. The number of house trades rose strongly in March, reflecting an announced increase in the stamp duty in April. The number of house trades, housing loans approved and house prices have all shown a relatively flat trend since the referendum,

Employment is rising in the euro area

Chart 4

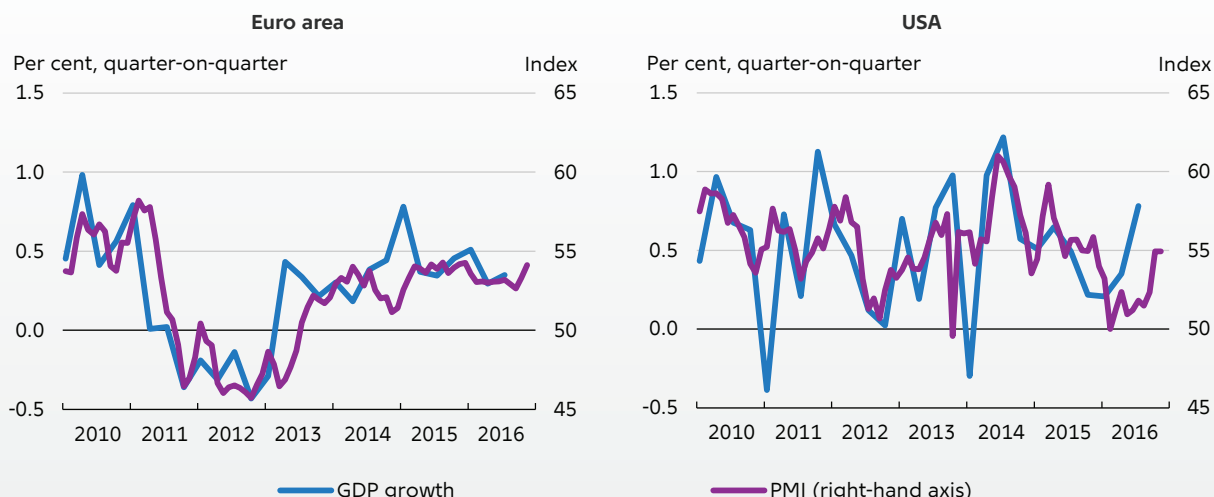


Note: Left-hand chart: The employment rate is calculated as employment as a share of the population aged 15-64 years. Unemployment has been compiled in accordance with principles laid down by the International Labour Organization, ILO. The chart shows the OECD's estimate of structural unemployment. Right-hand chart: The output gap is calculated as the difference between actual and potential output as a percentage of potential output. The chart shows the average of the estimates from the European Commission, the International Monetary Fund, IMF, and the OECD.

Source: OECD, IMF, European Commission and Macrobond.

Economic activity in the euro area and the USA is still increasing

Chart 5



Note: Composite output PMI for the service and industrial sectors. A value above (below) 50 indicates positive (negative) growth.
Source: Macrobond.

cf. Chart 6 (right). Until now, the most significant effect of the Brexit referendum has been the weakening of the pound, cf. Box 1.

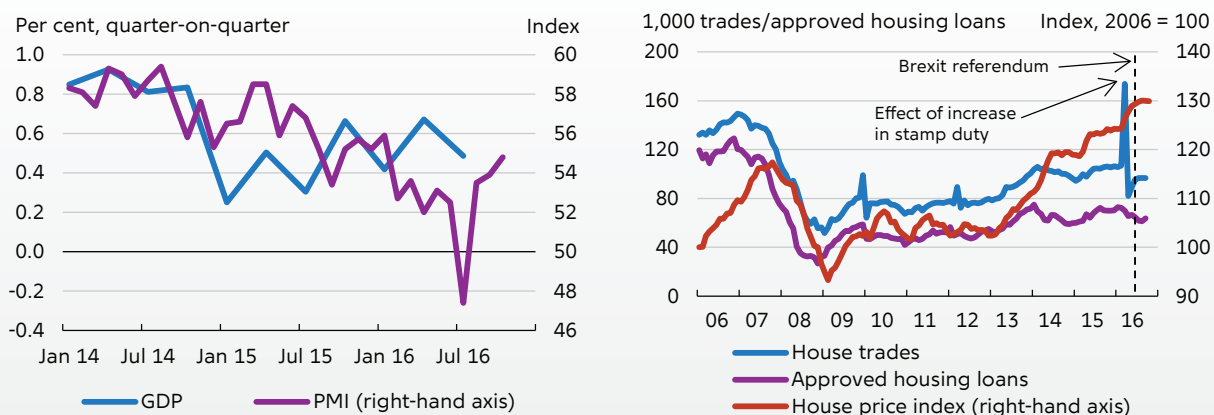
In Japan, GDP grew by 0.5 per cent in the 3rd quarter, implying positive growth for three consecutive quarters for the first time since 2013. The effective exchange rate of the yen has risen by almost 20 per cent over the last year, which has contributed to pushing the already low rate

of consumer price inflation down to 0.5 per cent in September relative to the same month of last year.

Growth in the Swedish economy has slowed down a little in 2016 compared with the high growth rates in 2015. GDP growth was 0.5 per cent in the 3rd quarter, driven mainly by private consumption and exports. House prices are still rising strongly.

Limited short-term effect of the Brexit referendum on economic activity in the UK

Chart 6



Note: Left-hand chart: Composite output PMI for the service and industrial sectors. A value above (below) 50 indicates positive (negative) growth. Right-hand chart: The house price index is based on the Nationwide index.
Source: Macrobond.

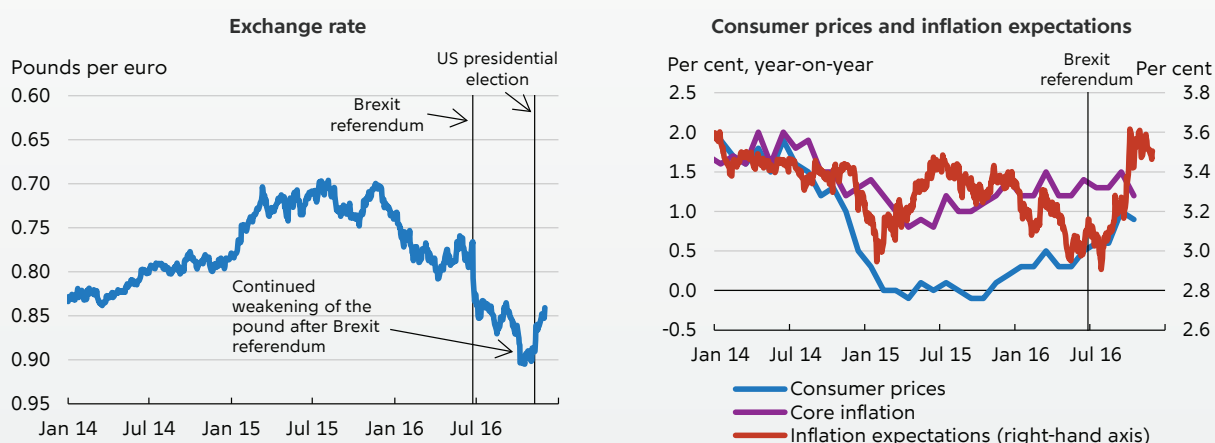
Consequences of the Brexit referendum

Box 1

The pound sterling fell considerably in the hours after the Brexit referendum. The weakening of the pound continued in the subsequent months, but was partly reversed after the US presidential election, cf. the chart below (left). Overall, the pound has weakened by 10 per cent vis-à-vis the euro since the referendum. The continued depreciation may be linked to uncertainty in connection with the UK's exit from the EU. The development in the exchange rate has improved the competitiveness of UK exporters, but at the same time British purchasing power has deteriorated. This dampens domestic demand.

The depreciation of the pound has also contributed to higher price increases and especially higher inflation expectations in recent months, cf. the chart below (right). The was one of the reasons why the Bank of England kept its monetary policy unchanged at the most recent meeting in early November and adjusted its expectations of future consumer price inflation upwards. At the same time, it was made clear that future key indicators will determine the short-term monetary policy stance. That was a tightening compared with the August announcement, in which an interest rate cut was considered to be the most probable scenario.

Weakening of the pound and rising consumer prices



Note: Right-hand chart: Inflation expectations have been derived via the inflation swap rate and can be interpreted as the expected average rate of price inflation 5-10 years into the future.

Source: Macrobond.

Due to the outcome of the Brexit referendum, the international organisations expect UK growth to slow down in the next couple of years, reflecting factors such as lower investment growth as a result of the uncertainty about the future.

Longer-term developments will depend on the agreement to be negotiated between the UK and the EU. As a main rule, structural growth is expected to be higher, the fewer barriers to trade and labour mobility the agreement contains.

In Norway, growth continues to be subdued. This should be viewed in the context of recent years' falling oil prices. The Norwegian krone has fallen with oil prices since 2014, but has appreciated during 2016. As a result, annual consumer price inflation has declined from the peak of 5.0 per cent in July to 4.1 per cent in October.

Among the emerging market economies, there are signs of recovery in Brazil and Russia, which have both been in recession for a couple of years. In the case of Brazil, this reflects that the fall in commodity prices and the domestic turmoil seems to be subsiding. The Russian economy is expected to stabilise after the negative shocks from oil price falls and sanctions in the last couple of years.

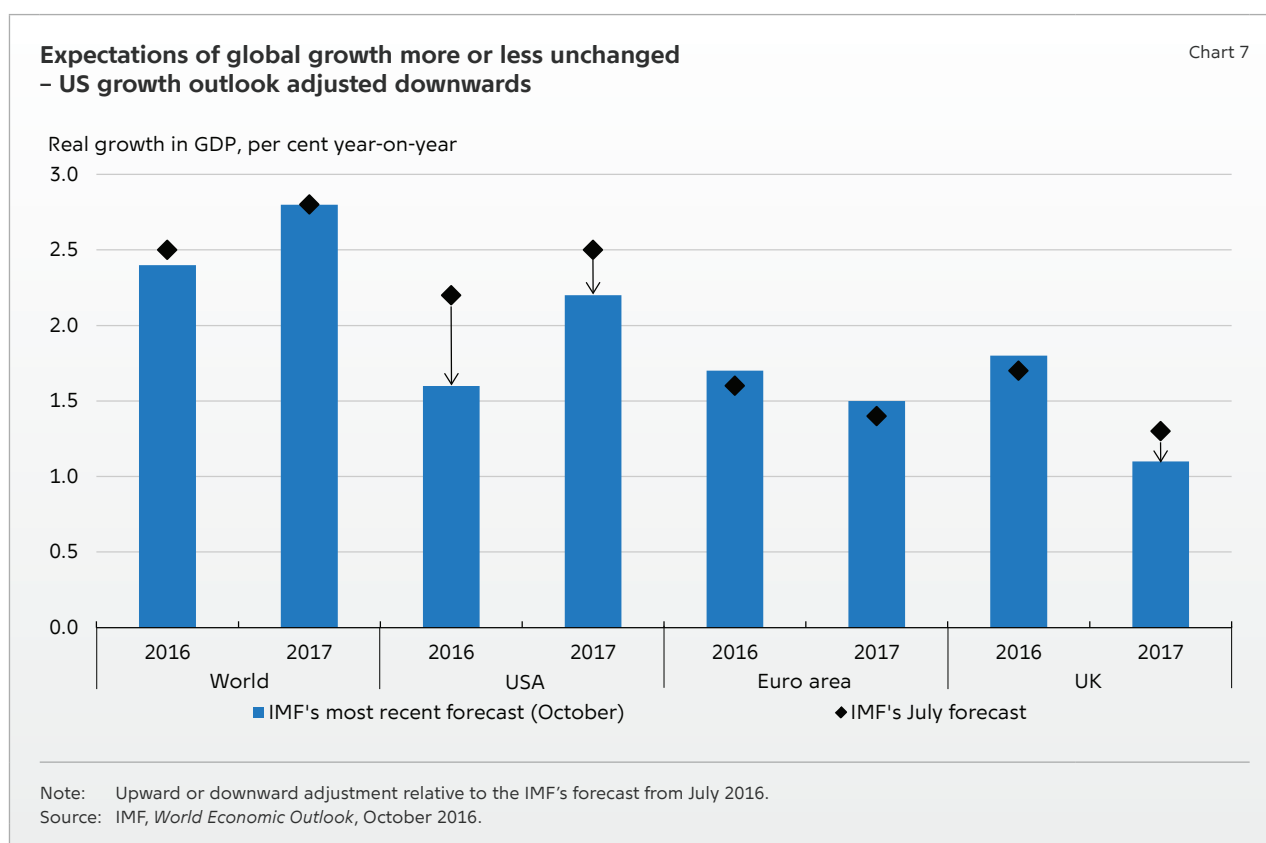
In recent years, India has been among the emerging market economies that have seen the most positive development in economic activity. The Indian economy has benefitted from improved terms of trade and effective policy measures, including reforms of subsidies, agriculture, the labour and product markets and fewer restrictions on inward foreign direct investment. These measures have helped to boost confidence in the future of the economy. Growth is now higher than in China, but India's GDP is approximately one fifth of China's and therefore of less importance to global growth. India's GDP exceeded that of Russia in 2014 and that of Brazil in 2015. The ongoing cash exchange, which means that the

largest two banknotes (500 and 1,000 rupees) are no longer legal tender, is an attempt to combat counterfeiting and tax evasion. These banknotes account for 86 per cent of the money base, and the initiative may have a negative short-term impact on India's economy, which is predominantly cash-based.

In China, the gradual moderation of growth is expected to continue as the economy switches to being driven more by private consumption and less by investment and exports. Despite the dampening, there are signs of overheating of the housing markets in the major cities. In some cities this has led the authorities to take action by increasing down payment requirements and capping the number of homes that one person may own. On several occasions, the International Monetary Fund, IMF, has expressed concerns

about Chinese credit growth and the rising level of indebtedness, which are significant risk factors in relation to the economy.

The IMF has made a marginal downward adjustment of global growth in 2016, to 2.4 per cent, while growth is still expected to rise to 2.8 per cent in 2017, cf. Chart 7. The growth forecast for 2017 corresponds to the average annual rate of growth in the period 1980-2015. The forecast for US GDP growth in 2016 has been adjusted substantially downwards in response to the weak growth in the first quarters of the year. The growth forecast for 2017 has also been adjusted downwards, but remains above 2 per cent.¹ The IMF points to several negative risk elements in relation to the forecast, including protectionist tendencies and protracted weak demand in the advanced economies.



1 The IMF's forecast was made before the US presidential election. On 28 November, the OECD published a forecast based on an assumption of more expansionary US fiscal policy. According to the OECD, this is expected to raise US GDP growth by 0.4 percentage point, to 2.3 per cent, in 2017 and by 0.9 percentage point, to 3.0 per cent, in 2018 relative to the baseline scenario. The OECD notes that the effect may be smaller, e.g. if monetary policy interest rates are increased markedly.

WORLD TRADE REMAINS WEAK

Recent years' weak development in world trade continued into 2016, with growth close to zero, cf. Chart 8. The global growth outlook will deteriorate if world trade slows down further, e.g. due to increased protectionism. One of the reasons is that countries miss out on the gains from international trade, including stronger productivity growth due to increased competition, knowledge-sharing and scope for specialisation. Furthermore, international trade can act as an economic stabiliser, as higher imports can reduce the impact of domestic capacity pressures. According to the World Trade Organization, WTO, the number of trade-restricting measures taken by the largest economies, the G20 countries, has increased in recent years. In addition, average customs tariffs are now being reduced more slowly than previously.

Average annual real growth in world trade has been just 1.9 per cent since 2012, compared with 5.1 per cent in the period 2000-11. The slowdown in imports is broad-based across advanced economies and emerging market economies. Several factors have contributed to the weak trend in world trade. These include cyclical factors, as imports of goods are generally cyclical. Moreover, investments – which are relatively import-intensive – remain low. Add to this a number of structural factors, such as slower development of global

value chains (split-up of production across national borders) and shifts in growth from advanced economies to emerging market economies, which are typically less trade-intensive.

SOLID GROWTH IN REAL WAGES AND SIGNS OF HIGHER CONSUMER PRICE INFLATION

Despite the recovery in the labour market, nominal wage growth remains moderate in the euro area, cf. Chart 9 (left). The main reason is that there is still spare capacity in the labour market, but the low price rises in recent years also play a role as they may have affected wage expectations, thereby contributing to the slowdown in nominal wage growth over the last year. Since 2014, real wage growth has been above the historical average, cf. Chart 9 (right). The USA has seen slightly higher nominal wage increases than the euro area since 2013, and the gap has widened during 2016. This indicates that the decline in spare resources in the US labour market is beginning to have an impact on wage formation.

Since 2002, the average increase in both nominal and real wages has been virtually the same in the euro area and the USA. At the same time, the exchange rate of the euro vis-à-vis the dollar is at more or less the same level as at the end of 2002.

Inflation in the euro area rose to 0.6 per cent in November. This is the highest level since 2014, when energy prices began to dive, cf. Chart 10. The higher inflation rate since April is mainly attributable to a reduction of the negative contribution from energy price developments. There has also been an upward impact from service prices, while prices for food and industrial goods have had a small downward impact. Core inflation remained unchanged at 0.8 per cent in November.

In the USA, inflation has been subdued since late 2014, cf. Chart 11. The contribution from services to the total price development has been stable during this period, while the contribution from goods has been negative. This is to a large extent attributable to developments in energy prices, but the negative contribution has decreased in recent months, which has led to an increase in overall inflation. Core inflation (excluding food and energy), which is currently 1.7 per cent, has been closer to the inflation target of 2 per cent and has been rising slightly over the last year.

Weak development in world trade since 2012

Chart 8

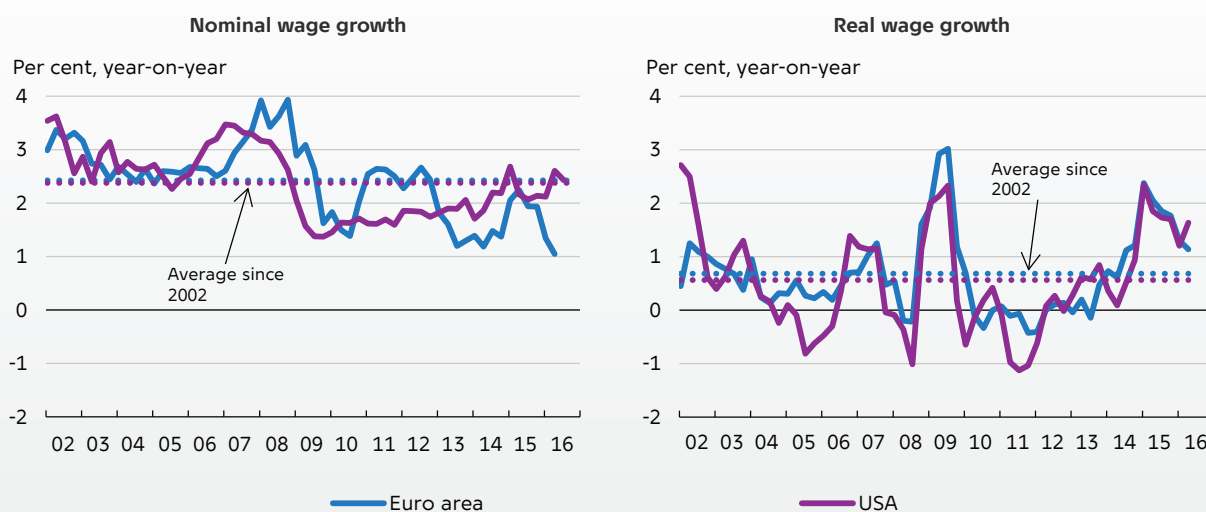


Note: 3-month moving average.

Source: CBP Netherlands Bureau for Economic Policy Analysis.

Subdued nominal wage growth – but solid growth in real wages in both the euro area and the USA

Chart 9

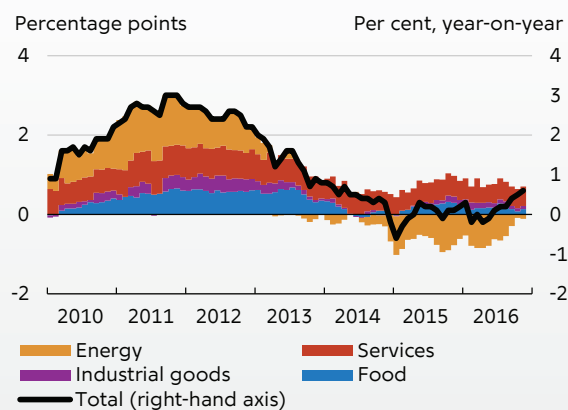


Note: Private sector wage growth. Right-hand chart: The Personal Consumption Expenditures, PCE, deflator has been applied for the USA and the EU Harmonised Index of Consumer Prices, HICP, for the euro area.

Source: Macrobond.

Higher price inflation in the euro area

Chart 10

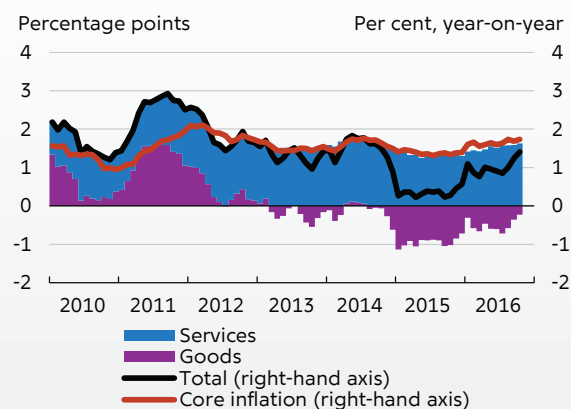


Note: HICP inflation.

Source: Macrobond.

US price inflation is increasing

Chart 11



Note: PCE inflation.

Source: Macrobond.

EXPECTATIONS OF RISING MONETARY POLICY INTEREST RATES IN THE USA AND AN UNCHANGED LEVEL IN THE EURO AREA

The Federal Reserve's Federal Open Market Committee, FOMC, kept its interest rate unchanged at the meeting in early November. But in its press release the FOMC indicated that the arguments in favour of higher interest rates have strengthened. Following the US presidential election,

market participants expect interest rates to rise more rapidly and strongly than expected before the election, cf. Chart 12. Pricing of Fed funds futures now shows that market participants regard it as almost certain that the FOMC will raise its rate of interest at the December meeting. The US markets have also been affected by the reform of money market funds implemented in October, cf. Box 2.

The US money market reform

Box 2
Continues

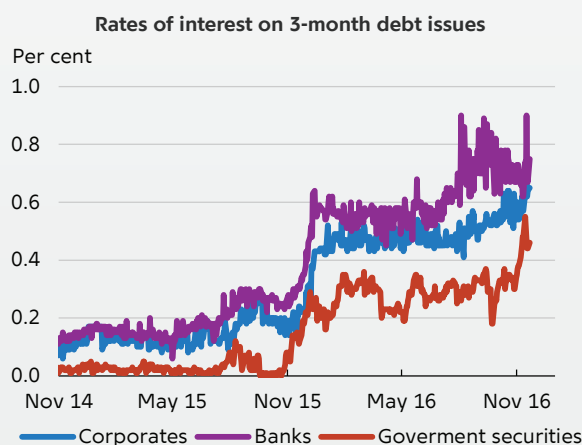
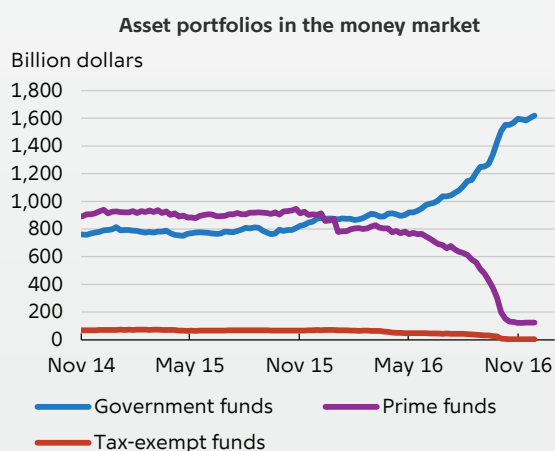
On 14 October 2016, the most recent reform of US money market funds entered into force. The reform was adopted in 2014, so the effects on the financial markets have been underway for some time.

Money market funds are a type of investment association that emerged in the 1970s as an alternative to bank deposits, which did not accrue interest (or accrued only very little interest) due to the regulation existing at the time. The funds invest only in short-term money market instruments with low risk, such as US T-bills and Commercial Paper (CP). The credit risk on these investments is often seen as comparable to the risk on bank deposits, although money market funds are not comprised by a depositor guarantee as they have historically sought to keep the principal value stable at 1.00 dollar per unit. Until the crisis in 2008, there had been only one case where the value of a fund's assets fell below 1.00 dollar per unit. However, the crisis became a watershed for the money market as many funds had been involved in subprime loans in the US housing market, including via the investment bank Lehman Brothers. The financial turmoil in connection with the collapse of Lehman Brothers in September 2008 resulted in large bailout programmes for the otherwise "secure" funds. Since then, the authorities have sought to strengthen financial stability via increased regulation of US money market funds, which today manage assets worth 2,700 billion dollars (corresponding to one seventh of the USA's GDP).

The reform primarily comprises two measures – ensuring market-based valuation of assets, and making it possible, in periods of liquidity pressure, to freeze assets and charge fees in connection with withdrawals from funds. The money market is divided into different types of funds, depending on the primary area of investment activity. For example, "prime" funds invest mainly in bank issues and corporate issues, while "government" funds invest mainly in government securities. The new requirements apply to prime and tax-exempt funds only.

The reform has triggered strong flows in the US money market. Just within the last year, more than 800 billion dollars have been withdrawn from prime and tax-exempt money market funds in favour of government funds in particular, which have had inflows of 750 billion dollars in the same period, cf. the chart below (left). This tendency has initially been driven by some prime funds deciding to change their portfolio composition in order to be reclassified as government funds, which are not comprised by the new rules, before the reform entered into force. At the same time, a number of investors in money market funds have reduced their exposures to prime funds in particular as the risk of assets being frozen has introduced an additional liquidity risk compared with previous regulation.

The reform has had substantial implications for the US money market funds



Source: Investment Company Institute, Bloomberg and own calculations.

Continued

Box 2

The lower activity in the US money market has a particular impact on firms and banks that normally cover their short-term dollar requirements by issuing CP. Prime funds invest predominantly in CP, so the fall in demand means that funding in this market has become more expensive, cf. the chart above (right). For example, the rate of interest on 3-month CP issued by a bank rose by around 20 basis points from June to October. In the same period, the rate of interest on an equivalent 3-month US government issue remained more or less unchanged, and hence the development in the CP market can be assumed to be a direct response to the new reform. Subsequently, US government yields have risen in response to the outcome of the presidential election, and so have CP interest rates.

Higher dollar borrowing costs are not limited to the CP market, but are a more general tendency that can partly be attributed to higher US monetary policy interest rates and partly to increased financial regulation, such as the new money market reform. For instance, the USD LIBOR (London

Interbank Offered Rate), which indicates the rate of interest at which banks are willing to trade dollars among themselves, has risen to the highest level since 2009. The more expensive dollar liquidity is also reflected in the forward market, where loans in dollars against other currencies as collateral have also risen in price.

The response in the Danish financial markets has been very limited, however. This is because Danish banks and firms are not particularly active users of US money market funds. This is in contrast to the situation in Sweden, where banks and firms issue considerable volumes of CP so that the reform has had a stronger impact there. For example, holdings of Swedish banks' debt issues in US money market funds has more than halved since the beginning of 2016, standing at the equivalent of 39 billion dollars in October. The higher borrowing costs and shrinking demand in the CP market means that Swedish banks and firms will increasingly seek to meet their dollar requirements in other ways, e.g. through the forward market.

In the euro area, interest rate expectations have risen considerably since the monetary policy meeting of the European Central Bank, ECB, in September. The forward curve now has a flat profile for the coming months, whereas it had a negative slope earlier in the year, cf. Chart 12. This means that market participants no longer expect money market interest rates to fall. But the very accommodative monetary policy in the euro area is still expected to normalise slowly, with negative interest rates until 2020.

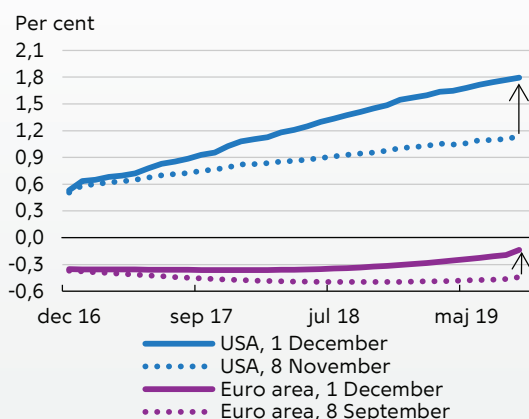
The ECB kept its monetary policy unchanged at the interest rate meeting in October. Hence, the deposit rate remains at -0.4 per cent, and the programme to purchase government and corporate bonds for 80 billion euro per month remains unchanged until and including March 2017. Market participants expect the ECB to extend the asset purchase programme beyond March 2017, but according to market analysts this will presumably require adjustment of the programme, cf. Box 3.

On 21 September, the Bank of Japan, BoJ, announced two major changes to its monetary policy framework. Firstly, the BoJ introduced yield curve control. The short end of the curve is controlled by the deposit rate, which is currently -0.1 per cent, while the long end is controlled by purchases of 10-year government bonds so that the yield is approximately 0 per cent. The purpose of controlling the yield curve is mainly to support economic activity. Purchases of government securities continue

Interest rates are expected to rise in the USA and the euro area

Chart 12

Interest rate expectations in the euro area and the USA



Note: The ECB held an interest rate meeting on 8 September. Interest rate expectations are based on Fed funds futures and Overnight Interest Swaps, respectively, and indicate the expected overnight interest rates at a given time.

Source: Scanrate Rio and Macrobond.

at more or less the same rate (approximately 16 per cent of GDP p.a.), but may be adjusted in order to meet the yield curve target. Secondly, the BoJ made a commitment to keep monetary policy accommodative until inflation is permanently above 2 per cent (inflation overshooting commitment). The aim is first and foremost to increase inflation expectations, which are affected by the many years of weak price developments.

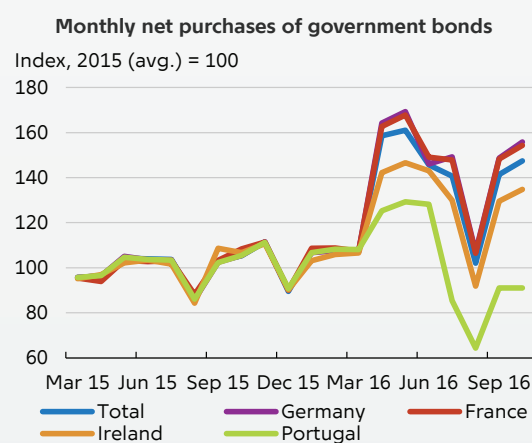
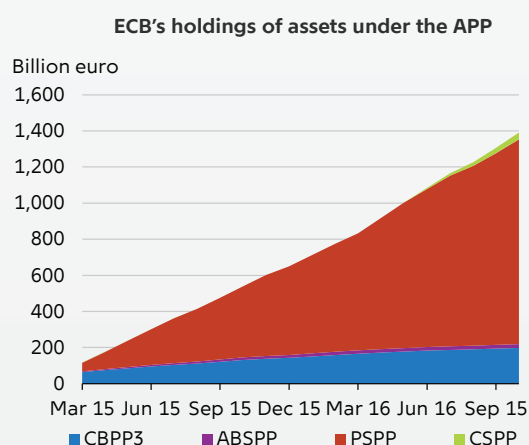
One of the purposes of the ECB's asset purchase programme (APP) is to support the monetary policy transmission, thereby improving access to credit for households and firms. At present, the APP is set to continue until the end of March 2017, or until the Governing Council sees a sustained adjustment in the path of inflation towards the ECB's medium-term inflation target. All in all, the ECB has purchased for 1,400 billion euro, corresponding to around 13 per cent of the euro area's GDP. At the current rate of purchase, total net purchases will reach 1,800 billion euro in March 2017, corresponding to 17 per cent of the euro area's GDP. Speculations on the future of the programme have begun, and market analysts expect the ECB to extend the programme further. However, an extension could increase the Eurosystem's operational challenges in relation to implementing the programme as the ECB's purchases of government bonds are subject to a number of technical restrictions, including that:

- the yield on the government bonds purchased must be higher than the ECB's own deposit rate (currently -0.4 per cent);
- the remaining maturities of the government bonds purchased must be between 2 and 30 years;
- the ECB may not, as a main rule, hold more than 33 per cent of any bond series (issuance limit);

- the ECB may not purchase more than 33 per cent of the outstanding volume of government bonds from any member state (issuer limit);¹
- the bond issuers must, as a minimum, have Investment Grade credit ratings, i.e. at least BBB- or equivalent.²

The ECB's net purchases of assets currently take place via four different programmes comprising covered bonds (CBPP3), asset-backed securities (ABSPP), government bonds (PSPP) and corporate bonds (CSPP). At more than 1,100 billion euro, the PSPP is by far the largest component of the APP, cf. the chart below (left).³ Allocation of purchases between member states is managed on a monthly basis using the ECB's capital key. In April, the ECB increased the purchase volume from 60 billion euro to 80 billion euro per month, and since then the values of purchases have deviated from the capital key in several member states. Especially in Portugal, monthly purchases have decreased, cf. the chart below (right). The accommodative monetary policy and the currently low interest rate environment have also meant that many euro area government bonds are traded at negative yields. In several member states this has led to challenges in relation to finding a sufficient volume of eligible government bonds, which has been reflected in longer maturities for the government bonds purchased by the ECB.

The ECB's APP primarily comprises purchases of government bonds



Note: Right-hand chart: The data shows seasonal fluctuations as the ECB purchases more bonds up to the summer months, during which purchases are reduced correspondingly.
Source: ECB.

According to market analysts, extension of the ECB's APP may require that the ECB eases its current restrictions. The President of the ECB, Mario Draghi, has said that all possibilities are being considered as regards amending the rules for

purchase of government bonds and adding flexibility to the implementation of the APP. Market analysts expect potential changes to be announced in connection with the ECB's interest rate meeting on 8 December 2016.

1. The issuer limit applies to bonds with remaining maturities of between 2 and 30 years. This includes the ECB's existing holdings of government bonds purchased under the Securities Markets Programme (SMP).
2. The ECB has no obligation to sell assets downgraded after having been purchased.
3. Under the ECB's Public Sector Purchasing Programme (PSPP), bonds offered by public sector institutions and authorities in the euro area are also purchased. Purchases under the PSPP are made in the secondary market only due to the ban on monetary financing.

BRIEF MARKET TURMOIL IN CONNECTION WITH THE US PRESIDENTIAL ELECTION

In the days just before the US presidential election, there was a brief spell of heightened volatility in the financial markets, cf. Chart 13 (left). Yields on US Treasury bonds dropped sharply when the election result was clear, but the tide turned during the trading day and yields ultimately rose considerably. This should be viewed in the light of expected easing of fiscal policy by the incoming administration. Stock indices also rose after initial falls, and US equity prices are now 4 per cent higher than at the beginning of November, cf. Chart 13 (right).

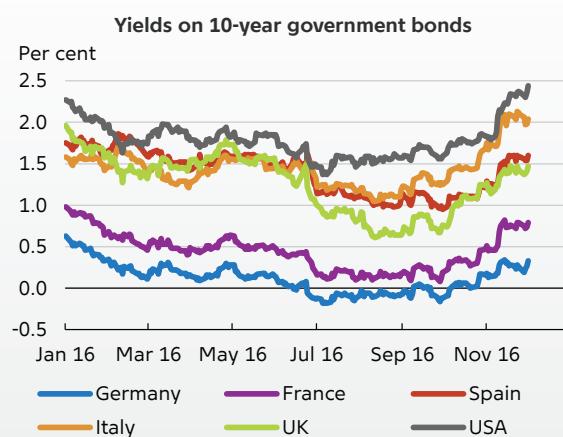
Yields on 10-year government bonds have risen a little in the advanced economies following historically low levels in several countries in July-August, cf. Chart 14. This means that the yield level for many 10-year government bonds in the advanced economies is now close to or above the level seen before the summer. The spread between Italian and German 10-year government bonds increased considerably in September and October – by a total of more than 25 basis points. This reflects factors such as turmoil surrounding the Italian banks and possible political instability up to the constitutional referendum on 4 December. Furthermore, on 25 October, the EU requested clarification from the Italian government as to why the budgeted deficit in 2017 had risen from 1.8 to 2.3 per cent of GDP. UK yields remain below

the level seen before the Brexit referendum, but have risen a little again.

The dollar has strengthened vis-à-vis a number of currencies since the election. One of the reasons is that expectations in the market of higher US monetary policy interest rates have risen. From the election on 8 November until 1 December, the euro and the Japanese yen fell by 4 per cent and 8 per cent, respectively, against the dollar, cf. Chart 15. A number of emerging market economies have seen their currencies dive. The Mexican

Rising yields on government bonds

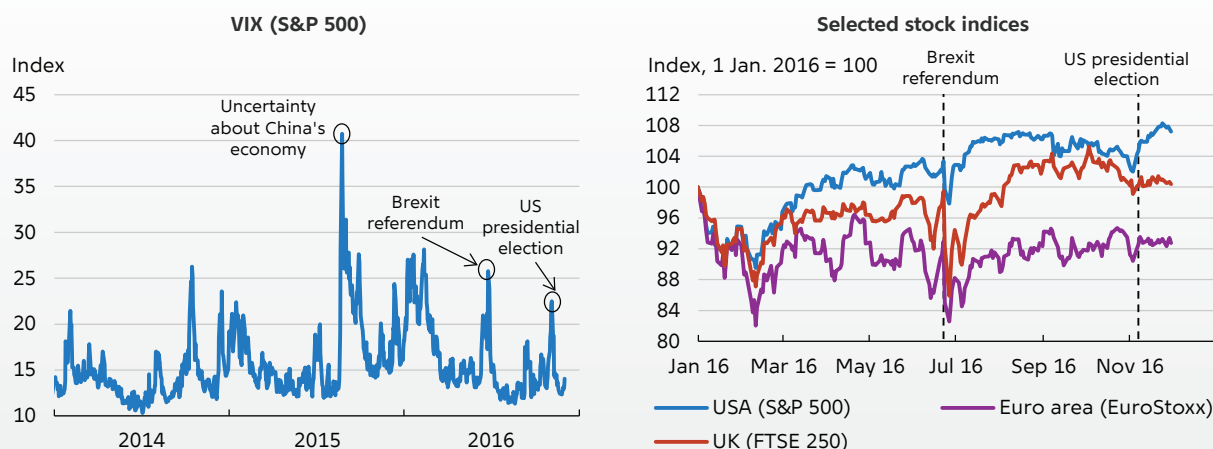
Chart 14



Source: Macrobond.

The US presidential election has had an impact on the financial markets

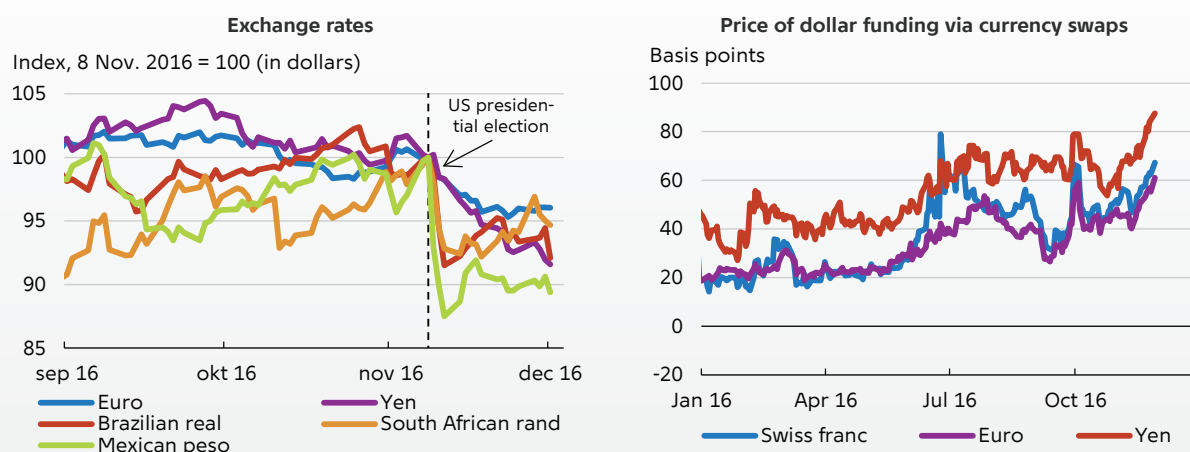
Chart 13



Note: VIX expresses the implied volatility in options on the US S&P 500 stock index.
Source: Macrobond.

**The dollar has strengthened considerably after the US presidential election
– dollar funding via currency swaps has become more expensive**

Chart 15



Note: Right-hand chart: The chart shows the *basis* in 3-month cross-currency swaps between the respective currencies and the US dollar. Positive values indicate a premium on the 3-month (uncollateralised) money market interest rate in dollars payable for receiving a 3-month (uncollateralised) money market interest rate in the local currency. Hence, higher values indicate increased costs of obtaining dollar funding via the currency swap market.

Source: Macrobond and Bloomberg.

peso fell by more than 7 per cent against the dollar the day after the election and showed the strongest fluctuations since 2008. This should be viewed against the backdrop of Donald Trump's announcements during his election campaign that he would introduce heavy customs tariffs on goods imported from Mexico.

During 2016 it has become more expensive to obtain dollar funding via the currency swap market, where payment flows in other currencies can be exchanged into dollars, cf. Chart 15 (right). Developments in recent months reflect uncertainty about funding conditions at the turn of the year, when liquidity in the financial markets is reduced. Furthermore, in connection with the US money market reform it has become more difficult to obtain dollar funding via e.g. Commercial Paper, CP, cf. Box 2.

MONETARY AND EXCHANGE RATE CONDITIONS

THE KRONE IS STABLE ON THE STRONG SIDE OF THE CENTRAL RATE

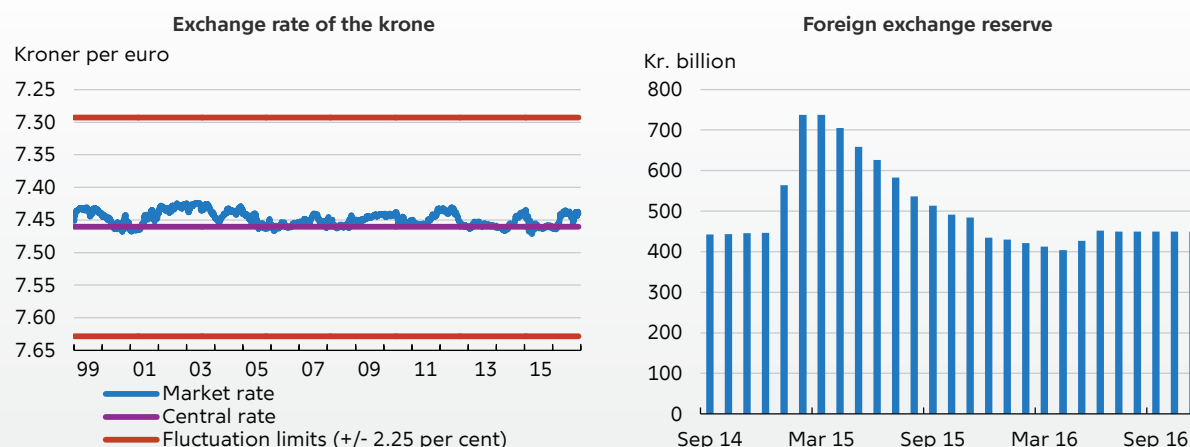
In recent months, the krone has been stable vis-à-vis the euro at a slightly stronger level than its central rate in ERM2, cf. Chart 16 (left). During September, the krone gradually weakened, followed by a rapid reversal in early October.

Danmarks Nationalbank did not intervene in the period July-November, and the foreign exchange reserve was kr. 449.8 billion at end-November, cf. Chart 16 (right). Danmarks Nationalbank has kept the rate of interest on certificates of deposit at -0.65 per cent since January, and the ECB has kept its key policy rate at -0.40 per cent since March. The monetary policy interest rate spread remains unchanged at -0.25 per cent. No changes to the ECB's asset purchase programme have been announced.²

² See Box 3 for a description of the ECB's asset purchase programme.

The krone is on the strong side of the central rate

Chart 16



Note: Left-hand chart: Reverse scale. The most recent observation is from 1 December 2016.
Source: Danmarks Nationalbank.

SLIGHTLY HIGHER TURNOVER IN THE DANISH FOREIGN EXCHANGE MARKET FOR KRONER

Average turnover per banking day in the Danish foreign exchange market for kroner – i.e. foreign exchange turnover in Danish kroner involving a bank located in Denmark – was kr. 125 billion in April 2016.³ That is slightly higher than three years earlier, cf. Chart 17 (left).

Turnover in the market for Danish kroner involves various foreign exchange market products, cf. Box 4. Since 2013, turnover in spot transactions and forward contracts has decreased slightly, while turnover in FX swaps has risen. Over a longer period since 2007, the breakdown into individual products in the Danish foreign exchange market for kroner has been more or less unchanged.

Danish kroner are not necessarily traded via banks located in Denmark. The *global* market for Danish kroner comprises not only the *Danish* foreign exchange market for kroner, but also foreign exchange turnover in Danish kroner involving banks located outside Denmark. In the global market for Danish kroner, average daily turnover rose from kr. 240 billion in April 2013 to kr. 278

Products in the foreign exchange market for Danish kroner

Box 4

The primary products in the foreign exchange market for Danish kroner are spot and forward contracts and FX swaps. In a spot transaction, kroner are exchanged for foreign currency immediately (typically two days) after the conclusion of the trade, while forward contracts comprise exchange at an agreed future date at an exchange rate agreed at the time of conclusion of the trade. Both spot and forward contracts may affect the exchange rate of the krone because demand for kroner changes. In spot trades, there is a direct impact on demand. In connection with forward contracts, the banks typically hedge the forward contract by means of a spot trade, which has an impact on demand.

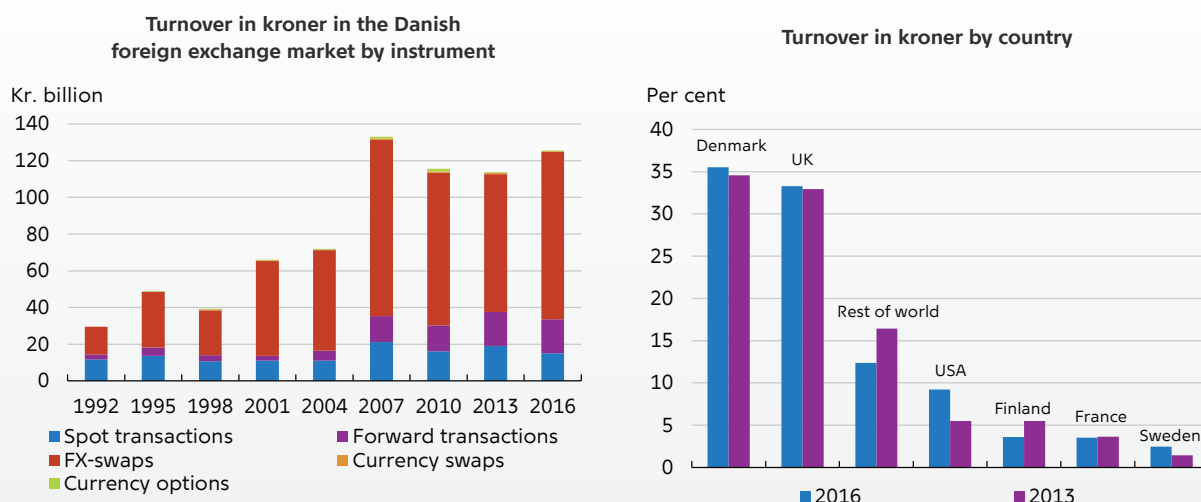
FX swaps comprise a spot trade combined with an opposite forward contract and therefore they generally do not affect the exchange rate. FX swaps are often seen as money market products in which loans in kroner against foreign exchange are granted or raised. In addition, there are currency swaps and currency options.¹

1. See Danmarks Nationalbank (2009), Monetary policy in Denmark, for a more detailed description.

3 Every three years, the Bank for International Settlements, BIS, coordinates the compilation of international statistics on turnover in the foreign exchange market. The most recent survey took place in April 2016. The Danish contribution is compiled by Danmarks Nationalbank on the basis of responses from the major Danish market participants. For further information, see "Survey of the Danish foreign exchange and OTC derivatives market in 2016", Danmarks Nationalbank.

Slightly higher turnover in the Danish foreign exchange market for kroner

Chart 17



Note: The survey registers all currency transactions in currency pairs. This means that each transaction is included twice. Includes trading with both financial and non-financial counterparties. Left-hand chart: Average daily turnover in April of the relevant year. Adjusted for double inclusion of reporting institutions' mutual currency transactions. Right-hand chart: Share of global turnover in Danish kroner involving a bank from the country in question. The compilation method is not fully comparable with the method for compilation of total global turnover. For further details, see "Triennial Central Bank survey of foreign exchange and OTC derivatives markets in 2016", Bank for International Settlements.

Source: BIS and Danmarks Nationalbank.

billion in April 2016. Turnover has risen for spot transactions, forward transactions and FX swaps alike, the latter accounting for approximately 70 per cent of total turnover in the global market for Danish kroner.

Transactions in the foreign exchange market in Denmark make up approximately 36 per cent of total turnover involving Danish kroner. The UK market accounts for 33 per cent, so that some 70 per cent of total turnover in Danish kroner takes place in either the Danish or the UK foreign exchange market, cf. Chart 17 (right).

The Danish pension sector is one of the key private sector participants in the market for Danish kroner and its significance in the foreign exchange market is analysed in the article "The pension sector as a foreign exchange market participant" in this Monetary Review. Due to Denmark's fixed exchange rate policy, the pension sector's average hedging of foreign exchange exposures is considerably lower for euro than for e.g. dollars. As regards euro exposures, the companies' policies differ considerably. Some hedge the entire position, some operate with practically no hedging. This is attributable to factors such as differences

in product portfolios. The gradual transition to market rate products means that the pension companies' need to hedge foreign exchange exposures is declining.

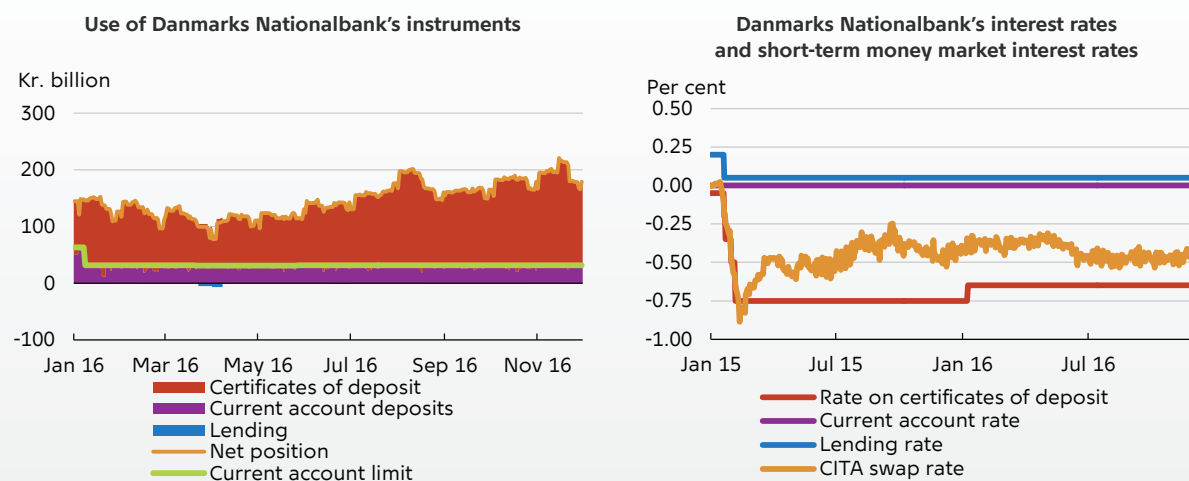
At the beginning of 2015, large volumes of foreign exchange flowed into Denmark, one reason being that the pension companies increased their foreign exchange hedging. To counter the pressure on the krone, Danmarks Nationalbank intervened in the market for large amounts. Danmarks Nationalbank's intervention works effectively to counter pressure on the exchange rate of the krone by influencing the supply of and demand for kroner, cf. the article "Effects of Danmarks Nationalbank's interventions in the foreign exchange market" in this Monetary Review. The findings in the article also indicate that Danmarks Nationalbank's intervention has a further effect if market participants see the intervention as a sign of potential future interest rate changes.

LOW TURNOVER IN THE MONEY MARKET

The banks' net position vis-à-vis Danmarks Nationalbank briefly increased in mid-November due to redemptions and interest payments on the central-

The banks' net position and short-term money market interest rates remain unchanged

Chart 18



Note: The most recent observations are from 1 December 2016. Left-hand chart: The net position is the monetary policy counterparties' total net account in kroner with Danmarks Nationalbank. It is defined as the counterparties' holdings of certificates of deposit and current account deposits less monetary policy loans. Right-hand chart: The CITA swap rate shown has a maturity of 1 month.

Source: Thomson Reuters Datastream and Danmarks Nationalbank.

government debt, cf. Chart 18 (left). In recent months, the net position has been relatively stable at just under kr. 200 billion. In the same period, money market interest rates have been unchanged at around -45 basis points, cf. Chart 18 (right).

According to Danmarks Nationalbank's annual money market survey, recent years' fall in turnover in the money market has continued in 2016, cf. Box 5. The modest turnover should be viewed in the context of ample krone liquidity for the banks overall, so that their need to use the money market for handling day-to-day liquidity fluctuations is generally smaller.

Furthermore, Danmarks Nationalbank has made increased use of extraordinary market operations in recent years. This is because the sector's aggregate deposits in current accounts have, on average, been close to the overall current account limit. So it requires only small shocks for the sector's overall limit to be exceeded. In addition, patterns for payments from firms to the central government have changed in step with the introduction of negative deposit rates for some firms.

The spread between 3-month money market interest rates in Denmark and the euro area has been virtually unchanged in the last few months, cf. Chart 19 (left). Current longer-term interest rates indicate that market participants now expect higher money market interest rates in the euro area in the coming years than they did three months ago. The same applies to market-implied expectations of Danish money market interest rates, cf. Chart 19 (right). This means that market participants expect a gradual increase in monetary policy interest rates in Denmark. Overall, market prices indicate that the spread between money market interest rates in Denmark and the euro area is expected to be close to zero in the coming years.

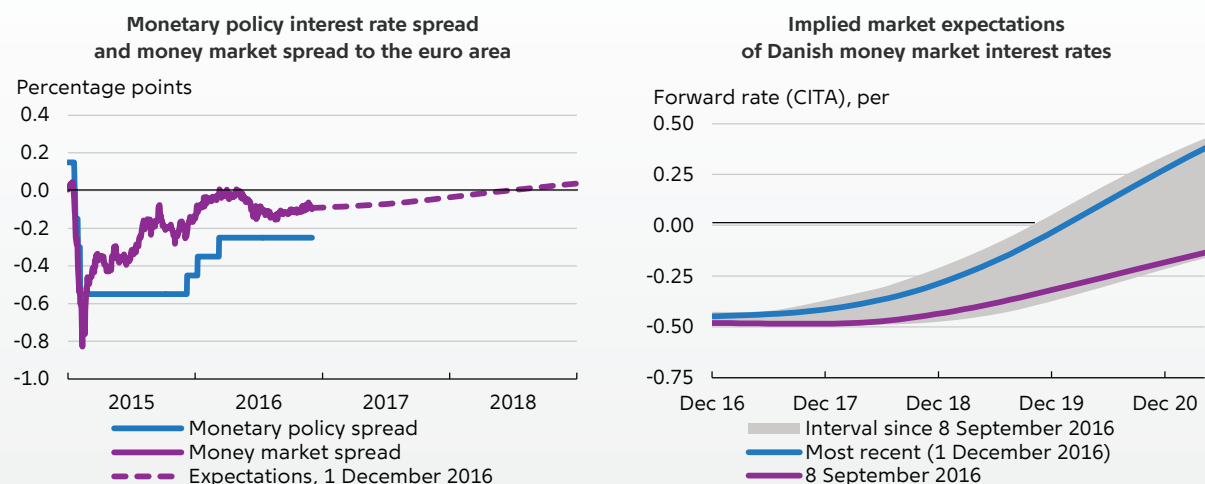
UNCHANGED SHARE OF BANK DEPOSITS AT NEGATIVE INTEREST RATES

Following the reductions of the rate of interest on certificates of deposit in connection with the pressure on the krone in early 2015, the banks have been hesitant to pass on negative interest rates at Danmarks Nationalbank to small firms and households.⁴ According to Danmarks Natio-

4 Cf. Pass-through from Danmarks Nationalbank's interest rates to the banks' interest rates, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter 2016.

Money market spreads and expectations of money market interest rates

Chart 19

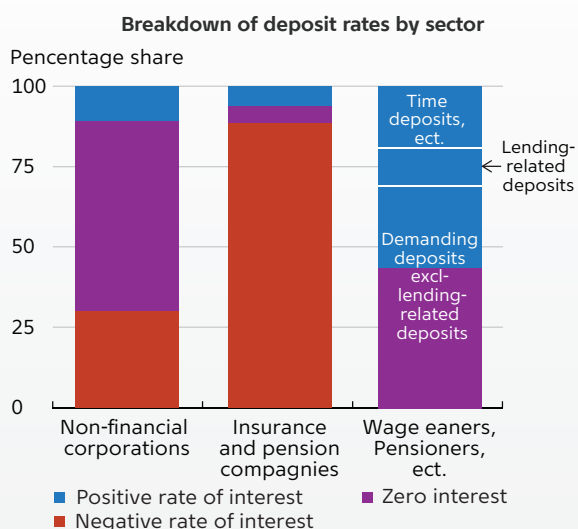


Note: Left-hand chart: The monetary policy spread is the spread between Danmarks Nationalbank's rate of interest on certificates of deposit and the ECB's deposit rate. The money market spread is based on 3-month CITA and EONIA swap rates. Expectations relate to the money market spread and are based on forward rates calculated on the basis of current CITA and EONIA swap rates with different maturities. Right-hand chart: Shows forward rates calculated on the basis of CITA interest rate swaps with different maturities and indicates what the overnight interest rate is expected to be at a given time in the future.

Source: Scanrate Rio, Thomson Reuters and Danmarks Nationalbank.

Negative interest rates are in widespread use for several customer segments

Chart 20



Note: Compared with the survey from March 2016, the sample has been expanded so that coverage relative to Danmarks Nationalbank's interest rate statistics in September 2016 is approximately 72.5 per cent for deposits (excluding pooling schemes) from wage earners, pensioners, etc., while it is 77.5 per cent for non-financial corporations. For deposits from insurance companies and pension funds, coverage is approximately 60 per cent. The corresponding figures from the March 2016 survey were approximately 57 per cent, 61 per cent and approximately 54 per cent, respectively.

Source: Danmarks Nationalbank.

nalbank's most recent sample analysis, which was performed in October, deposit rates are still not negative for households. The share of non-financial corporations met with negative deposit rates is approximately 30 per cent, cf. Chart 20. This is the same level as in the previous survey in March 2016.

Insurance and pension companies earn negative interest on a large share of their bank deposits. This is because their alternatives to bank deposits are money market-like instruments, for which the rate of interest is negative.

NO SIGNS OF EXTRAORDINARY DEMAND FOR CASH

There are still no indications that the negative deposit rates vis-à-vis certain customer segments has led to an extraordinary rise in the demand for cash, cf. Chart 21. One of the reasons is that household deposits are not at negative interest rates. For other sectors, the negative interest rates on their bank deposits need to be weighed against the various costs of handling large cash volumes.

RIISING LONG-TERM YIELDS

Since the beginning of October, yields on long-term Danish government bonds have risen, cf. Chart 22.

Turnover remains low in the Danish money market

Box 5

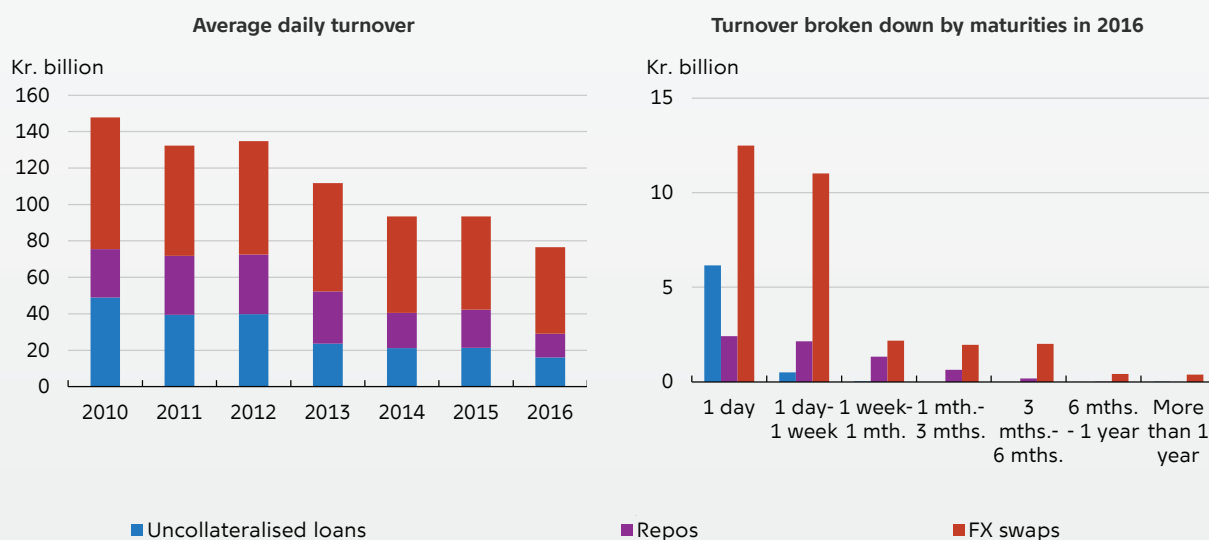
According to Danmarks Nationalbank's annual money market survey, aggregate turnover in Danish money market loans was still at a low level in the 2nd quarter of 2016, cf. the chart (left). The modest turnover should be viewed against the backdrop of ample krone liquidity among the banks overall. Furthermore, the banks to a large extent exploit their current account limits at Danmarks Nationalbank to the full, which reduces their need to use the money market for handling day-to-day liquidity fluctuations. In the euro area there have also been large volumes of excess liquidity in the banking sector. This is reflected in, inter alia, a reduction of turnover behind the EONIA fixing – especially since the ECB began to purchase government bonds in March 2015.

The money market survey comprises mutual transactions between banks and mortgage banks in kroner with maturities of up to 1 year. This means that the calculated turnover in FX swaps is lower in the money market survey than in the currency market survey, which also includes trading with other financial sector participants, e.g. pension and insurance companies.

The increased focus on liquidity and credit risk since the financial crisis has triggered a shift from uncollateralised to collateralised loans such as repos and FX swaps. Repos are loans against bonds as collateral, while FX swaps can be seen as loans in kroner against foreign exchange as collateral. Furthermore, there has been a tendency for the maturities of the loans to decline considerably. Practically all turnover in uncollateralised loans takes place at maturities of up to one week, cf. the chart (right).

The money market also comprises interest rate derivatives such as CITA swaps, which are short-term interest rate swaps involving exchange of a variable rate of interest (the T/N rate) against a fixed rate. The fixed rate of interest is agreed at the start of the contract. CITA swaps can be used e.g. to adjust the interest rate risk on a portfolio. Average daily turnover in CITA swaps with maturities of up to one year was just over kr. 4 billion in the 2nd quarter of 2016. This was a little lower than in the corresponding quarter of 2015.

Average daily turnover for uncollateralised loans, repos and FX swaps in the Danish money market

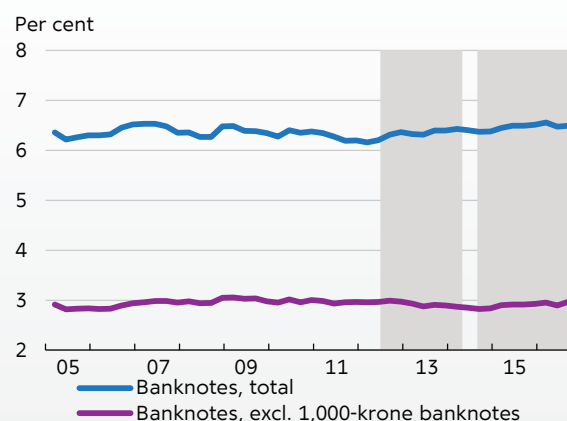


Note: Left-hand chart: Average daily turnover in both loans and deposits in April for 2010-11 and in the 2nd quarter for 2012-16. Right-hand chart: Average daily turnover in the 2nd quarter of 2016. The intervals stretch from the start of the interval up to and including the end of the interval. For instance, "1 week – 1 month" covers loans with a maturity of more than 1 week up to and including 1 month. Since loans can be prolonged by renewing short-term loans, turnover will tend to be higher for short maturities than for long maturities. For instance, five overnight loans can be raised instead of one 1-week loan.

Source: Danmarks Nationalbank.

Unchanged cash fraction

Chart 21

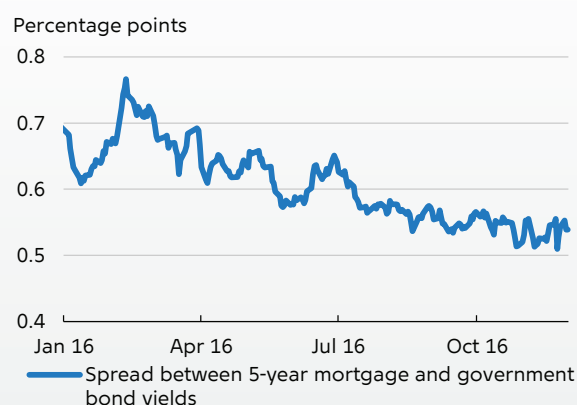


Note: The cash fraction is cash in circulation as a share of private consumption at current prices. The series have been seasonally adjusted. The grey areas denote periods with a negative rate of interest on certificates of deposit. The most recent observation is from the 3rd quarter of 2016.

Source: Danmarks Nationalbank and Statistics Denmark.

Smaller yield spread between mortgage and government bonds

Chart 23

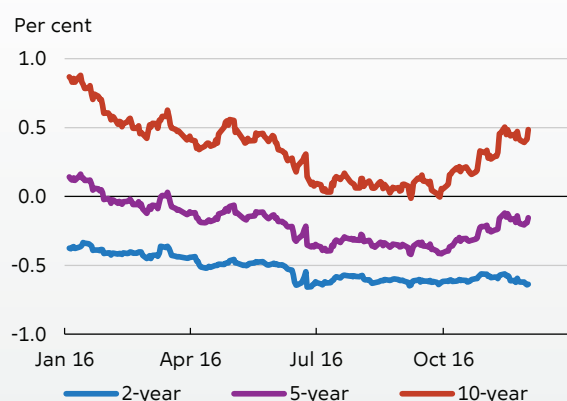


Note: Zero-coupon rates. The most recent observation is from 1 December 2016.

Source: Nordea Analytics.

Higher long-term government bond yields in Denmark

Chart 22



Note: Zero-coupon rates. The most recent observations are from 1 December 2016.

Source: Nordea Analytics.

Short-term government bond yields have remained more or less unchanged, and consequently the yield curve has become steeper. The development of Danish government bond yields is similar to those of the euro area and the USA, where long-term yields have also risen, and the yield spread to Germany is virtually unchanged. The rising yields are attributable to higher inflation expectations, among other factors.

Yields on mortgage bonds have followed the same pattern, but have risen less strongly, so the 5-year spread between government and mortgage yields has narrowed further, cf. Chart 23.

MODEST GROWTH IN LENDING TO THE CORPORATE SECTOR AND HOUSEHOLDS

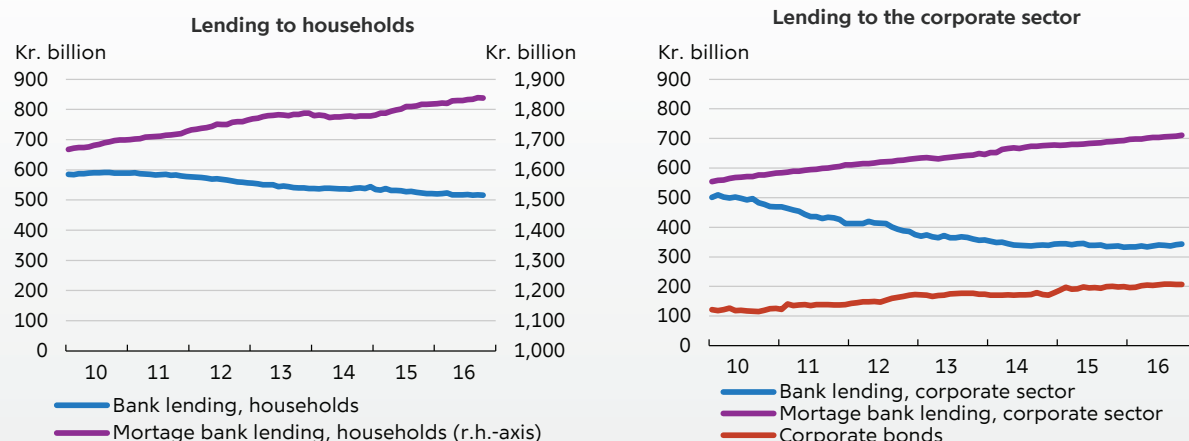
Lending to households and non-financial corporations has grown at a modest pace over the last year. Total lending to households by banks and mortgage banks was just under 1 per cent higher in September than one year earlier. The rise is attributable to increased mortgage lending as lending by banks has decreased, cf. Chart 24 (left).

Total lending to non-financial corporations rose by 2.8 per cent year-on-year in October. This reflects growth in mortgage lending and corporate bonds, while lending by banks has remained unchanged, cf. Chart 24 (right).

The fixed interest period for new mortgage lending remains high. The share of fixed rate

Total lending to households and the corporate sector is growing slightly

Chart 24



Note: Seasonally adjusted data at nominal value. The most recent observations are from October 2016.

Source: Danmarks Nationalbank.

loans has been rising since the beginning of the year, cf. Chart 25. Over the year, households have increasingly been encouraged to choose loans with long fixed interest periods and amortisation. This is the result of higher administration margins for loans with short fixed interest periods in particular. Furthermore, the spread between long-term and short-term mortgage yields has narrowed.

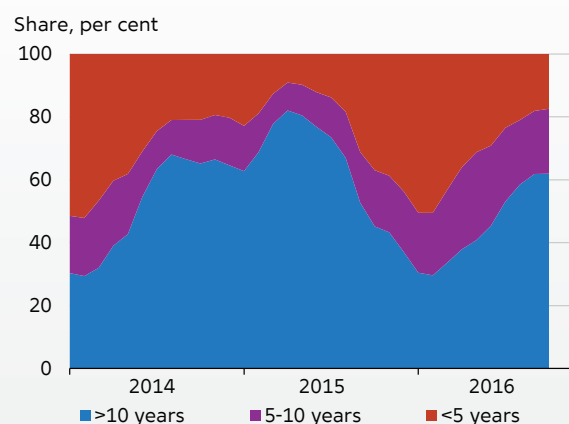
CREDIT STANDARDS FOR HOUSEHOLDS ARE STILL BEING TIGHTENED

In Danmarks Nationalbank's most recent lending survey, both the banks and the mortgage banks stated that they expect to tighten their credit standards for households in the 4th quarter, cf. Chart 26. For example, some of the mortgage banks have raised their administration margins from the beginning of the 4th quarter. Credit policies vis-à-vis households have been tightened in the last four quarters.

Credit policies vis-à-vis the corporate sector have been eased in the last two quarters and the banks and mortgage banks expect to ease them further in the 4th quarter.

The fixed interest period for new mortgage lending has increased

Chart 25

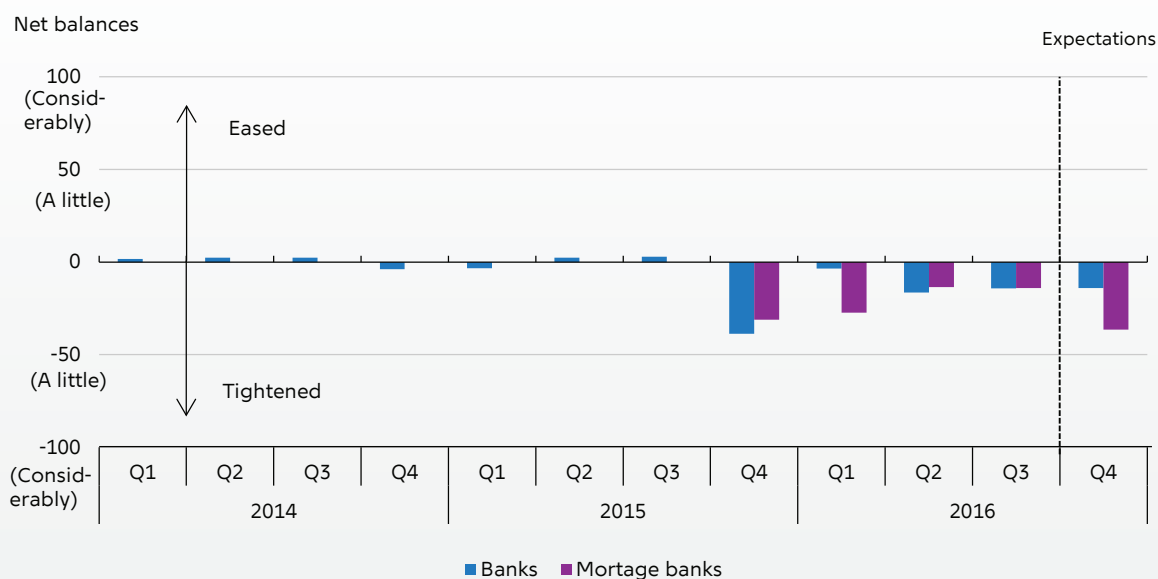


Note: The most recent observation is from October 2016.
3-month moving average of new mortgage lending to wage earners, pensioners, etc.

Source: Danmarks Nationalbank.

Credit standards for households are being tightened further

Chart 26



Note: The lending survey provides qualitative statistical data based on responses from the largest Danish banks and mortgage banks. The responses are assigned a value of -100, -50, 0, 50 or 100, and the value is weighted according to the institution's share of total lending. Hence, the net balance lies within the interval -100 to 100, a negative figure indicating tightening, a positive figure easing. For example, a net balance of -100 (100) means that all institutions have tightened (eased) their credit standards considerably, while a net balance of -50 (50) means that they have tightened (eased) them a little.

Source: Danmarks Nationalbank.

THE DANISH ECONOMY

THE DANISH ECONOMY IS HEADING TOWARDS A BOOM

The Danish economy is in an upswing. This has been visible in the labour market for quite some time, and it was further underscored by Statistics Denmark's most recent revision of the national accounts, cf. Box 6. The revised figures point to stronger GDP growth in the Danish economy since the financial crisis in 2008 than the previous compilation showed. Growth in real GDP is now far more in line with the marked rise in employment seen since the beginning of 2013. In the last couple of years, Danmarks Nationalbank's assessment of the strength of the upswing has to a large extent been based on developments in the labour market. The revision of the GDP figures emphasises that an assessment of the Danish economy cannot be based merely on the compilation of GDP.

In the 3rd quarter of 2016, GDP rose by 0.4 per cent, cf. Chart 27 (left). This primarily reflects strong

inventory build-up, while investment and private consumption were virtually unchanged, cf. Table 1. The rise in GDP is mainly attributable to growth in industry and in the financial sector. Employment rose by 11,000 persons in the 3rd quarter.

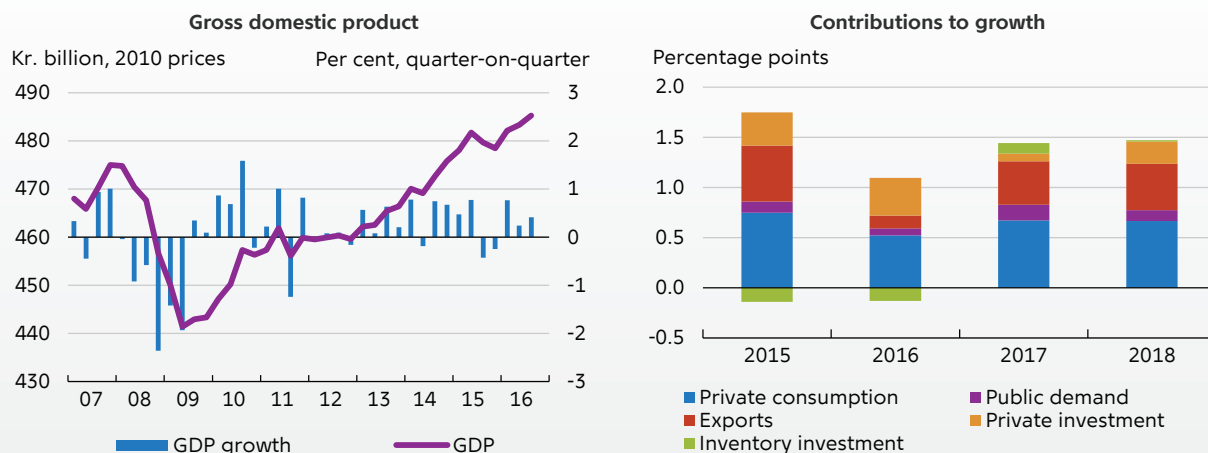
There are still strong underlying forces that support demand, although they have abated a little recently. The outlook for Denmark's export markets has weakened. This is mainly because the forecasts of import growth among Denmark's trading partners have been adjusted downwards, cf. Appendix 1.

Low interest rates continue to fuel demand. However, yields on 10-year government bonds in the advanced economies have risen slightly since October, especially after the US presidential election. In Denmark, this has had an impact on mortgage yields. The average bond yield included in the projection is assumed to be a little higher towards 2018 than assumed in the September forecast.

The dollar strengthened after the US election, and that has weakened the effective krone rate a little in recent weeks. But this follows a period

Flattening of growth in real GDP

Chart 27



Note: Left-hand chart: Quarterly GDP, seasonally adjusted.

Right-hand chart: Growth contributions have been adjusted for average import content.

Source: Statistics Denmark and Danmarks Nationalbank.

of strengthening in the preceding months, and the point of departure in the projection is a small strengthening since September. Viewed in isolation, that weakens Denmark's competitiveness.

Combined with slightly higher interest rates and the strengthening of the effective krone rate, the reduced demand from abroad means that growth in Denmark is now expected to be more subdued. In a situation where the economy is approaching its capacity limit, lower growth in demand would be expedient.

This year's growth in GDP is forecast at 1.0 per cent. In 2017 and 2018, growth rates are expected to be 1.4 and 1.5 per cent, respectively. This is a little lower than in the most recent projection, mainly as a result of the weaker export growth. This year's growth is driven primarily by private consumption, cf. Chart 27 (right). In the coming years, exports are expected to contribute more to growth, along with private consumption.

Disposable incomes are rising steadily and the level of interest rates remains low. This is a good point of departure for private consumption. Another factor pointing in the same direction is a certain increase in the consumption ratio, which is still low compared with the average since 1995. At the same time, the wealth ratio is above its average, mainly as a result of rising housing wealth. Against this background, private consumption is expected to grow by 1.9 per cent this year and 1.7 per cent next

year, followed by a small rise again in 2018. Private investment is also expected to rise in the coming years, reflecting a tighter capacity situation.

The cyclical position entails that growth in employment will slow down a little, but there will still be solid growth towards 2018. This slowdown has been predicted for a while, but each time growth in employment has proved to be stronger than expected. The weak productivity growth since 2009 calculated so far did not as such point to continued strong growth in employment. Hence, the slowdown in employment has been relatively sudden in the most recent projections, but is now assumed to be more gradual. On the basis of the new compilation of GDP and stronger-than-expected growth in employment in the 3rd quarter, employment has been adjusted upwards throughout the rest of the projection period, by 14,000 persons next year and by 11,000 in 2018. However, growth will still be weaker than in the upswing so far. Employment is now expected to rise by just under 50,000 from the 3rd quarter of 2016 to the 4th quarter of 2018.

In view of the upward adjustment of employment and the weaker growth outlook, expectations of future productivity growth have been adjusted downwards. Productivity in the private non-primary sector is expected to rise by just over 0.8 per cent p.a. in the projection period. This is slightly below the average of 1.1 per cent in the

Key economic variables

Table 1

| Real growth on preceding period, per cent | 2016 | | | | | | |
|---|-------|-------|-------|-------|-------|-------|-------|
| | 2015 | 2016 | 2017 | 2018 | Q1 | Q2 | Q3 |
| GDP | 1.6 | 1.0 | 1.4 | 1.5 | 0.8 | 0.2 | 0.4 |
| Private consumption ¹ | 1.9 | 1.9 | 1.7 | 1.9 | 0.7 | 0.3 | 0.0 |
| Public consumption | 0.6 | 0.9 | 0.5 | 0.6 | 0.9 | 0.6 | 1.4 |
| Residential investment | 3.8 | 11.1 | 1.0 | 3.4 | 9.6 | 0.0 | -3.3 |
| Public investment | -3.9 | 0.3 | -0.9 | -0.7 | 2.0 | -0.9 | -3.3 |
| Business investment | 4.1 | 0.3 | 2.2 | 2.3 | -1.4 | -0.2 | 2.2 |
| Inventory investment, etc. ² | -0.3 | -0.3 | 0.2 | 0.0 | -0.1 | -0.3 | 0.5 |
| Exports | 1.8 | 0.1 | 2.4 | 2.4 | -0.6 | 1.0 | 0.0 |
| Industrial exports | 0.7 | 0.4 | 2.4 | 3.0 | 3.2 | 0.4 | -1.1 |
| Imports | 1.3 | 0.9 | 2.7 | 2.8 | -0.8 | 0.5 | 0.8 |
| Employment, 1,000 persons | 2,829 | 2,875 | 2,909 | 2,927 | 2,859 | 2,870 | 2,882 |
| Gross unemployment, 1,000 persons | 123 | 112 | 108 | 106 | 115 | 112 | 112 |
| Balance of payments, per cent of GDP | 9.1 | 7.4 | 7.1 | 6.9 | 7.2 | 8.6 | 6.6 |
| Government balance, per cent of GDP | -1.3 | -1.5 | -1.5 | -1.2 | -1.5 | -0.3 | -2.2 |
| House prices ³ , per cent year-on-year | 6.1 | 3.9 | 3.0 | 2.7 | 4.5 | 3.8 | 3.9 |
| Consumer prices, per cent year-on-year | 0.2 | 0.0 | 1.1 | 1.8 | 0.1 | -0.1 | -0.1 |
| Hourly wages, per cent year-on-year | 1.8 | 2.2 | 2.5 | 2.7 | 2.2 | 2.1 | 2.1 |

1. Includes both households and non-profit institutions serving households, NPISH.

2. Contribution to GDP growth (this item comprises inventory investment, valuables and statistical discrepancy).

3. Cash prices for single-family houses.

upswing until now. This pattern, whereby employment drives a larger share of output growth, is more in line with a normal cyclical pattern at this point where the Danish economy is well into the upswing. At the same time, it indicates that the upswing is approaching a boom, i.e. a situation with a positive output gap, cf. Box 7.

Following the revision, the estimated output gap has narrowed somewhat and is now forecast at -0.6 per cent of GDP in 2016. The cyclical position means that the labour market gap will close already next year. There is still room for wage growth and higher employment in the Danish economy, and the positive gap may persist for some time. However, it is important that this situation does not lead to strong imbalances in the form of an overheated labour market and a

housing price bubble as seen in the mid-2000s. As employment has risen and unemployment fallen, some indicators point to mounting pressures in the labour market.

The projection involves both downside and upside risks.

The global tendency for countries to turn their backs on the advantages of free trade may – if it leads to protectionist measures – impede international trade, thereby further weakening exports. If US fiscal policy becomes very expansionary, as the President-elect has indicated, this may, on the one hand, strengthen Denmark's exports to the USA. But on the other hand, the market response could be an abrupt rise in long-term interest rates, which will hit other Danish export markets as well as domestic demand.

The revision of the national accounts provides a clearer picture of the upswing

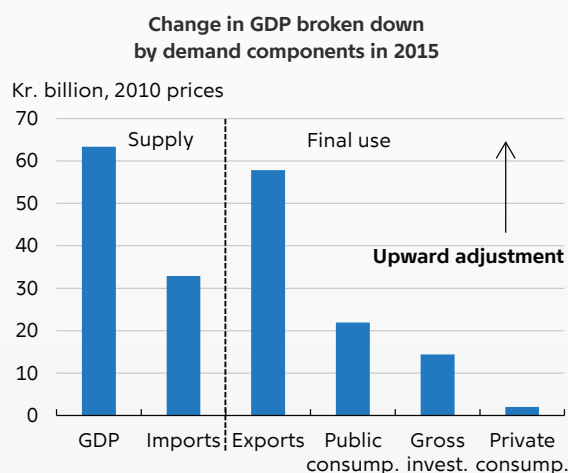
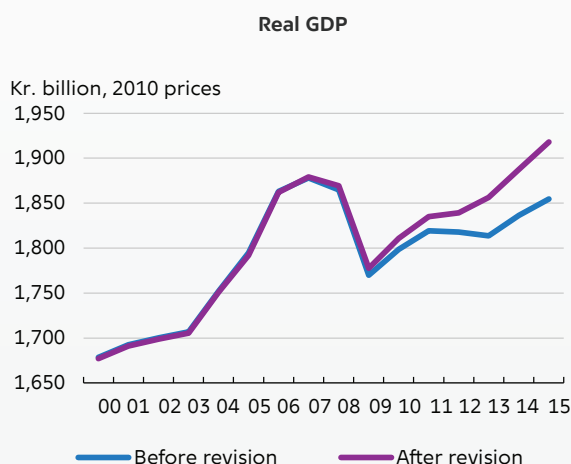
Box 6
Continues

Extraordinary revisions of the annual national accounts have led to a considerable upward adjustment of growth in real GDP since 2009. The revisions include a revision of the balance of payments statistics and revised calculations of public sector hospital services. Combined with a downward adjustment of hours worked, this means that hourly productivity since 2009 has risen more strongly than assumed so far.

The calculation of exports in the balance of payments is based on a change of ownership principle, and exports in-

clude trade in goods which do not cross the Danish border. This applies to both purchase and sale of goods (merchandise) and sales of goods abroad after processing abroad. The revised accounts incorporate such trade in a more comprehensive manner than previously. As a result, exports have increased by almost kr. 60 billion in 2015. However, imports have also been adjusted upwards by approximately kr. 30 million.

Stronger real growth driven by rising exports, public consumption and investment

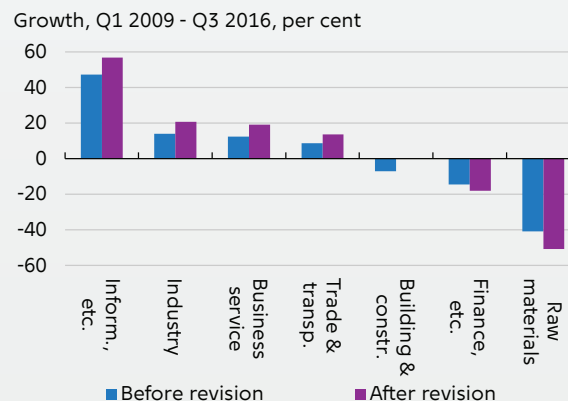
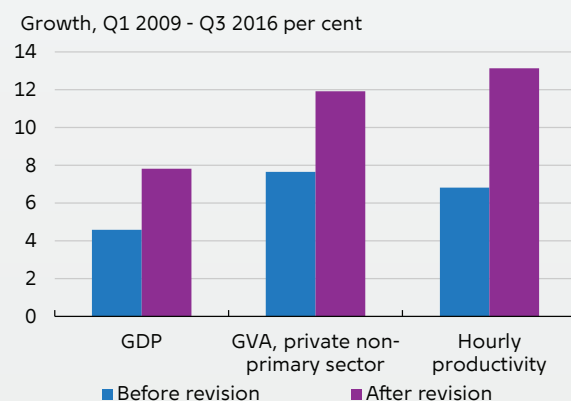


Source: Statistics Denmark and own calculations.

Real GDP was adjusted upwards by 3.4 per cent in 2015, and according to the new figures it exceeded the previous pre-crisis peak already in 2014, cf. the chart above (left). According to the previous projections, this would not occur until sometime during 2017. Average annual growth in the period 2010-15 has now been calculated at 1.3 per cent p.a., up from 0.8 per cent p.a. The upward adjustment of GDP has been driven mainly by exports, cf. the chart above (right).

Furthermore, the level of real public consumption has been adjusted upwards by around kr. 20 billion. Gross investment has also been increased. The revision is unevenly distributed across industries, cf. the chart below (right). Especially information, etc., building and construction, business service and the industrial sector have been adjusted upwards, while financing, etc. and raw material extraction are lower in the revised national accounts.

Upward revision of real GVA and hourly productivity, but with differences across industries



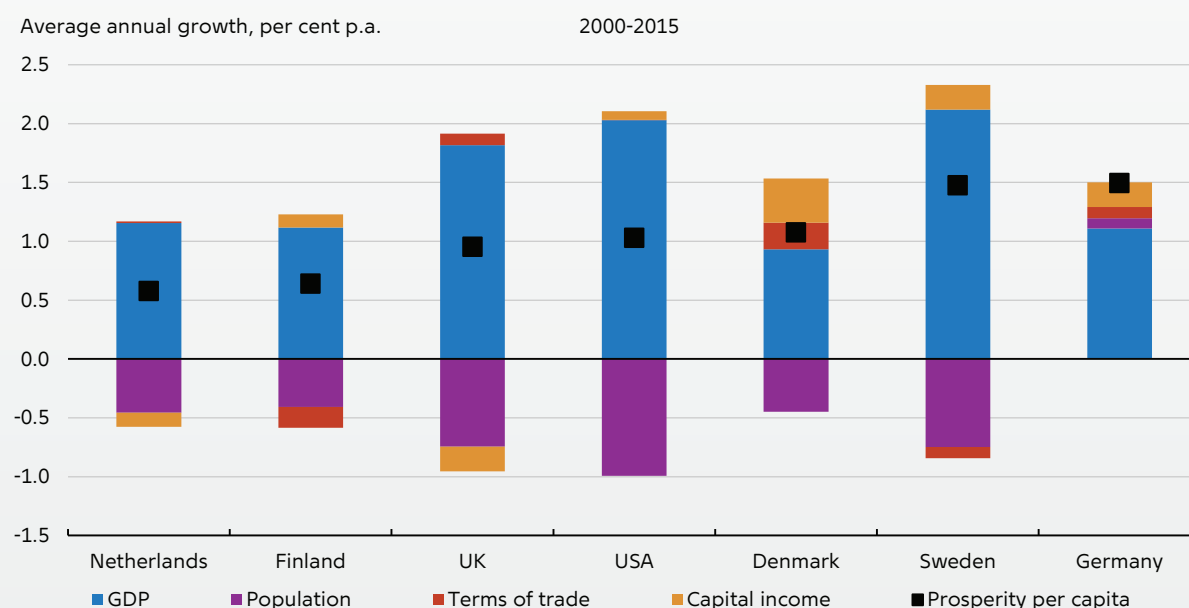
Note: Development in real GDP and GVA over the period in question. Left-hand chart: Hourly productivity in the private non-primary sector.
Source: Statistics Denmark.

Following a revision of the working time accounts, the number of hours worked in the private non-primary sector has been adjusted downwards by 1.5 per cent in 2015, so that hours worked have risen more slowly since 2012. Combined with an upward revision of gross value added, this means that hourly productivity rose more after the crisis than assumed so far, cf. the chart above (left). Productivity growth in the private non-primary sector doubled from the 1st quarter of 2009 to the 3rd quarter of 2016.

If not only GDP, but also terms of trade, return on net foreign assets and population, i.e. terms of trade-adjusted

real gross national income per capita, is taken into account, the analysis until now has shown that prosperity growth has been at the same level in Denmark as abroad in the last 15 years. Since a picture of stronger growth in real GDP is now emerging, Denmark moves up the rankings. Over the last 15 years, Denmark's prosperity growth has been at the high end relative to comparable countries, but still a little weaker than in Sweden and Germany, cf. the chart below.

Prosperity growth per capita in the last 15 years has been at the high end



Anm.: "Prosperity per capita" shows the average annual rate of growth in the period 2000-15 in the real gross national product per capita adjusted for terms of trade.

Kilde: OECD, US Bureau of Labor, Statistics Denmark and Danmarks Nationalbank.

As regards domestic factors, uncertainty is mainly linked to the demand potential of a faster-than-predicted recovery in the currently low consumption and investment ratios. This could lead to stronger growth in domestic demand than assumed in the projection, especially in a situation with a continued low level of interest rates, lower oil prices and expansionary measures in the housing market in the form of a freeze on land taxes.

Updated calculations of output gap

Box 7
Continues

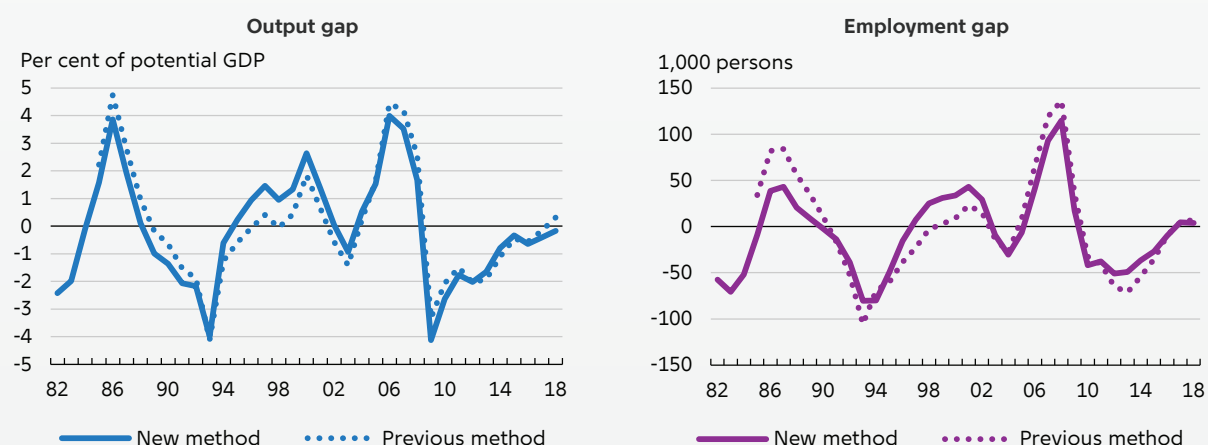
The output gap indicates how far Danish output (measured by GDP) is from the structural level, corresponding to normal capacity utilisation in the economy. It is a key element of Danmarks Nationalbank's cyclical assessments, to which policy recommendations are also linked. Hence, the method for estimating the output gap should regularly be revisited and perhaps adjusted with a view to providing as accurate and reliable results as possible in real time. This box presents new calculations of the output gap, which will also be documented in a forthcoming working paper.

Danmarks Nationalbank's method for calculation of the output gap is based on the production factors used in total output in the Danish economy.¹ This means that, in practice, the output gap is calculated on the basis of gaps in productivity (the TFP gap) and labour (the employment gap). The employment gap comprises spare capacity within the labour force (the unemployment gap) as well as that outside the labour force (the labour force gap). This approach has not been changed, but the individual models for the unemployment and labour force gaps and the productivity gap have been adjusted.

Generally speaking, the change of method does not give rise to a materially different picture of capacity pressures in the Danish economy, cf. the charts below. This is because the revised method basically applies the same information and indicators as previously, reflecting that the method used by Danmarks Nationalbank before the revision also provided a relatively reliable picture of the cyclical position, cf. Danielsen and Jørgensen, 2015. Above all, the method has been adjusted so as to capture demographic changes in the labour market better and to be more robust to data revisions in the estimation of structural unemployment.

It is important to emphasise that the employment and output gaps are calculated figures that will always be subject to uncertainty. This means that caution should be exercised in drawing firm conclusions about the exact size of the cyclical gaps. Estimated gaps should not stand alone in an assessment of the cyclical position. It is always necessary to see things in a broader perspective.

Output and employment gaps



Note: Estimations of the new and previous methods are based on the same data.
Source: Own calculations.

Structural gross unemployment and gross unemployment gap

Estimation of structural gross unemployment takes place in a model that links price and wage developments to developments in the labour market. Until now, the unemployment gap (gap between actual and structural gross unemployment) has been estimated on the basis of developments in the wage share from the national accounts. The wage share is basically an expression of the relationship between developments in real wages and productivity, and hence it is an indicator of wage pressures in the labour market. See Box 4.1 in Andersen and Rasmussen, 2011, for a discussion of the relationship between the wage share and the unemployment gap.

However, the wage share is often revised and sometimes considerably. So it is not always an appropriate indicator as it may over time provide ambiguous signals about developments in the labour market at a given point. Instead, structural gross unemployment is now estimated using a more general approach that is based on developments in real wages. Like the previous model, this one also includes information about changes in commodity prices, exchange rates and productivity. In other words, the estimation has the same theoretical foundation as the previous one, but it is a little more robust.

¹ See Danielsen and Jørgensen, 2015, and Andersen and Rasmussen, 2011, for a description of Danmarks Nationalbank's previous method for calculating the output gap.

Continued

Box 7
Continues

The new estimation does not alter the assessment of structural unemployment since the mid-2000s, cf. the chart below. But the structural unemployment level is now estimated to have been a little higher in the late 1990s and somewhat lower in the 1980s than previously assumed.

Structural participation rate and labour force gap

Like unemployment, the participation rate shows cyclical fluctuations. One of the reasons is that the labour force does not include job seekers not comprised by the gross unemployment figures, such as self-supporting people without employment and students looking for jobs. Especially among young people, more of whom are in the educational system, and people aged 30 to 49, the participation rate varies with the business cycle, while it is more cyclically stable in the older age groups, cf. Danielsen and Jørgensen (2015).

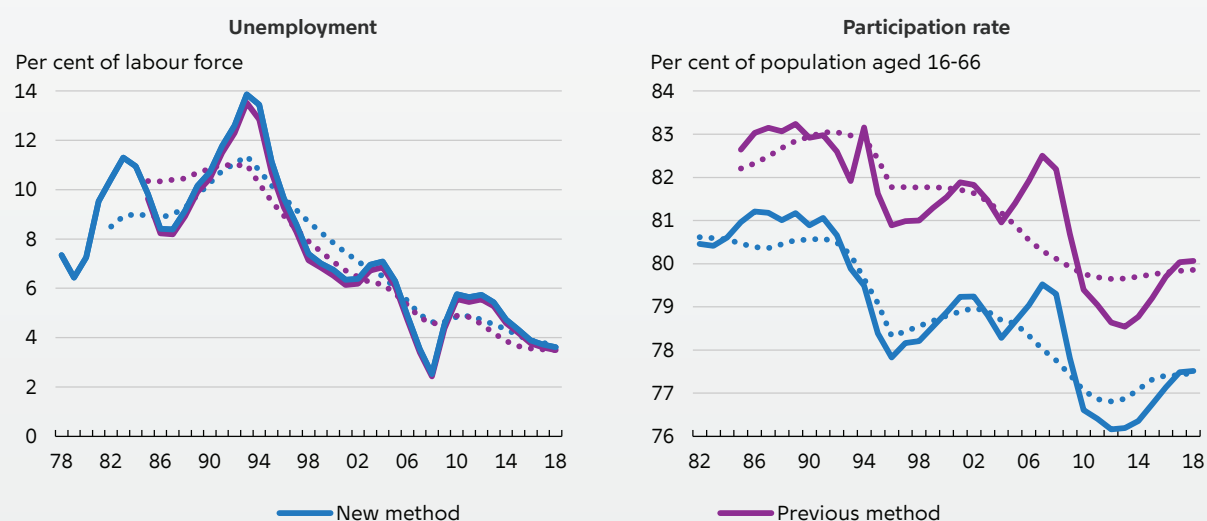
To better capture the demographic differences in the calculation of the cyclical gap in the labour force, the labour force is now divided into five age groups, which are handled separately. For the 16-29-year-olds and the 30-49-year-olds, separate models are established which include information about labour shortages in order to derive the cyclical vari-

ation in the participation rate. These models are basically the same as the method previously used, but adjusted to the special circumstances in each age group, including the increased propensity for young people to study. For the age groups over the age of 49, cyclical fluctuations are fairly limited, so in this case the structural participation rate is calculated by means of smoothing.

Unlike the previous estimation method, the new one is based on the labour force excluding people on leave. As a result, both the actual and the structural participation rates are reduced slightly more than previously from the early 1990s onwards, cf. the chart below (right). From the mid-2000s, the reduced structural participation rate is driven mainly by an increased tendency for young people to study, while a rising participation rate in the older groups, reflecting factors such as reforms of the retirement age, has the opposite effect.

The transition to the new estimation method means that the cyclical gap during the boom in the mid-2000s and under the subsequent downturn has narrowed slightly. However, the current assessment of spare capacity outside the labour force remains unchanged.

Actual and structural unemployment and participation rate



Note: Dotted lines indicate the structural level. The participation rate is defined as the sum of the number of people in employment and gross unemployment less people in subsidised employment divided by the number of people aged 16-66. In the method used until now, people on leave, etc. were included in the labour force, which is why the actual participation rate and unemployment as a percentage of the labour force differ.

Source: Statistics Denmark and own calculations.

Actual and structural total factor productivity (TFP)

Cyclical fluctuations in productivity indicate that firms typically adapt the intensity with which existing machines are used and the number of hours worked by employees to the changing cyclical situations. Capacity utilisation – and hence productivity growth – often increases at the beginning of an economic upswing and falls during a cyclical slowdown. This is because firms often adjust their input of capital and labour with a certain lag in relation to cyclical turning points, e.g. because it may be costly to take on new labour or invest in new machinery.

Literature:

Andersen, Asger Lau and Morten Hedegaard Rasmussen (2011), Potential output in Denmark, Danmarks Nationalbank, *Monetary Review*, 3rd Quarter, Part 2.

Danielsen, Troels and Casper Winther Jørgensen (2015), Calculation of output gap, Danmarks Nationalbank, *Monetary Review*, 4th Quarter.

Danmarks Nationalbank uses the questionnaire-based information about spare capacity in the industrial sector compiled by Statistics Denmark. So far, the indicator for spare capacity has been used in a simple statistical smoothing process. This has changed, so now a model is specified for actual and structural TFP, as for the unemployment and participation rates. This provides the same overall picture as the previous method, but the results indicate that the TFP gap has in effect closed in 2016.

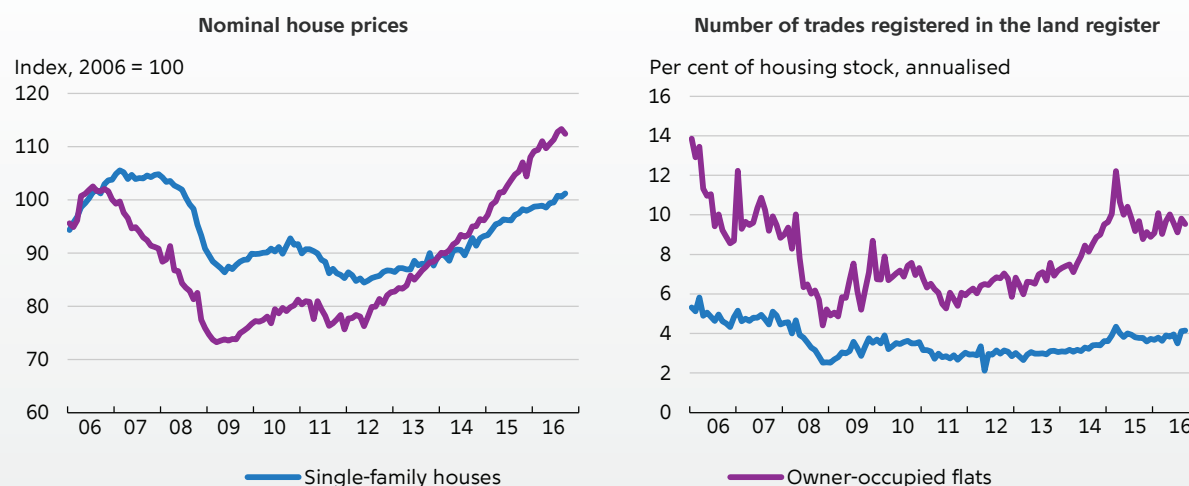
PRICES OF OWNER-OCCUPIED DWELLINGS ARE RISING A LITTLE MORE SLOWLY

Prices of single-family houses are still rising, but the annual rate of increase has dampened slightly, cf. Chart 28 (left). In September, the price level for detached and terraced houses was 4 per cent higher than one year earlier, while prices of owner-occupied flats had risen by nearly 7 per cent. Especially

in the cities, prices of owner-occupied dwellings continue to rise strongly⁵. The price level for owner-occupied flats in Copenhagen is high relative to incomes and interest rates. Add to this a risk that prices are being pushed up by self-fulfilling expectations. At the same time, interest rate sensitivity is higher in Copenhagen than the average for Denmark overall. This makes the Copenhagen housing

The housing market is still growing

Chart 28



Note: Own seasonal adjustment.

Source: Statistics Denmark and Danmarks Nationalbank.

5 The article "Regional aspects of the housing market" in this Monetary Review contains an analysis of the market for owner-occupied flats in Copenhagen.

market vulnerable to interest rate hikes. Hence, there is a considerable risk that if the real price rises seen in recent years continue, they will be followed by corresponding falls.

Turnover of single-family houses, measured by the number of trades registered in the land register relative to the housing stock, has been stable throughout 2016. The same applies to owner-occupied flats. For the latter, turnover is higher than otherwise seen in the period since the financial crisis in 2008, cf. Chart 28 (right). The supply of houses and flats for sale has also been at a constant level in 2016 to date.

Developments in prices and trading activity should be viewed in the light of mortgage yields. Both short-term and long-term mortgage yields have been falling steadily in 2016, but over the last month long-term yields have picked up a little. The continued low level of interest rates and rising disposable incomes may contribute to further house price rises in the near term. On the other hand, prices have been rising for some time and have reached rather high levels in some areas. Against that background, house prices in Denmark overall are forecast to grow by around 3 per cent p.a. in the coming years.

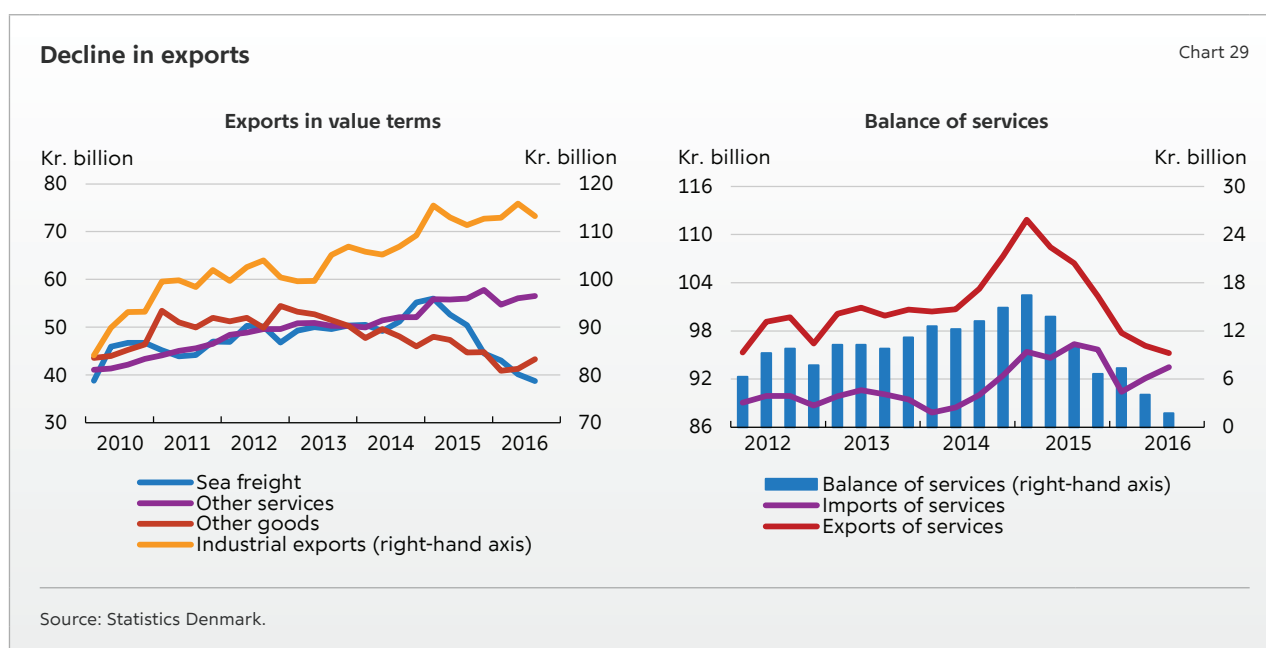
STAGNANT EXPORTS OF GOODS AND FALLING EXPORTS OF SERVICES

In October, a revision of the balance of payments from 2005 onwards was published. The revision

entailed higher current account surpluses, particularly in recent years. Over the 12-month period up to and including September, the revised current account surplus was kr. 160 billion – corresponding to 8 per cent of GDP – compared with kr. 190 billion in the preceding 12-month period. Considerable current account surpluses are also expected in the coming years, inter alia due to returns on net foreign assets.

The trade figures in the balance of payments show that exports of goods, excluding ships, aircraft and fuel etc., were a little higher in September than one year earlier, but in recent months both exports and imports of goods have declined. According to the foreign trade statistics, a fall in trade in industrial goods in particular has reduced total exports of goods, while there has been an increase in exports of food and of commodities and fuel, cf. Chart 29 (left).

Exports of services fell by more than 11 per cent in the first three quarters of the year compared with the same period of last year. This is mainly attributable to a marked decline in exports of sea freight due to lower freight rates. This should be viewed in the light of factors such as stagnant world trade, with global GDP now growing at a faster pace than international trade for the first time in a long period. The balance of services showed a surplus of just under kr. 2 billion in the 3rd quarter, which is well below the level seen in recent years, cf. Chart 29 (right).



Consumer prices

Table 2

| Per cent, year-on-year | Weights ¹ | 2016/2017 | | | | | | | | | |
|----------------------------|----------------------|-----------|------|------|------|------|------|-----|------|------|------|
| | | 2015 | 2016 | 2017 | 2018 | Q3 | Q4 | Q1 | Oct. | Nov. | Dec. |
| HICP | | 0.2 | 0.0 | 1.1 | 1.8 | -0.1 | 0.2 | 0.6 | 0.1 | 0.2 | 0.2 |
| Index of net retail prices | 100.0 | 0.7 | 0.5 | 1.5 | 2.0 | 0.4 | 0.6 | 1.1 | 0.5 | 0.7 | 0.8 |
| Exogenous: | | | | | | | | | | | |
| Energy | 6.9 | -9.9 | -6.3 | 5.7 | 3.9 | -7.4 | -0.8 | 3.6 | -1.0 | -1.7 | -0.2 |
| Unprocessed food | 4.8 | 2.6 | 1.7 | 1.3 | 1.6 | 1.3 | 1.1 | 1.4 | 0.0 | 1.7 | 1.5 |
| Adm. prices | 4.1 | 0.9 | 2.1 | 2.7 | 2.8 | 2.0 | 2.2 | 2.4 | 2.0 | 2.3 | 2.4 |
| Rent | 26.0 | 2.1 | 2.2 | 1.9 | 2.3 | 2.2 | 2.1 | 2.0 | 2.2 | 2.2 | 2.1 |
| Excl. exogenous: | 58.2 | 1.3 | 0.5 | 0.9 | 1.6 | 0.6 | 0.0 | 0.3 | -0.2 | 0.1 | 0.0 |
| Imports | 18.7 | 2.4 | 0.1 | 0.9 | 1.3 | -0.4 | -0.3 | 0.3 | -0.5 | -0.3 | -0.2 |
| IMI | 39.5 | 1.0 | 0.7 | 0.9 | 1.8 | 0.9 | 0.1 | 0.4 | 0.0 | 0.2 | 0.2 |

Note: The most recent actual figures are from October 2016.

1. Weight in the index of net retail prices, per cent. The weights are from January 2016.

PRICE PRESSURES IN THE ECONOMY ARE LOW

Consumer prices are still showing a weak trend. The annual rate of increase in the EU Harmonised Index of Consumer Prices, HICP, was 0.1 per cent in October, cf. Table 2. In the preceding month, consumer prices fell by 0.3 per cent. Prices of goods have been falling for some time. Recent months have seen considerable price falls for communication, with prices in October that were some 10 per cent below the level in the spring. Core inflation, which captures prices excluding energy and unprocessed foods, has been close to zero in recent months, after having been a little higher for some time, cf. Chart 30.

Domestic market-determined inflation, IMI, which is ultimately determined by developments in the level of costs in the economy, has been close to zero for the last couple of months. That is lower than in the first part of the year, reflecting factors such as a sharp drop in roaming costs for mobile telephony from June to July.

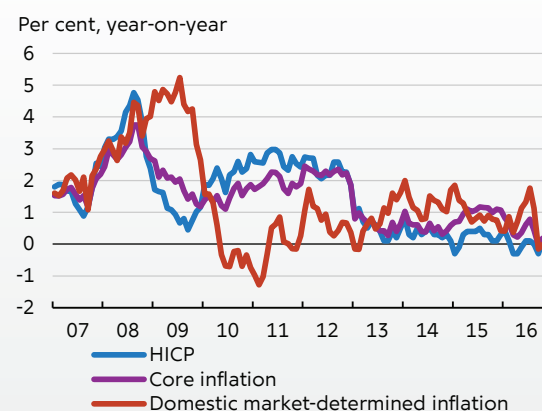
Consumer prices in Denmark usually develop in line with those of the euro area, but in recent months that has not been the case. In October, the annual rates of increase in the HICP differed by 0.4 percentage point. This is mainly attributable to communication prices, which have not

fallen in the euro area as they have in Denmark, cf. Box 8.

Wholesale prices were lower in October than one year earlier, partly because a stronger effective krone rate has led to lower import prices. This means that aggregate price pressures from the wholesale link are low. Energy prices no

Price inflation remains low

Chart 30

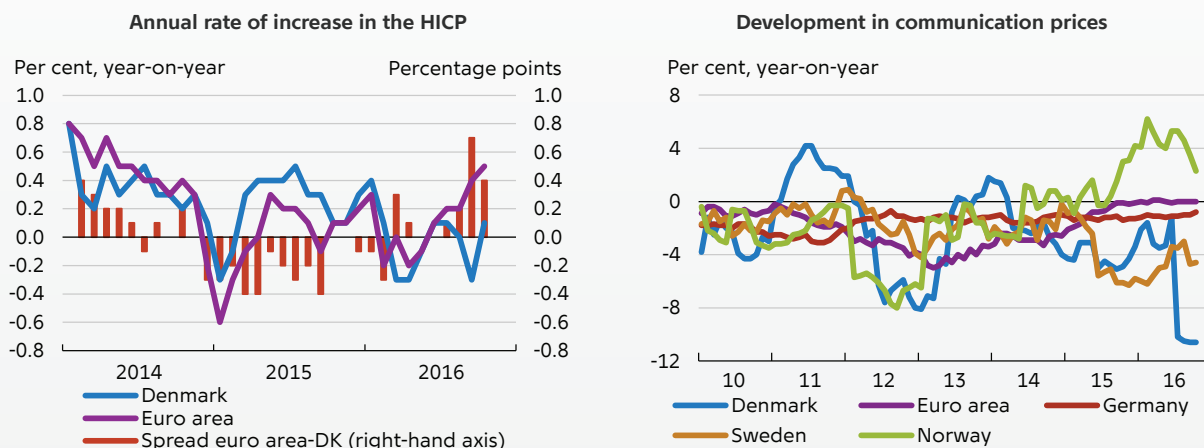


Note: HICP is the EU Harmonised Index of Consumer Prices.
Source: Statistics Denmark and Danmarks Nationalbank.

In recent months, consumer prices have shown diverging tendencies in Denmark and the euro area. The annual rate of increase in the EU Harmonised Index of Consumer Prices, HICP, was 0.1 per cent in Denmark in October, compared with 0.5 per cent in the euro area, cf. the chart below (left). In other words, the spread was 0.4 percentage point in

October. In September, the spread was 0.7 percentage point.¹ This is higher than the average monthly spread of 0.1 percentage point in the period from 2000 until today. The spread has emerged since June, when HICP increased by 0.1 per cent year-on-year both in Denmark and in the euro area.

Price developments in Denmark and the euro area



Source: Eurostat and own calculations.

Communication prices are the key factor behind the weaker price development in Denmark than in the euro area. Over the last year, communication prices have fallen by 10.6 per cent in Denmark, while they have been unchanged in the euro area, cf. the chart above (right). This is mainly attributable to mobile services, for which prices in Denmark fell

by 24.7 per cent from June to July 2016, reflecting a fall in roaming costs when using mobile services abroad.² Besides communication, especially the prices of clothing and footwear contribute to the most recent difference in consumer price developments.

1. However, a spread of 0.7 percentage point between annual HICP inflation in Denmark and the euro area is not exceptional in a historical perspective. There have been larger numerical spreads in around one quarter of all months since January 2000 (46 out of 202).
2. On 30 April 2016, new EU rules on roaming charges entered into force, reducing the cap on roaming charges considerably. Technical issues in relation to Statistics Denmark's compilation of prices mean that this change was not reflected in the consumer price index until July. Roaming charges for Danes calling home from abroad fell by around 75 per cent for consumers who had not already concluded fixed price agreements with their service providers. On 15 June 2017, roaming charges will be abolished completely for consumers' use of roaming services within the EU, subject to certain limitations.

longer have a downward impact on the annual rate of increase. Producer prices for Danish goods for the domestic market are also showing a weak trend.

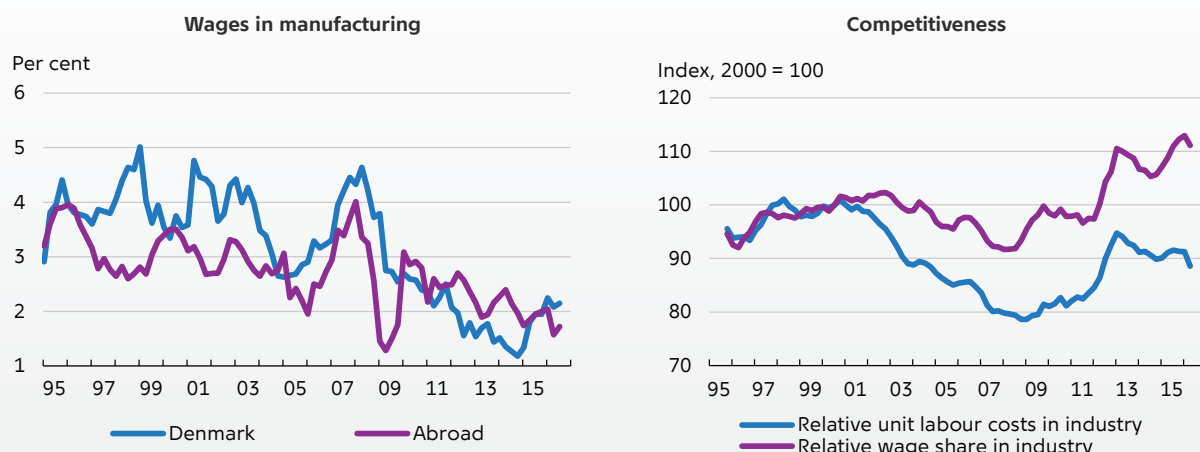
The lower oil price has dampened consumer price inflation this year, and growth in the HICP is forecast at zero. The effect of the lower oil price on inflation will cease at the turn of the year, but domestic price pressures will remain low going into 2017. HICP is expected to grow by 1.1 per cent next year, rising to 1.8 per cent in 2018 as spare capacity in the economy decreases.

MODERATE WAGE GROWTH

Private sector wage growth remains relatively low. According to Statistics Denmark, wages were 1.7 per cent higher in the 3rd quarter of 2016 than one year earlier. Wage growth in the export-intensive manufacturing sector was unchanged at 2.2 per cent p.a., while the growth rate in trade and transport was somewhat lower at 1.3 per cent. In the construction sector, wages grew by 2.1 per cent, which is less than at the beginning of the year. This fall has taken place despite indications of a growing shortage of labour in the construction sector.

Moderate wage growth and improved Danish competitiveness

Chart 31



Note: Left-hand chart: Wages in manufacturing. Foreign wages have been weighted using the weights in the effective krone rate index. Right-hand chart: Foreign wages over Danish wages. A rise in the index indicates improved competitiveness.

Source: OECD, Statistics Denmark and Danmarks Nationalbank.

As consumer prices are hardly rising, wage growth in the private sector entails a solid increase in real wages.

In 2016 to date, industrial wages have, once again, risen a little faster in Denmark than in competing countries. This comes after a period of slower increases, cf. Chart 31 (left). Since 2007, foreign competitors' wage share has risen more strongly than that of Danish firms, and overall the competitiveness of Danish manufacturing firms relative to foreign competitors can be said to be good, cf. Chart 31 (right).

Public sector wage growth is still moderate. For a while after the financial crisis in 2008, wages rose at a faster pace than in the private sector. But in the longer term, public sector wages are regulated so that they move in parallel with those of the private sector. Consequently, public sector wage growth is set to be relatively moderate in the coming years.

MOUNTING PRESSURES IN THE LABOUR MARKET

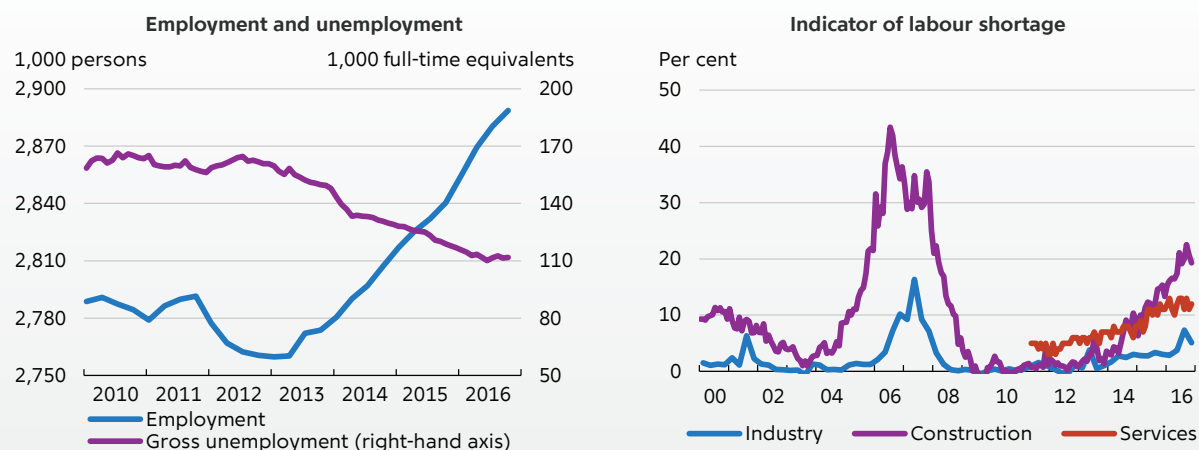
Employment has continued to rise, while unemployment has flattened at a level close to its cyclically neutral level of around 110,000 persons, cf. Chart 32 (left). This is equivalent to a gross unemployment rate of 4.2 per cent of the labour force. Combined with a rising wage share and labour shortages, this supports the impression of mounting capacity pressures in the labour market.

According to the national accounts, employment rose by 11,000 in the 3rd quarter and has now increased by approximately 120,000 persons since the upswing began to gain momentum in early 2013. The increase has taken place in the private sector only, while public sector employment has declined. Private sector employment growth has been broad-based across industries, but particularly visible within business service, trade and transport, and building and construction. Indicators of the future development in employment, including the number of new job advertisements, point to rising employment in the 4th quarter. The indicators of labour shortage have risen in 2016, especially in the building and construction sector, but the shortage is broad-based across industries, cf. Chart 32 (right).

Employment is expected to increase by 50,000 persons from the 3rd quarter of 2016 to the end of 2018. That is considerably more than the current labour market gap of fewer than 10,000 persons. The labour market gap indicates how much employment can rise without causing pressures in the economy. It will be necessary to bring people currently outside the labour force onto the labour market. Alternatively, some of the increased demand can be met if those currently in the labour force retire later. The projection assumes that the structural labour force will rise in the coming years, reflecting measures such as the

Signs that the labour market is tightening

Chart 32



Note: Left-hand chart: Employment according to the national accounts.
Right-hand chart: Share of firms, adjusted for employment, stating that shortage of labour is an impediment to production.
Source: Statistics Denmark.

retirement reform of 2011, which will increase the participation rate in the older age groups in the labour market.

PUBLIC FINANCES ARE SET TO DETERIORATE A LITTLE

Public consumption is expected to grow at a moderate pace in the coming years. The increase in government spending is attributable to factors such as a rise in the number of senior citizens. Public investment has been at a high level for some years, but in 2017 and 2018 public sector investment activity is expected to fall marginally.

A government deficit of 1.5 per cent of GDP is forecast for this year. This is 0.6 percentage point higher than in the previous projection. The main reason for this deterioration is that higher interest rates and lower returns on equities lead to lower-than-expected revenue from pension yield taxes. The deficit will remain unchanged at 1.5 per cent of GDP next year. In 2018 it will decrease a little due to the continued economic upswing.

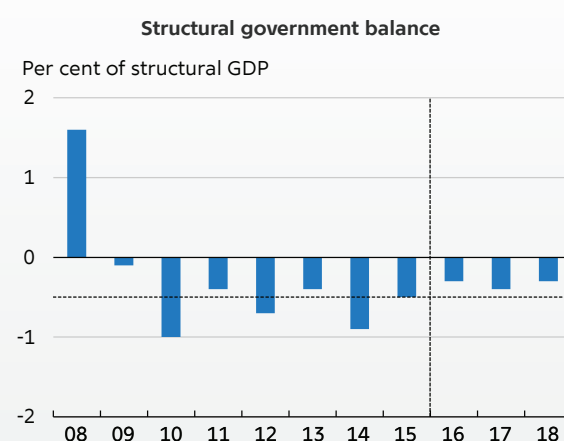
In the Economic Survey from August, the government forecasts the structural deficit at 0.3 per cent of GDP this year, cf. Chart 33. That represents a tightening relative to last year. But next year the structural balance will deteriorate again, leading to an expected deficit of 0.4 per cent of GDP. This is within the limit of the Budget Act, but leaves very little margin for unforeseen events.

ECONOMIC POLICY

The Danish economy has been in an upswing since late 2012. For a long time, this has been reflected in the strong employment growth in the labour market, but now it is also supported by GDP figures, following Statistics Denmark's extraordinary revision of the national accounts.

Slight tightening of fiscal policy in the coming years

Figure 33



Note: The structural government balance is the government balance adjusted for cyclical fluctuations and special factors. The broken horizontal line indicates the Budget Act's limit for the structural deficit.
Source: Ministry of Finance.

There are still clearer indications of a shortage of labour, and a new compilation of the output gap also shows that capacity is tightening.

There are signs that the economy is more or less at its cyclically neutral position and is heading towards a boom. Consequently, the aim should be to achieve equilibrium on the structural balance within the next couple of years so that fiscal policy contributes to stabilising the economy. At the same time, this will provide scope for fiscal easing if the economy enters a new recession.

The annual rate of increase in house prices has fallen slightly, but remains high. The price level for owner-occupied flats in Copenhagen is high relative to incomes and interest rates. Add to this a risk that prices are being pushed up by self-fulfilling expectations. At the same time, interest rate sensitivity is higher in Copenhagen than the average for Denmark overall. This makes the Copenhagen housing market vulnerable to interest rate hikes. Hence, there is a considerable risk that if the real price rises seen in recent years continue, they will be followed by corresponding falls.

Before the new coalition was formed, the former government presented a proposal for a new

housing tax scheme containing elements that will stabilise the housing market, but not until their implementation in 2021. So uncertainty remains as to what will happen before 2021. It is important that until a reform is phased in no initiatives are introduced that could exert further upward pressure on prices in the short term. The freeze on land taxes in 2017 and possibly up until 2021 is procyclical. It increases price pressures, especially in areas where prices rises are already worryingly high, and at the same time the stabilising elements of the former government's proposal are eroded.

The debates in connection with the Brexit referendum and the US election campaign reflect a global tendency for countries increasingly to turn their backs on the advantages of free trade. Much prosperity in Denmark and globally is based on international trade, and increased protectionism could potentially have a severe negative impact on the Danish economy. Whenever possible, Denmark should work to promote international trade.

APPENDIX 1: ASSUMPTIONS IN THE PROJECTION FOR THE DANISH ECONOMY

The projection has been prepared using the macroeconomic model MONA⁶ and is based on the available economic statistics, including Statistics Denmark's preliminary quarterly national accounts for the 3rd quarter of 2016. The projection involves a number of assumptions concerning the international economy, financial conditions and fiscal policy.

THE INTERNATIONAL ECONOMY

Global growth is expected to increase from 2.4 per cent in 2016 to 2.8 per cent in 2017. In the advanced economies, growth is being driven by higher private consumption, which is supported by rising employment, low oil prices and low interest rates. According to the international organisations, the downward risks dominate in the projection period, including mounting protectionist tendencies, the risk of protracted weak demand in the advanced economies and a high level of indebtedness in China.

There has been a marked slowdown in world trade in recent years, and future developments are now expected to be even weaker than previously assumed. This has an impact on Denmark's export market growth. Growth in the markets for Danish industrial exports is predicted to be 2.4 per cent this year, rising to 3.2 per cent in 2017 and 3.4 per cent in 2018, cf. Table 3. That is 0.8 and 0.7 percentage point, respectively, lower than assumed in September.

In the coming years, wage growth in the advanced economies is expected to accelerate from a low level. This should be seen in the context of a labour market recovery, so that actual unemployment is close to its structural level in a number of countries. At the same time, consumer price inflation is expected to rise, but the rate of price increase will remain low in a historical perspective.

INTEREST RATES, EXCHANGE RATES AND OIL PRICES

Developments in short-term and long-term interest rates in the projection are based on the expectations of future developments that can be derived from current interest rates with different maturities. Throughout the projection period, the 3-month money market interest rate, measured by the 3-month CITA swap rate, is expected to be negative, although it will rise slightly, from approximately -0.4 to approximately 0.3 per cent.

The average bond yield is an average of the yields to maturity on outstanding government and mortgage bonds. It is expected to rise slightly over the projection period, from 0.7 per cent initially to 1.3 per cent by the end of 2018.

The dollar strengthened after the US election, and this has weakened the effective krone rate a little in recent weeks. In the projection, the effective krone rate and the dollar rate are assumed to remain constant at the current levels.

In early December 2016, the price of oil was around 54 dollars per barrel. The oil price is assumed to develop in line with futures prices, rising to around 56 dollars towards the end of 2018.

FISCAL ASSUMPTIONS

The projection is based on preliminary national accounts data on public sector consumption and investment, the planned fiscal policy in the Economic Survey from August 2016 and the agreement on the Finance Bill for 2017.

Real public consumption is assumed to rise by 0.9 per cent this year and by 0.5 and 0.6 per cent in 2017 and 2018, respectively, while public investment is assumed to rise by 0.3 per cent this year and then to fall by 0.9 and 0.7 per cent in 2017 and 2018, respectively.

⁶ The model is described in Danmarks Nationalbank, *MONA – a quarterly model of the Danish economy*, 2003.

Overview of projection assumptions

Table 3

| | 2015 | 2016 | 2017 | 2018 |
|--|------|-------|-------|-------|
| International economy: | | | | |
| Export market growth, per cent year-on-year | 3.8 | 2.4 | 3.2 | 3.4 |
| Export market price ¹ , per cent year-on-year | -2.7 | -1.2 | 1.7 | 1.5 |
| Foreign price ² , per cent year-on-year | -2.7 | -1.2 | 1.7 | 1.5 |
| Foreign hourly wages, per cent year-on-year | 1.9 | 1.8 | 2.1 | 2.5 |
| Financial conditions, etc.: | | | | |
| 3-month money market interest rate, per cent p.a. | -0.4 | -0.4 | -0.4 | -0.3 |
| Average bond yield, per cent p.a. | 1.0 | 0.8 | 0.9 | 1.2 |
| Effective krone rate, 1980 = 100 | 99.2 | 100.8 | 101.2 | 101.2 |
| Dollar exchange rate, DKK per USD | 6.7 | 6.7 | 6.9 | 6.9 |
| Oil price, Brent, USD per barrel | 52.4 | 43.1 | 55.3 | 56.2 |
| Fiscal policy: | | | | |
| Public consumption, per cent year-on-year | 0.6 | 0.9 | 0.5 | 0.6 |
| Public investment, per cent year-on-year | -3.9 | 0.3 | -0.9 | -0.7 |
| Public sector employment, 1,000 persons | 824 | 819 | 821 | 823 |

¹ Weighted import price for all countries to which Denmark exports.

² Weighted export price for all countries from which Denmark imports.

APPENDIX 2: REVISIONS IN RELATION TO THE PREVIOUS PROJECTION

The growth outlook for the Danish economy in 2016 has been adjusted upwards by 0.1 percentage point, reflecting a slightly stronger-than-expected 3rd quarter. The international organisations predict weaker growth, while interest rates are a little higher and are expected to rise faster than anticipated in September. GDP growth is adjusted downwards by 0.1 percentage point in 2017 and by 0.3 percentage point in 2018, cf.

Table 4. Most of this adjustment is attributable to weaker exports due to lower export market growth, while growth in domestic demand remains more or less unchanged.

Consumer prices have been adjusted downwards for 2016 and especially for 2017. Consumer prices have shown a weaker trend than forecast in the September projection, primarily as a result of a fall in domestic market-determined inflation.

Revisions in relation to the previous projection

Table 4

| Per cent, year-on-year | GDP | | | Consumer prices, HICP | | |
|--|------|------|------|-----------------------|------|------|
| | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| Projection, September 2016 | 0.9 | 1.5 | 1.8 | 0.3 | 1.5 | 1.8 |
| Contribution to revised projection from: | | | | | | |
| Export market growth | -0.2 | -0.2 | -0.2 | 0.0 | 0.0 | -0.1 |
| Interest rates | 0.0 | 0.0 | -0.1 | 0.0 | 0.0 | 0.0 |
| Exchange rates | 0.1 | 0.1 | -0.1 | 0.0 | 0.1 | 0.1 |
| Oil prices | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 |
| Other factors | 0.1 | 0.1 | 0.1 | -0.2 | -0.6 | 0.0 |
| This projection | 1.0 | 1.4 | 1.5 | 0.0 | 1.1 | 1.8 |

Note: The transition from the previous to this projection may not add up due to rounding. "Other factors" includes data revisions.

ARTICLES

REGIONAL ASPECTS OF THE HOUSING MARKET

Simon Juul Hviid, Tina Saaby Hvolbøl and Erik Haller Pedersen, Economics and Monetary Policy

INTRODUCTION AND SUMMARY

The housing market has picked up over the last three to four years. This trend is particularly pronounced in Copenhagen, where the population has been growing. Initially, new construction has not followed the upward trend, and as a result increasing demand has pushed up prices.

The Copenhagen housing market tends to set the course for the rest of Denmark, with house price movements rippling out to the rest of the country. The ripple effect of higher prices in Copenhagen will prompt more families to move to the surrounding areas, which has a stabilising impact on prices. However, there is a risk that expectation-driven house price developments in Copenhagen will thus spread to the rest of the country.

This article focuses on the housing market in Copenhagen, and a demand relation is estimated for the Copenhagen market for owner-occupied flats. Against this backdrop, it is concluded that prices in Copenhagen are high relative to incomes and interest rates. Moreover, prices may be driven by self-fulfilling expectations, cf. also the article "House price bubbles and the advantages of stabilising housing taxation", Danmarks Nationalbank, Monetary Review, 3rd Quarter 2016. Thus, there is a real risk that continuation of the real price increases of recent years may be followed by corresponding price falls. At the national level, house price developments do not give cause for concern.

The Copenhagen housing market is more vulnerable to sudden interest rate hikes than the rest of the country. The combination of high

interest rate sensitivity and house prices that are high relative to incomes and interest rates increases the risk that even a small rise in interest rates could trigger price falls. In recent years, large-scale new construction has been initiated in Copenhagen. This is a natural consequence of a growing market and provides some measure of stability to price developments in the medium term. However, expanding the housing stock takes time, and in a worst-case scenario a price drop driven by interest rate increases may be reinforced by a large supply of new housing.

REGIONAL DIFFERENCES IN DEVELOPMENTS

PRICE INCREASES FOR OWNER-OCCUPIED HOUSING HAVE BEEN STRONGEST IN THE MAJOR CITIES

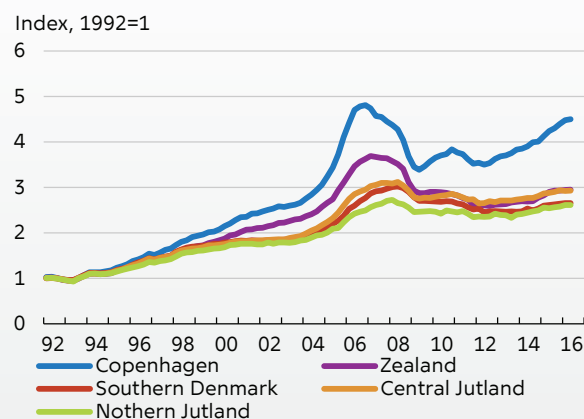
The housing market has been growing over the last three to four years after the strong downturn in the wake of the house price bubble in the mid-2000s, cf. Chart 1 (left). This growth has coincided with a general upswing in the Danish economy and has been supported by historically low interest rates and rising incomes. This trend has been particularly pronounced in the Capital Region and large provincial towns and cities, cf. Chart 1 (right).

Since the upswing began to gain momentum in 2012, price increases in Copenhagen have exceed-

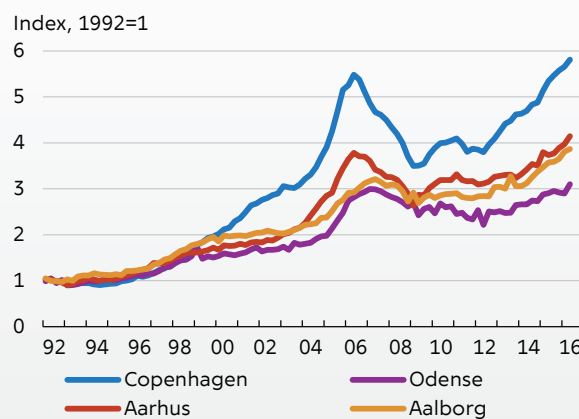
House prices are rising in all Danish regions

Chart 1

Nominal prices of single-family houses



Nominal prices of owner-occupied flats



Note: The most recent observations are from the 2nd quarter of 2016.
Source: Statistics Denmark, Housing Price Statistics and own seasonal adjustment.

ed 10 per cent p.a. for owner-occupied flats, while they have been a little lower for houses. At the same time, trading activity has been high. The annual rate of increase in prices of owner-occupied flats decelerated slightly in the first half of 2016, but remains high.

THE HOUSING STOCK IN COPENHAGEN IS DIFFERENT FROM THAT OF THE REST OF DENMARK

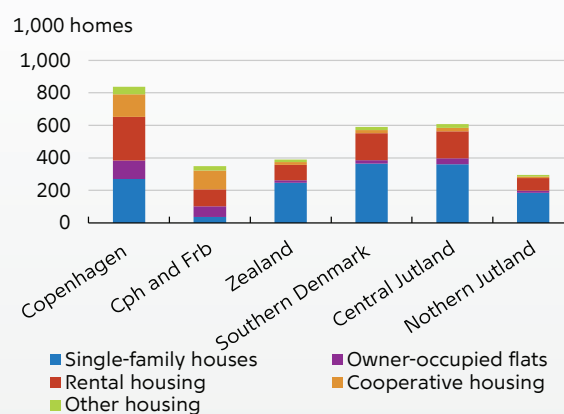
Owner-occupied housing makes up only a very limited share of the total housing stock in the Municipalities of Copenhagen and Frederiksberg. In other words, only a small share of the total number of homes can be sold freely in the market, and these are the homes that determine house prices. The possibilities of meeting the increased demand for housing by e.g. cooperative, rental or social housing are limited due to extensive public regulation of these types of housing. This is reflected in the prices of owner-occupied housing, which are pushed up further when demand for housing in the Capital Region is strong – and vice versa when demand is low. For this reason alone, price fluctuations are greater than in the rest of Denmark.

There are considerable regional differences in the composition of the housing stock in Denmark. More than half of the housing stock is made up of single-family and terraced houses, the typical type of housing outside large towns and cities, while flats and cooperative housing are primarily found

in the cities, cf. Chart 2. Just under 20 per cent of Denmark's single-family and terraced houses are located in the Capital Region, where more than half of Denmark's owner-occupied flats are also located. Most cooperative housing is also located in the Capital Region, with a further concentration in the Municipalities of Copenhagen and Frederiksberg.

The housing composition in Copenhagen is dominated by rental and cooperative housing

Chart 2

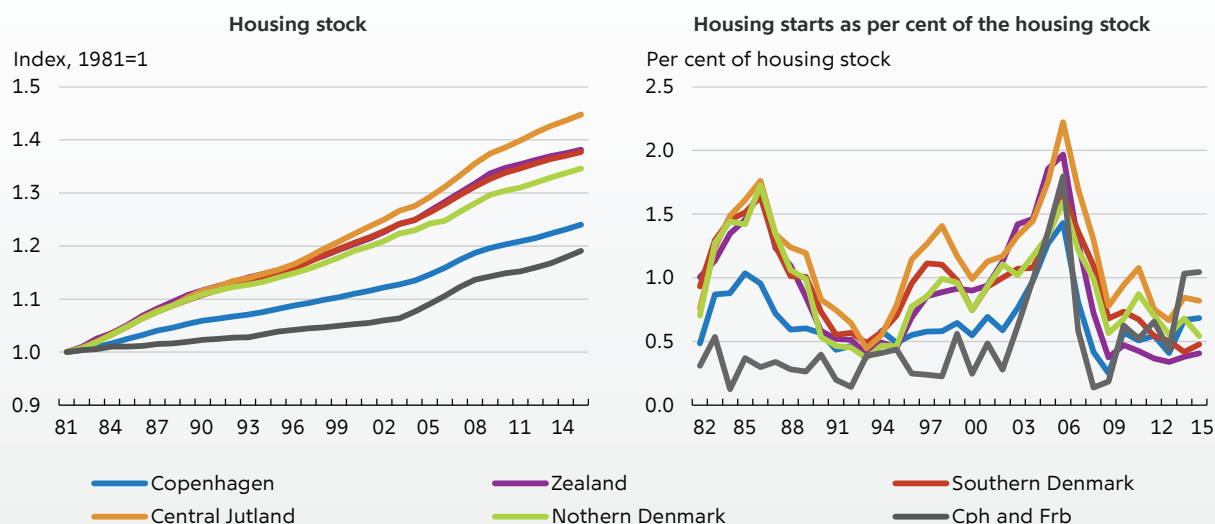


Note: Other housing does not include holiday homes. Owner-occupied flats and single-family houses include housing owned by private individuals, including partnerships. The composition of the housing stock is calculated at end-2015. 'Cph and Frb' denotes the Municipalities of Copenhagen and Frederiksberg.

Source: Statistics Denmark and own calculations

The housing stock is slowly adjusting in Copenhagen

Chart 3



Note: The housing stock and housing starts are calculated in number of square metres. The most recent observations are from end-2015. Housing starts include farmers' houses of farm properties, single family houses, terraced, linked or semi-detached houses and multi-family buildings. The most recent observations about housing starts are subject to some uncertainty.
Source: Statistics Denmark, real estate register data and own calculations.

Urban prices per square metre are higher than non-urban prices. Consequently, the urban concentration of housing wealth is higher than would be indicated by the number of dwellings. About 40 per cent of Denmark's total housing wealth is found in the Capital Region, although the region accounts for just 26 per cent of the number of owner-occupied square metres. The Municipalities of Copenhagen and Frederiksberg, where dwellings are relatively small, account for 14 per cent of Denmark's housing wealth and 9 per cent of total owner-occupied square metres.

The housing stock is currently expanded through new construction. The level of total construction in Denmark remains low in a long-term perspective. In addition to new construction, residential investment also comprises major repairs, which are closely linked to the size of the housing stock and, contrary to new construction, are not limited by the number of available construction sites. Major repairs, currently accounting for most residential investment, have proved to be highly sensitive to cyclical fluctuations and were an important explanatory factor for the high level of residential investment in connection with the house price bubble of the mid-2000s. By expanding the housing stock, new construction is a main contributor to keeping price increases at

bay when housing demand is high. Major repairs primarily impact the quality of housing and, to some extent, contribute to an upward price pressure, since improvements in the housing quality increase the willingness of households to pay.¹

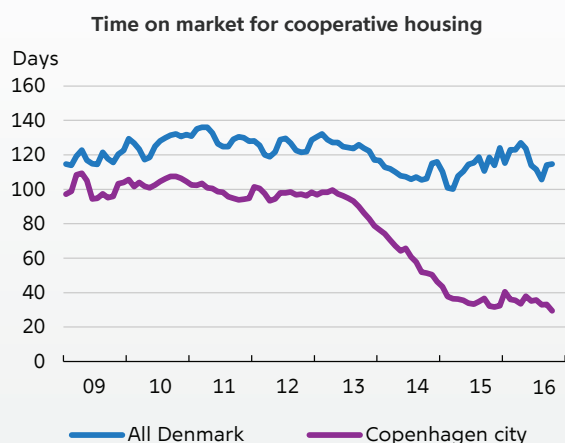
Since 1981, there has been a modest increase in the number of housing square metres in the Capital Region, cf. Chart 3 (left). However, in recent years, the Municipalities of Copenhagen and Frederiksberg have seen a relatively high number of housing starts, cf. Chart 3 (right). This is a natural consequence of a growing market and helps to dampen the strong price growth in the medium term.

Just over 32 per cent of the housing in the Municipalities of Copenhagen and Frederiksberg is cooperative housing, which is regulated in the sense that prices are not fully market-based². Vacant cooperative housing can help to absorb an increase in the demand for housing. However,

- 1 Statistics Denmark applies a quality-adjusted price index to eliminate the effect of different housing units being sold during different quarters. However, allowance is made only for quality improvements reflected in public valuations. Thus, differences in housing maintenance and renovation are not fully captured by the price index.
- 2 The price of cooperative housing can be adjusted on an ongoing basis based on the assessment by a valuer. However, such valuations are voluntary and are usually performed at annual intervals.

The Copenhagen market for cooperative housing is under pressure

Chart 4



Note: The chart comprises only sales arranged by an estate agent, and much cooperative housing is not. A 3-month moving average has been applied. The most recent observations are from October 2016.

Source: Boligsiden.dk.

the time on market for cooperative housing has dropped sharply in Copenhagen city since 2013, cf. Chart 4. Today, the average time on market for cooperative housing sold through an estate agent is down to approximately one month. More or less the same applies to the regulated segment of the rental market. If the regulated rent is lower than the market rent and is unable to adjust, the price effect, which ought to release housing, will be deactivated. Thus, part of the demand for rental housing cannot be met by the housing supply. This means that demand shifts to the market for owner-occupied housing, resulting in higher price increases, cf. Häckner and Nyberg (2000).

THE POPULATION HAS INCREASINGLY MIGRATED TO THE CAPITAL REGION

With a population of 1.8 million, the Capital Region is the largest of Denmark's five regions. The population of the Capital Region was largely unchanged during the downturn from the mid-1980s until the mid-1990s, after which time it outpaced the national growth rate until the mid-2000s. During the boom in 2005-08, growth was halted by increasing migration from the Capital Region to Region Zealand, in particular.

From 2008, migration flows were reversed, and the Capital Region, particularly Copenhagen and Frederiksberg, saw a massive influx of inhabitants, driven by young people and people in employment, while pensioners migrated from the region. Urban migration is, to a great extent, driven by young people migrating to the cities for education purposes and increasingly tending to settle down permanently in the city. Consequently, the 25-39-year-old group, accounting for a large proportion of home buyers, is growing considerably. This group includes both first-time buyers and families in need of more space. On the other hand, the 65+ age group is decreasing, cf. Chart 5 (left). Changing family patterns, with more single households, also increase the housing demand for a given population, cf. Chart 5 (right). The relative shift in age groups is likely to have contributed to the price growth over the last 20 years.

Recent years have seen increasing migration to Copenhagen from abroad. To this should be added a large excess of births, cf. Chart 6. This excess is likely, in itself, to increase the housing demand, albeit to a lesser extent than net immigration.

If the population growth is seen in relation to the relatively modest increase in available housing, this helps to explain why prices in Copenhagen have been rising faster than in the rest of Denmark.

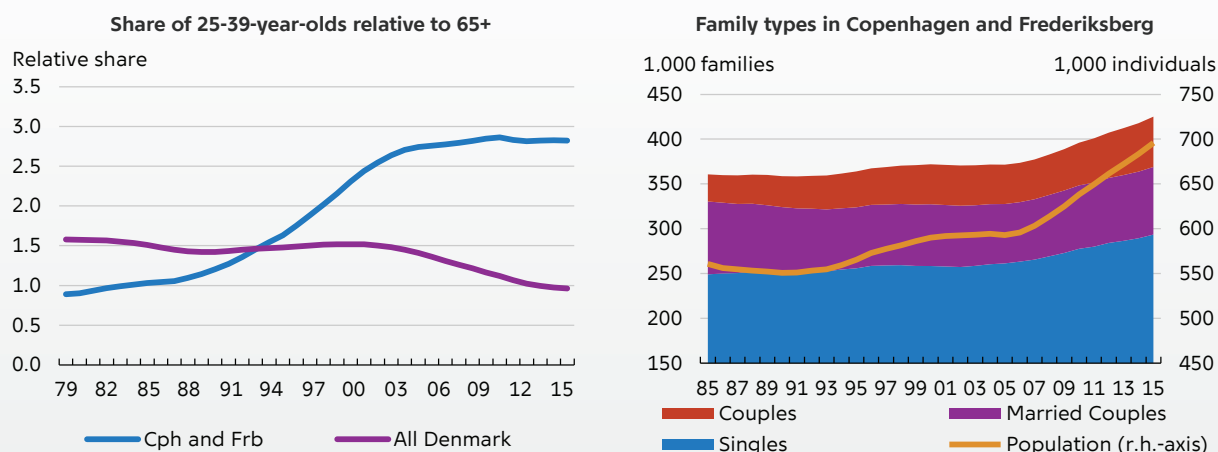
According to Statistics Denmark's population projection, the population growth is expected to continue until 2030, at which time the population of Copenhagen city is expected to be 18 per cent higher than it currently is. This should be seen against the backdrop of an underlying structural trend to urban migration.

RIPPLE EFFECT IN HOUSE PRICES FROM COPENHAGEN

Alongside the structural movement towards a growing population in Copenhagen and the major provincial towns, the Capital Region tends to experience migration from the region during boom periods when house prices soar to levels that fewer people can afford and are willing to pay. There are strong indications that this level has been reached. After a number of years with net immigration, 2015 thus saw net migration from Copenhagen to the rest of Denmark. Box 1 describes this cyclical movement in more detail. The result is that movements in house prices, especially from the Capital Region, ripple out to

The percentage of young people and the number of single households have increased in Copenhagen and Frederiksberg

Chart 5



Note: Couples cover cohabiting couples and registered partners. The most recent population number was calculated on 1 January 2016.
Source: Statistics Denmark and own calculations.

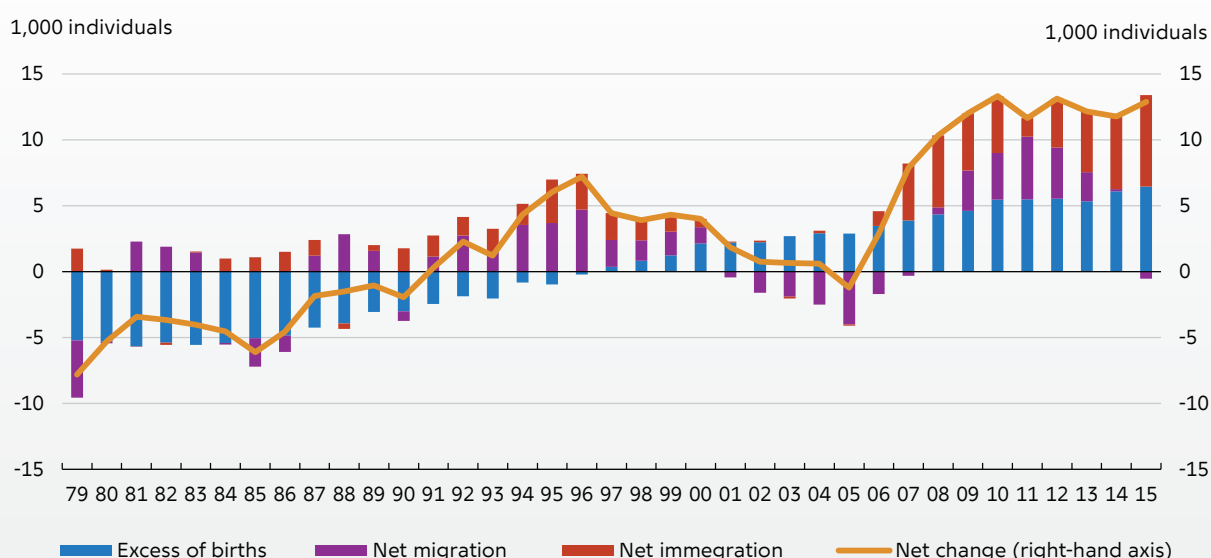
the rest of the country. The further away from Copenhagen housing is located, the longer the lag and the smaller the impact. The ripple effect of housing demand has a stabilising effect on price developments in Copenhagen. However,

price growth driven by self-fulfilling expectations in Copenhagen may also ripple out to the rest of the country.

Copenhagen currently has the highest prices per square metre, and prices clearly tend to fall

Demographic developments in Copenhagen are dominated by an excess of births and immigration

Chart 6



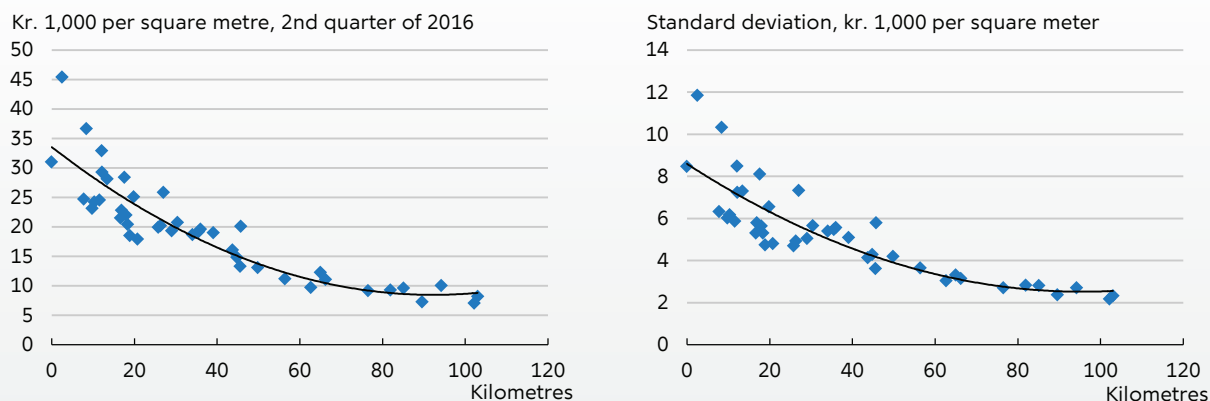
Note: The most recent observations are from 2015. A small number of corrections are disregarded.
Source: Statistics Denmark.

proportionately with the distance to Copenhagen, cf. Chart 7 (left). Moreover, house prices in Copenhagen are more susceptible to volatility than prices in the rest of Denmark, cf. 7 (right). One

reason is the sluggish supply of housing, which causes changes in demand to have a stronger pass-through to prices.

Zealand house prices and their volatility are falling with the distance to Copenhagen

Chart 7



Note: Distance indicates the shortest driving distance. The chart covers municipalities in Region Zealand and the Capital Region of Denmark, less Bornholm, Lolland and Falster. The standard deviation is calculated from the 2nd quarter of 1992 to the 2nd quarter of 2016.
Source: Housing market statistics, Krak and own calculations.

Housing demand is spreading from areas with high house prices – the ripple effect

Box 1
continues

Regional housing markets are interconnected in multiple ways. Firstly, national developments have a simultaneous impact on regional housing markets. For instance, a demand shock in the form of changes in housing market interest rates. Moreover, a price-driven regional substitution effect causes demand to spread out via prices over the country when house price differentials increase. A given municipality will thus experience both a direct and an indirect effect of a national demand shock to house prices. The indirect interconnectedness is described in Meen (1999 and 2001) and is referred to as the 'ripple effect'. Since a home purchase is a cost- and time-consuming process, the indirect effect is likely to be more sluggish.¹

To quantify the size of the two effects, a correlation analysis of house prices has been performed on Danish regions and parts of the country, cf. the chart. The underlying regional trend towards higher house prices has been excluded, entailing that the regional cyclical variation in house prices is analysed.

If there was only a direct effect resulting from, for instance, national demand shocks, the greatest correlation between regional house prices would be in the current quarter, equivalent to the time 0 in the charts below. The other times in the chart show the correlation between regional

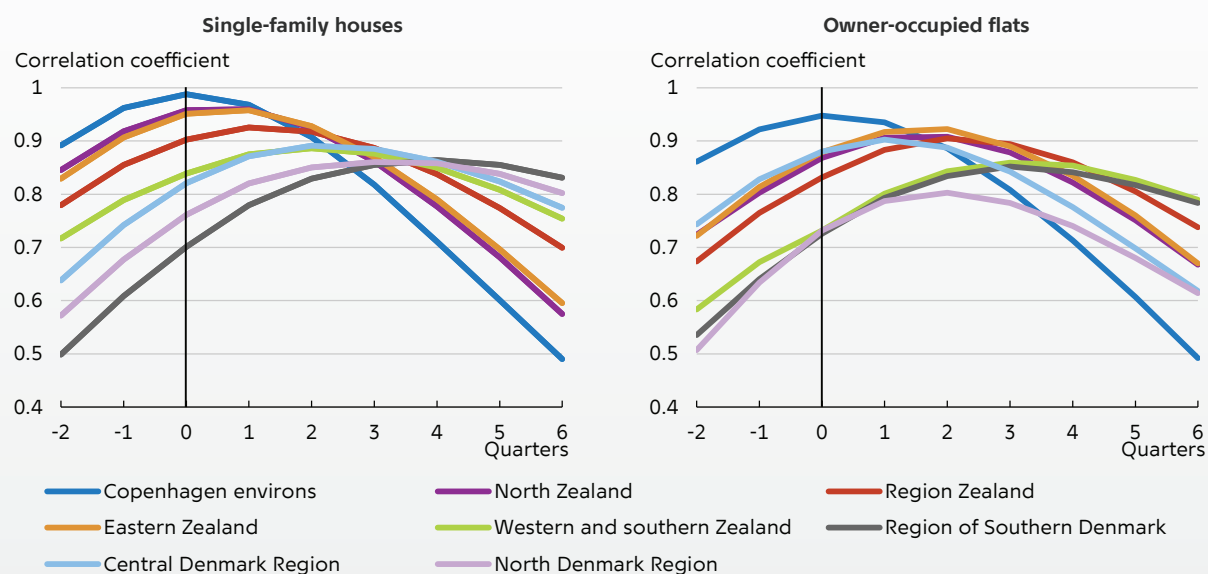
house prices and house prices in Copenhagen city for the lags of various numbers of quarters. Here, two dimensions are related to the integration of regional housing markets. Firstly, the size of the correlation and secondly the lag in the pass-through to prices. Both effects are related to the geographical distance between markets, where the Copenhagen environs have a very high correlation in the cyclical variation in the current quarter and no quantifiable lag in the pass-through. At the opposite end of the spectrum, for instance the Region of Southern Denmark, the covariation with the Copenhagen housing market is substantially lower and there is a lagged pass-through of around one year.

Thus, the ripple effect spreads out over the country, with the amplitude, measured by the size of the correlation coefficient, decreasing with the distance to the Copenhagen housing market, while the phase shift increases with the distance to the Copenhagen housing market.

The geographical ripple effect of house prices may be due to a spillover effect from household moving patterns, as described above, but other channels may also contribute to the development. Whether the ripple effect is driven by one explanation or another, there are geographical differences in how the housing market absorbs these demand shocks and thus in the regional impact of the ripple effect.

1. Heebøll (2014) has estimated a regional model, allowing a regional ripple effect of house prices, on Danish data.

The house price ripple effect from Copenhagen city



Note: The chart shows the correlation coefficient between the price of single-family houses in Copenhagen city and other regions and parts of Denmark for various quarterly lags and leads. The series used describe the cyclical variation in prices, as the series are filtered using an HP filter with a smoothing parameter value of 400,000. Thus, geographical differences in fundamental price developments are excluded. The correlations are based on quarterly data from the 1st quarter of 1992 to the 4th quarter of 2015.

Source: Statistics Denmark and own calculations.

DISPOSABLE INCOME DIVERGES ACROSS THE COUNTRY

Economic growth in Denmark increasingly takes place in the cities, primarily the Capital Region. This has been the case for many years and the same pattern is seen in other countries, but the trend seems to have accelerated in Denmark in recent years, driven by both demographic and cyclical factors.³ Causality between population growth and regional economic growth can be bidirectional.

Part of the output of the Capital Region is generated by labour living outside the region, inter alia in Region Zealand. But if commuting is taken into account, as well as regional redistribution via the public funds, disposable per capita income is more equally distributed across the country, albeit still with considerable differences, cf. Chart 8 (left).

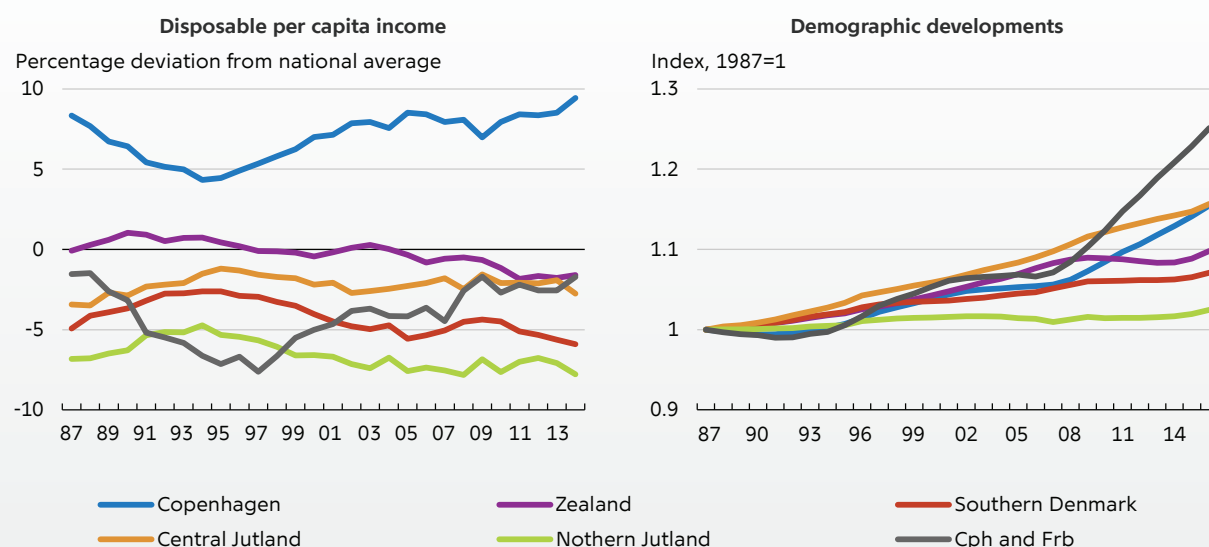
Thus, the Municipalities of Copenhagen and Frederiksberg are below the national average, while the entire Capital Region is substantially above the average. Disposable income is a measure of the payment capacity of home buyers. During the most recent upswing, the disposable per capita income has increased more in Copenhagen than in other parts of Denmark. At the same time, the population growth has been stronger in the Capital Region, cf. Chart 8 (right).

Not all home buyers live in the geographical area in which they buy a home. A case in point is 'parent purchases' (i.e. parents are buying flats for their children). Most parents buying an owner-occupied flat in Copenhagen for rental to their children live in the Capital Region outside

³ Approximately 40 per cent of the Danish value creation is generated in the Capital Region. GDP per capita in Region Zealand is only just over half of that of the Capital Region. However, GDP indicates the geographical distribution of output, not purchasing power.

Disposable per capita income in Copenhagen is catching up with the national average

Chart 8



Note: Left: The most recent observations are from 2014. Right: The most recent observations are from the beginning of 2016.
Source: Statistics Denmark and own calculations.

Copenhagen city. Thus, price developments are also impacted by developments in the disposable income across regions. However, disposable incomes in the Capital Region and in the Municipalities of Copenhagen and Frederiksberg more or less move in tandem.

CAN THE PRICES OF OWNER-OCCUPIED FLATS IN COPENHAGEN BE EXPLAINED?

A growing population, low interest rates and rising incomes have led to higher house prices. The reason is that – despite an increase in recent years – demand for housing has outpaced supply. However, the question is whether the strong growth in house prices in recent years has pushed up prices to such an extent that they no longer reflect economic fundamentals. To get an impression of this, a relation for owner-occupied flats in the Municipalities of Copenhagen and Frederiksberg is defined and estimated.⁴ This relation is an adjusted version of the MONA house price

relation as presented in Dam et al. (2011). As described earlier, Copenhagen sets the course for the overall Danish housing market, and thus price growth driven by self-fulfilling expectations may ripple out to the rest of the country.

House price developments are determined by a combination of supply and demand components. In the short term, the housing supply is fixed and adjustment of the supply tends to take several years. Thus, demand is the predominant driver of house prices in the short term.

Demand is assumed to be determined by the real disposable income of households and the costs of investing in a home. The disposable income of a given region is impacted by the composition of the population in the sense that it sums up the income of the individual households. This entails that a substantial portion of the population growth and the demographics of Copenhagen are captured by this variable.

Costs are a combination of user cost and first-year payments. The user cost includes the interest rate after tax on a 30-year fixed rate mortgage loan as well as administration margins payable

⁴ The focus is on owner-occupied flats, given that single-family houses make up a relatively small percentage of the housing stock in the Municipalities of Copenhagen and Frederiksberg.

on mortgage loans, the tax rate and inflation expectations. First-year payments affect home buyers' willingness to pay, as they may be credit constrained. First-year payments are a measure of the lowest cost a home buyer has to pay to live in his or her home and include a short, flexible after-tax rate, administration margins and amortisation. In principle, home loan amortisation is a redistribution of savings and thus, in the absence of liquidity constraints, should have no implications for household housing demand. However, mortgage amortisation requirements may have been of major significance for some groups of home buyers until the introduction of deferred amortisation loans in 2003. Therefore, they are included in the first-year payments. The effective tax rate varies considerably across the country due to the nominal freeze on property value taxes in 2002, cf. Klein et al. (2016), and there are municipal differences in land tax rates⁵. On the other hand, administration margins, housing market rates and inflation expectations are not assumed to differ across the country.

A characteristic of the housing stock area is that an increase in the supply will have a dampening

effect on prices. The interpretation of a housing stock concept that includes quality improvements is more ambiguous, however, since major repairs improve the quality of the housing and thus tend to increase prices, cf. above. Here the number of living space square metres is used, entailing that the interpretation of the estimated coefficients is unambiguous. However, this approach is likely to overestimate the sensitivity of the price to increases in the housing stock. This approach is derived, inter alia, from data limitations and differs from other known relations, including the house price relation at the national level in Denmark's Nationalbank's macroeconomic model, MONA.

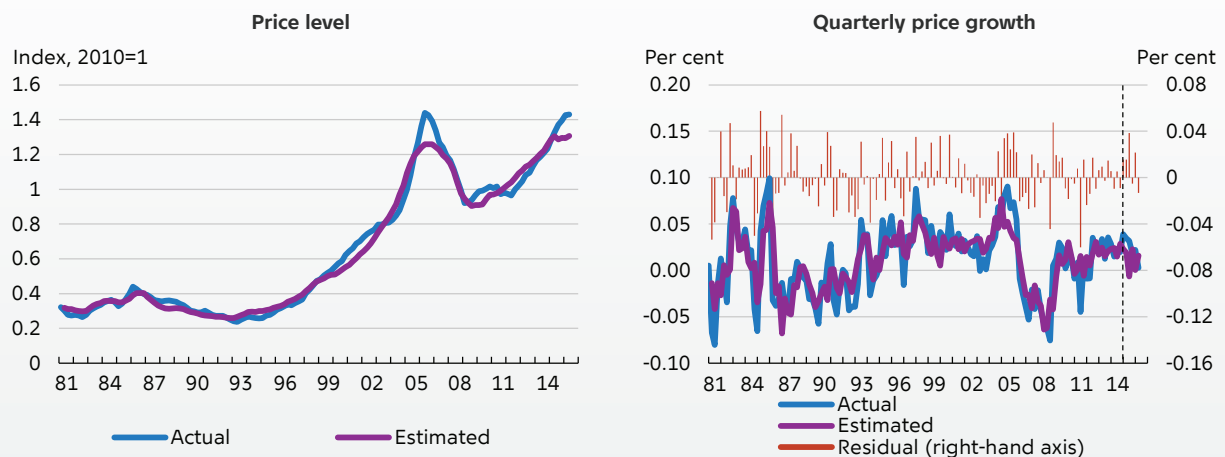
Specification and estimates are set out in Box 2.

The relation can explain a great deal of the development in house prices. It can be used to analyse whether the level of prices can be explained based on e.g. the level of interest rates and the disposable income. That way, it is possible to assess whether the current level of house prices is higher than warranted by economic fundamentals, cf. Chart 9 (left).

The analysis shows that the prices of owner-occupied flats in Copenhagen have been above

Owner-occupied flats in Copenhagen are more expensive than warranted by the estimated relation

Chart 9



Note: The demand relation is estimated based on growth in the prices of owner-occupied flats, and the explanatory power and residuals of the model are illustrated by the right-hand chart. The estimated level in the left-hand chart is based on a dynamic simulation from the 2nd quarter of 1981, in which the predicted prices in a given period are based on predicted prices in previous periods. The simulation has been extended to the 2nd quarter of 2016.

Source: Statistics Denmark and own calculations.

5 Including the effects of the regulation ratio.

Relation for the real price of owner-occupied flats in Copenhagen and Frederiksberg

Box 2

Household demand for owner-occupied flats is assumed to be determined by the disposable real income, Y , the real price of owner-occupied flats, P , and a combination of the user cost, u , and the lowest possible first-year payments, y . As a case in point, if interest rates decrease, housing demand will increase. As the housing stock is fixed in the short term, with a high degree of sluggishness in the adjustment, a change in housing demand will initially be reflected in the price. If the housing supply does not fully adjust in the longer run, there will be a permanent price effect. In this analysis, we do not consider the supply side, i.e. we do not define a relation for the housing stock. In other words, the analysis does not provide a full price formation model.

The relation is specified on an error correction form. The inverse demand curve for real prices of owner-occupied flats in the Municipalities of Copenhagen and Frederiksberg can be derived from the estimated relation

$$\log P = 6,9 \cdot \log Y - 27,4 \cdot \log H - 29,8 \cdot (0,3 \cdot u + 0,7 \cdot y) + \text{constant}$$

The demand relation implies that a 1 per cent increase in household disposable real income will lead to a 6.9 per cent

increase in the real price if the housing stock is not adjusted.¹ In the combination of the user cost and first-year payments, the main emphasis of households is on first-year payments, i.e. 70 per cent and 30 per cent on user cost. The specification of the relation entails that a semi-elasticity of costs is estimated. Thus, a combined increase in both the short-term and long-term housing market rates of 0.1 percentage points (before tax) will cause long-term house prices to be reduced by around 2 per cent if the income and housing stock remain unchanged. The size of the effect of a 0.1 per cent change in, for instance, the effective property value taxation will be approximately 3 per cent. For a similar specification of the model for single-family houses at the national level, the estimated interest rate sensitivity is around half.

In the demand relation above, all short-term components (variables that are included in changes) have been excluded from the estimated error correction model. The short-run dynamics include changes in the household disposable income, the last quarter's price increase and the change in long-term interest rates after tax, r , and the housing tax rate, s , cf. the table.

The estimated relation

| Variable | | Coefficient | t-value |
|---|------------------------------|-------------|---------|
| Real prices of owner-occupied flats, change | $\Delta \log P_t$ | | |
| Real prices of owner-occupied flats, change, lagged | $\Delta \log P_{t-1}$ | 0.382 | 5.1 |
| Real income, change | $\Delta \log Y_{t-1}$ | 0.343 | 3.4 |
| Interest and tax rates, change | $\Delta (s_{t-1} + r_{t-1})$ | -3.465 | 5.3 |
| Real prices of owner-occupied flats | $\log P_{t-1}$ | -0.033 | 3.1 |
| User cost | u_{t-1} | -0.316 | 1.8 |
| First-year payments | y_{t-1} | -0.657 | 2.4 |
| Real income | $\log Y_{t-1}$ | 0.226 | 3.1 |
| Housing stock | $\log H_{t-1}$ | -0.894 | 4.0 |
| Constant | | 6.089 | 4.0 |

Misspecification test

| | | | |
|-----------------------|------------|---------------|------------|
| T = 1981Q2 – 2014Q4 | DW = 1.940 | AR(1) = 1.249 | SE = 0.025 |
| R ² = 0.61 | JB = 0.973 | AR(4) = 7.270 | |

Anm.: The data is described in more detail in the Appendix.

It should be noted that the price according to the demand relation is very sensitive to changes in income, housing stock and costs. One reason is that the relation is estimated over a period in which households have allocated a growing share of their consumption to housing consumption. House prices cannot increase more than household incomes allow in the long term. In traditional macroeconomic models such as MONA and ADAM, coefficients for income and housing stock are set to be identical (with opposing signs), entailing that housing demand increases one-on-one with real income.

Since the price index is quality-adjusted only to some extent and the volume of square metres for the housing stock is also applied, the effect of the quality improvement in Copenhagen over the estimation period is underestimated, and the coefficient estimate is thus overestimated. Despite the high sensitivity of the demand relation, the short-term sensitivity is limited, since just over 3 per cent of a deviation from the long-term level of the price is passed through to current prices, cf. the coefficient of $\log P_{t-1}$.

1. Studies for other western countries show that the income elasticity of prices at the national level is in the region of 0.5-3.2, and in large towns and cities results of 0.8-8.3 are seen, cf. Girouard (2006). In MONA and ADAM, the income elasticity of the price is 2.0 and 3.3, respectively, at the national level.

the level calculated by the model since the 1st quarter of 2015. In the 2nd quarter of 2016, the deviation was 9 per cent. At the peak in the 2nd quarter of 2006, the deviation was just over 14 per cent. However, the current deviation is not greater than what can be found in the estimation period.

An earlier analysis demonstrated that the increases in house prices seen in the Capital Region in recent years may be driven, in part, by expectations of higher future prices, but that increases in prices can be explained if income and interest rate developments are taken into account, cf. Klein et al. (2016). This estimated relation also shows that the price level in the Copenhagen market for owner-occupied flats is higher than warranted by economic fundamentals.

A fall in interest rates or a rise in incomes will increase the housing demand and thus prices. In the Municipalities of Copenhagen and Frederiksberg, these effects are two or three times stronger than for Denmark overall. The explanation for this is multi-faceted, and several of the elements are described above. The implication is that the market for owner-occupied housing in Copenhagen and Frederiksberg is more exposed to demand shocks than the rest of the housing market, and prices may respond strongly to, for instance, a sudden increase in interest rates.

Since 2001, nominal property value taxes have been frozen. As a result, the effective tax rate has been moving in the opposite direction of house prices, thus amplifying fluctuations. This has been especially problematic in areas such as Copenhagen where prices surged in the years leading up to the financial crisis and subsequently dropped the most. In 2002, the effective property value tax rate in the Municipalities of Copenhagen and Frederiksberg was 0.8 per cent, but in 2016 the rate had been halved to 0.4 per cent. Based on the estimated relation, it can be determined how much of the strong price increases over the past 15 years can be attributed to housing tax measures. If the property value tax rate had been retained, the prices of owner-occupied prices would thus have been close to 10 per cent lower today. At the same time, both the increases until 2007 and the subsequent sharp drop would have been lower, had the tax rate been retained.

Effective from 2003, land taxes have been subject to a regulation ratio, which has prevented

the land tax paid from following increases in land values. In 2016, due to the regulation ratio and the systematic underestimation of land values for owner-occupied flats, the land tax paid accounts for just 0.2 per cent of the market value of owner-occupied flats in the Municipalities of Copenhagen and Frederiksberg. Given that the effective rate is relatively low, the cap on the increase in land tax has had a modest impact on the prices of owner-occupied flats up until now. Thus, the freeze on land taxes in 2016 and 2017 – and potentially until 2021, which is the aspiration of the Danish government – is also likely to have a modest impact. However, for home owners in the Capital Region, the cap on the increase in land tax has a substantially greater impact.

A projection of the relation until 2018 provides an indication of house price developments. Under the given assumptions, the relation indicates that the estimated level of real house prices in the Municipalities of Copenhagen and Frederiksberg will see a decline over the projection period. This is mainly the result of the expected expansion of the housing stock, which is already underway. In addition, interest rates are expected to rise moderately. In a scenario in which housing market rates also rise more than expected, as has been the case since the summer of 2016, the price correction will be even stronger.

It can be concluded that prices of owner-occupied flats in Copenhagen are high relative to incomes and interest rates. Given that prices are already higher than can be explained by the model, there is a considerable risk that if the real price rises seen in recent years continue, they will eventually be followed by corresponding falls.

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APPENDIX

Data in the house price relation

| Variable | Source | Notes |
|--------------------------------|--|--|
| Prices of owner-occupied flats | Danish Customs and Tax Authority and Statistics Denmark. | Before 1992: owner-occupied flats in the Municipalities of Copenhagen and Frederiksberg |
| Consumer price index | The MONA data bank | |
| Interest rates | The MONA data bank | 30-year bond yield and a short-term bond yield (average for maturities up to two years). |
| Interest rate deductibility | The MONA data bank | |
| Administration margin | Realkredit Danmark | Own calculations before 1992. |
| Tax rate | Statistics Denmark and the MONA data bank. | Effective tax rates (currently land tax and property value tax). From 2004: own calculations based on register data. Before 2004: revenue relative to owner-occupied housing wealth. |
| Amortisation ratio | The MONA data bank | |
| Disposable income | Statistics Denmark and the MONA data bank | The income statistics 1987-2014 (Municipalities of Copenhagen and Frederiksberg). Reversed by household disposable income at the national level from the MONA data bank (the national accounts) 1981-86, and after 2014. |
| Housing stock | Statistics Denmark | Register data. Calculated in square metres. Excluding institutions and businesses, shared accommodation and summer/holiday homes. |

EFFECTS OF DANMARKS NATIONALBANK'S INTERVENTIONS IN THE FOREIGN EXCHANGE MARKET

Morten Spange and Jonas Sørensen,
Economics and Monetary Policy

INTRODUCTION AND SUMMARY

Danmarks Nationalbank's interventions in the foreign exchange market play an important role in the implementation of Denmark's monetary policy, which is designed to maintain a fixed exchange rate of the Danish krone against the euro close to its central rate.¹ This takes place within the framework of the European Exchange Rate Mechanism, ERM2. Officially, the krone may fluctuate by up to 2.25 per cent on either side of its central rate, but in practice the fluctuations are much smaller. This reflects that the fixed exchange rate policy enjoys strong credibility among investors and society as a whole, but also that Danmarks Nationalbank takes consistent action in response to fluctuations in the krone rate.

If Danmarks Nationalbank wants to influence the exchange rate of the krone vis-à-vis the euro, this will initially be achieved through intervention in the foreign exchange market, buying or selling Danish kroner against foreign exchange. This will alter the relationship between the supply of and demand for krone-denominated assets and thereby the price of kroner relative to other currencies. Market participants may also see interventions as an indication that Danmarks Nationalbank is prepared to adjust its monetary policy interest rates if the krone rate does not evolve as desired. Interest rate changes are the next step in the monetary policy reaction function.

The pressure on the krone in January and February 2015 was one of the most extensive tests to date of the Danish exchange rate regime. The system passed the test, and in 2016 the situation of the krone has been stable again. After such an episode, it is relevant to examine whether the instruments at Danmarks Nationalbank's disposal for its defence of the fixed exchange rate policy still serve their purpose. The analysis in this article shows that Danmarks Nationalbank's interventions constitute an effective instrument to stabilise the exchange rate. This applies in periods of calm in the foreign exchange market for Danish kroner, but also in periods of considerable pressure on the krone to either appreciate or depreciate against the euro. The strongest effects of intervention were seen during the financial crisis in 2008-09 and during the pressure on the krone in 2015. Those are the episodes in the analysed period with the most pronounced pressure on the krone.

When Danmarks Nationalbank purchases kroner in the market, this typically coincides with private agents selling kroner to their banks. If there is a substantial excess of sales orders for kroner from their customers, banks tend to reduce the price of kroner, while they tend to raise it when there is an excess of purchase orders. Against this background, transactions involving

1 See Spange and Toftdahl (2014) for an introduction to Danish monetary policy. A broader review can be found in Danmarks Nationalbank (2009).

kroner between banks and their customers will impact on the exchange rate. An intervention on the part of Danmarks Nationalbank may therefore be successful even though there are no immediate signs that it has an impact on the krone rate. Alternatively, the purchases and sales of kroner by private agents might have led to an undesirable development in the exchange rate.

While kroner are traded between banks and their customers on all days, Danmarks Nationalbank is only active in the foreign exchange market on selected days. There are indications of a slightly greater impact on the exchange rate when Danmarks Nationalbank intervenes compared to when private agents trade kroner against foreign exchange. The slightly greater impact of Danmarks Nationalbank's interventions may reflect that market participants see interventions as a sign of a potential, imminent interest rate change.

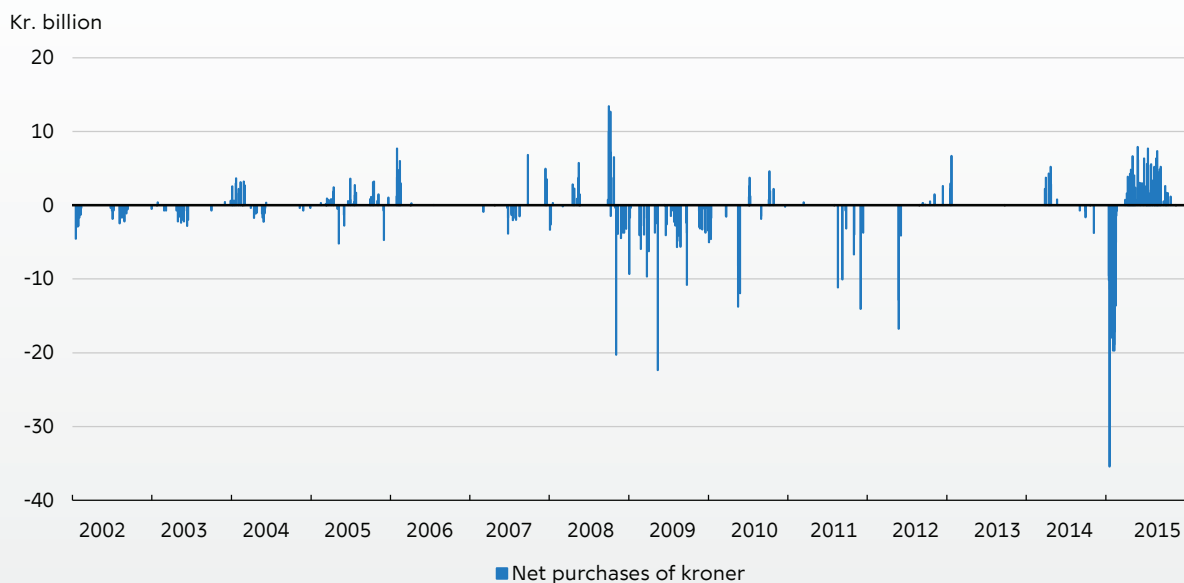
DANMARKS NATIONALBANK'S MONETARY POLICY REACTION FUNCTION

If Danmarks Nationalbank wants to influence the rate of the krone vis-à-vis the euro, this will initially be achieved through interventions in the foreign exchange market where Danish kroner are bought or sold against foreign exchange. For this purpose, Danmarks Nationalbank holds a considerable foreign exchange reserve. The reserve is mainly placed as collateralised deposits in European banks or invested in euro-denominated government bonds. This reflects the importance of the reserve being liquid and stable in value.

Since January 2002, Danmarks Nationalbank has intervened in the foreign exchange market on 12 per cent of all trading days, cf. Chart 1. On just over half of those days, Danmarks Nationalbank

Danmarks Nationalbank's daily interventions in the foreign exchange market

Chart 1



Note: The most recent observation is from 4 November 2015.
Source: Danmarks Nationalbank.

sold kroner against foreign exchange on a net basis, while purchasing kroner net on the remaining intervention days. On days when Danmarks Nationalbank sold kroner, its interventions averaged approximately kr. 3.6 billion, while they averaged approximately kr. 2.5 billion on days of purchases. By comparison, total daily, global turnover in the spot and forward markets for kroner amounted to kr. 80.7 billion in April 2016, while averaging kr. 48.8 billion in April 2007.²

The interventions were generally largest in the second half of the period. This may reflect the general increase in turnover in the foreign exchange market for Danish kroner, but also that the years leading up to 2008 were characterised by low volatility in financial markets. The subsequent period has been characterised by greater uncertainty and periods of considerable fluctuations in investors' demand for kroner, which has resulted in larger interventions.

The intervention averages mask considerable differences across individual days and periods. The most substantial interventions took place during the pressure on the krone in January-February 2015. During that period, on a single day net sales of kroner amounted to more than kr. 35 billion. This should be seen in light of the fact that the deposit rate was reduced to -0.75 per cent and that Danmarks Nationalbank favoured interventions over further interest rate reductions, given the low level of interest rates. In general, 2015 was characterised by frequent and substantial interventions, as the strong increase in the size of the reserve during the defence of the krone was gradually reversed. On the other hand, there was a continuous period of more than 14 months up to March 2014, during which Danmarks Nationalbank did not intervene in the foreign exchange market at all.

Interventions in the foreign exchange market are often sufficient to impact the exchange rate of the krone in the desired direction. If this is not the case, Danmarks Nationalbank's next step is to adjust monetary policy interest rates. An interest rate increase will make it more attractive for investors to hold assets denominated in Danish kroner. This increases the demand for kroner, thereby strengthening the krone exchange rate. Invest-

ors are familiar with Danmarks Nationalbank's reaction function. Hence, banks will initially often absorb shocks to the demand for kroner from their customers by changing their own foreign exchange positions. This in itself helps keep to the krone stable.

INTERVENTIONS MAY IMPACT THE EXCHANGE RATE VIA SEVERAL CHANNELS

Danmarks Nationalbank's interventions in the foreign exchange market impact the relative supply of Danish kroner available to other market participants. In so far as investors do not consider Danish and foreign assets perfect substitutes, the shift in the relative supply will lead to a shift in relative prices. That is the mechanism behind the *portfolio balance channel*. This channel works whether or not market participants know when and to what extent Danmarks Nationalbank intervenes.

Danmarks Nationalbank's interventions typically coincide with private agents changing, via the banks, the composition of their portfolios across kroner and foreign exchange. When there is a substantial excess of sales orders for kroner from their customers, the banks tend to reduce prices, while they tend to raise them when there is an excess of purchase orders. Against this background, transactions involving Danish kroner between banks and their customers will impact the exchange rate. An intervention by Danmarks Nationalbank may therefore be successful even though there are no immediate signs that it has an impact on the exchange rate of the krone. Instead, the interventions ensure that the relationship between the supply of and the demand for kroner is balanced so that the krone rate remains unchanged. This is also a result of the portfolio balance channel.

The mechanism behind the *signalling channel* is that market participants may see interventions as signals that Danmarks Nationalbank is not satisfied with the trend in the krone rate. The interventions may thus induce market participants to adjust their expectations of future monetary policy rates, thereby impacting the exchange rate. The signalling channel assumes that the interventions are published or somehow become known to market participants.

Although Danmarks Nationalbank does not publish data on its interventions on a daily basis, market participants may sense whether Danmarks

2 Cf. Bank for International Settlements (2016).

Signal value of Danmarks Nationalbank's interventions

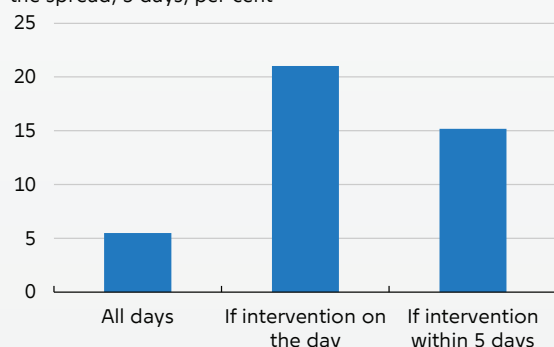
Box 1

Based on data for the period since 2002, the probability on a random day of an announcement of a change in the monetary policy interest rate spread to the euro area within the next five banking days (including the day itself) is approximately 5 per cent. However, a change in the spread is announced within five banking days on 21 per cent of the days when Danmarks Nationalbank intervened in the foreign exchange market on the same day. And in case it intervened on one of the preceding five days (including the day itself), but not necessarily on the day itself, a change in the spread is announced within five banking days in 15 per cent of the cases.

The announcement can be made by Danmarks Nationalbank announcing an interest rate change independently of the ECB, or by the ECB announcing an interest rate change that Danmarks Nationalbank chooses not to match or to match only in part. Most of Danmarks Nationalbank's interest rate changes have taken effect on the day after the announcement, while the ECB's interest rate adjustments have typically taken effect a few days after the day of the announcement.

Intervention and interest rate changes

Probability of a change of the spread, 5 days, per cent



Note: The bars show the share of days on which the benchmark monetary policy interest rate spread to the euro area is changed within the next five days (including the day itself). The bar on the right includes days when interventions have not necessarily been made on the day itself.

Source: Danmarks Nationalbank.

Purchases and sales of kroner increase the probability that a widening or a narrowing of the monetary policy interest rate spread is announced. Hence, for almost one third of the days when Danmarks Nationalbank sold kroner, a narrowing of the spread was announced within the following five banking days (including the day itself).

However, purchases of kroner only increase the probability that a widening of the spread will be announced within five banking days to approximately 11 per cent. This primarily reflects the period since 2011, when the krone tended to appreciate during periods of uncertainty. Here, only 6 per cent of the purchases of kroner on a given day were followed by a widening of the monetary policy spread. Since April 2015 in particular, purchases of kroner have thus given rise to a gradual reduction of the foreign exchange reserve with no attempts to offset this via interest rate increases.

Nationalbank is active in the foreign exchange market. This is because interventions are conducted with the commercial banks as counterparties. Moreover, market participants follow the banks' net position vis-à-vis Danmarks Nationalbank. Major deviations from Danmarks Nationalbank's liquidity projection, which provides an overview of the expected changes on a daily basis, may also be an indication of intervention.³

Historically, the probability of Danmarks Nationalbank changing the monetary policy spread to the euro area has been relatively high in the days immediately after an intervention event, cf. Box 1. Against that background, the signalling channel could be a factor in Denmark. Market participants may thus see Danmarks Nationalbank's interventions as a signal that the current trend in the exchange rate of the krone will not be allowed to continue, thereby triggering a change in interest rates, if necessary. However, the frequency and the size of Danmarks Nationalbank's intervention before adjusting monetary policy rates do not follow a regular pattern, and the level of the krone exchange rate at which Danmarks Nationalbank intervenes also depends on the specific situation.

IMPACT OF INTERVENTION EVENTS

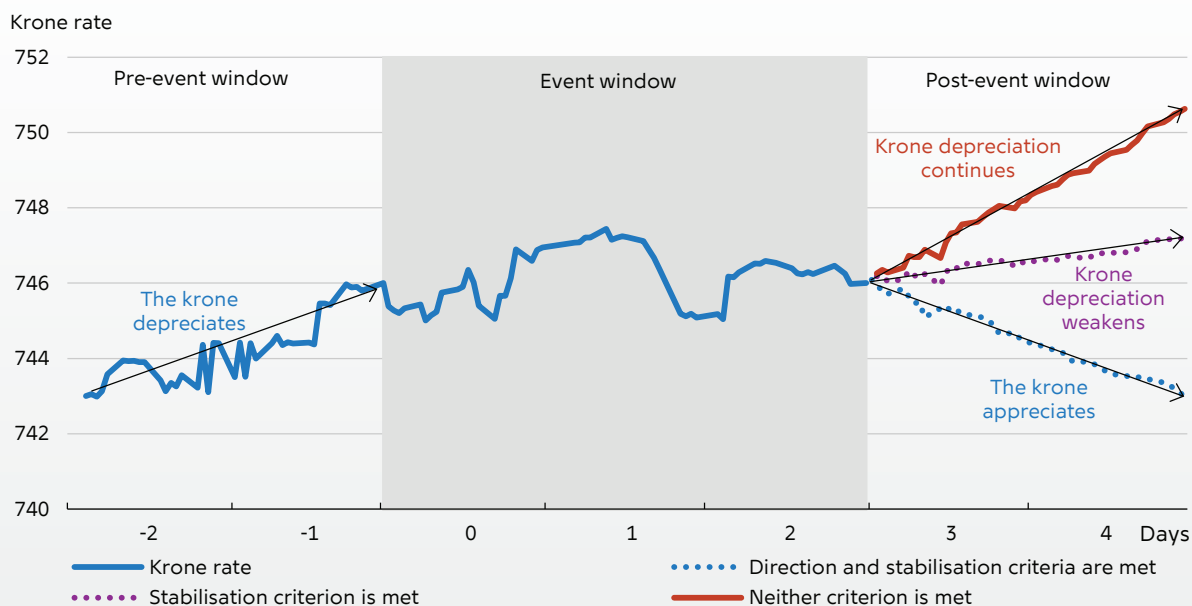
In most cases, investor demand for kroner supports a stable exchange rate of the krone without the intervention of Danmarks Nationalbank. Occasionally, intervention in the foreign exchange market will be necessary, however. In some cases, intervening on a single day is sufficient. However, Danmarks Nationalbank is often active in the foreign exchange market several times within a period of a few days. Against that backdrop, this section examines the impact of intervention events.

An intervention event consists of one or more days of interventions pointing in the same direction which are close together in time. Specifically, an event is defined as not containing consecutive days during which Danmarks Nationalbank does *not* intervene in the foreign exchange market. But single days without interventions may occur.

³ See Chapter 2 in Danmarks Nationalbank (2009) for a description of the relationship between Danmarks Nationalbank's interventions in the foreign exchange market and krone liquidity in the banking sector.

Illustration of impact assessment criteria

Chart 2



Note: Illustration. The exchange rate is stated in kroner per 100 euro.
Source: Own work.

Two events will always be separated by minimum two days without interventions. Based on this definition, there have been 162 intervention events since 2002, lasting just over three days on average. While 73 events cover just one day of interventions, the longest event lasted more than 28 days in the autumn of 2015. Table 1 summarises the key characteristics of Danmarks Nationalbank's interventions since 2002.

IMPACT ASSESSMENT CRITERIA

Two criteria are defined for assessment of the effect of intervention events, i.e. the *direction criterion* and the *stabilisation criterion*.⁴ The direction criterion is met if an event, in which Danmarks Nationalbank sells kroner against foreign exchange, is followed by depreciation of the krone. Likewise, the criterion is met if an intervention event, in which Danmarks Nationalbank buys kroner against foreign exchange, is followed by appreciation of the krone.

The stabilisation criterion is met if an intervention event dampens a current trend in the exchange rate of the krone. For an event where Dan-

Interventions by
Danmarks Nationalbank, 2002-16

Table 1

| | |
|---|------------------|
| Average size of intervention ¹ | kr. 3.0 billion |
| Average size of intervention ¹ , purchases of kroner | kr. 2.5 billion |
| Average size of intervention ¹ , sales of kroner | kr. 3.6 billion |
| Largest intervention on a single day | kr. 35.4 billion |
| Number of intervention events | 162 |
| Average duration, event | 3.1 days |
| Number of events of only one day duration | 73 |
| Longest event | 28 days |

Source: Danmarks Nationalbank.

1. Daily values on days of intervention.

marks Nationalbank buys kroner, this corresponds to the krone depreciating less in the period after the event than it did in the days preceding the event and vice versa for an event entailing sales of kroner. The direction criterion is stricter than the stabilisation criterion. The criteria are illustrated in Chart 2.

⁴ The method follows Fatum and Hutchison (2003). Andersen (2005) applied the same method to Danmarks Nationalbank's interventions for the period 1999-2004.

The periods before and after the intervention events, i.e. pre- and post-event windows, are determined so that the pre-event window includes the last two days up to the intervention event, while the post-event window includes the two days immediately after the interventions have ceased. The precise definitions of an event and the duration of the pre- and post-event windows are adjusted to match Danmarks Nationalbank's reaction function and comply with Andersen (2005).

CLEAR INDICATIONS OF EFFECT OF INTERVENTION

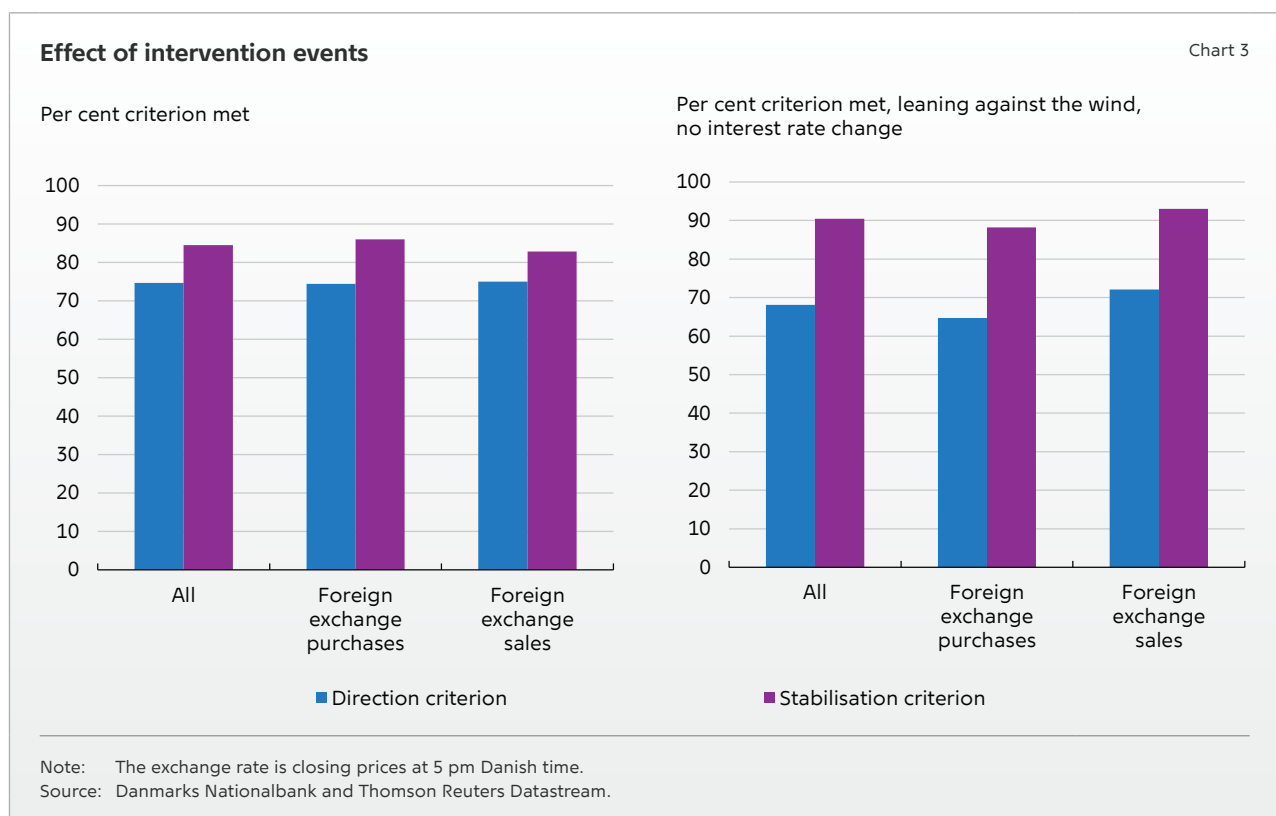
The stabilisation criterion is met for more than four out of five events, cf. Chart 3 (left). This is true of events involving purchases of kroner on a net basis as well as events involving sales of kroner. The stricter direction criterion is met for around three out of four intervention events.

In order to focus on the effect of the events directly aimed at countering undesirable developments in the exchange rate, attention can be centred on events that have been "leaning against the wind". An event involving purchases of kroner against foreign exchange is defined as leaning against the wind if there was an overall weakening

of the krone rate in the last two days prior to the intervention. Similarly, an event is leaning against the wind if it involves sales of kroner in response to a strengthening of the exchange rate in the last two days prior to the intervention. A total of 117 events are leaning against the wind.

Some of the intervention events are characterised by Danmarks Nationalbank adjusting its monetary policy interest rates during or immediately before or after the event. For such events, both the interventions and the interest rate changes will have an impact on the krone rate. The relationship between interest rate changes, exchange rates and intervention is discussed in Box 2.

Chart 3 (right) considers only the 94 intervention events that are leaning against the wind, and which do not coincide with or involve an announcement of a change in the monetary policy interest rate spread immediately prior or subsequent to the event. This does not change the conclusions to any significant extent. The direction criterion and the stabilisation criterion are met for 68 per cent and 90 per cent of the events, respectively. There is overwhelming evidence that the high degree to which both criteria are met reflects the effect of the interventions, cf. Box 3.



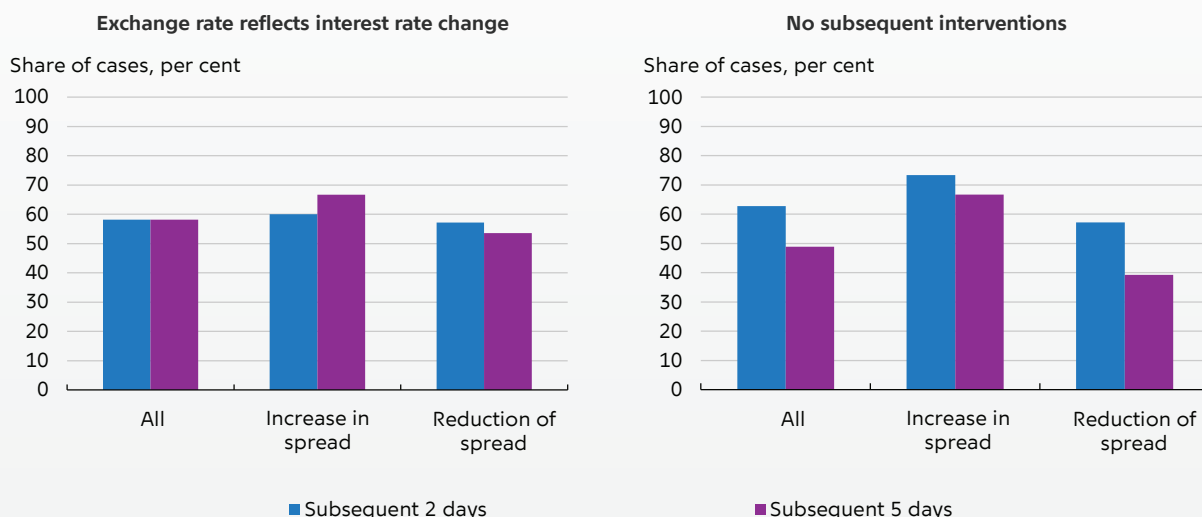
Interest rate changes, exchange rate and intervention

Box 2

Changes in interest rates is the second step in Denmark's Nationalbank's monetary policy reaction function after intervention in the foreign exchange market. Of the 43 announcements of changes in the monetary policy interest rate spread since 2002, Denmark's Nationalbank intervened in the foreign exchange market within the preceding five

days (including the day itself) in 39 cases. There is no strong tendency for the exchange rate of the krone to move in the direction warranted by the change in the monetary policy spread in the days after announcement of the change in the spread, cf. the chart (left).

Impact of interest rate adjustments on the krone rate and interventions



Note: The period is 2002-16.
Source: Denmark's Nationalbank.

An increase in the spread often means that Denmark's Nationalbank can stop intervening in the foreign exchange market, cf. the chart (right). Conversely, announcements of a reduction in the monetary policy interest rate spread have often been followed by sales of kroner within the next five weekdays. This may reflect that the spread is usually reduced in stages. When restoring the foreign exchange reserve after a period of using foreign exchange for intervention purchases in support of the krone, there may be a wish to gradually adjust the interest rate spread to an equilibrium level with no tendencies for strengthening or weakening of the krone.

Furthermore, the spread was reduced in stages in connection with the tendencies for strengthening of the krone in early 2015. This reflected several factors, including that interest rates fell to a level that had not previously been tested. In situations of downward pressure on the krone, on the other hand, the interest rate spread has often been increased markedly so as to cease the pressure immediately, bringing Denmark's Nationalbank's interventions in the foreign exchange market to a close.

Test for effect of interventions

Box 3

The direction criterion and the stabilisation criterion are met for 68 per cent and 90 per cent of the events, respectively. But even without interventions, the development in the krone rate tends to ease off. Based on the period 2002-16 as a whole, the probability that the krone rate will stabilise from one day to the next is 71 per cent, when no account is taken of whether or not intervention is carried out. The probability of the krone rate changing direction from one day to the next, whether or not intervention is carried out, is 51 per cent.

Therefore, a statistical test is conducted to examine whether the observed effects of the events deviate significantly from what could be expected to have happened without intervention. The null hypothesis is that the number

of events meeting the criteria follows a binomial distribution with 94 observations and with a 71 per cent probability that the stabilisation criterion is met and a 51 per cent probability that the direction criterion is met.

The test shows that the P value, which indicates the probability that the direction criterion is met for 90 per cent of the 94 events, is only 0.0001 per cent if the interventions had not had any effect. Hence, the observed pattern would be highly unlikely under the assumption that intervening in the foreign exchange market has no effect. Against this background, it can be concluded that the interventions have worked. Similarly, the P value in relation to the direction criterion is only 0.03 per cent. Again, there is overwhelming evidence of the effect of interventions.

INTERVENTIONS AND MARKET MOVEMENTS

Danmarks Nationalbank's interventions in the foreign exchange market are far from being the only driver of krone rate developments. This section therefore specifies and estimates an economic relation taking into account that the exchange rate is also affected by other market participants' purchases and sales of kroner. These market movements are estimated on the basis of daily reports to Danmarks Nationalbank from the largest Danish banks. The method and the data used are described in more detail in Box 4.

DANMARKS NATIONALBANK'S INTERVENTIONS ARE IN RESPONSE TO THE PRIVATE SECTOR'S NET DEMAND FOR KRONER

Danmarks Nationalbank intervenes in the foreign exchange market in response to the current conditions in the foreign exchange market for kroner.

The krone rate is dependent on private agents' demand for kroner, e.g. an exporter that has received payment in euro and wishes to exchange it for Danish kroner. Institutional investors such as insurance companies and pension funds also play a key role in terms of demand for kroner, cf. the article *The Pension Sector as a Foreign Exchange Market Participant* in this Monetary Review.

Major cross-border acquisitions may also lead to considerable fluctuations in the demand for kroner. If e.g. a foreign firm acquires a Danish firm, the demand for kroner will often increase up to the settlement of the acquisition, while the previous owners may subsequently choose to reinvest the proceeds in foreign assets. Hence, the acquisition process typically involves several foreign exchange transactions at different times.

Private agents' foreign exchange transactions are typically made through a bank. Initially, a bank customer's purchase of kroner against e.g. euro leads to a shift in the bank's holdings of kroner

Regression model for the krone rate

Box 4

A simple relation is estimated for the percentage change in the krone rate in a given day:

$$\Delta \text{Krone rate}_t = \text{constant} + \beta_1 \text{Interventions}_t + \beta_2 \text{Customer purchases}_t + \varepsilon_t$$

$\Delta \text{Krone rate}_t$ is the daily percentage change in the krone rate stated as kroner per 100 euro.

Interventions_t indicates Danmarks Nationalbank's net purchases of kroner against foreign exchange on a given day stated in kr. billion. Danmarks Nationalbank's intervention purchases are expected to strengthen the krone rate, corresponding to a negative sign of β_1 .

$\text{Customer purchases}_t$ indicates bank customers' net purchases of kroner against foreign exchange in kr. billion, covering both spot and forward contracts. Customers are residents who are not banks and non-residents (both banks and non-banks). As with Danmarks Nationalbank's intervention purchases of kroner, the krone rate is expected to strengthen when bank customers purchase more kroner, corresponding to a negative sign of β_2 .

The constant in the model is not expected to be significantly different from zero, as that will be incompatible with a fixed exchange rate against the euro in the long term.

Data

The data period runs from early 2002 up to and including 24 October 2016. The exchange rate applied is stated at 5 pm Danish time, while Danmarks Nationalbank's interventions typically take place between 9 am and 4 pm. Accordingly, the effect of the interventions made during a particular day is captured in the applied exchange rate.

Bank customers' net purchases of kroner are part of the information on turnover in the foreign exchange market for kroner collected by Danmarks Nationalbank on a daily basis. The statistics for foreign exchange turnover include a number of the largest Danish banks' spot and forward contracts with customers and other currency dealers.

Identification of causal effects

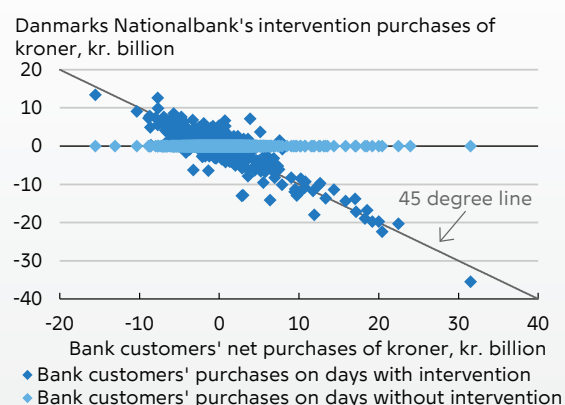
To allow for the fact that Danmarks Nationalbank's interventions respond to the current development in the krone rate, instrument-variable estimation (IV estimation) is performed. The interventions of the preceding five trading days are used as the instrument for the intervention on a given day. The instrument is valid, since the interventions on the preceding days cannot be expected to have a separate effect on the change in the krone rate on that given day. The instrument is relevant, as Danmarks Nationalbank's interventions often take the form of events, meaning that the interventions of the preceding days may to some extent predict intervention purchases on a given day.

Bank customers' purchases of kroner may also be affected by the day's development in the krone rate and thus be partly endogenous. The problem is deemed to be considerably smaller than for Danmarks Nationalbank's interventions, because bank customers' purchases and sales of kroner are a naturally integral part of trade and investments in and out of Denmark. Presumably, any decisions concerning such payment flows depend only to a limited extent on the development in the krone rate on a given day.

Newey-West standard errors are used when estimating the statistical significance of parameter estimates to allow for autocorrelation and heteroscedasticity in the residuals.

Purchases of kroner by Danmarks Nationalbank and bank customers

Chart 4



Note: Around 88 per cent of the observations are on the zero line, corresponding to Danmarks Nationalbank having intervened on approximately 12 per cent of all trading days from January 2002 to October 2016.

Source: Danmarks Nationalbank.

and euro. For smaller transactions, the bank will often absorb the associated change in the bank's own foreign exchange exposure at current market prices. This way, the banks themselves contribute to stabilising the krone without the participation of Danmarks Nationalbank. In periods of turmoil in the foreign exchange market for Danish kroner, however, the currency flows may be too strong for the banks to be willing to assume increased foreign exchange exposure without major adjustments to the exchange rates they offer their customers. When there is a substantial excess of purchase orders for kroner, the banks tend to raise prices, while they tend to reduce them when there is an excess of sales orders. This has an impact on the exchange rate.⁵

In order to get an unbiased estimate of the effect of Danmarks Nationalbank's interventions, it is vital to allow for bank customers' net purchases of kroner. Danmarks Nationalbank's interventions may thus be effective without necessarily having a visible impact on the krone rate. That would be the case if the interventions counter the effect of the purchases and sales of kroner by the other market participants. Historically, there has been a clear link between Danmarks Nationalbank's

5 It is a well-known finding in the literature that a significant relationship exists between order flows and exchange rate changes, cf. e.g. Lyons (2001).

interventions and bank customers' purchases of kroner, cf. Chart 4.

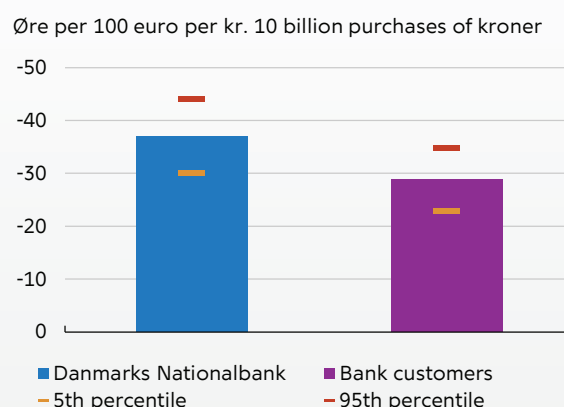
The estimated model is based on the assumption that bank customers initiate the realised trades in kroner. The banks, on the other hand, are assumed not to actively initiate net purchases or sales of kroner themselves, but to meet the demand from their customers. Accordingly, in the model market participants' demand for kroner is expressed by bank customers' net purchases of kroner, while the banks' own demand for kroner is not included in the model.

ESTIMATION OF THE EFFECT OF DANMARKS NATIONALBANK'S INTERVENTIONS ON THE KRONE RATE

According to the analysis, intervention in the foreign exchange market by Danmarks Nationalbank to purchase Danish kroner causes the krone to strengthen. For the entire period 2002-16, total purchases of kroner for kr. 1 billion will strengthen the exchange rate of the krone against the euro by approximately 0.005 per cent. This means that the krone rate measured in kroner per 100 euro is strengthened by just under kr. 0.40 when intervention purchases are made for kr. 10 billion, cf. Chart 5. The effect is statistically significant.

Estimated effect of purchases and sales of kroner against foreign exchange, 2002-16

Chart 5



Note: Reverse scale. Negative values correspond to a strengthening of the krone. The chart illustrates the impact on the krone rate of krone purchases in the amount of kr. 10 billion, measured at the central rate of kr. 746.038 per 100 euro. See Box 4 for model specification. The 5th and 95th percentiles span a 90 per cent confidence interval for the estimates.

Source: Own calculations.

The estimated effect on the krone rate from bank customers' purchases of kroner is slightly lower than the estimated effect of Danmarks Nationalbank's interventions. While bank customers' purchases and sales of kroner only impact the exchange rate through their impact on the relative supply of and demand for kroner (the portfolio balance channel), Danmarks Nationalbank's interventions may also have the effect of market participants seeing them as signalling a potentially imminent interest rate change.⁶ Hence, the slightly higher estimated effect of Danmarks Nationalbank's interventions compared to the effect of bank customers' purchases is an indication that the interventions work through *both* the signalling and the portfolio balance channels. For the period as a whole, the portfolio balance channel seems to have been the most significant channel, however.

THE EFFECTS OF EXCHANGE RATE FLUCTUATIONS VARY OVER TIME

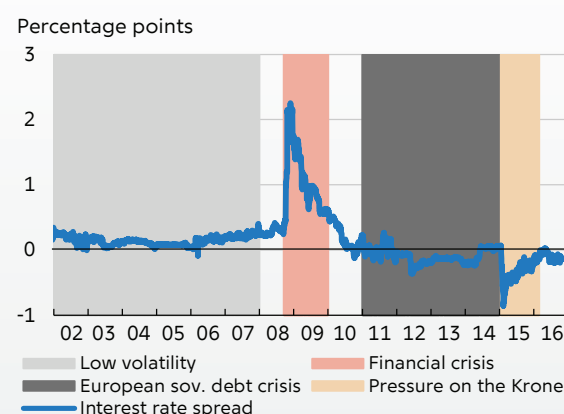
There are no indications that the rising turnover in the foreign exchange market for kroner has generally reduced the effect of Danmarks Nationalbank's interventions. This may reflect that conditions in the foreign exchange market for Danish kroner have fluctuated considerably over the past 15 years. The krone has been stable for long periods of time. For example, this was the case for most of the time up to 2008, when the spread between money market interest rates in Denmark and in the euro area was very stable around 10-20 basis points, cf. Chart 6.

Against the backdrop of the financial crisis in the autumn of 2008, there was a considerable outflow of kroner. In response to this, Danmarks Nationalbank made intervention purchases in the foreign exchange market for just under kr. 65 billion in September and October 2008, while the money market spread briefly widened as a result of unilateral Danish monetary policy interest rate increases.

As Denmark has become a creditor nation holding substantial net external assets, turbulence in the foreign exchange market has tended to

Changing conditions in the foreign exchange market for kroner

Chart 6



Note: The interest rate spread shown is the spread between the 1-month CITA and EONIA swap rates.

Source: Thomson Reuters Datastream and Danmarks Nationalbank.

result in a strengthening of the krone and a negative spread to money market interest rates in the euro area. For example, this was the case in 2012, when the krone gained status as a safe haven currency during the sovereign debt crisis in a number of euro area member states, cf. Jørgensen et al. (2013). Most recently, there were very large inflows of capital in January-February 2015. During both episodes, Danmarks Nationalbank sold kroner. With sales totalling kr. 275 billion in January-February 2015, this intervention is Danmarks Nationalbank's largest within such a short period.⁷

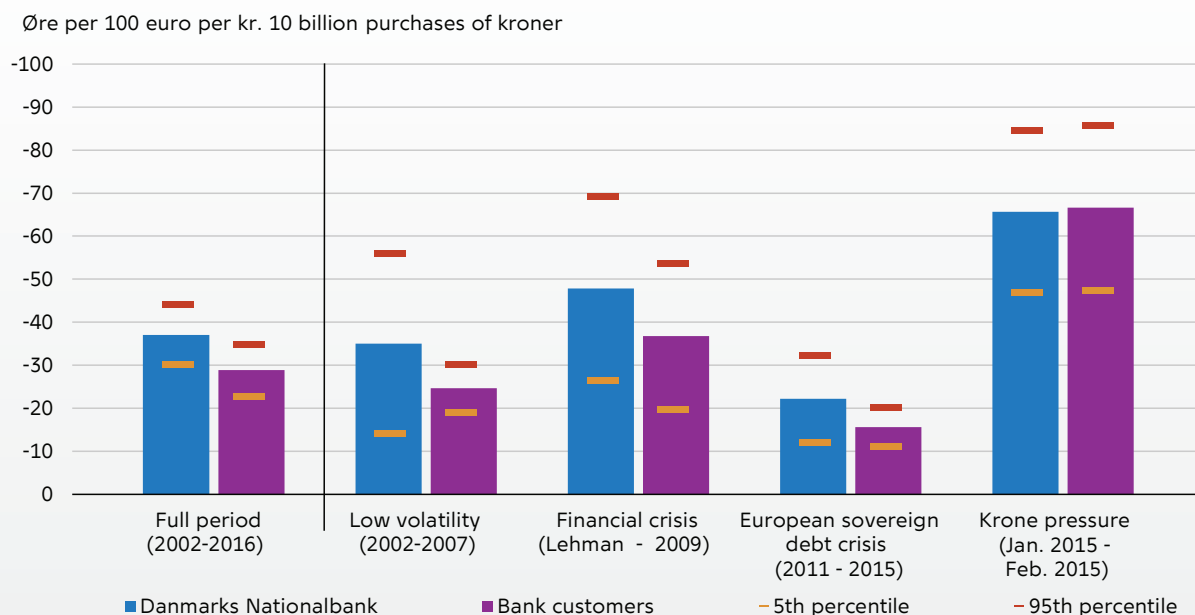
In order to assess the effect of interventions under the varying conditions in the foreign exchange market for kroner, the relation in Box 4 is estimated on four sub-periods. The basic message is that Danmarks Nationalbank's interventions were effective in all sub-periods, cf. Chart 7. The smallest effect was seen in the period 2011-14, while the strongest effects were seen during the financial crisis in 2008-09 and in early 2015. This may reflect that the latter episodes were characterised by considerable, one-sided foreign exchange flows. In such cases, the banks' risk

6 It cannot be ruled out that the lower estimate of the effect of bank customers' purchases of kroner is partly attributable to the fact that those purchases are not completely exogenous in the model, thus creating an endogeneity bias.

7 See Danmarks Nationalbank (2015) for an overview of the pressure on the krone in January-February 2015.

Effect on the krone rate of net purchases of kroner in the foreign exchange market

Chart 7



Note: Reverse scale. The chart illustrates the impact on the krone rate of krone purchases in the amount of kr. 10 billion, measured at the central rate of kr. 746.038 per 100 euro. See Box 4 for model specification. The 5th and 95th percentiles span a 90 per cent confidence interval for the estimates.

Source: Own calculations.

appetite and capacity will typically be insufficient to absorb the fluctuations in their customers' demand for kroner, and the banks will be more inclined to adjust the exchange rates they offer their customers.

In the period during the pressure on the krone in January-February 2015 and the subsequent reversal there is no difference between the estimated effects of Danmarks Nationalbank's and bank customers' purchases of kroner in the foreign exchange market. The reason may be that, during this period, Danmarks Nationalbank declared itself willing to intervene for unlimited amounts, whereas changes in interest rates played a minor role. Against that background, investors could not interpret the interventions as a signal of imminent interest rate changes.

INCLUSION OF OTHER VARIABLES

Although the effect of Danmarks Nationalbank's interventions and bank customers' net purchases of kroner are both very pronounced, the estimated regression model only explains a limited part of the total fluctuations in the krone rate. This reflects that the krone rate also depends on a large number of factors that are not included in the model, such as the spread between money market interest rates in Denmark and the euro area. Neither the money market spread nor other potentially relevant variables are significant in the regression analysis, cf. Box 5. This may reflect the method used.

Other factors affecting the exchange rate

Box 5

The exchange rate of the krone vis-à-vis the euro is potentially affected by a large number of factors in addition to Danmarks Nationalbank's interventions and bank customers' purchases of kroner. These include, inter alia, the difference between money market interest rates in Denmark and the euro area. Widening of the spread between money market interest rates in Denmark and the euro area must be expected to increase the inflow of foreign exchange and contribute to strengthening the krone rate.

Changes in the short-term money market interest rate spread are not significant when added to the estimated relation. This is true whether the difference between the 1-month or 3-month CITA and EONIA swap rates or implied interest rate spreads from FX swaps are used. The reason for the lack of statistical significance may be that e.g. narrower interest rate spreads – whether due to changes in monetary policy interest rates or changed expectations thereof – are more likely to reduce bank customers' demand for kroner. Hence, the effect of the money market interest rates is indirectly included in the model via customers' purchases of kroner.

In a credible fixed exchange rate regime such as Denmark's, the level of the krone rate may affect the change in the krone rate. If, for example, the krone is at a relatively strong level within the fluctuation band, the probability of a weakening towards the central rate is greater than the probability of a strengthening. Such underlying movement towards an equilibrium exchange rate does not appear as significant when estimating the relation on a daily basis.

In recent years – e.g. in view of increasing net foreign assets – Denmark has experienced periods of pressure towards a strengthening of the krone and a negative spread to money market interest rates in the euro area. The Danish krone may have gained status as a safe haven currency which investors will turn to in periods of considerable uncertainty in the financial markets, cf. Jørgensen et al. (2013). Based on this, it has also been examined whether changes in the financial market risk outlook expressed by changes in the VIX index may contribute to explaining the daily fluctuations in the krone rate. The effect is not statistically significant.

RESULTS ARE PREDOMINANTLY IN LINE WITH PREVIOUS STUDIES

The effect of Danmarks Nationalbank's interventions on the krone rate has been examined in several previous analyses.⁸ The results of the previous analyses of interventions are not fully comparable with the results in this article as they are based on different models, estimation methods, data periods and frequencies. Overall, the different studies find that, in a stable foreign exchange market, the interventions impact the krone rate in the anticipated direction.

Hansen and Storgaard (2005) assess that while the effect on the krone rate of Danmarks Nationalbank's interventions are more or less in accordance with the effect from portfolio flows to and from Denmark, the findings of this analysis indicate that Danmarks Nationalbank's interventions have a greater effect.

⁸ Andersen (2005), Hansen and Storgaard (2005), Beier and Storgaard (2006), Abildgren (2008), Fatum and Pedersen (2009) and Jørgensen et al. (2013).

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THE PENSION SECTOR AS A FOREIGN EXCHANGE MARKET PARTICIPANT

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and Jakob Roager Jensen and Anders Larsen,
Economics and Monetary Policy

INTRODUCTION AND SUMMARY

Danish pension wealth has grown substantially in recent years, and Danish pension companies' balance sheets now total approximately 175 per cent of GDP.¹ Half of the sector's balance sheet is placed in foreign assets. Consequently, pension companies' investment and risk hedging decisions have a considerable impact on the foreign exchange market.

As a result of the regulation of pension companies and the credibility of Denmark's fixed exchange rate policy, pension companies' level of hedging of foreign exchange risks tends to be considerably smaller in euro than in other currencies such as dollars.

During certain episodes in 2015 and 2016, the pension companies increased their hedging of exchange rate risks in euro in connection with turmoil in the European financial markets. A marked share of the stronger demand for kroner in early 2015 could be attributed to pension companies' increased hedging of positions in euro following Switzerland's abandonment of the minimum exchange rate of the Swiss franc against the euro.² Hedging of positions in euro also grew in connection with the UK referendum on EU membership in June 2016. Due to the size of the pension com-

panies, even small changes in the hedge ratio impact the foreign exchange market.

The sector's liabilities have shifted from guaranteed products towards market rate products in recent years. In this way, the individual pension saver directly bears a larger share of the pension saving risk. Companies with large shares of market rate products tend to rely less on hedging of exchange rate risk. The hedge ratio is expected to fall in step with the gradual transition to market rate products. Hedging of the foreign exchange exposure varies greatly across pension companies.

Given the large and expanding net foreign assets, the Danes have an overall foreign exchange exposure. This also entails that, all else equal, the exchange rate of the krone appreciates if investors in foreign assets do not want the foreign exchange exposure. A substantial share of the exposure in euro is currently held by the private sector, including pension companies. If Danish pension companies and other Danish investors are not willing to take on the foreign exchange risk associated with larger net external assets, it falls upon Danmarks Nationalbank. It comes with the mandate for the fixed exchange rate policy against the euro. The key point for Danmarks Nationalbank is to maintain a stable exchange rate of the krone vis-à-vis the euro.

1 In this article, the insurance and pension sector is referred to as pension companies and the pension sector. The insurance and pension sector consists of life insurance companies, multi-employer occupational pension funds, non-life insurance companies and ATP.

2 See, inter alia, Danmarks Nationalbank, *Monetary Review*, 1st Quarter 2015, and *Monetary Review*, 2nd Quarter 2015.

THE PENSION SECTOR IN TRANSITION

The current account of Denmark's balance of payments has shown a surplus since 1990, following a long period of deficits. The surplus is attributable to a private sector savings surplus, which is channelled, inter alia, into contributions to labour market pensions.³ This has generated a marked increase in Denmark's net foreign assets in recent years, cf. Chart 1 (left). The transition from a debtor to a creditor nation thus reflects considerable increase in gross savings in the economy over the last 30-35 years. Pension contributions have led to pension companies' net foreign assets exceeding Denmark's total net foreign assets. Part of the sector's investment is made via domestic investment funds which have invested abroad, meaning that the pension sector's net foreign assets are larger than the chart shows. Besides the pension sector, investment funds and Danmarks Nationalbank have positive net foreign assets, cf. Chart 1 (right). Investment funds and pension companies typically hold assets ultimately owned by households.

The size of the pension sector makes it a major participant in the Danish financial markets. Labour market pensions are expected to continue to mature towards 2040-50,⁴ meaning that the sector's role in the financial markets is likely to increase further.

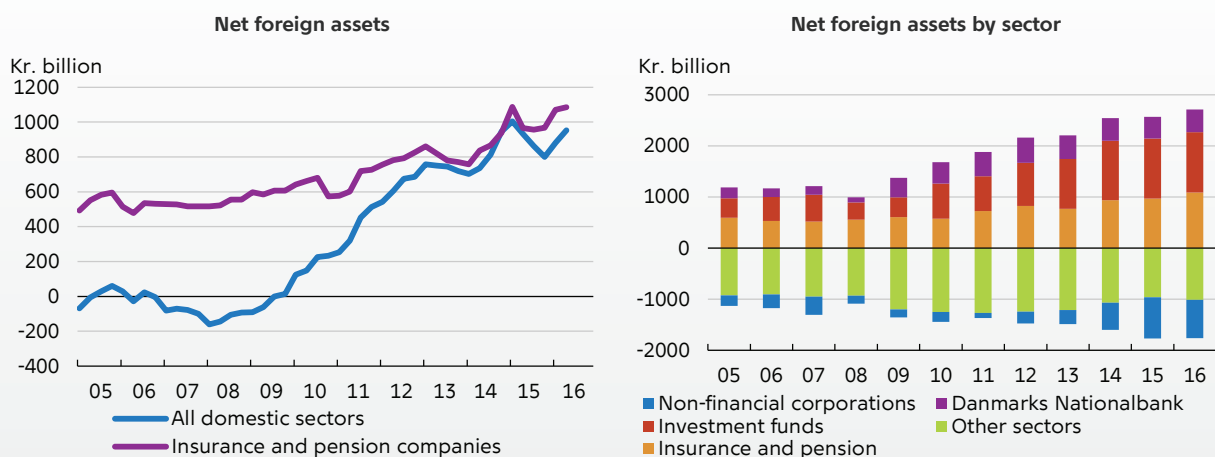
FROM AVERAGE TO MARKET RATE PRODUCTS

Against the backdrop of growing pension savings, the sector is changing in several respects. The sector's liabilities are changing, as the sector is undergoing a transition from guaranteed products to market rate products.⁵ The shift towards market rate products implies a changing asset composition. Moreover, higher pension savings generate a growing need to place funds abroad.

The transition to market rate products entails a lower degree of guaranteed return for pension savers. The size of the return is directly dependent on the return earned by the pension company. This means that the risk of pension savings is borne to a higher degree borne directly by the individual pension saver, while the risk of average rate products is to a higher degree shared collectively

Net foreign assets by sector

Chart 1



Note: Left: The pension sector's holdings of foreign assets via Danish investment funds are excluded. Right: For 2016, the holdings for the 2nd quarter are shown. The pension sector's holdings of foreign assets via Danish investment funds are excluded.
Source: Danmarks Nationalbank.

3 See, inter alia, Autrup, Kramp, Pedersen and Spange, 2015

4 See, inter alia, Autrup, Kramp, Pedersen and Spange, 2015.

5 See Danmarks Nationalbank, *Financial stability*, 2nd Half 2016.

between pension savers.⁶ Another implication of the transition to market rate products is a closer match between the value of assets and the liabilities associated with market rate products. This gives pension companies offering market rate products more degrees of freedom in their investment choices.⁷ Market rate products accounted for 5 per cent of the companies' insurance liabilities in 2005, but 37 per cent in 2015.⁸ The absolute level of liabilities associated with average rate products has not declined for the sector overall, however.

The pension companies' total assets amount to around kr. 3,500 billion, and slightly more than half is placed in Denmark, primarily in government and mortgage bonds. The remainder, around kr. 1,700 billion, is invested in assets abroad, approximately 85 per cent in euro or dollar assets, cf. Chart 2. The pension sector's holdings of dollar assets have grown in recent years, now accounting for

a larger share of the sector's balance sheet than euro assets. Especially foreign equities have risen substantially during this period. In terms of total global market value, US equities considerably exceed European equities. A shift towards foreign equities would thus mean a shift towards dollar assets.

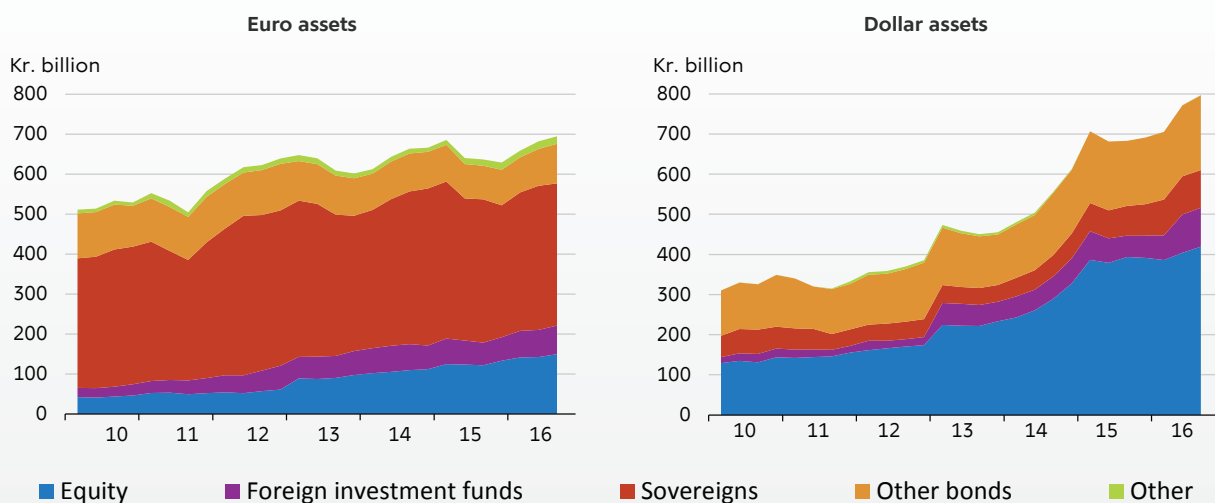
PENSION COMPANIES' PURCHASES AND SALES OF ASSETS ABROAD AND THE IMPACT ON THE FOREIGN EXCHANGE MARKET

HOW DO PURCHASES AND SALES OF ASSETS AFFECT THE FOREIGN EXCHANGE MARKET?

Pension companies' purchases and sales of foreign financial assets contribute to changes in the

Development in asset composition by currency

Chart 2



Note: The pension sector's indirect holdings of assets in euro and dollars via Danish investment funds are included. Holdings of assets via foreign investment funds cannot be broken down. These holdings have been stated under the listing currency of the foreign investment funds. The "Other" category consists mainly of Danish mortgage bonds issued in currencies other than kroner. The "Equities" category consists of shares and other equity investments. The values have been calculated on the basis of securities portfolios, and derivatives and lending and deposits are not included. Data break at the turn of the year 2012-13. The most recent observation is from the end of the 3rd quarter of 2016.

Source: Danmarks Nationalbank.

6 See, inter alia, Danish Financial Supervisory Authority, 2016, and *Financial stability*, 2nd Half 2016.

7 See also *Financial stability*, 2nd Half 2016.

8 Non-life insurance companies are not included. ATP's provisions, totalling kr. 705 billion at end-2015, are not included either. See *Financial stability*, 2nd Half 2016.

exchange rate of the krone. The ultimate effect on the exchange rate of a purchase of a foreign asset depends on how the purchase is funded and how the associated exchange rate risk is hedged.

There are several different funding methods. As a main rule, the purchase of a foreign asset requires foreign currency. If the purchase of the foreign asset is funded by borrowing or selling kroner, the result is a sale of kroner against foreign currency. This weakens the krone. If, instead, the purchase of the foreign asset is funded by borrowing or selling another currency, two currencies are traded against each other with no effect on the krone. The key question is thus whether the purchase is funded by kroner or another currency. This also applies to sales of foreign assets. If the sale is funded by the purchase of a krone asset, the result is a sale of foreign currency against kroner, which will strengthen the krone. If, instead, the sale funds the purchase of another foreign asset, it has no effect on the krone.

Besides the asset funding method, the impact on the foreign exchange market also depends on

the hedging of the exchange rate risk. Pension companies normally rely on forward contracts when hedging foreign exchange exposure. A pension company's purchase of a foreign asset will generally not influence the exchange rate of the krone if the foreign exchange exposure is hedged, cf. Box 1.

Purchases and sales of assets by pension companies are driven by several factors. For instance, more favourable growth prospects in a given country may prompt long-term investors to buy assets from that country, cf. IMF, 2011. Other drivers of pension companies' purchases and sales of assets are capital requirements and risk management. Losses in the financial markets weaken pension companies' ability to take on risk in relation to the solvency requirements. During the financial crisis in 2008-09, the Danish pension sector increased the volume of German euro-denominated bonds, which are regarded as secure and liquid. This also happened during the sovereign debt crisis in 2012 in the euro area. Under the assumption of low hedging of euro exposures and funding in Danish kroner, this contributed to weakening the krone.

Example of forward hedging of exchange rate risk from the purchase of a foreign asset

Box 1

When a Danish pension company buys a US bond, the first step is to buy dollars against kroner in the foreign exchange market (spot) to pay for the bond. This will weaken the exchange rate of the krone. However, the pension company wishes to hedge the exchange rate risk. Accordingly, the company concludes a forward contract, typically with a bank, on the purchase of kroner against dollars at a fixed exchange rate. This enables the pension company to buy kroner against dollars at an agreed price at an agreed time.

In general, the bank will not undertake the risk associated with the forward contract and will hedge the exchange rate and interest rate risks involved in the forward contract. The bank can do so by selling dollars and buying kroner immediately (spot). This means that the bank will already have the amount in kroner to pass on to the domestic investor on the expiry of the forward contract. The original sale of kroner by the pension company is thus offset by a corresponding krone purchase by the bank. The net effect of the purchase of the foreign asset in the krone market is therefore basically zero.

1. See also "The Danish krone under pressure in January-February 2015", Danmarks Nationalbank, *Monetary Review*, 1st Quarter 2015, and "Monetary policy in Denmark", Danmarks Nationalbank, 2009, for more detailed examples of the use of forward contracts.

VARIATION IN HEDGING BEHAVIOUR ACROSS COMPANIES

HEDGING BY PENSION COMPANIES

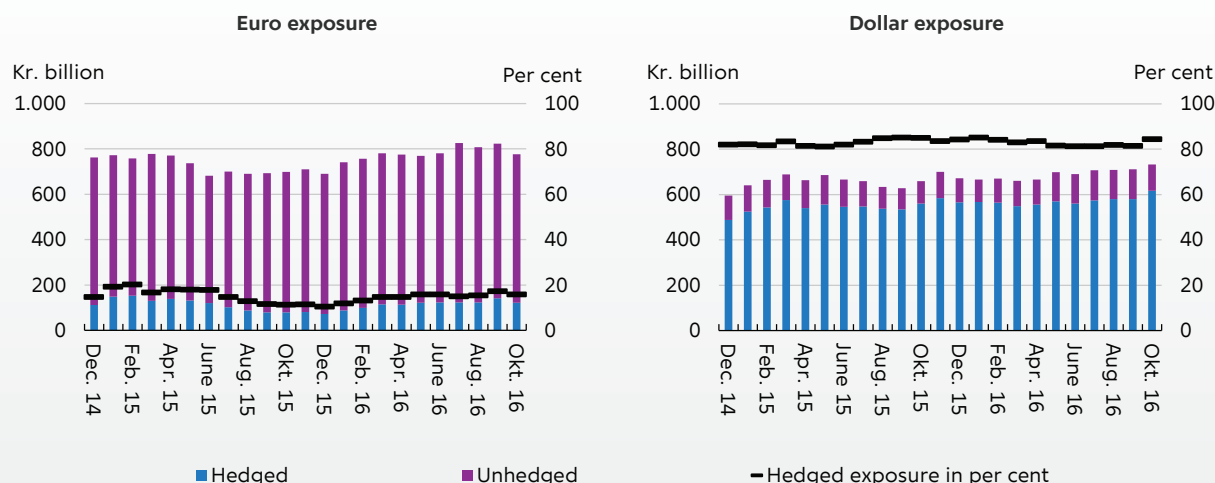
Pension companies' hedging of exchange rate risks may potentially have a great impact on the foreign exchange market. In January 2015, the sector's total hedging of euro rose by five percentage points in the course of one month, following Switzerland's abandonment of the minimum exchange rate of the Swiss franc against the euro. This led to increased demand for kroner. Pension companies' behaviour thus contributed to the pressure on the krone in the first months of 2015, despite the small increase in hedging in percentage points, cf. Chart 3.⁹

Pension companies' decisions on hedging of foreign exchange risk are shaped by two factors: One is the decision on the overall risk profile of a pension company laid down by its board of directors;

9 The reporting population accounts for more than 90 per cent of the sector in terms of asset size.

Pension sector exposure in euro and dollars

Chart 3



Note: No other currencies than euro and dollars have been included.
Source: Danmarks Nationalbank and own calculations.

the other is the market-related decisions made within the overall risk profile. Key contributors to the decision on the overall risk profile are typically regulatory requirements, the long-term strategic development and protection of the company's equity, while the market-related decisions tend to be more tactical with a shorter time horizon.

The regulatory framework and the capital requirements for pension companies influence their hedging behaviour. The current regulation is based on the EU Solvency II Directive adopted in 2009.¹⁰ After gradual implementation, with the introduction of the standardised approach to the calculation of capital requirements in the 1st quarter of 2014, the Solvency II rules were fully implemented by the beginning of 2016. Under these rules, pension companies must have enough capital to be able to meet a risk-based capital requirement¹¹. This implies that pension companies are subject to a capital requirement related to the type of the unhedged foreign exchange exposure. The direct capital requirement is 0.39 per cent of unhedged exposures in euro and 25 per cent of unhedged exposures in other currencies. This

gives pension companies an incentive to hedge their foreign exchange exposures in other currencies to euro or Danish kroner. Pension companies are also subject to other requirements, such as regular assessment of own risk and solvency and that the companies' investment strategies must reflect the benefits and risk profile offered to the customers (the prudent person principle).¹²

The capital requirements, together with the credibility of Denmark's fixed exchange rate policy, have induced the pension companies to have considerably higher unhedged exposures to the euro than to the dollar. The price of hedging euro exposure also influences the decision to hedge euro. Moreover, the dispersion of foreign exchange hedging is obviously considerably more pronounced in euro than in dollars. Although the average hedging of euro exposures is low, some pension companies have opted for hedging of virtually their entire euro exposure, cf. Chart 4. Consequently, hedging of foreign exchange exposures varies considerably across companies.¹³ This is attributable to factors such as regulation and differences in the composition of liabilities.

10 <https://www.finanstilsynet.dk/Lovgivning/Solvens/Forsikringsomraadet>.

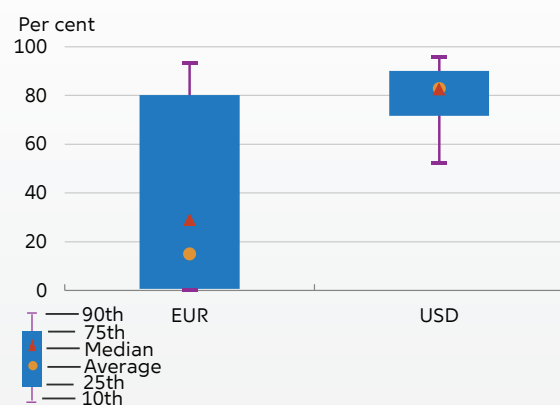
11 The capital requirement can be calculated using a standardised approach or an IRB, Internal Ratings Based, approach approved by the Danish Financial Supervisory Authority.

12 See "Markedsudviklingen i 2015 for livsforsikringsselskaber og tværgående pensionskasser" (Market developments for life-assurance companies and multi-employer occupational pension funds in 2015 – in Danish only), Danish Financial Supervisory Authority.

13 See also Larsen, 2015.

Cross-sector variation in hedging behaviour

Chart 4



Note: The chart shows the pension companies' average dispersion in foreign exchange hedge ratios from December 2014 to October 2016. If the hedging of assets exceeds their value, the result is regarded as additional exposure. The average is weighted in relation to the companies' exposure.

Source: Danmarks Nationalbank and own calculations.

Pension companies tend to hedge dollar exposures to a greater extent than euro exposures. This means that purchases of dollar assets generally have a smaller impact on the exchange rate than purchases of euro assets, assuming that the hedge ratio is unchanged. The difference in foreign exchange hedging also means that a change from dollar to euro assets implies sales of kroner and vice versa. As the foreign assets of the sector grow, the percentage value adjustments of the foreign portfolio become more important to the exchange rate of the krone. Companies opting for a constant hedge ratio need to hedge larger amounts for this purpose. This is normally achieved by means of forward contracts, implying sales of dollars and purchases of kroner.

Given the large and expanding net foreign assets, the Danes have an overall foreign exchange exposure. This also entails that, all else equal, the exchange rate of the krone appreciates if investors in foreign assets do not want the foreign exchange exposure. A substantial share of the exposure in euro is currently held by the private sector, including pension companies. If Danish pension companies and other Danish investors are not willing to take on the foreign exchange risk associated with larger net external assets, it falls upon Danmarks Nationalbank. It comes with

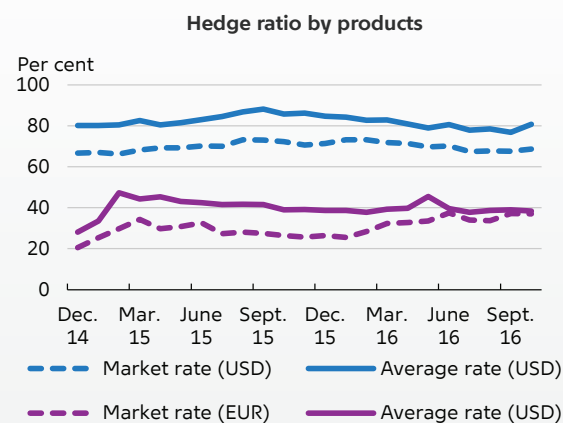
the mandate for the fixed exchange rate policy against the euro. The key point for Danmarks Nationalbank is to maintain a stable exchange rate of the krone vis-à-vis the euro.

THE COMPOSITION OF LIABILITIES INFLUENCES FOREIGN EXCHANGE HEDGING

The shift towards market rate products implies a change in the companies' hedging of exchange rate risks, due to a lower foreign exchange hedge ratio for companies with a larger share of market rate products, cf. Chart 5.¹⁴ Consequently, the composition of liabilities influences the companies' hedging behaviour. This applies especially to foreign exchange hedging of dollars. For dollar hedging, there are substantial differences between market rate and average rate products. One reason is that risks associated with market rate products affect pension companies' total capital less than risks associated with average rate products. For market rate products, the exchange rate risk is directly borne by the individual customer. This enables pension companies to assume greater

Foreign exchange hedging depends on the liabilities composition

Chart 5



Note: The charts have been calculated by weighting pension companies' foreign exchange hedge ratio by the market rate and average rate shares of liabilities. Total liabilities have been calculated as provisions for life insurance, collective bonus potential and unit-linked contracts. Liabilities have been projected flat from a quarterly to a monthly basis.

Source: Danmarks Nationalbank and own calculations.

¹⁴ Non-life insurance companies are not included.

exchange rate risks if this reflects the customers' risk appetite, cf. the prudent person principle. The gradual transition to market rate products is thus expected to reduce pension companies' desire to hedge the exchange rate risk.

The prevalence of market rate products may also imply a different asset composition with a potential impact on the hedging behaviour. Market rate portfolios allow riskier assets, e.g. equities, while average rate portfolios may require a stable and secure return, which can be achieved to a greater extent by investing in government and mortgage bonds. The foreign exchange risk will typically be hedged to a higher degree on bonds than on equities.

Companies with large shares of average rate products had higher hedge ratios in the period from December 2014 to October 2016. After January 2016, the spread has narrowed for hedging of euro, which may be attributed to uncertainty in connection with the UK referendum on EU membership in June 2016.

HOW GREAT IS THE PENSION SECTOR'S INFLUENCE ON THE FOREIGN EXCHANGE MARKET?

The pension sector's purchases and sales of kroner have substantial influence on the foreign exchange market. The exchange rate of the krone may potentially be affected by pension companies' investments in various assets, portfolio restructuring and hedging decisions. For instance, if pension companies increase their hedging of euro assets by one percentage point, the demand for kroner will, all else equal, rise by approximately kr. 8 billion on average.

The effect of pension companies' purchases and sales of foreign exchange can be estimated by applying the study "Effects of Danmarks Nationalbank's interventions in the foreign exchange market" in this Monetary Review, cf. Box 2.¹⁵ Throughout the period, pension companies' purchases of kroner have had a significant impact on the change in the exchange rate of the krone against the euro, cf. Table 1.

Changes in the krone rate explained by sector transactions

Table 1

| Dependent variable: Change in krone rate (per cent) | Full period | 2007-2009 | 2015-2016 |
|---|-------------|------------|------------|
| Net purchases from: | | | |
| - Insurance and pension | -0.0047*** | -0.0063*** | -0.0073*** |
| - Other domestic customers | -0.0052*** | -0.0061*** | -0.0072*** |
| - Domestic banks | -0.0024*** | -0.0045*** | -0.0002 |
| - Non-residents | -0.0038*** | -0.0047*** | -0.0081*** |
| Interventions | -0.0055*** | -0.0071*** | -0.0076*** |
| Constant | Yes | Yes | Yes |
| Observations | 2974 | 746 | 452 |

Note: One asterisk, two asterisks and three asterisks denote the significance of the estimate of 10, 5 and 1 per cent, respectively. Newey-West standard error has been used. The interventions of the preceding 5 days have been used as instrument for interventions. The full estimation period is from 1 December 2004 to 24 October 2016.

Source: Danmarks Nationalbank and own calculations.

¹⁵ See the description of data and methodology in Box 4 in "Effects of Danmarks Nationalbank's interventions in the foreign exchange market" in this Monetary Review.

According to the analysis, the krone strengthens if the demand for kroner from pension companies rises. Purchase of kr. 1 billion against euro causes the krone to strengthen by 0.0047 per cent. Viewed over the entire period, this means that krone purchases by pension companies for kr. 10 billion have strengthened the krone rate by kr. 0.35 per 100 euro. This implies that even a small increase in the hedge ratio of euro exposures has a marked impact on the krone rate. Pension companies' demand for kroner rose in January and February 2015. Of the sector's total purchases of kroner of around kr. 130 billion in January and February, approximately kr. 40 billion can be attributed to increased hedging of the euro exposure.¹⁶ So, viewed in isolation, the more pronounced hedging strengthened the krone by kr. 1.40 per 100 euro.

The effect per krone traded is in line with the effect of krone purchases by other domestic sectors. In the periods around the financial crisis in 2007-09 and the pressure on the krone in 2015, the effect of domestic sectors' purchases of kroner is estimated to have been stronger than in the whole period, including for the insurance and pension sector. Moreover, foreign purchases of kroner had a stronger effect in the period around the pressure on the krone in 2015.

An indication of the importance of pension companies to the foreign exchange market is that the pension sector is the only sector whose purchases/sales of euro against kroner are statistically significant in a probability model for whether Danmarks Nationalbank will intervene or not. Pension companies' total purchases or sales of kr. 1 billion in the foreign exchange market increase the probability that Danmarks Nationalbank will need to intervene by 7-14 per cent, cf. Table 2. This indicates that pension companies' behaviour has impacted Danmarks Nationalbank's intervention viewed over the period as a whole.

Pension companies' purchases of kroner increase the probability of intervention by Danmarks Nationalbank

Table 2

| Dependent variable: Intervention or not | Probit model | Logit model |
|--|-----------------|----------------|
| Net purchases from: | | |
| - Insurance and pension | 0.07*** | 0.14*** |
| - Other domestic customers | 0.01 | 0.03 |
| - Domestic banks | -0.03 | -0.05 |
| - Non-residents | -0.00 | -0.00 |
| Lagged interventions | Yes | Yes |
| Constant | -1.19*** | -2.05*** |
| Observations | 2975 | 2975 |

Note: One asterisk, two asterisks and three asterisks denote the significance of the estimate of 10, 5 and 1 per cent, respectively. The full estimation period is from 1 December 2004 to 24 October 2016.

Source: Danmarks Nationalbank and own calculations.

Estimation of the effect of the pension sector's krone purchases on the krone rate

Box 2

The largest Danish banks' purchases and sales of foreign exchange as reported to Danmarks Nationalbank can be broken down by the pension sector and other domestic sectors. The estimation in the article "Effects of Danmarks Nationalbank's interventions in the foreign exchange market" in this Monetary Review is elaborated on, focusing on the effect of various sectors on the exchange rate of the krone. This is done by estimating the following relationship by means of instrument variables:

$$\Delta Krone\ rate_t = \beta_0 + \beta_1 I\&P_{Net\ purchases} + \beta_2 Intervention_t + \gamma' X_t + \varepsilon_t$$

Where $\Delta Krone\ rate$ is the relative change in the krone rate in kroner per euro, $I\&P_{net\ purchases}$ denotes the pension sector's net purchases of kroner in billion kroner, $Intervention$ denotes Danmarks Nationalbank's interventions in billion kroner, X_t is a vector of control variables consisting of purchases of foreign exchange by other domestic sectors. Since interventions cannot be regarded as an exogenous variable, the interventions of the preceding 5 days are used as the instrument for interventions today. Table 1 shows the results of the regressions.

16 See Danmarks Nationalbank, *Monetary Review*, 2nd Quarter 2015.

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